ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR

ZEGAMI TIN MINE PROJECT

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MYANMAR LIMITED

NOVEMBER, 2017

LETTER OF ENDORSEMENT BY THE PROJECT PROPONENT

This Environmental Impact Assessment Report for Zegami Tin Mine Project was prepared by OSHE Services Company Limited on behalf of A&M Myanmar Limited. I hereby issue my letter of endorsement to confirm:

(a) the accuracy and completeness of the EIA;

(b) that the EIA has been prepared in strict compliance with applicable laws including the EIA Procedure and with the ToR for the EIA; and

(c) that the Project will at all times comply fully with the commitments, mitigation measures, and plans in the EIA Report.

Signed

Name : ……

Position : ……

Organization : ……

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COMMITMENT OF THIRD PARTY

This Environmental Impact Assessment report has been done with resonable skills, care and diligence in accordance with the standing laws, rules, regulations, notifications, orders and procedures of the Republic of the Union of Myanmar. We have signed this report to certify that all the information in it are true and convincing to the best of our knowledge.

Sr.	Name	Role	Responsibility	Sign
1	U San Nyunt	MD	Policy & Legal	
2	U Soe Myint	Director	SIA	
3	U Nyunt Htay	Consultant	Processing Analysis	
4	U Zaw Win	Consultant	Mine Planning & Design Analysis	
5	U Yan Naing Aung	GM	Project Management & EIA	
6	Dr. Aung Lay Tin	Noise Consultant	Air quality &Noise	
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8	U Kyaw Zin Latt	Geology Consultant	Environmental Geology	
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10	Dr. Aung Aung	Biodiversity Consultant	Biodiversity	

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LIST OF ABBREVIATION

BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
CSH	Community Safety and Health
CSR	Cooperate Social Responsibility
DGSE	Department of Geological Survey and Mineral Exploration
ECC	Environmental Compliance Certificate
ECL	Environmental Conservation Law
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EME	Earth Moving Equipment
EMP	Environmental Management Plan
FDP	Farmers Development Programme
HECs	Health Effect Categories
HIA	Health Impact Assessment
IFC	International Finance Corporation
INGOs	International Non-Government Organizations
MAZAM	Myanmar Asia Zone Mining
MONREC	Ministry of Natural Resources and Environmental Conservation
MEMs	Mitigation and Enhancement Measures
MRCP	Mine Reclamation and Closure Plan
NEQG	National Environmental Quality Guidelines
OSH	Occupational Safety and Health
ppm	parts per million
STEL	Short Time Emission Level
UNEP	United Nations Environment Programme
WBT	Wet Bulb Temperature
WHO	World Health Organization

EXECUTIVE SUMMARY

1. INTRODUCTION

Myanmar Asia Zone Mining Co. Ltd. (MAZAM) obtained approval to carry out exploration work at the area in the vicinity of Zegami village, Kyunsu Township, Myeik District in Tanintharyi Region following signing of an exploration agreement between Department of Geological Survey and Mineral Exploration, Ministry of Mines and MAZAM on 24 April 2014. MAZAM appointed its associate company A&M Myanmar Co. Ltd. (A&M), a company incorporated in Myanmar to perform exploration over the Area. Exploration and Feasibility Study were carried out between in 2014 and 2016.

Based on the findings of exploration, which proved the occurrence of about 3381 tonnes of tin, MAZAM decided to establish a mine project for production of tin in accordance with the prevailing laws of Myanmar. Under Myanmar Mines Law, A&M shall have to acquire a Large Scale Mineral Production Permit for the deposit by fulfilling all legal requirements thereupon. Undertaking an Environmental Impact Assessment for the project area is the essential prerequisite for the implementation.

Environmental Impact Assessment (EIA) study for the project was carried out by OSHE Services Company Limited from March 2015 to November 2017. The study was performed in accordance with the Environmental Conservation Law 2012, Environmental Conservation Rules (2014) and EIA Procedures (2015).

2. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Stipulations from the following laws, rules regulation and international guidelines are reviewed as part of the EIA study.

(a) Environmental Conservation Law
(b) Environmental Conservation Rules
(c) EIA Regulations
(d) National Environmental Quality (Emissions) Guidelines
(e) General EHS Guidelines (IFC)
(f) Employment and skill Development Law
(h) Minimum Wages Law
(i) Ward or Village Tract Administration Law
(j) Myanmar Investment Law
(k) Myanmar Mines Law

(l) Prevention of Hazard from Chemical and Related Substances Law

3. DESCRIPTION OF THE SURROUNDING ENVIRONMENT

3.1 Stakeholder Analysis

Stakeholders are categorized in four groups such as local people, government organizations, project proponent and other interested groups such as NGOs according to UNEP EIA MANUAL Guideline. Analysis was based on primary impact factors such as involvement in land acquisition, vicinity to the project, common use of utilities such as water and infrastructures. Paragraph 49 (g) of the EIA procedures stipulates that the scoping shall identify potentially affected communities and other stakeholders with an interest in the Project. The following table shows level of interest by stakeholders on the project.

Table.A. Stakeholders of Zegami Tin Mine

Sr.	Stakeholder Group	Stakeholder	Interest Level		Interest
			Level	Reason	
1	Local people	Zegami Village	High	Close Vicinity	-Pollution -CSR (Road, Electricity, Water, Health) -Nearby plantation -Job opportunity
		Taungpu Village	High	Close Vicinity Existing plantation near the project	
		Shwedu Village	High	Close Vicinity Existing plantation near the project	
		Pantaung Village	High	Existing plantation near the project	
		Wettoe Village	Medium	Relevant CSR	
		Anyin Village	Medium	Relevant CSR	
		Nyaungbeee Village	Medium	Relevant CSR	
		Maunghlaw Village	Low	Limited interrelation	
2	Government Organization	General Administration Department	High	Rural Administration	-Administration -Pollution -CSR -Coordination - Rule of law
		Township Educational Office	Low	Relevant CSR	
		Township Health Department	Low	Relevant CSR	

		Township Environmental Conservation Department	-	Not yet established	
		Township Fire Brigade	Low	Low risk of fire hazard	
		Department of Mine	High	Direct regulatory body	
		Township Police Force	Medium	Rule of law	
3	Proponent	Project management	High	-Project Owner	-Operation and Management
4	Other Interested Party	None	-	-	-

3.2 Biological Components

Baseline study of biological environment, ecosystem and impact assessment for both direct and indirect area were carried out. A "walk-through" survey method was conducted in (10 to 18) April, 2015 to analyze the presence or absence of ecologically or commercially important species diversity of flora and fauna on the site. For the baseline study of biological impact assessment, direct impact area of mine project and indirect impact area that is 7 km closer to the project had been surveyed for fauna (animals) diversity and the second is diversity of floral (plantation). According to the assessment of the EIA for the fauna survey, a total of 49 species of insects, a total of freshwater 40 fish species and those of marine 73 fish species, a total of 18 species of amphibians and reptiles, a total of terrestrial birds 41 species and those of aquatic birds 11 species, and a total of 19 mammals species were recorded. In case of flora survey, 193 species representing 60 families of terrestrial plants and 13 species under 7 families of herbal vegetation with their respective habitats have been recorded. The flora and fauna species were checked with the IUCN Red List (2015). Most of the flora and fauna species are least concerned in List. But aquatic bird *Leptoplilus javanica* (lesser adjunt) is vulnerable species.

3.3 Socio-Economic Components

Socioeconomic profile of local communities is portrayed by collecting baseline data in eight local villages. Sample size for 95% confidence level and 5% confidence interval was calculated by using Cochran's formula. There were about 1244 households

in eight villages with a required sample size of 294 households. A total of 319 households were sampled and actual confidence interval after sampling is 4.7%.

4. PROJECT DESCRIPTION

Zegami Tin Mining Project is to be developed and established for extraction and marketing of tin concentrates from the Zegami tin deposit where preliminary information collected indicated the sizable occurrence of an economic tin deposit. Zegami tin deposit is situated in Kyunsu Township, Tanintharyi Region, Myanmar (location map attached). Myanmar Asia Zone Activities Mining Co. Ltd., appointed its associate company A&M Myanmar Co., Ltd., a company incorporated in Myanmar to develop the Zegami tin deposit. In accordance with the procedure as stipulated in Myanmar Mines Law (2015), A&M on 8 April 2013 applied an exploration permit for the area measuring approximately 650 acres. With the approval of the Ministry of Natural Resources and Environmental Conservation (formerly Ministry of Mines) the company A&M received Mineral Exploration Permit No.0076, Dated 1 April 2014 and entered into an Exploration and Feasibility Study Agreement with Department of Geological Survey and Mineral Exploration on 24 April 2014.

A&M executed the exploration activities in accordance with the terms of the Exploration agreement since then. A&M completed 74 bore holes covering an area of approximately 182 hectares and other related exploration activities to determine the occurrence of tin deposit as to its tonnage, grade and essential geological data related thereto. Feasibility study followed immediately after the exploration works were completed.

The project covers an area of 1.4423 sq.km (356.38 acres) which constitutes deposit proper Block 1 and Block 2, mineral processing plant site, residential quarters for labors, office buildings, industrial buildings, material supply stores, internal access roads, tailing dump and other auxiliary structures. Yearly production is targeted at 200.88 tons of tin concentrates assaying a minimum of 70 % metallic tin content. Other particulars of the project are shown in the following table.

Table B. Project Information

Sr.	Particular	Information
1	Type of Project	Tin Mining

2	Location of Project	Zegami Village Tract, Kyunsu Township, Myeik District, Tanintharyi Region
6	Capital Investment	$ 2.4 Millions
7	Fuel requirement	7,700 liters per day
8	Electricity requirement	480 kW
9	Water requirement	425 cubic meters per hour

Table C. List of equipments

Sr.	Process	Equipment	Quantity
1.	Ore mining	Excavator	2
		Dump Truck	6
2.	Waste removal	Excavator	1
		Dump Truck	2

5. IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

To identify the potential environmental and social impacts of the project, project activities were correlated with environmental and social receptors and their interactions were identified for potential environmental and social impacts. EIA team finds out twenty four key environmental and social impacts of the project on its environment.

5.1 Impact Identification

5.1.1 Preconstruction

1. Domestic wastewater from mine camp
2. Waste from site preparation
3. Solid waste from mine camp
4. Conflict with plantation owner in exploration
5. Job opportunities in camp and exploration

5.1.2 Construction

1. Dust from road and tailing site constructions
2. Sedimentation from site runoff water
3. Domestic wastewater from mine town

4. Destruction of natural drainage from road and tailing site constructions
5. Loss of flora and fauna in site clearing
6. Conflict with plantation owner in site clearing works
7. Job opportunities in construction works (and supply chain)

5.1.3 Operation

1. Noise from operation works
2. Dust from operation works
3. Sedimentation from site runoff water
4. Waste water from dressing plant and tailing site
5. Tailing waste
6. Loss of flora and fauna in site clearing works
7. Economic displacement
8. OSH
9. CSH

5.1.4 Decommisioning

In the decommision phase, there is only solid waste from decommission works as project impact.

5.1.5 Closure and post-closure

1. Dust from refilling works
2. Landform change by refilling

5.2 Impact Assessment

Assessment of the identified impacts are carried out with rating matrix method the detail of which are shown in the previous part of this chapter. The assessment results are shown in the following table.

Table D. Impact Ratings without MEMs

Sr.	Impact	Severity	Duration	Spatial Scope	Frequency	Probability	Total Rating	Significance Level
PRE-CONSTRUCTION								
1	Mine camp wastewater	1	4	2	5	4	63	Low-Medium
2	Solid waste	1	4	2	5	4	63	Low-Medium
3	Job opportunities	1	4	3	1	4	40	Low
4	Conflict with plantation owner	3	1	2	1	4	30	Low
5	Site preparation waste	1	2	2	1	4	25	Very Low
CONSTRUCTION								
1	Destruction of natural drainage from road and tailing site constructions	3	4	3	5	4	90	Medium-High
2	Sedimentation from site runoff water	3	4	3	4	4	80	Medium – High
3	Domestic wastewater from mine town	3	4	3	4	4	80	Medium – High
4	Dust from road and tailing site constructions	4	4	1	4	4	72	Low-Medium
5	Loss of flora and fauna in site clearing	2	4	3	2	3	45	Low
6	Conflict with plantation owner in site clearing works	4	1	3	1	4	40	Low
7	Job opportunities in construction works (and supply chain)	1	4	3	1	4	40	Low
OPERATION								
1	Dust from operation works	3	4	3	5	4	90	Medium-High
2	Waste water from dressing plant and tailing site	3	4	3	5	4	90	Medium-High
3	CSH	3	4	3	5	4	90	Medium-High
4	OSH	3	4	2	5	4	81	Medium-High
5	Sedimentation from site runoff water	3	4	3	4	4	80	Mediu –High
6	Noise from operation works	4	4	1	4	4	72	Low-Medium
7	Tailing waste	3	4	1	4	4	64	Low- Medium
8	Loss of flora and fauna in site clearing works	2	4	3	2	3	45	Low
9	Economic displacement	3	4	3	1	4	40	Low
DECOMMISSION								

1	Solid waste	4	4	1	4	4	72	Low-Medium
CLOSURE AND POST-CLOSURE								
1	Landform change by refilling	3	3	3	5	4	81	Medium-High
2	Dust from refilling works	3	3	3	5	4	81	Low-Medium

5.3 Impact Mitigations

Following mitigation measures are formulated to prevent, reduce, or compensate the effect of the impacts caused by the project activities. Detail plan for management actions, implementation and follow-up of the impact mitigations are delineated in EMP chapter.

Table E Summary of MEMs

Sr.	Impact	Mitigation
Pre-Construction		
1	Mine camp wastewater	(1) Providing a settling pond of about (10,000) ft^3 at the designated location (2) Providing a sand filtration unit at the discharge of the settling pond (3) Carrying out weekly maintenance work for sand filtration unit (4) Carrying out annual maintenance work for settling pond (5) Monitoring the quality of all liquid waste streams discharged from the site to ensure compliance with NEQG standards (6) The pre-treatment of oil and grease containing effluents from canteens by the use of a grease trap prior to discharge into settling pond
2	Solid waste from mine camp	(1) Providing adequate waste bins (2) Providing waste pit and systematically dumping waste only in pit (3) The waste pit must be located and designed in such a way so as to minimize the risk of contamination of ground water resources; (4) All employees will be informed of correct waste management procedures (5) Soil contaminated with hydrocarbon should be immediately removed and disposed of as hazardous waste. (6) Providing adequate number of sanitary worker

3	Job opportunities	(1) Local people must be prioritized for employment (2) Advertisement must be made for every recruitment in village administrator office and other public places (3) Recruitment and plant operation must be done in accordance with labour and employment laws
4	Conflict with plantation owner	(1) Conduct adequate negotiation prior to operation (2) Notify respective plantation owners prior to operation
5	Site preparation waste	(1) Systematically compiling site preparing waste to prevent them from disrupting natural drainages (2) Site Preparation wastes such as bushes will be reused as fuel
Construction		
1	Dust from road and tailing site constructions	(1) Water sprays at area to be cleared, to be graded, unpaved haulage road (2) Ensure exposed areas remain moist through regular water spraying during dry, windy periods
2	Sedimentation from site runoff water	(1) Access and haul roads will have gradients and surface treatment to limit erosion, and road drainage systems will be provided (2) A drainage ditch will be built around dump area which will be connected to tailing ponds (3)Direct water away from disturbed areas
3	Domestic wastewater from mine town	(1) Carrying out weekly maintenance work for sand filtration unit (2) Carrying out annual maintenance work for settling pond (3) Monitoring the quality of all liquid waste streams discharged from the site to ensure compliance with NEQG standards (4) The pre-treatment of oil and grease containing effluents from canteens by the use of a grease trap prior to discharge into settling pond
4	Destruction of natural drainage from road and tailing site constructions	(1) Site infrastructure such as roads and fences should be aligned with the natural drainage lines to minimize additional erosion. (2) Natural drainage lines must not be obstructed or otherwise interfered with. (3) Erosion should be monitored over the entire site and, where initial indications of erosion are detected, appropriate remedial measures must be taken as soon as possible
5	Loss of flora and fauna in site clearing	(1) Layout of the access road to use existing roads and paths wherever possible. (2) Demarcating the construction area and ensure that the vegetation on the other side of these “barriers” is not disturbed.

		(3) Areas within the project area that are not required during mining should be demarcated as no-go areas and conserved. (4) Prevent mining employees from harvesting plants for personal use, firewood or charcoal within the project area. (5) Monitor the project area for any new invasive plant species eradicate alien plants as they appear.
6	Conflict with plantation owner in site clearing works	(1) Conduct adequate negotiation prior to operation (2) Notify respective plantation owners prior to operation
7	Job opportunities in construction works (and supply chain)	(1) Local people must be prioritized for employment (2) Advertisement must be made for every recruitment in village administrator office and other public places (3) Recruitment and plant operation must be done in accordance with labour and employment laws
Operation		
1	Noise from operation works	(1) Regular maintenance of machinery (2) Providing necessary PPE for workers at high noise area (3) Supervising regular use of PPE at high noise area
2	Dust from operation works	(1) Water sprays at area to be cleared, graded and unpaved haulage road (2) Ensure exposed areas remain moist through regular water spraying during dry, windy periods.
3	Sedimentation from site runoff water	(1) Access and haul roads will have gradients and surface treatment to limit erosion, and road drainage systems will be provided (2) Re-vegetation of disturbed areas will be performed immediately following application of the growth medium to avoid erosion (3) A drainage ditch will be built around dump area which will be connected to tailing ponds (4) Direct water away from disturbed areas
4	Waste water from dressing plant and tailing site	(1) Recycling supernatant from tailing pond to Palaung to minimize the amount of make-up water (2) The quality of effluent must be regularly monitored, the reasons for any non-conformances must be investigated as soon as they come to light and measures put in place to rectify them. (3) Contaminated runoff waters coming from hazardous areas such as concentrator plant, mineral stock-piling, concentrates, mine tailings accumulation areas are to be drained and treated before being disposed of at the discharge point.
5	Tailing waste	(1) The tailings facility must be sited in a location such that in the event of failure, pollution of soil

		and water as well as physical risk to communities is minimized. (2) The integrity of the waste rock dump and tailings facility must be inspected regularly by suitably qualified personnel throughout the life of the mine. (3) Access to waste rock dump will be restricted as far as practical and all local communities will be informed of the potential risks associated with these facilities through site notices and community meetings. (4) Regular monitoring of water quality around the waste rock dumps.
6	Loss of flora and fauna in site clearing works	(1) Layout of the access road to use existing roads and paths wherever possible. (2) Demarcating the mining area and ensure that the vegetation on the other side of these "barriers" is not disturbed. (3) Areas within the project area that are not required during mining should be demarcated as no-go areas and conserved. (4) Prevent mining employees from harvesting plants for personal use, firewood or charcoal within the project area. (5) Monitor the project area for any new invasive plant species eradicate alien plants as they appear.
7	Economic displacement	(1) Ensure that existing access routes to natural resources are not affected as far as possible. (2) Farmers Development Programme (FDP) should be developed with the intent of assisting residents increase agricultural production in their locality. (3) Local people must be prioritize for job opportunities (4) Workers involved in the construction phase should be incorporated as much as possible as the permanent staff for the operational phase.
8	OSH	(1) Procedure and guidelines on the health, safety and environment management system provided by A&M Myanmar Ltd must be followed completely (2) Labour accommodation units to be properly planned to avoid overcrowded living conditions. (3) As part of the labour recruitment policy, all labour to undergo a pre-employment health screening assessment. (4) Train employees to not urinate or defecate in open water sources. (5) Provide a healthy balanced diet to the workforce.

		(6) Strengthen partnerships with the local health authorities in the area.
9	CSH	(1) Implementation of a speed limit in mine site and villages for vehicles from mine site (2) Delivery vehicles will not be overloaded and loads will be securely fastened. Within each vehicle, an emergency response plan which specify the actions required of the driver in the event of an accident will be provided. (3) Support of a health post in the area that could benefit most of the PACs (Project Affected Communities). (4) Prior to the development and implementation of any healthcare assistance programme, local leaders, health authorities and the Government must be consulted to ensure the effectiveness of the assistance in the area. (5) A clinic at the mining site itself should offer on-site occupational and emergency services to cater for its workforce. (1) Strengthen partnerships with local health authorities and NGOs. (6) Develop an awareness campaign both for communicable- and non-communicable diseases and prevention strategies. This campaign should be aimed both at the workforce and also the wider PACs.
		Decommissioning
1	Decommissioning Solid waste	(1) Remove all above-ground structures, including all hazardous materials storage facilities (2) Remove any areas of contaminated soils (3) Empty and clean out water storage tanks and ponds (4) Waste from structural decommissioning must be segregated into recyclable, reusable, and landfill wastes (5) Systematically piled up or landfill decommissioning waste so as to prevent them from disrupting ground water or natural drainages
		Closure and Post-closure
1	Dust from refilling works	(1) Water sprays area carrying out filling and grading operations (2) Water sprays unpaved haulage roads as dust suppression measure
2	Landform change by refilling	(1) Refill all the mined out pit in accordance with MRCP (2) Top soil must be refilled back at the surface (3) Re-vegetate the entire site

6. MONITORING PROGRAMME

Table F. Environmental Monitoring Programme

Sr.	Management Actions	Monitoring	Parameter	Location	Frequency	Method	Responsi-bility
1	Carrying out weekly maintenance work	Maintenance record	- Yes/No	-	Weekly	Inspection	MD
2	Carrying out annual maintenance work for settling pond	Maintenance record	- Yes/No	-	Weekly	Inspection	MD
3	Waste water quality monitoring at the discharge of sand filtration unit	Waste water quality	NEQG	Fig 3	Monthly	Lab analysis	SC
4	Providing 6 nos. of 1100 liter waste bins	Waste bin	-Numbers -Conditions	Project area	Monthly	Inspection	MD
5	Carrying out weekly inspection works	Inspection record	-invasive species -erosion -spills -road	Project area	Weekly	Inspection	MD
6	Carrying out daily inspection works	Inspection record	waste, waste pit, dust, noise,erotion, waste rock dump	Project area	Daily	Inspection	MD
7	Carrying out monthly management review on overall project operation	Review meeting	meeting minutes	-	Monthly	Inspection	MM
8	Appointing local people for all the unskilled labour post	Unskilled labour	Local people	Employment list	Monthly	Inspection	HR
9	Spraying necessary places with water for dust supression	Water spraying	Dust emission	Project area	Weekly	Inspection	MD

10	Paving access roads and haulage roads with graval	Road paving	Gravel paving	Project roads	Monthly	Inspection	MD
11	Construction of demarcation	Pits and camp demarcation	Fences	Pits and camp boundary, tailing	Monthly	Inspection	MD
12	Construction of sign boards	Sign boards	-Restricted area -Fire wood cutting restriction -Hazardous area -Speed limit	Project area	Monthly	Inspection	HSE
13	Carrying out annual overall maintenance work	Maintenance work	Maintenance record	-	Annually	Inspection	MD
14	Providing 77 earmuffs for workers at high noise area	Earmuffs	-Number -Conditions	-	Monthly	Inspection	HSE
15	Setting up a nursery for revegetation	Nursury	-Yes/No -Condition	-	Monthly	Inspection	MD
16	Replantation according to MRCP	Replantation	-Yes/No -Area -No of plants -Conditions	Mined-out and refilled pit area	Monthly	Inspection	MD
17	Construction of a drainage	Drainages	-Yes/No -Condition	-Dump area -Concentration plant -Stock piling	Monthly	Inspection	MD
18	Weekly analysis of waste water from tailing at mine site lab	Water quality	NEQG	Tailing pond	Weekly	Lab analysis	SC

19	Analysis of waste water from waste rock dump at external lab once per three months	Water quality	NEQG	Tailing pond	Quarterly	Lab analysis	SC
20	Implementation of FDP	FDP	-Yes/No -Progress	-	Monthly	Inspection	MM
21	Providing adequate labour accommodation units	Labour accommodation	-Adequacy -Condition	Workers quaters	Monthly	Inspection	HSE
22	Providing annual medical check-up for all employee	Medical checkup	-Yes/No -Records	Clinic	Annually	Inspection	HSE
23	Providing at least 5 toilets for 161 workers	Toilet	-Numbers -Condition	Project area	Monthly	Inspection	HSE
24	Carrying out regular meeting with local health staffs, health authorities and local NGO	Health meeting	-Meeting minutes	-	Monthly	Inspection	HSE
25	Providing a clinic with a medical/health assistance at mine site	Mine site clinic	-Yes/No -Condition	Mine site	Monthly	Inspection	HSE
26	Providing health awareness trainings	Health awareness training	-Yes/No -Records	-Workers -Villages	Bi-annually	Inspection	HSE
27	Structural decommissioning	Strctural Decommissioning	-Structures -Landfills	Project area	Once after decommis-sioning	Inspection	MD
28	Refilling mined out pit	Refilling	-Yes/No -Area -Condition	Mined out pits	Monthly	Inspection	MM
29	Refilling top soil at the refilled surface	Top soil	-Yes/No -Area -Condition	Refilled area	Monthly	Inspection	MM

Table G. Projected budget for implementation of the EMP

Sr.	Management Actions	Budget
1	Excavating a 10000 ft^3 earth pond, digging inlet and outlet drainage	300000
2	Providing a (10ft x 10ft x 5 ft) sand filtration unit at the discharge of the settling pond	100000
3	Carrying out weekly maintenance work for sand filtration unit	100,000/yr
4	Carrying out annual maintenance work for settling pond	100,000/yr
5	Monitoring waste water quality at the discharge of sand filtration unit and other places on monthly basic	1,200,000/yr
6	Installing a grease trap at the discharge point of canteen	100000
7	Providing 6 nos. of 1100 liter waste bins	1,800,000/3yr (600000/yr)
8	Providing a waste pit of 1000 ft^3 with impermeable bedding at least 100 m away from wells and natural streams	300000
9	Systematic waste management methods must be notified with flyers and board within mine camp	100000/yr
10	Providing a truck with water spray tank	4,000,000
11	Paving access roads and haulage roads with graval	1,000,000/yr
12	Providing road drainage alongside all roads	600,000
13	Construction of a drainage around dump area and connecting the drainage with tailing pond by drainage	600,000
14	Construction of earth dike around disturbed areas	300,000
15	Systematic design of and construction of access roads and haulage roads in align with natural drainage lines	1,000,000
16	Providing necessary culvert at crossing with natural drainages	1,000,000
17	Construction of retaining wall at necessary places to prevent erosion	1,000,000
18	Construction of demarcation around mining pits and mine camp	1,000,000
19	Construction of sign boards at the edges of restricted area	300,000/3yr (100000/yr)
20	Providing sign boads prohibiting havaresting of fire wood within project areas	300,000/3yr (100000/yr)
21	Carrying out annual overall maintenance work	2,400,000/yr
22	Providing 77 earmuffs for workers at high noise area	1,000,000/yr
23	Construction of a drainage around dump area and connecting the drainage with tailing pond	300000

24	Construction of drainages around concentration plant, stock piling areas and connecting the drainage with tailing pond	300000
25	Providing fences around tailing area	300000/3 yrs (100000/yr)
26	Providing sign boards warning the hazards associated with tailing site	120000/3 yrs (40000/yr)
27	Weekly analysis of waste water from waste rock dump at mine site lab	600000/yr
28	Analysis of waste water from waste rock dump at external lab once per three months	800000/yr
29	Providing at least 5 toilets for workers	1000000/yr
30	Carrying out regular meeting with local health staffs, health authorities and local NGO	200000/yr
31	Providing speed limit sign boards within project areas	150000/3 yr
32	Providing awareness training for workers annually	100000/yr
33	Providing awareness training in eight villages bi-annually	100000/yr
34	Providing aids for local health facilities for awareness raising in local communities	200000/yr
Total One Time Cost		10,900,000
Total Recurring Cost		9,990,000/yr

7. PUBLIC CONSULTATION AND DISCLOSURE

In order to acquire public opinion on the implementation of the Zegami Tin Mine Project, public consultation works were done firstly by disclosing relevant project information in local community following by first public meeting for scoping. Then consultation works continued with a systematic household data survey. Final public consultation works is carried out in second public meeting where the results of all the study works are delineated to general public in the form of a translated executive summary report.

1 INTRODUCTION

Myanmar Asia Zone Mining Co. Ltd. (MAZAM) obtained approval to carry out exploration work at the area in the vicinity of Zegami village, Kyunsu Township, Myeik District in Tanintharyi Region following signing of an exploration agreement between Department of Geological Survey and Mineral Exploration, Ministry of Mines and MAZAM on 24 April 2014. MAZAM appointed its associate company A&M Myanmar Co. Ltd. (A&M), a company incorporated in Myanmar to perform exploration over the Area. Exploration and Feasibility Study were carried out between in 2014 and 2016.

Based on the findings of exploration, which proved the occurrence of about 3381 tonnes of tin, MAZAM decided to establish a mine project for production of tin in accordance with the prevailing laws of Myanmar. Under Myanmar Mines Law, A&M shall have to acquire a Large Scale Mineral Production Permit for the deposit by fulfilling all legal requirements thereupon. Undertaking an Environmental Impact Assessment for the project area is the essential prerequisite for the implementation.

Environmental Impact Assessment (EIA) study for the project was carried out by OSHE Services Company Limited from March 2015 to November 2017. The study was performed in accordance with the Environmental Conservation Law 2012, Environmental Conservation Rules (2014) and EIA Procedures (2015).

1.1 SCOPE OF THE EIA STUDY

The EIA study focusing the project area and its vicinity includes Zegami, Shwedu, Wettoe, Taungpu, Pantaung, Nyaungbee, Anyin, Maunghlaw villages. General study scope of EIA team includes:

- **Preliminary study –** collecting and analyzing preliminary information such as project information, project location, maps and technical background;
- **Scoping –** carrying out field trip identification of potential environmental impacts, and determination of what has to be covered in the EIA to which extent;
- **Public participation –** acquiring public comments, suggestions and input for the project by means of public meetings and consultation works;

- **Household survey –** carrying out a systematic socioeconomic data survey;
- **Baseline environmental data survey –** collecting baseline data relating to existing physical and biological environment of the project;
- **Impact identification and assessment –** identification of anticipated impacts and assessing them biological environment of the project;
- **EMP –** delineation of MEMs for the anticipated negative and positive impacts;
- **Reproting drafting** – preparation of a draft report and a translated non-technical executive summary;
- **Disclosure of draft report** – delivering the translated non-technical summary report to stakeholders; and
- **Finalizing the report** – finalization of the report putting together all the information obtained.

1.2 PRESENTATION OF THE PROJECT PROPONENT

A&M Myanmar Company Limited is a company incorporated in Myanmar for carrying out production of Tin in Zegami Tin Mine project. Particulars of the company are shown in the following table.

Table 1 Information of A&M Myanmar Limited

Sr.	Particular	Name/Address
1	Company Name	A & M Myanmar Co., Ltd.
2	Project Location	Zegami Village Tract, Kyunsu Township, Myeik District, Tanintharyi Region
3	Company Address	No.7(A), Hospital Road, Pyitharyar Ward, Yankin Township, Yangon, Myanmar
4	Project Owner	A & M Myanmar Co., Ltd.
5	Managing Director	Mr. Jesse Lim Chin Sin Jr (Passport No.A-26960335)

1.3 ENVIRONMENTAL, SOCIAL AND HEALTH EXPERTS

OSHE Services Co., Ltd. is a private company located at No. (92), KantKaw Myaing Lane (2), Block (33), North Dagon Township, Yangon, Myanmar. The company is holding transitional consultant registration from ECD with registration number 0018. OSHE EIA team for Zegami Tin Mine project consists of the multidisciplinary consultants as shown in the following table.

Table 2. OSHE Project Team for Zegami EIA Project

Sr.	Name	Role	Responsibility
1	U San Nyunt	MD	Policy & Legal
2	U Soe Myint	Director	SIA
3	U Nyunt Htay	Consultant	Mineral Processing Analysis
4	U Zaw Win	Consultant	Mine Planning & Design Analysis
5	U Yan Naing Aung	GM	EIA & Project Management
6	U Phyo Mg Mg	Project Engg:	Data Collection &Analysis
7	U Lin Thura Aung	Project Engg:	Data Collection &Analysis
8	U San Gar Daung	Project Engg:	Data Collection &Analysis
9	U Khant Myat Kaung	Data Collector	Data Collection
10	Dr. Aung Lay Tin	Noise Consultant	Air quality &Noise
11	Dr. Su Wai Mon	Health Consultant	HIA
12	U Kyaw Zin Latt	Geology Consultant	Environmental Geology
13	Dr. Kyu Kyu Mar	Geology Consultant	Environmental Geology
14	Dr. Kyaw Naing Oo	Biodiversity Consultant	Biodiversity
15	Dr. Than Than Myint	Biodiversity Consultant	Biodiversity
16	Dr. Aung Aung	Biodiversity Consultant	Biodiversity
17	Dr. Thet Naing	Biodiversity Consultant	Biodiversity
18	Dr. Poe Thandar Oo	Biodiversity Consultant	Biodiversity
19	Dr. Khaing Zar Ni	Biodiversity Consultant	Biodiversity

Table 3. Sector-wise Participant of OSHE

Sr.	Participant	Sector
1	U San Nyunt	Law Review
2	U Nyunt Htay	Mineral Processing Analysis
3	U Zaw Win	Mine Planning & Design Analysis
4	U Soe Myint U Yan Naing Aung U Phyo Maung Maung U Lin Thura Aung U Khant Myat Kaung U San Gar Daung U Myint Maung Maung Than	Social Impact Assessment
5	U Yan Naing Aung	Environmental Management Plan
6	Dr. Kyaw Naing Oo Dr. Than Than Myint Dr. Aung Aung Dr. Thet Naing Dr. Poe Thandar Oo Dr. Khaing Zar Ni	Biodiversity
7	Dr. Aung Lay Tin	Noise Study
8	U Kyaw Zin Lat Dr. Kyu Kyu Mar	Environmental Geology
9	Dr. Su Wai Mon	Health Impact Assessment
10	U Yan Naing Aung	Principle Report Drafting

2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 CORPORATE ENVIRONMENTAL POLICIES

A&M Myanmar Company Limited is committed to carrying out Zegami Tin Mine Project in an environmentally responsible manner. The company will fulfill its environmental commitment by:

- Ensuring compliance with applicable environmental legislations
- Adopting appropriate mitigation measures for adverse environment impacts caused by company's activities
- Continually improving processes and ways of production which reduce levels of environment impact through energy, water and natural resources conservation
- Raising staff consciousness and their competence in environmental protection

2.2 POLICY AND LEGAL FRAMEWORK

2.2.1 Myanmar Environmental Policy

The Constitution of the Republic of the Union of Myanmar stipulates the Government to protect and conserve the natural environmental and implies every citizen of Myanmar to assist the Government in environment conservation.

National Environment Policy (1994) is the basis for the integration of environmental consideration into development in Myanmar which proclaims the Government's commitment to sustainable development. It highlights the integration of environmental considerations with development process for a better quality of life of all citizens. The state has the responsibility and that environmental protection should always be the primary objective in seeking development.

The Myanmar Agenda 21 was development in (1997) for all natural resource management and environmental conversation work in pursuit of activities relating to biodiversity conversation.

National Sustainable Development Strategy (NSDS) prepared in 2009 includes three goals: (1) sustainable social development. One of the Government's main priorities is to mainstream sustainable environmental considerations into the national development planning and to develop an effective safeguards system to prevent the social and environmental impacts associated with rapid economic growth.

2.2.2 Laws and Rules

Stipulations from the following laws, rules regulation and international guidelines are reviewed as part of the EIA study.

(a) Environmental Conservation Law
(b) Environmental Conservation Rules
(c) EIA Regulations
(d) National Environmental Quality (Emissions) Guidelines
(e) General EHS Guidelines (IFC)
(f) Employment and skill Development Law
(h) Minimum Wages Law
(i) Ward or Village Tract Administration Law
(j) Myanmar Investment Law
(k) Myanmar Mines Law
(l) Prevention of Hazard from Chemical and Related Substances Law

2.2.2.1 Environmental Conservation Law

Myanmar enacted the Environmental Conservation Law on 30th March, 2012 as PyidaungsuHluttaw Law No. (9/2012). There are eight objectives of the law which stress on (i) implementation of Myanmar National Environmental Policy, (ii) integration of environmental conservation in sustainable development, (iii) emerging healthy and clean environment and conserving natural and cultural resources, (iv) reclaiming ecosystems, (v) sustainable and beneficial use of natural resources, (vi) promoting public awareness and cooperation, (vii) promoting international cooperation, and (viii) cooperation with government departments, INGOs, NGOs and individuals for the matters of environmental conservation.

There are (42) paragraphs in (14) sections of the law. Paragraph (14) of the law stipulates that "*a person causing a point source of pollution shall treat, emit, discharge and deposit the substances which cause pollution in the environment in accord with stipulated environmental quality standards*".

Moreover, paragraph (15) of the law says that "the owner or occupier of any business, material or place which causes a point source of pollution shall install or use an on-site facility or controlling equipment in order to monitor, control, manage, reduce or eliminate environmental pollution. If it is impracticable, it shall be arranged to dispose the waste in accord with environmentally sound methods".

According to paragraph (39(b)) of the law, if any terms and conditions of environmental conservation contained in the prior permission for a business is not complied with, the power to cancel the issued license, permit or register or suspend it for a limited period is granted for relevant government department, or government organization.

2.2.2.2 Environmental Conservation Rules

Environmental Conservation Rules were officially announced on 5th June 2014. Some of the highlights of the Environmental Conservation Rules are:

(i) proposal for incentive mechanisms, terms and conditions for green initiatives for sustainable development to mainstream into the development sectors;
(ii) establishment of the Integrated Environmental Monitoring System;
(iii) conduct of Environmental Impact Assessment;
(iv) development of Environmental Quality Standards
(v) carrying out sustainable management and utilization of natural resources;
(vi) waste management; and
(vii) setting up of the Environmental Management Fund.

2.2.2.3 EIA Regulations

Former MOECAF developed the Environmental Impact Assessment Procedures which were approved in December 2015. MOECAF is already applying the main principles of EIA Procedures before their approval. Under the Foreign Investments Rules, the environmental impact assessment and social impact assessment reports are needed to be attached together with the investment proposal. Capital intensive investment projects and designated businesses need to be assessed by the MOECAF in terms of environmental impacts and compliance. Under the EIA procedures, all projects undertaken in Myanmar that can cause significant adverse impacts are required to undertake an IEE or EIA and to obtain an Environmental Compliance Certificate (ECC).

EIA team for this current Zegami Tin Mine Project carried out thorough reviews on a number of laws, rules, procedures and notifications to justify the compliance of the project and its activities with relevant Myanmar laws. Some of the relevant laws EIA team focus are Foreign Investment Law; Ward or Village Tract Administration Law; Myanmar Mines Law, Prevention of Hazard from Chemical and Related

Substances Law, Minimum Wages Law and Rules (2013), Employment and Skill *Development Law and others.*

2.2.2.4 Employment and Skill Development Law

With the objectives to facilitate employment which is appropriate to the age and ability of the job seeker, to help workers obtain employment and to provide stability of employment and skills development for employees, to help employers obtain appropriate employees, the Employment and Skill Development Law came into force in late 2013. The law stipulates the facts required to be included and specified in the employment agreement between the employer and employee.

The law stipulates that a company must enter into written employment contracts with Myanmar citizens and foreign staff within (30) days of employment. A Standard Employment Contract is issued which is applicable to all employees, public and private, and shall be deemed to apply in all cases where the employee's written contract is silent. The Standard Employment Contract is largely provided for convenience. It allows employers and employees to vary the terms of the Standard Employment Contract so long as the variation is not in contravention of Myanmar's labor and employment laws.

Furthermore, an employment agreement may address issues such as job description, place of employment, working hours, wages and benefits, probation period, termination, and duration of the contract. Employee performance and work standards may be inserted into the employment contract too.

2.2.2.5 Minimum Wages Law

To meet with the essential needs of the workers, and their families, who are working at the commercial, production and service, agricultural and livestock breeding businesses and with the purpose of increasing the capacity of the workers and for the development of the competitiveness, the PyidaungsuHlutaw hereby enacts this law as the PyidaungsuHluttaw Law No. 7/2013 at 22nd March, 2013.

2.2.2.6 Ward or Village Tract Administration Law

The law is enacted in order to appoint and assign duty of Ward and Village Tract Administration in accord with law to any person who is respected by the society and has to implement and carry out the works relating to the Ward or Village Tract Administration as it is provided in section 289 of the constitution of the Republic of the

Union of Myanmar. It stipulates the formation of wards or village tracts, basic principles of function of the ward or village tract administrator and their functions and duties, duties of the person residing in the ward or village tract together with their rights.

There are five villages within the project areas. The project has to establish a dynamic relationship with all the villages. In due course of the project implementation, the area will encounter general development including expansion of businesses and villages as well as its dwelling population.

2.2.2.7 Myanmar Investment Law (2016)

At the 2nd, Waning of Thadingyut, 1378 M.E. (18, October, 2016), and the Pyidaungsu Hluttaw hereby enacts Myanmar Investment Law. This Law shall apply to all existing or new investments within the Union on the date of entry into force of this Law. The objectives of this Law are as follows:

i. to develop responsible investment businesses which do not cause harm to the natural environment and the social environment for the interest of the Union and its citizens;
ii. to protect the investors and their investment businesses in accordance with the law;
iii. to create job opportunities for the people;
iv. to develop human resources;
v. to develop high functioning production, service, and trading sectors;
vi. to develop technology, agriculture, livestock and industrial sectors;
vii. to develop various professional fields including infrastructure around the Union;
viii. to enable the citizens to be able to work alongside with the international community;
ix. to develop businesses and investment businesses that meet international standards

2.2.2.8 Myanmar Mines Laws

Recent amendments to the Myanmar Mines Law of 1994 though the enactment of law No. 72/2015 on 24 December 2015 (the "Mine Law Amendments") constitute some progress towards addressing areas of concern to potential investors. The laudable changes brought by the Mines Law Amendments include:

(a) Increasing the maximum production permit period, for large scale production projects only, to 50 years;

(b) Giving exploration permit holders who successively performed in compliance with the terms of exploration permits a clear right to production permits;

(c) Allowing medium scale, small scale processing and trading permit holders of citizens to cooperate with foreign investors as a Large scale mineral production permit with foreign investment depending on the deposit size and grade proved in the exploration report.

(d) Specifying the criteria for determining size of individual production permit areas; and

(e) Providing a guaranteed right to extraction/production permit for those who have successfully carried out prospecting and exploration and completed a feasibility study.

A summary of the major amendments under the Mine Law Amendments is provided in the following table.

Table 4 Mine Law Amendments

1.	Large Scale Extraction/Production (Section 2(k))	Permit term is now 15 to a maximum of 50 years
2.	Foreign Investment (Section 4(a))	Specifically allowed for applications including foreign investment for any or more of the Prospecting, Exploration, Feasibility Study, Large Scale Production, Processing and Trading
3.	Joint Ventures (Section 4(f))	Joint Venture with Foreign Investment in order to become Large Scale Production Permit is allowed to Citizen investors holding permits for medium and small scale production, processing and trading depending upon the size and grade of the deposit as proven by geological exploration report.
4.	Permits (Section 7(a)&(c))	Ministry of Mines with consent of Union Government authorized to grant permits for:

		(a)all permitted mining projects with foreign investment (b)conversion/upgrade of locally owned small/medium scale projects to large scale extraction/production projects operated as joint ventures with foreign investment (Section 11(a))-All permits for other non-foreign investment projects to be granted by newly formed Regional or State Permitting Boards.
5.	Classification of Production(Section 11)	Classification of Production Scale will be made taking into consideration (a) Term of Project (b) Area of Project (c) Amount of Investment (d) Utilization of Machinery and Equipment
6.	Right to Extraction/Production Permit (Section 11(a))	A guaranteed right to extraction/production permit for those who have successfully carried out prospecting and exploration and completed a feasibility study.
7.	Availability of Buying/Selling Permits (Section 11(b))	Non-producers wanting to carry out purchasing and processing of minerals may obtain buying/selling permits
8.	Royalty Payment Currency (Section 12(g))	Foreign Investors must pay royalties and other fees and payables which may be in foreign currency or in equivalent Myanmar currency calculated with official exchange rate as prescribed by Central Bank of the Republic of the Union of Myanmar.
9.	Royalty Rates (Section 18)	Applicable rates changes as follows: (a) gold, platinum, uranium etc. -now 5%, previously 4%to 5% (b) silver, copper, tungsten etc. -now4%, previously3%to4% (c) iron ore, zinc, lead, aluminum, manganese etc. -now3%, previously3% to 4% (d) industrial minerals and stone

		-now2%, previously1%to3%
10.	Calculation of Royalty Amount (Section 19)	Royalty amount to be calculated based on: (a) percentage of pure metallic mineral content (b) using prevailing international prices
11.	Environmental Obligations (Section 13(e)(1))	Obligation to establish to reserve fund for environmental conservation
12.	Reclamation Obligations (Section 13(e)(2))	Obligation to realize the mine reclamation and rehabilitation plan with establishment of a fund
13.	Exclusion of Gemstones (Section2(b),19and 21)	Gemstones and gemstone mining are no longer part of Mines Law and will, presumably, be separately regulated
14.	Offences and Penalties (Section 30(a)and 32-A)	Large increases in prison terms and fines for Mines Law offences
15.	State Participation (Section 35(A))	Ministry shall carry out mineral production in cooperation with the Mineral Permit holder under (i) the production sharing agreement in which environmental expenses will include Production cost or (ii) profit sharing agreement or (iii) profit sharing on equity participation

A&M acquired the Permit for undertaking exploration and feasibility study of Zegami Tin mine deposit on 1 April 2014 vide Permit no. 0076/2014. At the time the legislative procedures for amendment of Myanmar Mines Law were in progress. The Law amending Myanmar Mines Law was promulgated on 24 December 2015 while A&M was still undertaking the Environment Impact Assessment through the expertise of OSHE as the Assessor. Though the amended law constitutes significant changes in the permitting procedure, the Rules for implementing the Law is not yet enacted as of end October 2017. However, the amended law stipulates additional types of permits and allowed a longer term of permit for foreign investment projects, extending to 50 years from 25 years in the previous law. A&M had formerly targeted to produce 600 tonnes annually which will exhaust the calculated deposit in a matter of 6 to 7 years and the relevant feasibility report was prepared. After the amended law was enacted, in

order to enable enjoy terms and conditions allowed for Large Scale Production Permits A&M revised the Feasibility study report accordingly to suit a production life of more than 15 years, a minimum limit for Large Scale Production Permit.

There will be no significant change in the permitting process for Zegami Tin Mine Project regardless of the change to a longer period in the term of the project in the new amended law.

2.2.2.9 Prevention of Hazard from Chemical and Related Substances Law

This law is enacted at 5th Waning of Wagaung 1375 M.E (26th, August, 2013). The aims of this law are:

(a) to protect from being damaged the natural environment resources and being hazardous any loving beings by chemical and related substances:

(b) to supervise systematically in performing the chemical and related substances with permission for being safety;

(c) to perform the system of obtaining information and to perform widely educative and research for using the chemical and related substance systematically;

(d) to perform the sustainable development for the occupational safety, health and environmental conservation.

According to paragraph (27) in Chapter (9), the law says "A person who has obtained the license to be complied the following matters to control and decrease the hazard of the chemical and related substances:

(a) classifying the hazard level to protect in advance the hazard according to the properties substances;

(b) expressing the Material Safety Data Sheet and Pictogram;

(c) providing the safety requirements, the personal protection equipment to protect and decrease the accident and attending to the training to be used systematically;

(d) performing in accordance with the stipulations in respect of transporting, processing, storing, using, discharging the chemical and related substances;

(e) not being imported or exported the chemical and related substances banned by the Central Supervisory Board and the machinery and equipment which are used them."

2.3 NATIONAL STANDARDS AND GUIDELINES

National Environmental Quality (Emission) Guidelines (NEQG) for waste water and noise levels are referenced in this EIA report. Followings are the environmental standards and guidelines adopted by EIA team.

Table 5. Effluent Standard from Ore and Mineral Processinng (NEQG)

Sr.	Parameter	Unit	Guideline Value
1	Arsenic	mg/l	0.1
2	Cadmium	mg/l	0.05
3	Chemical oxygen demand	mg/l	150
4	Chromium (hexavalent)	mg/l	0.1
5	Copper	mg/l	0.3
6	Cyanide	mg/l	1
7	Cyanide(free)	mg/l	0.1
8	Cyanide (weak acid dissociable)	mg/l	0.5
9	Iron(total)	mg/l	2
10	Lead	mg/l	0.2
11	Mercury	mg/l	0.002
12	Nickel	mg/l	0.5
13	pH	S.U.[a]	6 - 9
14	Temperature	°C	<3 degree differential
15	Total suspended solids	mg/l	50
16	Zinc	mg/l	0.5

Table 6 Noise Level Standard (NEQG)

Receptor	One Hour LAeq (dBA)	
	Daytime (7:00 - 22:00) (10:00 – 22:00 for public holidays)	Nighttime (22:00-7:00) (22:00-10:00 for public holidays)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Table 7. Air Quality Standard (NEQG)

Sr	Parameter	Averaging Period	Guideline Value (µg/m3)
1	Nitrogen dioxide	1-year 1-hour	40 200
2	Ozone	8-hour daily Maximum	100
3	PM_{10}	1-year 24-hour	20 50
4	$PM_{2.5}$	1-year 14-hour	10 25
5	Sulfur dioxide	24-hour 10-minute	20 500

2.4 INTERNATIONAL STANDARDS AND GUIDELINES

The general Environmental, Health, and Safety (EHS) Guidelines of IFC is technical reference document with general examples of Good International Industry Practice (GIIP). The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. The applicability of the EHS Guidelines is tailored for Zegami Tin Mine Project by taking accounts the results of the environmental assessment.

Internationally accepted environmental standards and guidelines for ambient air, waste water, noise levels and environmental monitoring parameters are referenced in this EIA report. Following is the environmental standards and guidelines adopted by EIA team.

Table 8. Environmental Standards and Guidelines Referenced in this Report

Sr.	Standards	References
1	Environmental monitoring programme	IFC
2	Occupational safety and health	IFC

2.5 INSTITUTIONAL FRAMEWORK

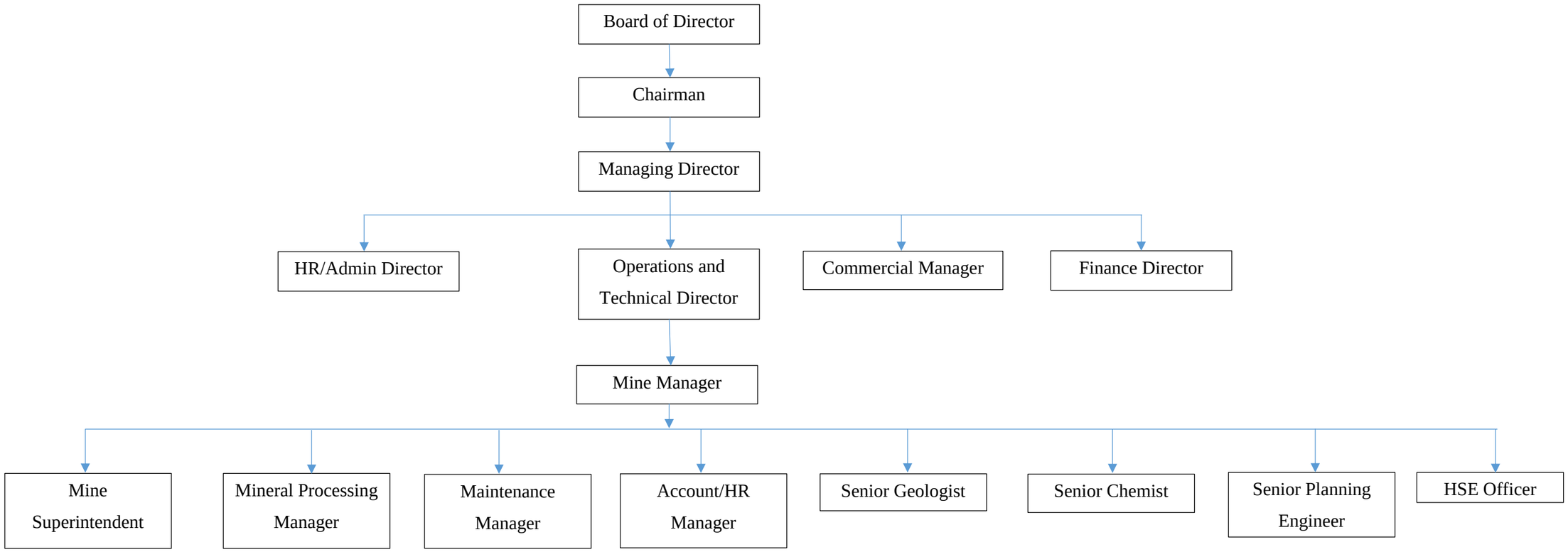


Figure 1. Organization Chart of A&M Myanmar Co., Ltd.

2.6 PROJECT'S ENVIRONMENTAL AND SOCIAL STANDARDS

Internationally accepted environmental standards and guidelines for ambient air, waste water, noise levels and environmental monitoring parameters are referenced in this EIA report. Following is the environmental standards and guidelines adopted by EIA team.

Table 9. Environmental Standards and Guidelines Referenced in this Report

Sr.	Standards	Reference
1	Ambient air quality	NEQG
2	Waste water quality	NEQG
3	Noise Levels	NEQG
4	Environmental monitoring programme	IFC

2.7 HEALTH STANDARDS

This HIA followed the standard steps of scoping, developing a baseline health profile, assessing impacts, developing recommendations and report writing. Prioritizing health effect category is used to assess the health impact of the project on its environment. This section indicates how the various health effect categories (HECs) should be prioritized by decision makers and why. Although this section does not provide a quantitative evaluation of health risks, it provides a qualitative ranking system that takes into consideration of four parameters for each HEC: (1) Stakeholder concern (2) data gaps (3) potential impact which considers the potential for both positive and negative health effects as a result of the project (4) likelihood, the prioritization level for each of the four parameters is defined as low, medium, or high.

Table 10. Parameter Ranking for Prioritizing HECs

Parameters	Rank		
	Low	Medium	High
Stakeholder concern	HEC not mentioned by stakeholders	HEC mentioned by stakeholders: Somewhat important	HEC highly important to stakeholders

Data Gaps	No data gaps exist for the HEC	Data gaps exist for the HEC but would provide little additional information if filled	Data gaps exist for the HEC and represent critically important information
Potential impact	HEC review reveals no potential impacts or minor positive or negative impacts only, easy adaptation	Modest increase(or decrease) in mild to moderate disease events; effective mitigation strategies exist	Substantial increase (or decrease) in moderate to severe morbidity or mortality events; adaptation with assistance
Likelihood	Unlikely, HEC effects not typically observed in similar settings or have never been observed in similar settings	Possible: At least some of the health effects in this HEC have occurred in similar settings and could occur given proper conditions or design features	Probable: At least some of the health effects in this HEC are known to be common in similar settings and will most likely occur

The HECs are a standard set of effects categories that have been developed and published by WHO (World Health Organization) are

1. Social Determinants of Health (SDH)
2. Water and sanitation
3. Communicable Disease
4. Food , Nutrition, and subsistence Activity
5. Non-communicable and chronic diseases
6. Exposure to potentially hazardous materials
7. Accidents and Injuries
8. Health services infrastructure and capacity

3 DESCRIPTION OF THE SURROUNDING ENVIRONMENT

3.1 SETTING THE STUDY LIMITS

The EIA study focusing the project area and its vicinity includes Zegami, Shwedu, Wettoe, Taungpu, Pantaung, Nyaungbee, Anyin and Maunghlaw villages.

Figure 2: EIA Study Area for Zegami Tin Mine Project

3.2 METHODOLOGY AND OBJECTIVES

The EIA study for the project includes analysis on base line data from local, government organization, Feasibility Study Report of the A&M and other related documents obtained from the project proponent.

Primary data collections include direct observation, interview, individual/target group consultations, public meetings, sampling and laboratory analysis on physicochemical parameters of water from the project area, listing biological resources such as flora and fauna, household data survey on demography, socioeconomics, occupation, education and health.

EIA study for Zegami Tin Mine Project is performed by OSHE with the following specific objectives as to investigate the legality of the project; to study the background environmental and socioeconomic profile of the area; to release project information for the general public; to study the environmental, social and socioeconomic issues likely

to occur; and to devise mitigation and enhancement measures for key environmental and social impacts.

3.3 STAKEHOLDER ANALYSIS

Stakeholders are categorized in four groups such as local people, government organizations, project proponent and other interested groups such as NGOs according to UNEP EIA Manual Guideline. Analysis was based on primary impact factors such as involvement in land acquisition, vicinity to the project, common use of utilities such as water and infrastructures. Paragraph 49 (g) of the EIA procedures stipulates that the scoping shall identify potentially affected communities and other stakeholders with an interest in the Project. The following table shows level of interest by stakeholders on the project.

Table 11. Stakeholders of Zegami Tin Mine

Sr.	Stakeholder Group	Stakeholder	Interest Level		Interest
			Level	Reason	
1	Local people	Zegami Village	High	Close Vicinity	-Pollution -CSR (Road, Electricity, Water, Health) -Nearby plantation -Job opportunity
		Taungpu Village	High	Close Vicinity Existing plantation near the project	
		Shwedu Village	High	Close Vicinity Existing plantation near the project	
		Pantaung Village	High	Existing plantation near the project	
		Wettoe Village	Medium	Relevant CSR	
		Anyin Village	Medium	Relevant CSR	
		Nyaungbeee Village	Medium	Relevant CSR	
		Maunghlaw Village	Low	Limited interrelation	
2	Government Organization	General Administration Department	High	Rural Administration	-Administration -Pollution -CSR -Coordination - Rule of law
		Township Educational Office	Low	Relevant CSR	
		Township Health Department	Low	Relevant CSR	

		Township Environmental Conservation Department	-	Not yet established	
		Township Fire Brigade	Low	Low risk of fire hazard	
		Department of Mine	High	Direct regulatory body	
		Township Police Force	Medium	Rule of law	
3	Proponent	Project management	High	-Project Owner	-Operation and Management
4	Other Interested Party	None	-	-	-

3.4 PROJECT AFFECTED AREA

Project affected area is demarcated based on the results of stakeholder analysis. Affected human settlements, noise environment, biological environment and land environment are shown in the following table.

Table 12. Project Affected Area of Zegami Tin Mine

Sr.	Category	Location	Factor
1	Human Settlements	Zegami Village Taungpu Village Shwedu Village Pantaung Village Wettoe Village	-Connecting the access road -Cashew nut plantations
		Anyin Village Nyaungbee Village Maunghlaw Village	-Vicinity
2	Hydrological Regime	Anyin Creek and Maunghlaw Creek	-Storm water -Waste water
3	Land Environment	-Adjacent plantation -Project area	-Soil -Natural topography
4	Biological Environment	Direct and indirect impact area within project compound, vicinity, Anyin Creek and Maunghlaw Creek	-Air Pollution -Water Pollution -Noise Pollution
5	Air and Noise Environment	Within project area and nearby community	Noise Levels
6	Water Environment	Within project area, nearby community, Anyin Creek and Maunghlaw Creek	-Water usages -Water quality -Waste water

3.5 PHYSICAL COMPONENTS

3.5.1 Topography

The topographic survey using total station was carried out by A&M survey team. EIA team study topography of the project area by using QGIS software and A&M topographic map. The 3D map and topographic map of the project area are shown in the following figures.

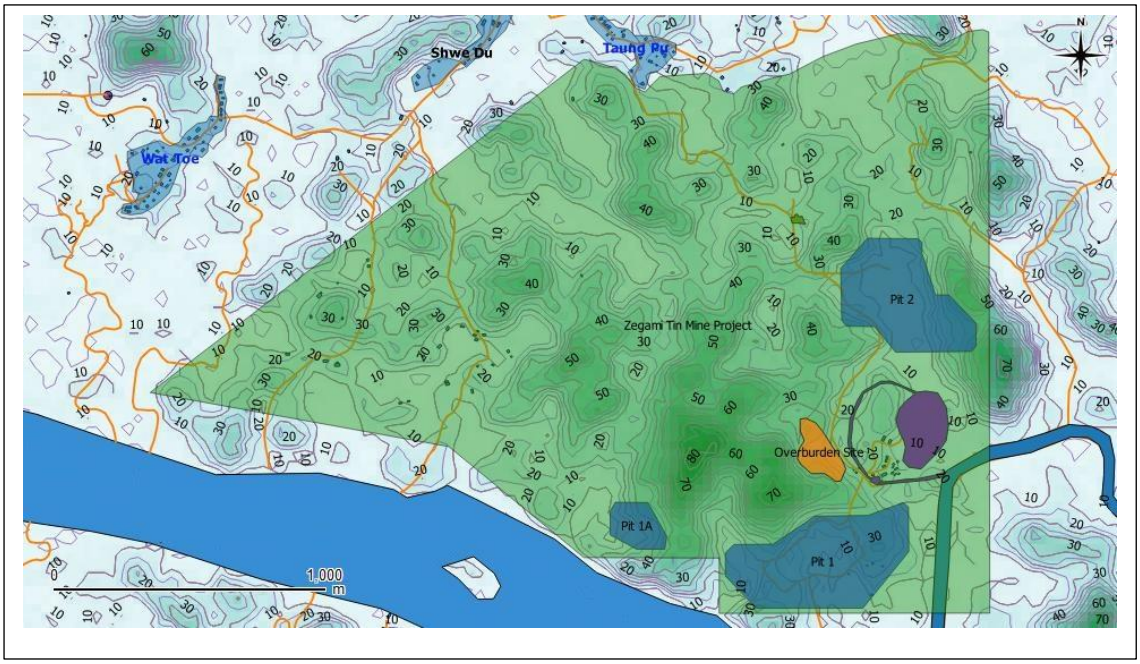


Figure 3. Topographic Map of the Project Area

3.5.2 Water Resources

Total amount of water required for various mineral processing operations is estimated to be 425 cubic meters per hour. The required amount of water will be obtained from nearby river or stream, channeled into the fresh water storage pond. A

stand-by pumping station is installed to replenish water in the dry season. A pontoon mounted 12/10 inch pressure pump will be employed for dewatering the mine pit during rainy season to protect large amount of influx of water. Discharge water will be available for use in clearing muddy tailings in the course of operations.

3.5.3 Geology and Soils, Hydrology/ Hydrogeology

The regional geology of the proposed area is predominantly covered by Mergui meta- sediments that is argillite, quartzite and schist which are trending N-S, dipping to the east. No intrusion is noted except pegmatite.

The local geology of the proposed area is widely covered by Argillite. Most of the argillite are altered by pegmatite intrusion and change its color into reddish to reddish brown. All these argillite are thinly bedded and quartzite are also highly weathered sometime it may be called quartzotic sandstone. Quartzite is interceded with micaceous green schist. From drill holes data, thickness of argillite is 50 to 100 ft.

3.5.3.1 Physiography

Zegami village is situated on the island formed between Thanintharyi river and Anyin chaung covering about 62 square miles. Generally, all mountain ranges are trending N-S to NW-SE in direction. The highest point in the region is 441 ft (grid ref,754549) and the highest point in our exploration area is 320 ft (grid ref. 754421). Two major ranges are trending parallel forming valley, creek and low flat land. Most of the hills are covered by cashew nut plantation, while low flat land become paddy field. All steams in this area is tidal effected.

3.5.3.2 Mineralization

Tin is occurred associated with highly weathered, highly decomposed pegmatite. Pegmatite is friable, very soft like sand. Local miners call it sand vein (Thaegyaw) and in some places local people call it white ground vein as the color of decomposed pegmatite is pure white. Most of the pegmatite occurrences are found under highly weathered or altered argillite and reddish brown color mudstone. In some places, tiny veinlet are noted in weathered argillite zone and tin content is rich in argillite in this situation. Pegmatite contains lepidolite mica at its outer zone and if weathered it turns to red color. This red color is the ore guide for pegmatite exploration.

Pitching and swelling of pegmatite ore zone is recognized in both lateral and vertical direction.

3.5.3.3. Characterization of Mined Materials

To investigate the mineralogical and chemical properties of mine materials, representative soil samples were mainly collected from the overburden soil (ZGM 1), Ore (ZGM 2), two samples from existing mine tailings of previous mine (ZGM 3 and ZGM 4) and agriculture soil (ZGM 5). The mineralogical and chemical compositions of these samples were investigated by XRD and XRF analyses. XRF analyses were conducted at University of Research Center, University of Mandalay, while XRD analyses were conducted at National Analytical Laboratory, Department of Research and Innovation, Ministry of Education.

3.5.3.3.1 Chemical composition of whole rock analysis

The XRF results showing wt. % of element in the soil samples is presented in Table 13. The results showed that all of the soil samples have high concentration of Si and Al with low concentration of S. However, the As content of ZGM 1 and ZGM 4 samples were 49 mg/kg and 64 mg/kg, respectively, whereas the As was not detected in ZGM 2, ZGM 3 and ZGM 5 samples. According to the results, the As content of ZGM 1 and ZGM 4 samples is higher than the average As concentration of sedimentary rock (around 5-10 mg/kg). Moreover, high content of Cr was observed in ZGM 1 (167 mg/kg).

The concentrations of toxic elements in ZGM 3 and ZGM 4 were analyzed at Pesticide Analytical Laboratory, Department of Agriculture, Ministry of Agriculture and Irrigation and the results are shown in Table 2. The analytical results of soil samples showed that concentrations of Ni, Cu and Zn in the soil sample (ZGM 3) were lower than the maximum permission level, whereas Pb, As and Cd were not detected. Similarly, the concentrations of Ni, Cu, Pb and Zn were below the maximum permission level in the soil sample of ZGM 4, while the As and Cd were not detected.

Table 13. Weight percent of elements in the samples

Sample	Si (wt.%)	Ti (wt.%)	Al (wt.%)	Fe (wt.%)	Mn (wt.%)	Mg (wt.%)	Ca (wt.%)	Na (wt.%)	K (wt.%)	P (wt.%)	S (wt.%)	As (mg/kg)	Cr (mg/kg)
Overburden soil (ZGM 1)	25.3	0.799	17.8	5.37	-	0.317	0.049	-	2.00	0.054	0.028	49	167
Ore rock (ZGM 2)	27.7	0.035	20.4	0.66	0.016	-	0.015	-	0.723	0.043	0.005	-	-
Tailing (ZGM 3)	34.1	0.185	11.7	1.14	0.015	0.221	-	-	1.45	0.067	0.146	-	-
Tailing (ZGM 4)	30.6	0.504	11.0	5.89	-	0.522	0.062		2.36	0.046	0.111	64	-
Agricultural soil (ZGM 5)	32.4	0.63	11.2	2.35	-	0.385	0.076	0.832	2.28	0.462	0.079	-	-

Table 14. Concentrations of heavy metals in Tailing samples

Elements	ZGM3	ZGM4	Maximum permitted level
	(concentration in ppm)	(concentration in ppm)	(ppm)
Cd	ND	ND	0.8
Ni	0.1	13.5	35
Pb	ND	3.15	85
As	ND	ND	29
Cu	0.65	4	20-300
Zn	14.65	18.5	20-100

3.5.3.3.2 Mineralogy of whole rock analysis

According to XRD results, the samples of overburden soil (ZGM 1), ore rock (ZGM 2) and mine tailing (ZGM 3) and were especially composed of the silicate minerals. The mineralogical compositions of the samples are shown in Appendix (1). The prominent mineral phase observed in ZGM1 and ZGM3 were silicate minerals like quartz and kaolinite whereas the iron sulphate mineral, xitieshanite was detected in ZGM2 in addition to silicate mineral.

3.5.3.4. Identification of potential geological impacts

The geological environment includes the parent rock and the soil overburden. Important or prominent geological features (geosites) that contribute to the aesthetic scenery of geological interest in the area, such as fossil sites, prominent rock outcrops or features must also be considered in the impact study. Geological features, such as caves, addits, middens, worship rocks, etc. which are important from heritage standpoint are not covered in this report as they are covered in the Heritage Impact Assessment. No prominent geological feature (geosites), such as fossil sites, prominent rock outcrops or features are present according to the previous literatures and there are no other known geo-sites within the study area.

Besides, hydrogeological assessments also do not form part of this study. But, Acid mine drainage and contaminant leaching will be discussed based on the base line data for impacts on water resources. Besides, impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities and mine wastes into surface waters will be discussed.

Mining is widely regarded as having adverse effects on environment of both magnitude and diversity. Some of these effects include erosion, formation of sinkhole, biodiversity loss and contamination of groundwater by chemical from the mining process in general and open-pit mining in particular.

The effects of open-pit mining and mineral processing plants on the environment include land degradation, noise, dust, poisonous gases, pollution of water, etc. Water pollution is another aspect of mine operations greatly impacting the environment. If a springhead is situated in the mine area, the pollution endangers springs existed in the area. Similarly, the contaminated water in the mining operation has vital impacts on the rivers, agriculture, fresh drinking waters and ecosystems,

because of abundance of heavy metals, suspended solid particles and decreasing level of pH.

Decreasing water level in the mines due to drainage not only causes undesirable changes in the nearby lakes but it can also threat the aquatics. The main reason of environment pollution of the fresh water is acidic water, draining from mines. Mining operations with degradation of the land largely contribute to the corrosion of soil—a phenomenon that can be seen more in the surface mining activities.

Mine waste can be defined as part of the materials resulting from the exploration, mining and processing of substances governed by legislation on mines and quarries. It may consist of natural materials without any modification other than crushing (ordinary mining waste, unusable mineralized materials), processed to varying degrees during the ore-dressing and enrichment phases, and possibly containing chemical, inorganic and organic additives. As overburden and topsoil are classified as waste the characteristics of such spoil could be variable and are influenced by the minerals and process methods involved the specific environmental situation, and the type of dumping and alteration. Much of the mine wastes has high concentration of heavy metals and toxic materials like lead, copper, zinc, aluminum, mercury, marcasite and pyrite (FeS_2), which are harmful for the environment. Specifically, wastes containing pyrite have the potentials of creating dangerous acid mine drainage (AMD). The proposed activity may have certain impacts on the geological environment, and this need to be assessed as an integral part of the broader EIA study.

3.5.3.4.1 Geological Impacts

By the very nature of the activity, mining will impact detrimentally on the physical composition of the environment. The removal of mineralized rock for feed to the tin processing plant will change the geological formation at the mining site permanently. The removal of mineralized rock and changing of the geological composition at the site cannot be mitigated.

3.5.3.4.2 Geomorphic Impacts

The geomorphic impacts caused by open- pit mining activities have an associated, often dramatic, visual impact. Open-pit mining is a type of strip mining in

which the ore deposit extends in the ground, necessitating the removal of layer upon layer of overburden and ore. In many cases, logging of trees and clear-cutting or burning of vegetation above the ore deposit may precede removal of the overburden. The use of heavy machinery, usually bulldozers and dump trucks, is the most common means of removing overburden. The principal geomorphic impact of open-pit mining is the removal of overburden, which results in the destruction of habitat including relict and active caves and natural sinkholes. The extent of the geomorphic impact is a function of the size of the open-pit mine especially with respect to the overall landscape and the local landforms. The influence of open-pit mine size on environmental impact is obvious: all other things being equal, the larger the mine, the larger the geomorphic impact. According to geological report from proposed mine project and the geological setting of proposed area, there is no relict, active caves and natural sinkholes. The area is covered with natural vegetation such as bamboo and useless trees and around of foreshore, is growing nipa palm with natural streams flowing from there. The potential geomorphic impact generated by open-pit mine is removal of overburden soil and destruction of land form and landscape.

3.5.3.4.3 Land Degradation and Overburden Waste

Mining and its subsequent activities have been found to degrade the land to a significant extent. Overburden removal from the mine area results in a very significant loss of rain forest and the rich top soil. Overburden removal is normally done by the process of blasting or using excavators, which results in generation of large volume of waste (soil, debris and other material). This is useless for the industry and is normally just stored in big piles within the mine lease area, and sometimes, on public land. The bigger the scale of the mine, greater is the quantum of waste generated. Opencast mines are therefore more pollution intensive as they generate much higher quantities of waste compared to the underground mines. Open-pit mines produce 8 to 10 times as much waste as underground mines.

3.5.3.4.3.1 Overburden Waste Quantities

The ratio of overburden excavated to the amount of mineral removed is called the stripping ratio. For example a stripping ratio of 4:1 means that 4 tons of waste rock

are removed to extract one tonne of ore. Lower the ratio, the more productive the mine. Stripping ratio varies with the area under mining.

According to the data generated by report on the feasibility of implementing the proposed mine, the ratio is low waste to ore ratio averaging 1:4.3. Pit design for Ore Block 1 at final pit slope of 1 : 1 resulted in a mining pit having a total area of 13.41 hectares. At average waste to ore ratio of 1 : 4.3 total volume of waste to be removed from the pit to expose the ore body is estimated at 425,255 m^3 and total volume of to be treated is estimated at 1,828,598 m^3 . At monthly average volumes of overburden to be removed and ore to be treated by the mineral processing plant of 11,493 m^3 and 49,326 m^3 respectively, the pit is capable to sustain a mine life of about 37 months.

3.5.3.4.3.2 Waste Disposal

According to the report on the feasibility of implementing the proposed mine, overburden and tailings from the mine are expected to dump into mined out area once the mined out area is available.

3.5.3.4.3.3 Geochemical Nature of Overburden Waste

The geochemical nature of overburden waste collected from ore block tested by XRD analysis indicates that it is composed by silicate minerals such as quartz and kaolinite predominantly. There is no significant sulphide mineral in overburden waste based on XRD analysis. However, there is occurred the trace amount of Arsenic (As) less than 100 ppm.

3.5.3.4.3.4 Soil Erosion and Sedimentation

The land degradation caused by open-pit mining activity is the removal, alteration or damage to soil and soil-forming processes which can be due to natural processes, such as erosion, or human influence during open-pit mining activities. The preservation of the natural soil is important to maintain environmental status.

Potential impacts relating to soil degradation are anticipated for the proposed activity. Such impacts include soil erosion and sedimentation. For most mining projects, the potential of soil and sediment eroding into and degrading surface water quality is a serious problem. Because of the large area of land disturbed by mining

operations and the large quantities of earthen materials exposed at sites, erosion can be a major concern at hard rock mining sites. Erosion may cause significant loading of sediments (and any entrained chemical pollutants) to nearby water bodies, especially during severe storm events and high snow melt periods. The types of impacts associated with erosion and sedimentation are numerous, typically producing both short-term and long-term impacts. Minerals associated with deposited sediments may depress the pH of surface runoff thereby mobilizing heavy metals that can infiltrate into the surrounding subsoil or can be carried away to nearby surface waters. The associated impacts could include substantial pH depression or metals loading to surface waters and/or persistent contamination of ground water sources. Contaminated sediments may also lower the pH of soils to the extent that vegetation and suitable habitat are lost. There are potential physical impacts associated with the increased runoff velocities and volumes from new land disturbance activities. Increased velocities and volumes can lead to downstream flooding, scouring of stream channels. The major causes of erosion problems at a surface mining operation are the extent of the disturbed areas, poor drainage plans and the lack of a sediment control strategy which is integrated with the mining operations.

3.5.3.4.4. Acid Mine Drainage (AMD) and Contaminant Leaching Potential

Degradation of water systems, including rivers, lakes, and marine coastal waters, and their aquatic ecosystems, is one of the most significant environmental impacts of mining. Sources of water pollution vary from discharge of process effluents containing remnants of process chemicals, to AMD from the mine or from mine waste dumps. The nature of wastewaters from mineral processing varies widely.

Rock containing sulphides oxidizes on contact with the air, producing sulphuric acid. AMD may originate from rainfall dissolving acidic salts from excavated mine surfaces, or as leachate emerging from oxidizing waste rock dumps or tailing disposal facilities. Leachates commonly dissolve metals from materials which they contact. In this way, metal may migrate to the groundwater or to the surrounding surface environment.

The most serious and pervasive environmental problem related to mine water management is arguably AMD and it is commonly associated with gold, copper, and other metal sulphide mining projects. It is also common at coal mines where sulphide

minerals may occur on partings in the coal or in interbedded shale. However, there are many mining projects where there is no potential for AMD. These include most laterite mining projects for nickel, iron and alumina, many uranium projects diamond and placer tin mines. Acid generation occurs when mine openings, pit walls, and sulphide-rich materials in waste rock and tailings exposed to, and react with, oxygen and water to form sulpuric acid as shown in Eq (1). Sulphuric acid, which is generally easily, dissolves metals such as iron, copper, aluminium, and lead. Sometimes dissolved metals in AMD discolour water and cause stains on exposed rocks and streambed. If this happens, AMD is easily detected by eye.

$$FeS_2 + 15/4O_2 + 7/2H_2O \rightarrow Fe(OH)_3 + 2H_2SO_4 \qquad \text{Eq (1)}$$

One of the most serious aspects of AMD is its persistence in the environment. An acid-generating mine waste storage facility has the potential for long-term, severe impacts on surface and groundwater and aquatic life. The process will continue until there are no remaining sulphides. This can take centuries, given the large quantities of exposed rock at some mine sites. Once the process of acid generation has started, it is difficult to stop. The combination of acidity and dissolved metals may harm or even kill aquatic life, rendering streams nearly sterile and making water unfit for human consumption.

AMD may occur in or may be derive from many parts of an operation, including:

- Runoff from surface excavations for access roads, drains, and site facilities
    - Drainage or seepage from underground excavations form mine access, exploration, development, ventilation, and extraction
- Runoff from open pit mines – exposures in pit walls, berms, and the mine floors
- Seepage of contaminated groundwater into surface or underground mines
    - Percolation through and drainage from rock masses fragmented by block caving or subsidence
- Runoff and/or drainage from stockpiles of ore awaiting processing
- Runoff and/or drainage from waste rock storages including coal rejects piles,
    - Seepage or overflow spillages or remnants of mineral concentrates around stockpiles, bins, conveyor transfer points, etc.

In the present study, the XRF and XRD results showed that there is a low concentration of S and any sulfide mineral was detected in all samples collected. The result indicated that the potential of AMD may be slightly low. However, monitoring should be done at least per week to assess the potential for AMD. The simplest tests used to delineate areas of AMD in the field, are the paste pH and electrical conductivity tests. For these tests, samples of less than 50 g are crushed to less than 1 mm and mixed with distilled water at a solid to liquid ratio of 1:2 (w/w) to form a paste. After period of equilibration, usually overnight, the pH and conductivity are measured. A pH of less than 4 indicates an acidic sample. An electrical conductivity of more than 2 deci-seimens per meter (ds/m) indicates high level of soluble salts, a result of oxidation with possible neutralization. Similar tests can be conducted on drill cores samples.

3.5.3.4.5. Impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities

The impacts of wet tailings impoundments, waste rock, heap leach, and dump leach facilities on water quality can be severe. These impacts include contamination of groundwater beneath these facilities and surface waters. Toxic substances can leach from these facilities, percolate through the ground, and contaminate groundwater, especially if the bottom of these facilities is not fitted with an impermeable liner.

A number of environmental concerns are associated with the disposal of waste rock. Waste rock dumps have a large footprint, and they often have a strong visual impact. Waste rock geochemistry affects runoff and leachate, often turning water into wastewater. Finally, erosion by water and wind may occur, and rehabilitation of waste dumps may be difficult to achieve, especially in arid environments.

Tailings (a by-product of metallic ore processing) is a high-volume waste that can contain harmful quantities of toxic substances, including arsenic, lead, cadmium, chromium, nickel, and cyanide (if cyanide leaching is used). Although it is rarely the environmentally-preferable option, most mining companies dispose of tailings by mixing them with water (to form a slurry) and disposing of the slurry behind a tall dam in a large wet tailings impoundment. Because the ore is usually extracted as a slurry, the resulting waste contains large amounts of water, and generally forms ponds at the top of the tailings dams that can be a threat to wildlife. Cyanide tailings in precious metals mines are particularly dangerous. Ultimately, tailing ponds will either dry, in

arid climates, or may release contaminated water, in wet climates. In both cases, specific management techniques are required to close these waste repositories and reduce environmental threats. During periods of heavy rain, more water may enter a tailings impoundment than it has the capacity to contain, necessitating the release of tailings impoundment effluent. Since this effluent can contain toxic substances, the release of this effluent can seriously degrade water quality of surrounding rivers and streams, especially if the effluent is not treated prior to discharge. Dozens of dam breaks at wet tailings impoundments have created some of the worst environmental consequences of all industrial accidents. Contaminated runoff and leachate from tailings storage areas pose threats to groundwater and surface water quality. Tailings may be acid generating, creating a long-term environmental liability for the mine operator. Because tailings are fine-grained they can be easily eroded by wind when they are dry. Finally, tailings disposal requires significant land areas, thereby creating undesirable visual impacts.

The results showed that the possible impact on leaching of toxic elements from tailing and waste rocks may not be serious. However, the XRF result showed that high content of As and Cr was observed in overburden soil (ZGM1) and tailing (ZGM4). The disposal of waste rocks like tailings and overburden soil should be done systematically to protect the potential environmental problem. In addition, monitoring of tailing disposal operations and storages should be taken place for several purposes; including - determining whether the tailings discharged to the storage have the same characteristics as predicted in the feasibility and environmental studies, and if not, whether the differences requires changes in design or operating procedures

- providing early warning of the development of conditions that could lead to unwanted events

- identifying areas or installations requiring maintenance or repairs

- providing feedback to improve management

- measuring the environmental effects of the operations, particularly the quantity and quality of seepage water

3.5.3.5. Assessment of potential geological impacts

The proposed activity will conduct open-pit mining activities using open-pit dry mining method, overburden and tailing disposal and construction of associated infrastructures. The important issues are the direct impacts of geomorphic impact generated by open pit mining activities, soil degradation generated by mining activities which include soil removal, soil alteration, soil pollution and specifically, soil erosion. Besides, Acid mine drainage and contaminant Leaching and Impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities are also considered as potential impact.

Table 15. Potential Environmental Impacts

Activity/ process	**Potential Environmental Impact**	**Nature**	**Extent**
Open-pit mining activities	• Geology • Geomorphic impact • Land degradation • Overburden waste	1. The removal of mineralized rock for feed to the tin processing plant will change the geological formation at the mining site permanently. The removal of mineralized rock and changing of the geological composition at the site cannot be migrated. 2. Geomorphic impact including removal of overburden soil and rock, destruction of land form and landscape and disruption of streams and its courses	Local to regional if mitigation measure cannot be done successfully for 2 and 3

		3. Overburden waste management problem	
Open-pit mining activities	• Erosion of soil and mine wastes into surface water	1. Significant loading of sediments to nearby waterbodies, especially during severe storm events 2. Soil and sediment eroding into and degrading surface water quality	Local to Regional
Open-pit mining activities	• Soil alteration	Alteration of soil texture, density, structure and chemistry due to soil mixing, stockpiling, compaction and removal of overburden soil	Local only
Open-pit mining activities	• Soil Pollution	Pollution of in situ soil due to spillage of hazardous substances such as fuel, oil and tailing	Local to regional
Open-pit mining activities	• Acid mine drainage and contaminant Leaching	Low possibility	Local only
Open-pit mining activities	• Impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities	Low to moderate possibility	Local only

3.5.3.6. Mitigation of potential geological impacts

As mentioned above, proposed activities will have certain potential environmental impacts in proposed area. The potential impacts should be mitigated successfully in order to protect serious environmental problems in and around proposed area. The following mitigation measures should be considered for the framework for the Environmental Management Plan (EMP) based on several guidelines:

Potential Environmental Impact	**Strategies to mitigate potential impact**
• Geology • Geomorphic Impact • Overburden Waste	1. Mining activities should be done in restricted areas and activities should be kept to a minimum as far as possible (limit unnecessary earthworks etc.) 2. Excavation process should be monitored to prevent over-excavation 3. Reclamation of mined pits by filling backfilling, recontoured, and revegetation to create a final surface that is consistent with the original topography of the area. 4. Overburden and waste rock are materials that a mining company should consider returning to open pits as backfill, to prevent pit lake formation. 5. Afforestation and green belt development 6. Natural Drainage should not be obstructed 7. The size of open-pit mine site should be limited and should be done in restricted area. 8. Adequate reclamation and closure plan should be established. 9. The Reclamation and Closure Plan should not allow for the formation of a pit lake. If the plan allows for the formation of a pit lake, the plan should include a detailed discussion of the efficacy and feasibility of all possible options for the prevention of acid mine drainage within the pit

	lake, the potential characteristics of pit lake effluent, and its impact on groundwater and adjoining surface waters. 10. Overburden waste should not be dumped beside the natural drainages or agricultural field. It should be strictly prohibited. Overburden waste are not allowed into existing natural drainages.
• Erosion of soil and mine wastes into surface water	In developing a sediment control plan the following basic approach should be adopted: a. minimize the area which is disturbed at any one time; b. develop a drainage control system for the mine lease area; c. integrate drainage, erosion and sediment control into each stage of the mining operation; d. develop a mining and rehabilitation plan prior to initiating mining activities; e. construct drainage and erosion controls in advance of mining activities ; f. divert storm runoff away from areas with high erosion potential; g. incorporate measures to reduce the flow velocity of storm runoff; h. limit the handling of spoil and topsoil materials; i. rehabilitate areas as soon as possible; j. maintain drainage and erosion control measures. Erosion control must be considered from the beginning of operations through completion of reclamation.

• Soil alteration	1. Avoid soil compaction by restricting the use of trucks and heavy equipment to limited area 2. Ensure those vehicles are restricted to existing roads to avoid soil compaction within and around the project site
• Soil Pollution	1. Correct use of hazardous substances should be controlled in order to prevent soil pollution 2. Tailing storage facility design should be adequate to prevent not only soil pollution but also groundwater pollution and surface water pollution 3. The impoundment should not be located in recharge zone, establishing hydraulic with aquifer.
• Acid mine drainage and contaminant Leaching	1. Surface shaping and capping with low permeability material, to minimize infiltration of rainwater 2. Total encapsulation to minimize infiltration and also to restrict oxygen supply 3. Preferential placement, with high capacity potentially acid forming (PAF) materials placed in central parts of the dump, and non-acid forming (NAF) materials in outer zones [8] 4. Compaction to reduce overall permeability, to minimize cracks that enable ready access to air and water, and to provide low permeability barrier.
• Impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities	For tailings storage facilities with the potential for AMD, the following two alternative approaches may be used. (1) wet cover, which means maintaining a pond on the surface of the tailing, thereby excluding atmospheric oxygen (2) dry cover, in which a low permeability capping is placed over the surface of the tailings, limiting both the ingress of oxygen and infiltration of rainfall

	The following alternatives may be adopted for the disposal of tailing in the project area. (1) use of a wet tailings impoundment facility or 'tailings pond' (2) dewatering and disposal of dry tailings as paste backfill or 'dry tailings disposal' (3) the release of tailings into the deep sea via a long pipeline or 'submarine tailings disposal

The geological study discussed related geological features. The potential impacts on geologic environment of proposed area has identified that geological impact, geomorphic impact, land degradation and overburden waste, acid mine drainage and impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities are the potential impact associated with geological environment for proposed activity. According to an overview of the discussed geological characteristics of the site, the main potential impacts that have been identified are considered local to regional impacts to geologic environments. The less the EMP is adequate, the more the impact level will be increased. So, the mitigation of impacts should be carried out strictly and successfully based on the EMP.

3.5.4 Environmental Quality

3.5.4.1 Water quality

The baseline water quality status in the region established by analyzing samples at sixteen locations consisting of four surface water samples , four pond water samples, three tube water and five well water samples from the project area and nearby villages. The criteria for the selection of sites was determined on the project location, agricultural land, slope of the land surface, topographical upstream and downstream of the project, channel adjacent to irrigated field, potential areas of polluted water and the location of the drainage and its discharge system. All water samples were analyzed for their physiochemical properties in ISO TECH laboratory and the result are as shown in the following tables.

Table 16 Results of Water Quality Analysis (Surface Water)

Parameter	Unit	Water Samples				
		NEQG	SW1	SW2	SW3	SW4
PH	S.U.[a]	6-9	6.5	6.9	7.9	6.9
Conductivity	Micro S/cm					
Total Hardness	mg/l					
Total Alkalinity	mg/l					
Iron	mg/l	3.5				
Chloride (as Cl)	mg/l					
Suspended solids	mg/l		417	300	40	80
Dissolved Solid	mg/l					
Sulphate (as SO_4)	mg/l		1140	5200	39	5300
Salinity	ppt		17.4	22.1	0.3	23.7
Lead (as Pb)	mg/l		Nil	Nil	Nil	Nil
Arsenic (As)	mg/l	0.1	Nil	Nil	Nil	Nil
Ammonia (NH_3)	mg/l		1.0	0.4	0.3	Nil
Ammonia (NH_4)	mg/l		1.1	0.42	0.32	Nil
Biochemical Oxygen Demand (BOD)	ppm	50	40	30	10	24
Chemical Oxygen Demand (COD)	ppm	250	128	96	32	96
Zinc (Zn)	mg/l		Nil	Nil	Nil	Nil
Copper (Cu)	mg/l		Nil	Nil	Nil	Nil
Silica (Si)	mg/l		Nil	Nil	Nil	Nil

Table 17 Results of Water Quality Analysis (pond water)

Parameter	Unit	Water Samples				
		NEQG	PW1	PW2	PW3	PW4
PH	S.U.[a]	6-9	4.7	4.2	4.9	3.8
Conductivity	Micro S/cm					
Total Hardness	mg/l					
Total Alkalinity	mg/l					
Iron	mg/l	3.5				
Chloride (as Cl)	mg/l					
Suspended solids	mg/l		58	20	22	10
Dissolved Solid	mg/l					
Sulphate (as SO_4)	mg/l		5	980	Nil	64
Salinity	ppt		0.1	6.6	0.1	0.2
Lead (as Pb)			Nil	Nil	Nil	Nil
Arsenic (As)	mg/l	0.1	Nil	Nil	Nil	Nil
Ammonia (NH_3)	mg/l		0.2	Nil	Nil	Nil
Ammonia (NH_4)	mg/l		0.21	Nil	Nil	Nil
Biochemical Oxygen Demand (BOD)	ppm	50	14	20	14	8
Chemical Oxygen Demand (COD)	ppm	250	32	64	32	32
Cyanide (CN)	mg/l		Nil	Nil	Nil	Nil
Zinc (Zn)	mg/l		Nil	Nil	Nil	Nil
Copper (Cu)	mg/l		Nil	Nil	Nil	Nil

Table 18. Results of Water Quality Analysis (Tube Water)

Parameter	Unit	Water Samples			
		NEQG	TW1	TW2	TW3
PH	S.U.[a]	6-9	10.2	7.3	5.7
Conductivity	Micro S/cm				
Total Hardness	mg/l				
Total Alkalinity	mg/l				
Iron	mg/l	3.5			
Chloride (as Cl)	mg/l				
Suspended solids	mg/l		20	30	45
Dissolved Solid	mg/l				
Sulphate (as SO_4)	mg/l		5	138	Nil
Salinity	ppt		0.1	1.4	0.1
Lead (as Pb)			Nil	Nil	Nil
Arsenic (As)	mg/l	0.1	Nil	Nil	Nil
Ammonia (NH_3)	mg/l		Nil	Nil	Nil
Ammonia (NH_4)	mg/l		Nil	Nil	Nil
Biochemical Oxygen Demand (BOD)	ppm	50	8	12	10
Chemical Oxygen Demand (COD)	ppm	250	32	32	32
Cyanide (CN)	mg/l		Nil	Nil	Nil
Zinc (Zn)	mg/l		Nil	Nil	Nil
Copper (Cu)	mg/l		Nil	Nil	Nil

Table 19. Results of Water Quality Analysis (opened well water)

Parameter	Unit	Water Samples					
		NEQG	WW1	WW2	WW3	WW4	WW5
PH	S.U.[a]	6-9	5.1	5.5	4.6	6.0	5.8
Conductivity	Micro S/cm						
Total Hardness	mg/l						
Total Alkalinity	mg/l						
Iron	mg/l	3.5					
Chloride (as Cl)	mg/l						
Suspended solids	mg/l		26	30	12	7	8
Dissolved Solid	mg/l						
Sulphate (as SO_4)	mg/l		Nil	Nil	Nil	Nil	Nil
Salinity	ppt		0.1	0.1	0.1	0.1	0.1
Lead (as Pb)			Nil	Nil	Nil	Nil	Nil
Arsenic (As)	mg/l	0.1	Nil	Nil	Nil	Nil	Nil
Ammonia (NH_3)	mg/l		0.1	1.5	0.2	Nil	Nil
Ammonia (NH_4)	mg/l		0.11	1.59	0.21	Nil	Nil
Biochemical Oxygen Demand (BOD)	ppm	50	14	16	8	8	8
Chemical Oxygen Demand (COD)	ppm	250	32	32	32	32	32
Cyanide (CN)	mg/l		Nil	Nil	Nil	Nil	Nil
Zinc (Zn)	mg/l		Nil	Nil	Nil	Nil	Nil
Copper (Cu)	mg/l		Nil	Nil	Nil	Nil	Nil

Figure 4 Water Sampling

Location of sampling points for water samples are shown in following figure.

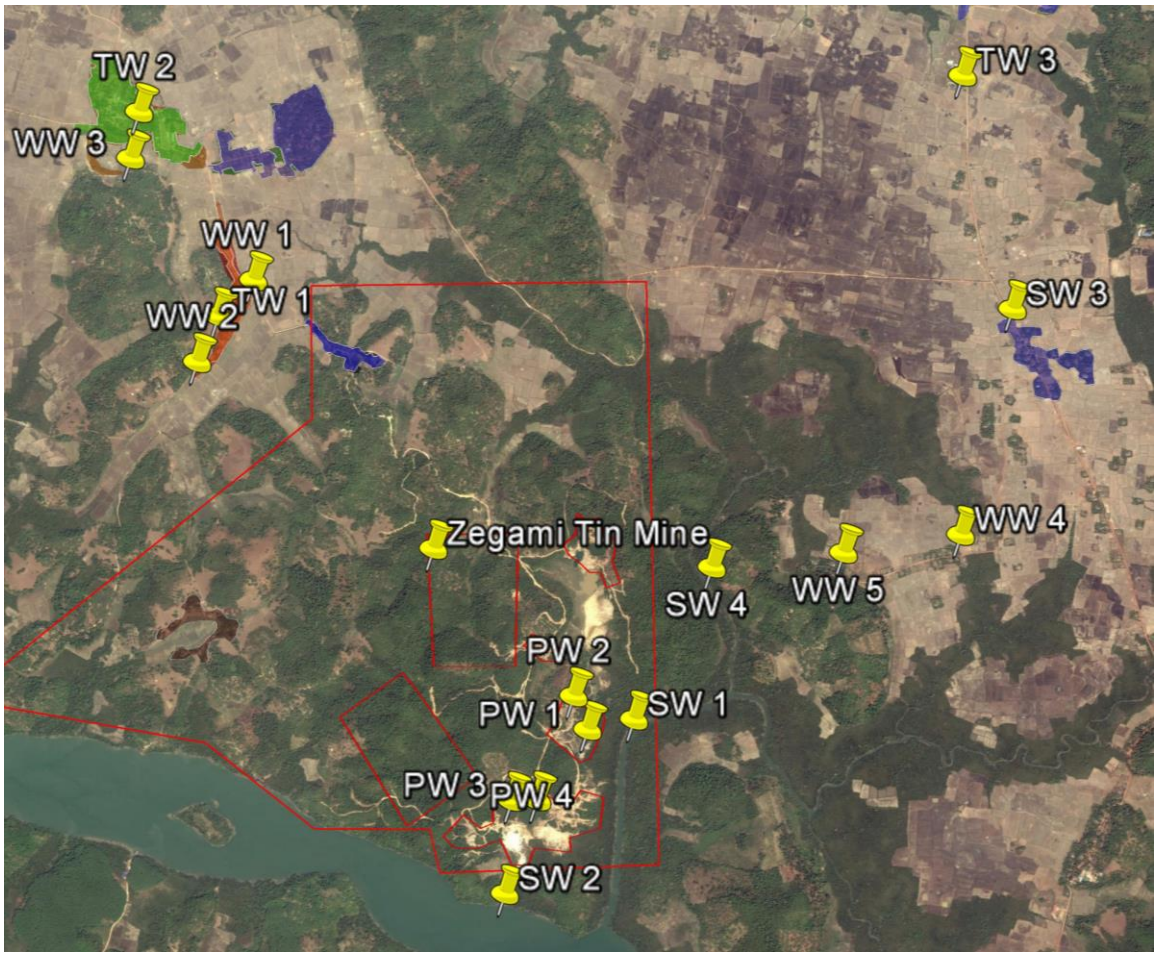


Figure 5. Sampling Points for Water Samples

3.5.4.2 Analysis on Water Quality Results

3.5.4.2.1 pH

pH value of the four surface water samples were 6.5, 6.9, 7.9 and 6.9 respectively. NEQG guideline for pH value of wastewater is 6-9 and the laboratory results were well within the range of guideline value. For pond water, pH values of the four samples were 4.7, 4.2, 4.9 and 3.8. So, the laboratory results were lower than NEQG guideline value. In three tube well water samples, 7.3 pH value of sample TW2 is within the limit but 10.2 pH value of sample TW1 is higher than the NEQG guideline value with pH 5.7. TW3 is lower than the guideline value. For opened well water, pH values of the samples were 5.1, 5.5, 4.6, 6.0 and 5.8. So, almost sample values are lower than the guideline value.

3.5.4.2.2 B.O.D

The maximum value of Biochemical Oxygen Demand was 40 ppm for Waste Water from project area. BOD content of wastewater from project area (40 ppm) is well within The NEQG standard guideline value of 50 ppm.

As of the A&M project, the project will generate domestic wastewater which will be discharged into the drainages nearby the project area. It is the responsibility of the project that the quality of the wastewater discharged must be in compliance with the set national guideline values.

3.5.4.2.3 C.O.D

For Chemical Oxygen Demand, the maximum value was 128 ppm for wastewater from project area. COD content of wastewater from project area is well within the NEQG standard guideline value of 250 ppm. The project has its responsibility to prevent adding up extra COD loading by treating its wastewater in compliance with the set guideline value.

3.5.5 Air Quality

Emission of air pollutants can occur from a wide variety of activities during the construction, operation, and decommissioning phases of the project. These activities can be point sources, fugitive sources, and mobile sources and by process such as combustion, materials storage, or other specific processed. Tin Mine project in near

Zegami Group of Villages will prevent or minimize impacts by ensuring that emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standard, and emission do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards.

3.5.5.1 Air Quality Survey Item

The parameters for air quality survey were CO_2, and Air Temperature, WBT, Dew Point, Relative Humidity and Wind Speed.

3.5.5.2 Air Quality Survey Location

To survey the air quality, there are ten air sampling points. There is No Construction works near the air station during air quality monitoring period, the possible emission source is mostly from smoke and particulate matter from vehicular movements or bypassing motorbikes through the air station (EPAS). The locations of the air sampling points are shown in the following table.

Table 20. The locations of air sampling points

Sr.	Sample Name	location	Coordinates	
			Latitude (N)	Longitude (E)
1	AS-1	Office area	12º18′33.16″	98º44′38.15″
2	AS-2	100m from the Office	12º18′34.77″	98º44′25.32″
3	AS-3	300m North Side of the Office area	12º18′22.64″	98º44′39.68″
4	AS-4	200m South Side of the Office area	12º18′49.75″	98º44′22.02″
5	AS-5	300m East Side of the Office area	12º18′51.99″	98º44′39.30″
6	AS-6	300m West Side of the Office area	12º18′54.30″	98º44′23.47″
7	AS-7	Near Shwedu Village	12º18′57.64″	98º44′1.55″
8	AS-8	Near Zegami Village	12º19′12.17″	98º43′55.51″
9	AS-9	Near Taungpu Village	12º19′4.68″	98º43′54.97″
10	AS-10	Residential Houses in Taungpu	12º18′44.65″	98º43′50.70″

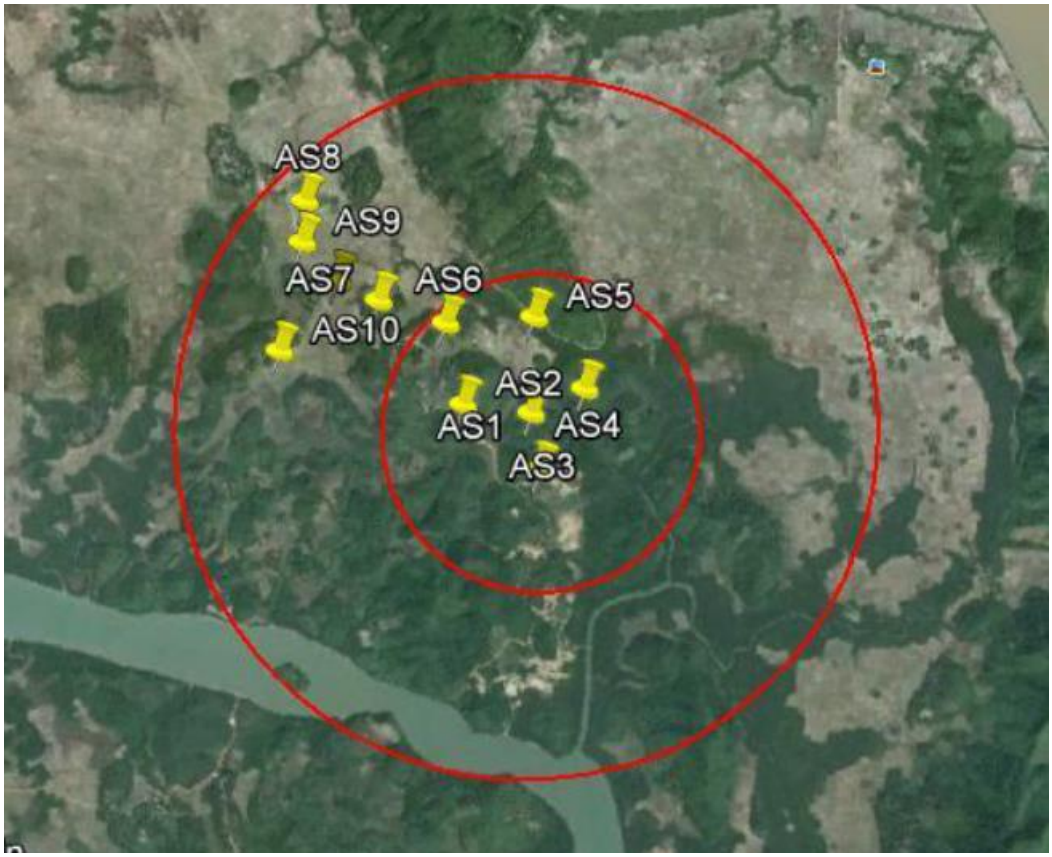


Figure 6. Air Quality Survey Location

3.5.5.3 Survey Result

The general conditions of ambient air quality at the time of sampling are shown in the following table.

Table 21. Survey Results Table

Sr.	Locations	Air Temp	WBT	Dew Point	Humidity	Time
1	Office area	27º	26.3º	26º	94%	7:30
2	100m from the Office	30.2º	26.1º	24.6º	73%	8:00
3	300m North Side of the Office area	30.5º	26,6º	24.8º	73%	10:30
4	200m South Side of the Office area	33.3º	27.8º	26º	63.5%	11:30
5	300m East Side of the Office area	34.5º	25.7º	24.4º	58.2%	1:30

6	300m West Side of the Office area	26.6º	25.5º	25.2º	93%	2:30
7	Near Shwedu Village	30º	26.6º	25.1º	70%	3:15
8	Near Zegami Village	35.0º	27.7º	25.5º	63.2%	4:00
9	Near Taungpu Village	34.2º	28.5º	25.8º	63.2%	4:30
10	Residential Houses in Taungpu	34.0º	27.2º	25.2	63.2%	5:00

The survey results of carbon dioxide concentrations are shown in the following table.

Table 22. Carbon Dioxide Concentrations

Sr.	Locations	CO_2(ppm)			Time
		Min	Max	STEL	
1	Office area	538	575	557	7:45
2	100m from the Office	446	456	448	8:15
3	300m North Side of the Office area	439	445	444	10:45
4	200m South Side of the Office area	446	501	447	11:55
5	300m East Side of the Office area	429	448	437	1:15
6	300m West Side of the Office area	477	488	482	2:50
7	Near Shwedu Village	435	447	425	3:15
8	Near Zegami Village	434	444	403	4:15
9	Near Taungpu Village	442	491	456	4:45
10	Residential Houses in Taungpu	433	443	438	5:15

According to the above table, average ambient air carbon dioxide levels range from 433 ppm to 575 ppm. According the result, Global carbon dioxide level is 401.3 ppm. So, It's could be noted that current ambient carbon dioxide level at the vicinity of the project is a little more than the global carbon dioxide level. But, the project is not a polluting project which emits carbon dioxide into the atmosphere; there could be no impact from the project on the background carbon dioxide level of local community.

Table 23. Wind Speed and Wind Direction

Sr.	Locations	Wind		
		Speed (ft/min)	Direction	Time
1	Office area	493	NS	7:30
2	100m from the Office	220	NS	8:00
3	300m North Side of the Office area	90	NS	10:30
4	200m South Side of the Office area	247	NS	11:30
5	300m East Side of the Office area	40	SN	1:30
6	300m West Side of the Office area	161	SN	2:30
7	Near Shwedu Village	124	SN	3:15
8	Near Zegami Village	40	SN	4:00
9	Near Taungpu Village	60	SN	4:30
10	Residential Houses in Taungpu	43	SN	5:00

3.5.6 Climate

Myeik has a tropical monsoon climate according to Köppen–Geiger climate classification system. Temperatures are very warm throughout the year. There is a short winter dry season (December–January) and a long wet season (February–November), with particularly heavy rain falling from May to September.

Table 24. Climate data of Myeik

Month	Average high °C (°F)	Average low °C (°F)	Average precipitation mm (inches)
January	31.4 (88.5)	20.7 (69.3)	4 (0.16)
February	32.1 (89.8)	21.6 (70.9)	51 (2.01)
March	33.1 (91.6)	23.1 (73.6)	55 (2.17)
April	33.6 (92.5)	24.6 (76.3)	128 (5.04)
May	31.8 (89.2)	24.2 (75.6)	422 (16.61)

June	29.4 (84.9)	23.6 (74.5)	783 (30.83)
July	29.1 (84.4)	23.4 (74.1)	740 (29.13)
August	28.8 (83.8)	23.3 (73.9)	868 (34.17)
September	29.5 (85.1)	23.5 (74.3)	482 (18.98)
October	30.7 (87.3)	23.2 (73.8)	302 (11.89)
November	31.6 (88.9)	22.7 (72.9)	73 (2.87)
December	31.5 (88.7)	21.0 (69.8)	13 (0.51)
Year	31.05 (87.89)	22.91 (73.25)	3921 (154.37)

Source: *"Myeik Climate Normals 1961-1990". National Oceanic and Atmospheric Administration.*

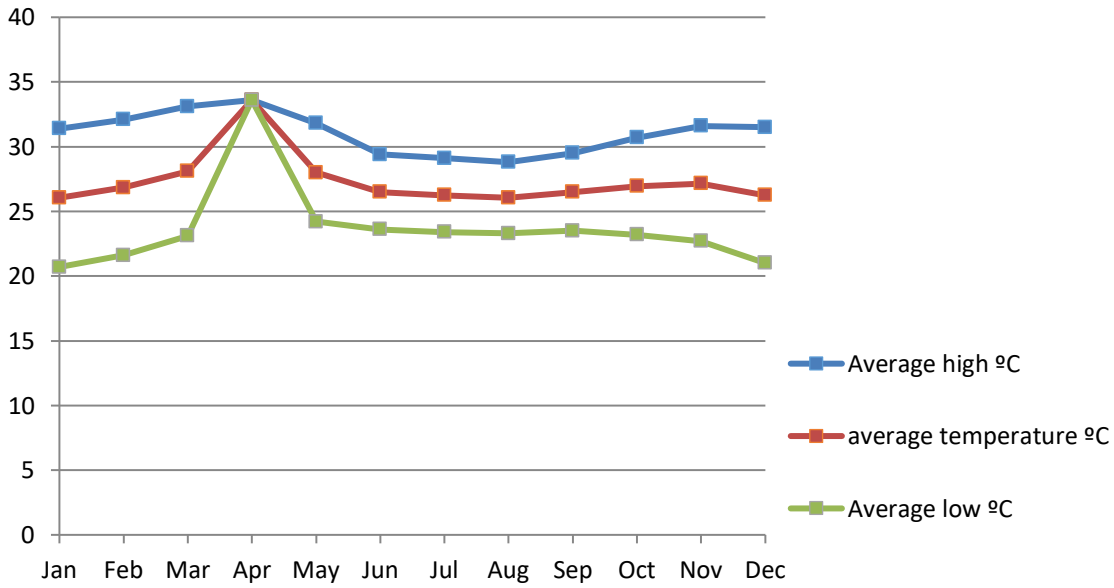


Figure 7. Temperature graph of Myeik

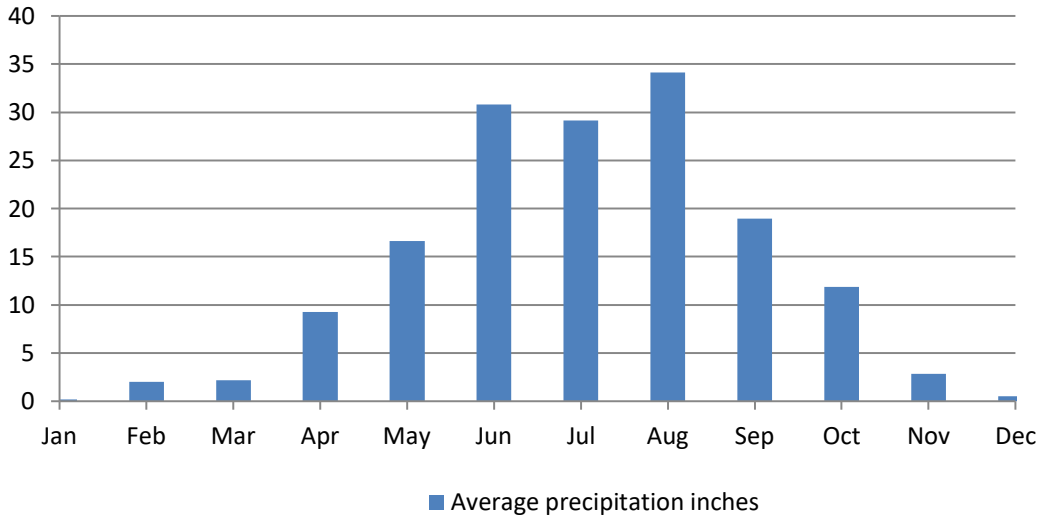


Figure 8. Rainfall Distribution of Myeik

3.5.7 Vegetation Cover

The area is mostly filled with secondary forest comprising plants and trees which are well suited for the humid tropical weather. Some of the fills or high ground areas have been cleared and planted with cashew nut.

3.5.8 Natural Hazards

The proposed project and its surrounding area is situated near the Andaman Sea and can be threatened by natural hazards. The following five hazards have the potential impacts on the project area:

- cyclones;
- earthquake;
- floods;
- storm surges; and
- tsunamis

Tropical cyclones are intense vortices in the atmosphere with strong winds circulating anti-clockwise around a low-pressure area. They are capable of causing massive destruction in three ways: by high winds; heavy rainfall causing inland flooding; and storm surge inundating low lying areas. They may last with destructive power for two weeks or more where a large open sea is available. The storm surges are by far the greatest killers in a cyclone. As a result of storm surge, sea water inundates low lying areas causing heavy floods in the project region, destroying vegetation and

reducing soil fertility. Very strong winds may damage overhead installations, dwellings, communication systems, trees etc., resulting in loss of life and property. Flood and tidal waves due to storm surges pollute drinking water sources resulting in shortage of drinking water and causing outbreak of epidemics, mostly water borne diseases.

Floods are excessive accumulation or flows of water, which result from heavy rainfall. They include flash floods, which are caused by rapidly rising and falling rivers and overland flows resulting from the rapid run-off of intense rainfall from upland areas (usually hilly upstream); river floods in which river water spills over adjoining land; rainwater floods from the ponding of rainfall run-off and the raised ground water-table flood plain depression; tidal flooding, usually saline from the outflow of coastal rivers at high tides; and storm surge floods associated with the passage of tropical cyclones.

Tsunami's (Japanese for "harbor wave"), are large waves generated by earthquakes, landslides, volcanic eruptions, explosions, and even the impact of cosmic bodies, which can savagely attack coastlines, causing devastating property damage and loss of life. Coastal zones are always prone to such tsunami hazards caused by natural phenomena occurring at regions far removed from the actual coastal zone. Although, tsunami is sometimes referred to as "seismic sea wave" because of its frequent association with an earthquake it can also be caused by a non-seismic event, such as a landslide or meteorite impact.

Tsunamis are characterized as shallow-water waves, with long periods and wave lengths. They are often observed with wavelengths in excess of 100 km and period on the order of one hour. Due to their large wavelengths, tsunamis propagate at high speeds; great transoceanic distances with limited energy losses. As a tsunami approaches shore, it begins to slow and grow in height. They inundate and flood hundreds of meters inland past the typical high-water level, damaging homes and other coastal structures. Despite energy losses on approaching shore, tsunamis still reach the coast with tremendous amounts of energy with great erosional potential, undermining trees and other coastal vegetation.

3.6 BIOLOGICAL COMPONENTS

Biodiversity, or the variety of life and its process, is a basis property of nature that provides enormous ecological, economic, and aesthetic benefits. Its loss is recognized as a major national as well as global concern, with potentially profound ecological and economic consequences.

Factors contributing to the deadline of biodiversity include physical alterations to the geography due to resource exploitation and changing land usages; pollution; overharvesting; introduction of exotic (non-native) species and elimination of native species through predation, competition, genetic modification, and disease transmission; disruption of natural process; and global climate change.

Impact identification methods such as interaction matrices, networks, or simple and descriptive checklists can provide a systematic basis for qualitatively delineating potential impacts of concerns. This description of existing Flora and Fauna primarily focuses on community types (habitat types) which include identifying certain selected species for each community types.

In this study, EIA team has focused on Biological Baseline Study and Impact Assessment of Zegami Tin Mine Project. The study identifies the biological impacts, existing biological condition, and mitigation measure for environmental management plan.

3.6.1 Objectives of the Study

- To evaluate the ecosystem that affects the flora and fauna those inhabited in the project area and nearby of the mine project
- To study and record the diversity of flora and fauna of this area
- To identify the recorded flora and fauna with their population assessment
- To assess and reveal the ecological and commercial values of different species of flora recorded from the mining sites and environs
- To identify the potential negative impacts of mine those may affect and threaten to the richness of biodiversity of the project area and nearby
- To recommend the mitigation measures and management plans for safety of flora and fauna diversity of the mining sites and environs

3.6.2 Fauna

3.6.2.1 Materials and Methods of Fauna Survey

Field studies of the direct impact area and indirect impact area were designated to record vertebrate species, i.e, fishes, amphibians, reptiles, birds and mammals. Fishery information and data were based on survey with the help of local people and fishermen. The larger fishes and herperto fauna such as frogs and toads were recorded thir morphological characters and identified urgently with the aids of field guide. Based

on interviews, some species those were difficult to catch had been also recorded as information within short duration of study period. Specimen collection dealt with insects, butterflies, dragonflies and damselflies were caught, identified and some had been carried as voucher specimens to identify later. Direct count method was applied to record and identify the different bird species with the aid of binoculars. Collected voucher specimens had been identified and those of the field were arranged and categorized in respective taxon with references.

3.6.2.2 Avifauna

An avifaunal survey conducted in April 13-18, 2015 was proposed to:

(a) Determine the bird species composition found on and in the vicinity of the proposed development site

(b) Identify the potential impacts of the proposed development on the avifauna.

Birds were identified and enumerated according to the Fixed Radius Point Count Census Method which is based on the principle of counting individuals from a defined location and estimating the distance to the individual contact. A point was selected from where all bird contacts (seen and heard) were recorded, and the distance estimated (< 25m or > 25m) for each contact. The procedure was repeated three times for every 10 min (Bibby *et al*., 1998), before moving to another location within a 100m radius. Avifaunal species observed between point counts were also recorded.

Avifauna identified was ranked according to the following criteria:

DAFOR Scale: D= 9-10; A= 7-8; F= 4-6; O=2-3; R=1

D = dominant, A = abundant, F = frequent, O = occasional, R = rare

Economic Scale Value – this value was based on five components: Status, DAFOR, IUCN rating

Advantages of this method include:

- Ease of observation of the birds and their habitats from a stationary position
- More time available to identify contacts
- Greater opportunity to identify cryptic and skulking species
- Easier to relate bird occurrence to habitat features

This method was used and a total of six (6) points done over a one day period (morning), following the parochial road, as well as along other paths within the area. Notation of species observed between surveys points formed the basis of transects counts for the area.

3.6.2.3 Other Fauna

Other animal groups examined on the direct and indirect impacts area were insects, fishes, amphibians, reptiles and small mammals being the most obvious groups observed on the site. Surveys to identify the presence or absence of these groups of animals were conducted through the use of stationary observation sites and walking transects on the property for general identification and utilizing the point count method. Recorded fish species have been studied with the help of fishermen at the aquatic environment closer up to the project area.

The **DAFOR** scale is an internationally recognized abundance scale for counting wildlife and other populations. It evaluates populations either quantitatively or qualitatively by dividing observations according to whether the population item is Dense, Abundant, Frequent, Occasional or Rare in numbers.

3.6.2.4 Results and Findings of Fauna

3.6.2.4.1 Insect fauna

A total of (49) species of insects including butterflies, dragonflies, damselflies represented with (13) families under the order Lepidoptera and Odonata were collected and identified (Table 25 and Table 26). Although no endemic or endangered species were recorded the collected species and population size was moderate in the study area.

Table 25. List of dragonfly (order- Odonata) from Zegami Tin Mine Project area

No.	Family	Scientific Name	Common name	Status
1.	Gomphidae	*Ictinogomphous rapax* (Male)	Common club tail	common
2.	Aeshnidae	*Anaciaeschnajaspidea*	Rusty darner	uncommon
3.		*Hemianax epiphiger*	Vagrant darner	common
4.	Libellurdae	*Acisoma panorpoides* (Female)	Trumpet tail	common
5.		*Brachydiplax sobrina*	Marsh hawk.	common
6.		*Brachythemis contaminate* (Male)	Little blue marsh hawks	Locally common

No.	Family	Scientific Name	Common name	Status
7.		*Crocothemis servilia* (Male)	Ditch jewel	common
8.		*Crocothemis servilia* (Female)	Ruddy marsh skimmer	common
9.		*Diplacodes trivialis* (Male)	Ground skimmer	very common
10.		*Diplacodes trivialis* (Female)	Ground skimmer	very common
11.		*Neuurothemis fluvia* (Male)	Fulvous forest skimmer	locally common
12.		*Neurothemis intermedia* (Female)	Ruddy meadow skimmer	locally common
13.		*Neurothemis tullia* (male)	Pied paddy skimmer	locally common
14.		*Neurothemis tullia* (Female)	Pied paddy skimmer	locally common
15.	Cordulegastridae	*Orthetrum pruinosum* (Male)	Crimson – tailed marsh havk	common
16.		*Orthetrum sabina* (Male)	Green marsh hawk	very common
17.		*Orthetrum sabina* (Female)		common
18.		*Potamarcha congener* (Male)	Yellow-tailed ashy skimmer	common
19.		*Rhodothemis rufa* (Male)	Rufous marsh glider	uncommon
20.		*Tramea Limbata* (Female)	Black marsh trotter	locally common

Ictinogomphaus rapax

Anaciaeschna jaspidea

Hemianax epiphiger

Acisoma panarpoides

Brachydiplax sobrina

Brachythemis contaminata

Crocothemis servilia (male)

Crocothemis servilia (female)

Diplocodes trivialis (male)

Diplocodes trivialis (female)

Neurothemis fulvia (male)

Neurothemis intermedia (female)

Neurothemis tullia (male)

Neurothemis tullia (female)

Ortherum pruinosums (female)

Ortherum sabina (male)

Ortherum sabina (female)

Potamarcha congener (male)

Rhodothemis rufa (male)

Tramea limbata (female)

Plate 2. Dragonfly species recorded from Zegami Tin Mine Project area

Table 26. List of Damselfly (Order Odonata) recorded from Project area

No.	Family	Scientific Name	Common name	Status
1..	Coenagrionidae	*Agriocnemis pygmaea*	Pigmy dartlcy	very common
2.		*Ceragrion auranticum*	Orange morsh dart	very common
3.		*Ceragrion coramandeliamum*	Coromandel marsh dart	very common
4.		*Enallagma parvum*	Azure dartlet	uncommon
5.		*Ischnura aurora*		common
6.		*Ischnura senegalensis*	Senegal golden dartley	Locally common
7.	Lestidae	*Lestes clatus*	Emcrald spread wing	uncommon
8.	Protoneuridae	*Caconeura ramburi*	Coorg bamboo tail	uncommon

Table 27. List of recorded Butterfly species (order Lepidoptera) from Project area

No.	Family	Scientific Name	Status
1.	Papilionidae	*Papilio polytes romulus*	VC
2.		*Pachliopta doubledayi*	RC
3.	Pieridae	*Catopsilia Scylla*	C
4.		*Appias lyncisa*	C
5.		*Leptosia nma*	C
6.		*Delias hyparete*	C
7.		*Eurema hecabe*	C
8.		*Hebomoia gloucippe*	C
9.	Nymphalidae	*Junonia almanac*	C
10.		*Junonia atlites*	C
11.		*Neptis Sappho*	UC
12.		*Tanaecia flora*	UC
13.	Satyridae	*Elymnias hypermnestra*	C
14.		*Mycalesis sangaica*	C
15.		*Ypthima Philomela*	UC
16.	Danidae	*Euploea godarta*	C
17.		*Danaus chrysippus*	C
18.		*Parantica aglcoides*	C
19.		*Acraea terpsicore*	C
20.		*Amathusia phidippus*	C
21.	Lycaenidae	*Castalius rosimon*	C

Common (C), Very Common (VC), Uncommon (UC), Rare (R)

(Upperside) (Underside)

A. *Papilio polytes*

(Upperside) (Underside)

(B) *Pachliopta doubledayi*

(Upperside) (Underside)

E. *Appias lyncida*

(Upperside) (Underside)

F. *Leptosia nina*

(Upperside)

(Underside)

H. *Eurema hecabe*

(Upperside)

(Underside)

E. *Neptis sappho*

(Upperside)

(Underside)

F. *Tanaecia flora*

(Upperside)

(Underside)

L. *Mycalesis sangaica*

(Upperside)

(Underside)

M. *Ypthima philomela*

(Upperside)

(Underside)

N. *Euploea godarti*

(Upperside)

(Underside)

Q. *Danaus chrysippus*

(Upperside)

(Underside)

R. *Parantica agleoides*

(Upperside)

(Underside)

S. *Acraea terpsicore*

(Upperside)

(Underside)

T. *Amathusia phidippus*

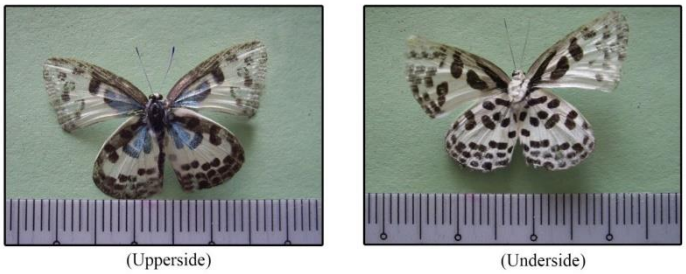


Figure 9. Butterfly species recorded from Zegami Tin Mine Project area

3.6.2.4.2 Fishes

Local fishermen near from this project helped for the collection of fish specimens. Total of freshwater (40) fish species included in (22) families under (7) order and those of marine (73) fish species included in (42) families under (22) order were recorded (Table 28 and Table 29) during study period.

Some larger species could be taken photo and identified in the field survey at fish landing site of Anyin creek where is brackish and marine upto the tide and other small species were collected as specimen voucher and identified later at office of Zegami Tin Mine Project.

Table 28. List of recorded freshwater fish Species from Project area

No	Order	Family	Scientific Name	Common Name	Vernacular Name
1	Osteoglossiformes	Notopteridae	*Notopterus notopterus*	Grey feather back	Nga-phe
2	Annguilliformes	Anguillidae	*Anguilla bicolor*		Nga-Kyauk-pha
3	Cypriniformes	Cyprinidae	*Catla catla*		
4			*Cirrhinus cirrhosis*		
5			*Cirrhinus mrigala*	Mrigal	Nga-gyin
6			*Ctenopharyngodon idellus*		
7			*Cyprinus carpio*		Shwe-war-nga-gyin
8			*Labeo calbasu*		
9			*Labeo rohita*		
10			*Osteobrama alfredianus*		
11			*Osteobrama cotio*		
12		Anabantidae	*Anabas testudineus*	Climbing perch	Nga-byay-ma
13		Belontiidae	*Trichogaster pectoralis*		Gorami-Nga
14		Channidae	*Channa striata*		Nga-yant
15			*Channa punctatus*		Nga-pa-naw
16		Mastacembelidae	*Mastocembelus armatus*		Nga-mway-naga
17			*Mastacembelus unicolor*		
18	Perciformes	Mugilidae	*Mugil cephalus*		
19	Cyprinodontiformes	Belonidae	*Xenentadon cancila*	Gar fish	Nga-phaung-yoe
20	Synvranchiformes	Synbranchidae	*Monopterus albus*		

No	Order	Family	Scientific Name	Common Name	Vernacular Name
21.			*Puntius sarana*		Nga-khone-ma
22.			*Puntius ticto*		Nga-khone-ma
23.			*Hypophthaimichtt ys molitrix*		
24.			*Amblyphanyngod on mola*	Mola carplet	Nga-bei-phyu
25.			*Lepidocephalus berdmorei*	Loach	Nga-tha-lae-doe
26.		Bagridae	*Mystus gulio*		
27.			*Mystus vittatus*	Cat fish	Nga-zin-yine
28.			*Rita sacerdotum*		
29.		Siluridae	*Ompok bimaculatus*	Butter catfish	Nga-nu-than
30.			*Wallago attu*	Freshwater shark	Nga-but
31.		Schilbeidae	*Neotropius acutirostis*		Nga-than-jate
32.		Pangasidae	*Pangasius pangasius*		
33.		Susirudae	*Bagarius bagarius*		
34.		Clarridae	*Clarias batrachus*	Walking catfish	Nga-khu
35.		Heteropneustidae	*Heteropneustes fossilis*	Stinging catfish	Nga-gyee
36.	Perciformes	Centropomidae	*Lates calcarifer*		
37.		Sciaenidae	*Johnius bomcensis*		

No	Order	Family	Scientific Name	Common Name	Vernacular Name
38.		Cichilidae	*Orechromis niloticus*		
39.		Gobiidae	*Glossogobius giuris*	Tank goby	Kathapoo
40.		Gobioididae	*Odontamblyopus rubicundus*		

Notopterus notopterus

Anabas testudineus

Trichogaster pectoralis

Channa striata

Channa punctatus

Mastocembelus armatus

Mastacembelus unicolor

Xenentadon cancila

Monopterus albus

Puntius sarana

Amblyphanyngodon mola

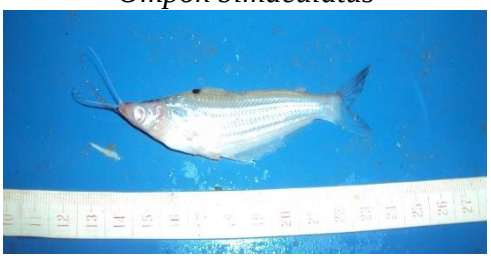
Lepidocephalus berdmorei

Mystus gulio

Rita sacerdotum

Ompok bimaculatus

Wallago attu



Neotropius acutirostis

Heteropneustes fossilis

Clarias batrachus

Figure 10. Freshwater fish species recorded from Project area

Table 29. List of recorded fish Species of marine and brackish water fish from area

No	Order	Family	Scientific Name	Common Name	Vernacular Name
1.	Auguilliformes	Muracenesocidae	*Congresonx talabonoides*	En-Indian pike conger	Nga-Shwe
2.	Clupeiformes	Engraulidae	*Coilia borneensis*	En-Gold spotted grenader anchovy	Mee-Tan-thew
3.			*Stolephorus indicus*	En-Indian anchovy	Nga-ni-tu
4.		Chiroccentridoe	*Chirocentrus dorab*	En-Dorab walf-herring	Nga-da-lwe
5.			*Chirocentrus nudus*	En-white fin wolf-herring	Nga-da-lwe
6.		Clupcidae	*Tenualosa ilisha*	En-Hilsa shad	Nga-tha-lauk
7.			*Ilisha elongate*	En-Elongate ilisha	Nga-zin-bya
8.			*Sardinella gibbosa*	En-Gold stripe sardinella	Nga-kone-nyo
9.	Siluriformes	Arridae	*Arius maculatus*	En-Spotted catfish	Nga-yaung
10.	Aulopiformes	Synodontidae	*Saurda undosquamis*	En-Brush tooth lizard fish	Nga-Pulway
11.	Scorpaceniformes	Platycephalidae	*Cociella crosodila*	En-Crocodile flatheod	Nga-sin-nin
12.	Perciformes	Synodontidae	*Harpadon neterew*	En-Bombay duck	Nga-hnut
13.		Serranidae	*Epinephelus areolatus*	En-Arcolate grouper	Kyaut-nga
14.			*Epinephelus*		Kyauk-nga
15.		Sillaginidae	*Sillago sihama*	En-silver sillago	Nga-pul way
16.		Rachycentridae	*Rachycentron canadum*	En-Cobia	Pin-lei-nga-yant
17.		Carangidae	*Carangadies malabaricus*	En-Malobar trevally	Waing-phyu-gyi
18.			*Medalaspis cordyla*	En-Torpeda sead	Pyi-daw-tha
19.			*Scomberoides tala*	En-Barred queenfish	Let-wa
20.			*Scomberoides Lyson*	En-Double spotted queenfish	Let-wa
21.	Perciformes	Carangidae	*Selaroides leptolepis*	En-Yellow stripe scad	Myet-san-kyi
22.			*Serionlina nigrofasciata*	En-Black bandend Travelly	Nga-htaw-bat
23.			*Decapterus macrostoma*	En-Short fin scad	Pann-Zin
24.			*Carangoide scoeruleopinnatus*	En-Blue trevally	Zar-gyan
25.			*Carangoides hedlandensis*	Buumpnose trevally	Zar-gyan

26.			*Gnathanodon speciasus*	En-Golden trevally	Ka-la-ngu
27.			*Elagatis bipinnulata*	En-Rainbow-runner	Nga-thet-thant
28.			*Caranx ignobilis*	En-Giant trevally	Zar-gyan
29.		Leioganthidae	*Leiognathus equulus*	En-Common pony-fish	Nga-dinn-gar/ Nga-waing
30.			*Leiognathus splendens*	En-Splendid pony	Nga-dinn-gar/ Nga-waing
31.		Lutijanidae	*Lutijanus Lutjanus*	En-Big-eye snapper	Nga-ba-yin
32.			*Lutijanus johnii*	En-common blue stipe snapper	Nga-pa-ni
33.			*Lutijanus vita*	En-Whipfin Brown stipe snapper	Nga-pa-ni
34.		Gerreidae	*Gerres filamentosus*	En-Whipfin silver biddy	Nga-si-ooe
35.			*Pentaprion longimanus*	En-long fin silver biddy	Nga-bae-phyu
36.		Lethrinidae	*Lethrinus lentjan*	En- Pink ear empesor	Nga-wet-sut
37.		Sparidae	*Argyrops spinifer*	En-King soldier bream	Nga-war-nga
38.		Polynemidae	*Eleutheronema tetradactulum*	En-four finger threadfin	Za-yaw-gyi
39.			*Polynemus plebeius*	En- stripd thread fin	Za-yaw
40.			*Polynemus indicus*	En-India thread fin	Ka-ku-yan
41.		Sciaenidae	*Chrysochir aurcus*	En-Reever's	Thin-war
				crooker	
42.	Perciformes	Sciaenidae	*Johnius dussumieri*	En-Bearded croaler	Nga-poke-thin
43.			*Panna microdon*	En-Panna croaker	Nat-ka-daw
44.			*Protonibea diacanthus*	En-Spotted croaker	Ka-tha-myin
45.			*Pennahia macrophthalmus*	En-Big head pennah croaker	Gaung-pwa
46.			*Otholithoides biauritus*	En-Bronze croaker	Nat-ka-daw-gyi
47.		Mullidae	*Upeneus sulphureus*	En-Striped goat fish	Kyo-war
48.		Drepanidae	*Drepane punctate*	En-Spotted sickle fish	Nga-pa-lai
49.		Teraponidae	*Terapon theraps*	En-large scaled terapon	Gone-kyarr
50.		Siganidae	*Siganus javus*	En-streaking spine foot	Nga-yan-shar/ Nga-su-than
51.		Sphyraenidae	*Sphyraena jella*	En-Pick handle barracuda	Nga-mwe-doe
52.		Trichiuridae	*Tentoriceps cristatus*	En-Crested hair tail	Nga-da-gon
53.		Scombridae	*Rastrelliger brachysoma*	En-Short mackerel	Pa-la-tu

54.			*Rastrelliger faughni*	En-Island mackerel	Pa-La-lan
55.			*Rastrelliger kanagurta*	En-Indian mackerel	Pe-lo-tu
56.			*Scomberomorus commerson*	En-Narrow-barred spanish mackerel	Bee-zin
57.			*Scomberomorus guttatus*	En-Indo-pacific king mackerel	Nga-kun-shut
58.			*Euthynnus affinis*	En- Kawakawa	Nga-mae-lone
59.		Stromateidoe	*Pampus argenteus*	En-Silver pomfret	Nga-moke phyu
60.			*Pampus chinensis*	En-Chinese silver pomfret	Nga-moke phyu
61.	Pleuronectiformes	Psettodidae	*Psettodes crumei*	En-Indian halibut	Shar-gyi
62.	Pleuronectiformes	Cynoglossidae	*Cynoglassus lingua*	En-Long tongue sole	Shar-lay
63.	Tetraodoniformes	Balistidae	*Abalistes stellatus*	En-starry trigger fish	Nga-than
64.		Monacantnidoe	*Aluterus monoceros*	En-Unicorn leather jacket	Nga-hlwar par
65.	Perciformes	Ephippidae	*Ephippus orbis*	En-spade fish	Sin-na-pu
66.		Kurtidae	*Kurtus indicus*	Nursery fish	Nga-phauk-lauk
67.		Lactariidae	*Lactarius lactarius*	En-False trevally	Nga-tee
68.		Lobotidae	*Lobotes surinamensis*	En-Tripletail	Pin-lei-nga-pyay-ma
69.		Pomadosyidae	*Pomadasyi maculatum*	En-saddle grunt	Nga-gon
70.		Scaridae	*Scarus ghobban*	En-yellow scale parrot fish	Kyet-tu-yway-nga
71.		Scatophagidae	*Scatophagus argus*	En-Spotted scat	Nga-khet
72.		Ephippidae	*Ephippus orbis*	En-Spade fish	Sin-na-pu
73.		Pomadsyidae	*Pomadasys argyreus*	En-Bluecheek silver grunter	Nga-gon

Congresox talabonoides

Coilia borneensis

Chirocentrus nudus

Tenualosa ilisha

Ilisha elongata

Sardinella gibbosa

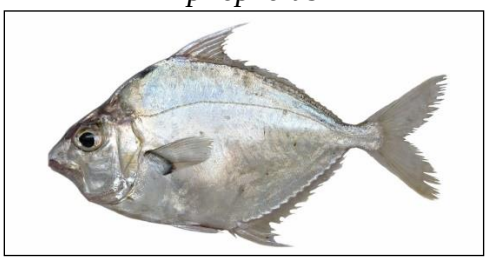
Arius maculatus

Cociella crocodile

Harpadonnehereus

Epilephelus

Epilephelus



Leiognathus equulus

Leiognathus splendens

Lutjanus lutjanus

Lutjanus johnii

Lutjanus vitta

Carangoides malabaricus

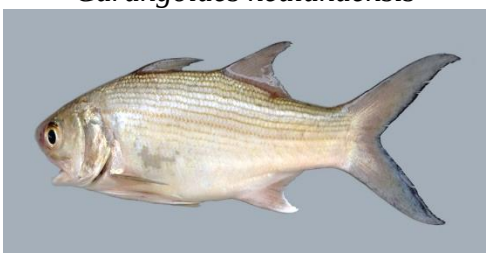
Scomberoides tala

Decapterus macrostoma

Carangoides coeruleopinnatus

Carangoides hedlandensis

Lethrinus lentjan



Polydactylus plebeius

Chrysochir aureus

Johnius cf. *dussumieri*

Otholithoides pama

Pennahia macrophthalmus

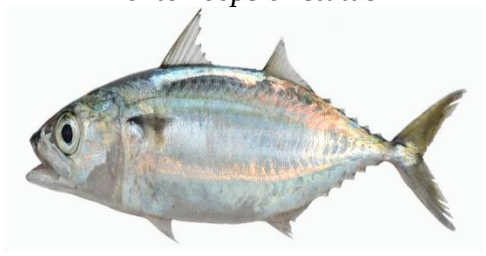
Otholithoides biauritus

Upeneus sulphurous

Sphyraena jello

Tentoriceps cristatus

Rastrelliger brachysoma



Rastrelliger faughni

Rastrelliger kanagurta

Scomberomorus commerson (juvenile)

Scomberomorus guttatus

Abalistes stellatus

Cynoglossus lingua

Ephippus orbis

Pomadasys argyreus

Scatophagus argus

Figure 11. Marine and brakish water fish species from Anyin Creek

3.6.2.4.3 Herpto fauna

A total of (18) species of amphibians and reptiles under (10) families of were recorded and reported (Table 30). Because of present occurrence within the limited study period, the species and population number is few in project sites. Up to conservation status of IUCN and CITES, all of these species are not serious for extinction.

Table 30. List of recorded Herpto fauna from Zegami Tin Mine Project area

Family	Scientific Name	Common Name	Vernacular Name	Habitat
Bufonidae	*Duttaphrynus melanostictus*	Asian common toad	Phar-pyok	Near pond
	Ingerophrynus macrotis	Large ear toad	Hpar pyok thay	ground
Microhylidae	*Kaloula pulchra*	Banded bull frog	Phar-kyaung	ground
	Microhyla ornate	Ornate narrow mouthed frog	Thé-phar	Near pond
Dicroglossidae	*Fejervarya limnocharis*	Paddy frog	Sar-phar	paddy field
	Hoplobatrachus tigerina	Indian bullfrog	Kaing phar	Mud
	Occidozyga martenii	Round-tongued floating frog		Lowland forest, swamps
	Occidozyga lima	Green puddle frog	Phar -han-lat	Marshes
Rhacophoridae	*Polypedates leucomystax*	Common tree frog	Phar-pyan	tree
Ranidae	*Hylarana erythraea*	Green paddy frog		Paddy feild
Gekkonidae	*Hemidactylus frenatus*	Common house gecko	Eing-myaung	bushes
Agamidae	*Calotes versicolor*	Garden fence lizard	Taut-tat	trunk
	Calotes mystaceus	Blue crested lizard	Poat thin nyo	trunk
Scincidae	*Mabuya multifasciata*	Common sun skink	Kyal-pyar-kinlate-shaw	Storage house
Colubridae	*Xenochrophis piscator*	Chequered keel back	Yal-mwaypyauk-Ma	water
	Ptyas mucosus	Banded rat snake	Lin-mway	field
Elapidae	*Hydrophis caerulescens*	Dwarf sea snake		Marine, brackish water
	Laticauda colubrine	banded sea krait		Marine, brackish water

A. *Duttaphrynus melanostictus*

B. *Hoplobatrachus tigerina*

C. *Kaloulapulchra*

D. *Fejervarya limnocharis*

E. *Polypedates Leucomystax*

F. *Hylarana erythraea*

G. *Occidozyga martenii*

H. *Calotes versicolor*

I. *Ptyas mucosus*

J. *Laticauda colubrina*

Figure 12. Herpto fauna recorded from Project area

3.6.2.4.4 Bird species

A total of terrestrial birds of (19) families representing (41) species were identified in direct and indirect impact area of the project sites (Table 31). Aquatic birds of (6) with (11) species occurring at paddy field nearby and Anyin creek were also described (Table 32). Their population abundance suh as dominant, abundance, frequent, occasional or rare status was also analysed with DAFOR scale in this work. Although no more tree and just paddy field were present in this area, mangroves support the richness of bird species for their foraging, roosting and nesting habitats. Only one species of aquatic bird *Leptoplilus javanica* (lesser adjunt) was vulnerable (VU) and others were least concern (LC) up to International Union of Conservation Nature (IUCN) red list (Table 31 and Table 32)

Table 31 List of recorded Bird species from Zegami Tin Mine Project Area

No.	Order name	Family name	Common name	Scientific name	Status				
					D	A	F	O	R
1	Galliformes	Phasianidae	Red Jungle fowl	*Gallus gallus*			*		
2	Falconiformes	Falconidae	Black Kite	*Milvus migrans*			*		
			Brahminy Kite	*Haliastur indus*			*		
			Crested Serpent-Eagle	*Spilornis cheela*				*	
			Shikra	*Accipiter badius*			*		
			Chinese Sparrowhawk	*Accipiter soloensis*			*		
			Eurasian Sparrowhawk	*Accipiter nisus*			*		
3	Columbiformes	Columbidae	Rock Pigeon	*Columba livia*			*		
			Spotted Dove	*Streptopelia chinensis*			*		
			Pink-Necked Green-Pigeon	*Treron vernans*				*	
			Orange-Brasted Green-Pigeon	*Treron bicincta*					
4	Psittaciformes	Psittacidae	Red-Breasted Parakeet	*Psittacula alexandri*			*		
5	Cuculiformes	Cuculidae	Chestnut-Winged Cuckoo	*Clamator coromandus*		*	*		
			Drongo Cuckoo	*Surniculus lugubris*			*		
			Asian Koel	*Eudynamys scolopaeus*			*		
			Green-Billed Malkoha	*Rhopodytes tristis*				*	
			Greater Coucal	*Centropus sinensis*					
6	Strigiformes	Strigidae	Oriental Scops-Owl	*Otus sunia*				*	
7	Apodiformes	Apodidae	Black-Nest Swiftlet	*Aerodramus maximus*			*		
			Edible-Nest Swiftlet	*Aerodramus fuciphaga*			*		
8	Coraciiformes	Alcedinidae	White-Throated Kingfisher	*Halcyon smyrnensis*			*		
			Black-Capped Kingfisher	*Halcyon pileata*			*		
			Common Kingfisher	*Alcedo atthis*				*	
		Coraciidae	Indian Roller	*Coracias benghalensis*			*		

No.	Order name	Family name	Common name	Scientific name	Status				
					D	A	F	O	R
		Meropidae	Chestnut-Headed Bee-Eater	*Merops leschenaulti*			*		
9	Piciformes	Ramphastidae	Lineated Barbet	*Megalaima lineata*	*				
		Picidae	Rufous Woodpecker	*Micropternus brachyurus*			*		
10	Passeriformes	Oriolidae	Black-Naped Oriole	*Oiolus chinensis*			*		
		Monarchidae	Black-Naped Monarch	*Hypothymis azurea*			*		
		Dicruridae	Black Drongo	*Dicrurus macrocercus*		*			
			Ashy Drongo	*Dicrurus leucophaeus*		*			
			Greater Racket-Tailed Drongo	*Dicrurus paradiseus*		*			
		Corvidae	House Crow	*Corvus splendens*			*		
			Racket-Tailed Treepie	*Crypsirina temia*			*		
		Aegithinidae	Common Iora	*Aegithina tiphia*				*	
		Laniidae	Brown Shrike	*Lanius cristatus*			*		
			Grey-Backed Shrike	*Lanius tephronotus*			*		
		Nectariniidae	Van Hasselt's Sunbird	*Leptocoma brasiliana*		*			
			Purple Sunbird	*Cinnyris asiaticus*		*			
			Olive-Backed Sunbird	*Cinnyris jugularis*		*			
			Ruby-Cheeked Sunbird	*Chalcoparia singalensis*		*			

Table 32. List of Recorded water birds species Zeka Tin Mine Project Area

No.	Order name	Family name	Common name	Scientific name	Status				
					D	A	F	O	R
1	Anseriformes	Anatidae	Lesser Whistling-Duck	*Dendrocygna javanica*		*			

2	Ciconiiformes	Ciconiidae	Lesser Adjutant	*Leptoptilos javanica*					*
3	Suliformes	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*			*		
4	Pelecaniformes	Ardeidae	Chinese Pond-Heron	*Ardeola bacchus*			*		
			Eastern Cattle Egret	*Bubulcus coromandus*			*		
			Great Egret	*Ardea alba*			*		
			Intermediate Egret	*Mesophoyx intermedia*			*		
			Little Egret	*Egretta garzetta*			*		
5	Charadriiformes	Vanellidae	Red-Wattle Lapwing	*Vanellus indicus*		*			
		Scolopacidae	Common Sandpiper	*Actitis hypoleucos*			*		
			Common Redshank	*Tringa totanus*			*		

Milvus migrans

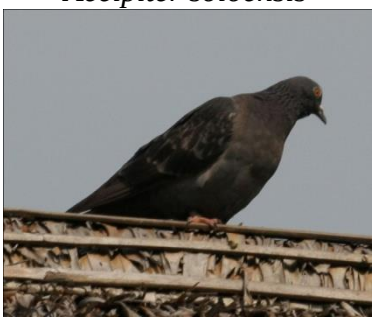
Haliastur Indus

Spilornis cheela

Acipiter badius

Accipiter soloensis

Accipiter nisus



Columba livia

Streptopelia chinensis

Treron vernans

Treron bicincta

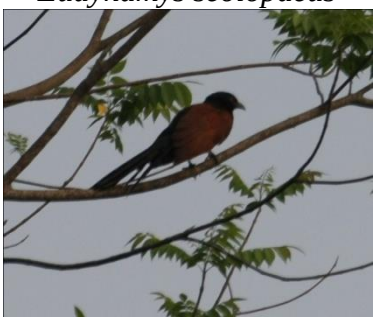
Psittacula alexandri

Clamator coromandus

Surniculus lugubris

Eudynamys scolopaeus

Rhopodytes tristis



Centropus sinensis

Otus sunia

Aerodramus maximus

Halcyon smyrnensis

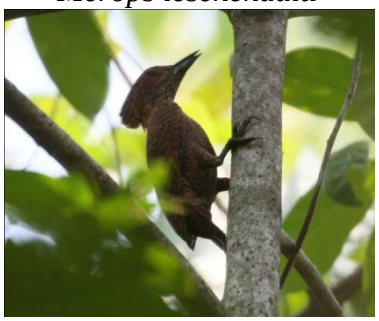
Halcyon pileata

Alcedo atthis

Coracias benghalensis

Merops leschenaulti

Megalaima lineata



Micropternus brachyurus

Oiolus chinensis

Hypothymis azurea

Dicrurus macrocercus

Dicrurus leucophaeus

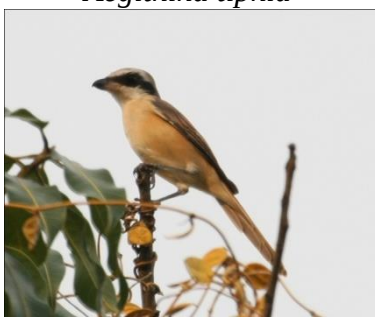
Dicrurus paradiseus

Corvus splendens

Crypsirina temia

Aegithina tiphia

Lanius cristatus



Lanius tephronotus

Leptocoma brasiliana

Cinnyris asiaticus

Cinnyris jugularis

Chalcoparia singalensis

Dicaeum trigonstigma

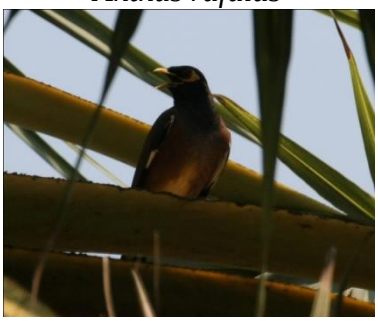
Dicaeum minullum

Dicaeum cruentatum

Passer montanus

Anthus rufulus

Acridotheres fuscus



Acridotheres tristis

Aplonis panayensis

Gracula religiosa

Gracupica contra

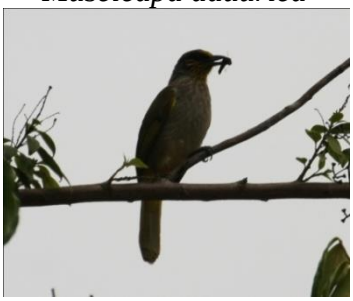
Copsychus saularis

Copsychus malabaricus

Ficedula albicilla

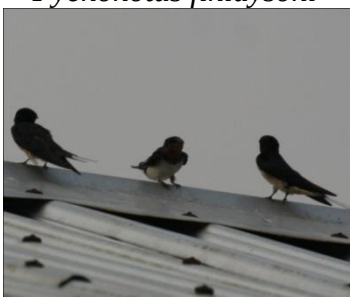
Muscicapa dauurica

Muscicapa williamsoni



Pycnonotus finlaysoni

Pycnonotus goiavier



Hirundo rustica

Phylloscopus fuscatus

Orthotomus sutorius

Figure 13. Terrestrial bird species recorded from Zegami Tin Mine Project area

Dendrocygna javanica

Leptoptilos javanica

Phalacrocorax niger

Ardeola bacchus

Bubulcus coromandus

Ardea alba

Mesophoyx intermedia

Egretta garzetta

Vanellus indicus

Actitis hypoleucos

Tringatetanus

Figure 14. Aquatic Bird species recorded from Zegami Tin Mine Project area

3.6.2.4.5 Mammals

A total of (19) mammals species under (12) families ; mouse, rat, mongoose, shrew, fruit bat and squirrel ,etc were recorded as information and they could not identified because of interview survey of local people and strong evidences of hunters during limited study period.

Table 33. List of recroded mammal species from Zegami Tin Mine Project area

Order	No.	Family	No.	Scientific name	Common name	IUCN status
SCANDENTIA	1	Tupaiidae	1	*Tupaia belangeri*	Northern Treeshew	LC
PRIMATES	2	Corcopithecidae	2	*Macaca fascicularis*	Long-tailed Macaque	LC
PHOLIDOTA	**3**	**Manidae**	**3**	***Manis javanica***	**Sunda Pangolin**	**CR**
RODENTIA	**4**	**Sciuridae**	**4**	***Ratufa bicolor***	**Black Giant Squirrel**	**NT**
			5	*Callosciurus erythraeus*	Pallas's Squirrel	LC
			6	*Tamiops swinhoei*	Swinhoe's Striped Squirrel	LC
			7	*Petaurista philippensis*	Indian Giant flying Squirrel	LC
	5	Hystricidae	8	*Hystrix brachyuran*	Malayan Porcupine	LC
CARNIVORA	6	Mustelidae	9	*Melogale personata*	Large-toothed Ferret Badger	DD
			10	*Aonyx cinerea*	Oriental Small-clawed Otter	VU
	7	Viverridae	11	*Viverricula indica*	Small Indian Civet	LC
			12	*Paradoxurus hermaphroditus*	Common Palm Civet	LC
	8	Felidae	13	*Prionailurus bengalensis*	Leopard Cat	LC
			14	*Neofelis nebulosa*	Clouded Leopard	VU
ARTIODACTYLA	9	Tragulidae	15	*Tragulus napu*	Greater Oriental Chevrotain	LC
			16	*Tragulus kanchil*	Lesser Oriental Chevrotain	LC
	10	Cervidae	17	*Muntiacus muntjak*	Red Muntjac	LC
CHIROPTERA	11	Pteropodidae	18	*Cynopterus sphinx*	Short-nosed Fruit bat	LC
	12	Rhinolophidae	19	*Rhinolophus pusillus*	Least Horeshoe bat	LC

3.6.3 Flora

3.6.3.1 Methods for flora survey

Diversity of plant species (flora) has been recorded in the direct impact area of mining site and indirect impact area of vicinity. Random study of way point to cover the direct impact and indirect impact area has been designated and navigated by the Global Positioning System (GPS). Recorded vegetation had been categorized into trees, shrubs and herbs according to their size and the nature of stem, the garden vegetation, medicinal plants and wood up to their commercial purposes.

Materials used in flora survey were quadrate and transecting, camera for taking photographs, GPS and different size of plastic boxes for sample collection such as leafs, flowers and fruits those were urgently unidentified and field note books.

Collected data was arranged and entry has been carried in excel work (2010) for assessment of floral diversity after field survey. For the purpose of this EIA boundaries of the study area are to determine the site maps and development plans provided. A "walk-through" survey method was conducted in (10 to 18) April to analyze the presence or absence of ecologically or commercially important species diversity of flora and fauna on the site. Species of flora and fauna were identified on location and selected samples collected and photographed for further verification. Vegetation and variety of their categories were conducted to create a comprehensive plant species list for the vegetation found on direct impact mining site and vicinity to indirect impact area of development site.

3.6.3.2 Result and findings for flora

Recorded species of flora have been mentioned with their families and respective habitat type in In the present work 193 species representing 60 families of terrestrial plants and 13 species under 7 families of herbal vegetation with their respective habitats have been recorded.

Table 34**.** List of recorded plant species from Zegami Tin Mine Project area

No	Family	Scientific Name	Common Name	Habitat type
●	Acanthaceae	*Acanthus ebracteatus*	Khaya	Shrub
●	Aegiceratаceae	*Madhuca Longifolia*	Kan- zaw	Tree

●	Amaranthaceae	*Aerva Javanica Juss*	On-hnye	Herb
●	Amaryllidaceae	*Crinum stenophyllum*	Padaing	Herb
●	Anacardiaceae	*Mangifera caloneura*	Taw-thayet	Tree
●		*Mangifera factida*	Thayet-pot	Tree
●		*Spondia pinnata*	Gwe	Tree
●		*Buchanania florida*	Lunbo	Tree
●	Annonaceae	*Annona muricata*	Duyin-awza	Small tree
●		*Canaga odorata*	Saga-sein	Tree
●		*Polyalthia hookeriana*	Bok	Tree
●	Apocynaceae	*Alstonia scholaris*	Letpan-ga	Tree
●		*Plumeria cubra*	Tayok-saga	Small tree
●	Asclepiadaceae	*Sarcolobus carinatus*	Ka-yu	Climbey creeper
●		*Sarcolobus globosus*	Ka-yu	Climbey creeper
●	Asteraceae	*Chromolaena odrata*	Bezat	Shrub
●		*Eclipta alba*	Kyeit-hman	Herb
●	Avivenniaceae	*Avicennia alba*	Lame	Tree
●		*Avicennia officinalis*	Thame-net	Tree
●	Bignoniaceae	*Heterophragma adenophylla*	Phet-than	Tree
●		*Oroxylum indicum*	Kyaung-sha	Tree
●		*Stereopermum fimbriatum*	Than-thit	Tree
●	Brassicaceae	*Raphanus sativus*	Monla-u	Herb
●	Capparaceae	*Capparis sepiaria*	Sugauk	Shrub
●		*Capparis trinervia*	Let maung-new	Climbery creeper
●	Celastraceae	*Kurrimia robusta*	Tagu-bok	Tree
●	Caricaceae	*Carica papaya*	Thinbaw	Small Tree
●	Convolvulaceae	*Erycibe citriniflora*	Eikhmwe	Small Tree
●		*Ipomoea aculeate*	Taung kazue	Creeper
●	Crassulaceae	*Crypteronia paniculata*	Hmaw-yone	Tree
●		*Crypteronia pubescens*	Yon	Tree
●	Cucurbitaceae	*Citrullus lanatus*	Hpaye	Climbery creeper
●		*Cucurbita moschata*	Hpayon	Climbery creeper

●		*Cucumis sativus*	Thakha	Climbery creeper
●	Cacsalpiniaceae	*Bauhinia ornate*	Swedaw-new	Climbery creeper
●		*Bauhinia pottsii*	Swedaw	Small tree
●		*Bauhinia Sulphurca*	Swedaw	Tree
●		*Cassia angustifolia*	Pwegaing	Shrub
●		*Cassia bicapsularis*	Dan-kywe	Shrub
●		*Cassia fistula*	Ngu	Tree
●		*Senna siamea*	Taw-mezali	Tree
●		*Tamarindus indica*	Magyi	Tree
●	Dilleniaceae	*Dillenia indica.*	Thabyu	Tree
●		*Dillenia ornata*	Zin byun	Tree
●		*Dillenia parviflora*	Kyet-zinbyun	Tree
●	Dipterocarpaceae	*Dipterocarpus alatus*	KAnyin-byu	Tree
●		*Dipterocarpus baudii*	KAnyin	Tree
●		*Dipterocarpus costatus*	KAnyin-ni	Tree
●		*Dipterocarpus dyeri*	KAnyin	Tree
●		*Dipterocarpus grandiflorus*	KAnyin-byan	Tree
●		*Dipterocarpus kerrii*	Sibin	Tree
●		*Dipterocarpus obtusifolius*	KAnyin gok	Tree
●	Dipterocarpaceae	*Dipterocarpus retusus*	KAnyin-ni	Tree
●		*Hopea helferi*	Thingan-net	Tree
●		*Hopca oblongifolia*	Thingan-byan	Tree
●		*Hopca sangal*	Thingan-pwe	Tree
●		*Parachorea dusiaudii*	Kadut	Tree
●		*Shorca gratissima*	U-ban-kaya	Tree
●		*Shorca cinerca*	Kadut-ni	Tree
●		*Shorea obtuse*	Thit-ya	Tree
●		*Vatica dyeri*	KAnyin-Kyaungche	Tree
●	Ebenaceae	*Diospyros crumentata*	Taung bok	Tree
●		*Diospyros ferrea*	Mepyaung	Small tree
●		*Diospyros malabrica*	Yengan-bok	Tree

●		*Diospyros peregrina*	Yengon-bok	Tree
●		*Diospyros wallichil*	Palaw	Tree
●	Elaeocarpaceae	*Elaeocarpus griffithii*	Kalamin kye	Tree
●		*Elaeocarpus robustus*	Kaya-hmwe	Tree
●		*Elaeocarpus wallichii*	Thitya-hmwe	Tree
●	Euphorbiaceae	*Aporusa villosula*	Thit-khauk	Small tree
●		*Baccourea parviflora*	Kanaso	Small tree
●		*Emblica officinalis*	Zinbyu	Tree
●		*Euphorbia antiquorum*	Kun	Small tree
●		*Macaranga denticulate*	Phet-wun	Small tree
●		*Macaranga albus*	Phet waing	Tree
●		*Sapium insigne*	Taung-ka-la	Tree
●	Fabaceae	*Callerya atropurpurca*	Letzin	Tree
●		*Desmodium oblongum*	Kyu	Shrub
●		*Dalbergia paniculata.*	Tapauk	Tree
●		*Dilochos uniflorus*	Pe-bi-zat	Climbery creeper
●		*Erythrina subumbrans*	Ye-kathit	Tree
●		*Erythrina variegate*	In-kathit	Tree
●		*Milletta pachycarpa*	Mi-gyaung new	Climber
●		*Pterocarpus macrocarpus*	Thit padauk	Tree
●	Gentianaceae	*Exacum tetragonum*	Pe-deing-nyo	Herb
●	Hypericaeae	*Calophyllum amocnum*	Tharipi	Tree
●		*Garcinia choisyana l*	Pala-kye	Tree
●		*Garcinia heterandra*	Taw-mingut	Tree
●		*Garcinia merguensis*	Ketmya	Tree
●		*Garcinia microstigma*	Taung-thaleni	Tree
●		*Garcinia speciosa*	Palawa	Tree
●		*Mesua nervosa*	Taung-gan gaw	Tree
●	Lamiaceae	*Ocimum americanum*	Pin-sein	Herb
●	Lauraceae	*Cryptocarya griffithian*	Kalak-thiang	Small-tree
●		*Litsea costalis*	Tagu	Tree

●		*Litsea elongate*	Tagu-ni	Tree
●		*Litsea grandis*	Tangu-ni	Tree
●		*Litsea panamanja*	Tangu-shaw	Tree
●		*Litsea salicifolia*	Tagu-thain	Tree
●	Leeaceae	*Leea harbacea*	Thagya-new than	Shurb
●		*Leea indica*	Ka-let	Shurb
●		*Leea Pumila*	Ka-let	Shurb
●	Lythraceae	*Largerstroemia floribunda*	Pyinma	Tree
●		*Lawsonia alba*	Dan	Shrub
●	Mangnoliaceae	*Michelia champaea*	Saga	Tree
●	Malvaceae	*Abclomoschus csculentus*	Yonbede	Shrub
●		*Hibiscus rosa – sinensis*	Khaung-yan	Shrub
●		*Hibiscus surattensis*	Taw-chin baung	Shrub
●	Melastomataceae	*Melastoma decemfidum*	Kyet-golay	Shrub
●		*Melastoma imbricatu*	Kyet-galay	Shrub
●		*Melastoma malabathricum*	Shame	Shrub
●	Meliaceae	*Chisocheton divergens*	Thagot	Tree
●		*Chisocheton grandiflorus*	Thit-ka-dan	Tree
●		*Sandoricum koetjape*	Thitto	Tree
●	Mimosaceae	*Abarema bigemina*	DAnyin	Tree
●		*Acacia concinna*	Kinmun-gyin	Climbey Creeper
●		*Acacia farnEIAna*	Nan-lon-kying	Small tree
●		*Albizia chinensis*	Kayan	Tree
●		*Adenanthera pavonina*	Ywe	Tree
●		*Leucaena glauea*	Bawzagaing	Tree
●		*Mimasa pudica*	Tikayon	Herb
●		*Parkia leiphylla*	Thit taut	Tree
●		*Ficus altissima*	Naung-peime	Tree
●		*Ficus annulata*	Naung-tha phan	Tree
●		*Ficus glabella*	Ngaung- thabye	Tree
●		*Ficus hirta*	Kayasha-tha-phan	Small tree

●		*Ficus hispida*	Kha-aung	Small tree
●		*Ficus indica.*	Nyaung-thabye	Tree
●		*Ficus regia*	Sin-thapan	Tree
●		*Ficus viren*	Nyaung-gyin	Tree
●	Crassulaceae	*Crypteronia paniculata*	Hmaw-yone	Tree
●		*Crypteronia pubescens*	Yon	Tree
●	Hypericaceae	*Garcinia choisyana*	Pala-kye	Tree
●		*Garcinia heterandra*	Taw-mingut	Tree
●		*Garcinia merguensi*	Ketmya	Tree
●		*Ficus chartacea*	Tha-phan	Tree
●		*Ficus hispida*	Kadut	Tree
●		*Artocarpus heterophyllus*	Peinne	Tree
●	Myrsinaceae	*Myrsine semiserrat*	Kazaw	Small tree
●	Myrtaceae	*Eugenia amplexicaulis*	Thabye-ge	Tree
●		*Eugenia bracteata*	Thabye-hmwe sok	Tree
●		*Eugenia claviflora*	Thabye-yit pauk	Tree
●		*Eugenia contracta*	Thabye	Shrub
●		*Eugenia khasiana*	Thabue-sal chi	Tree
●		*Eugenia manii*	Thabye-ni	Tree
●	Myrtaceae	*Eugenia tristis*	Thabye-ga	Tree
●		*Syzygium angkae*	Mai-wa	Tree
●		*Syzygium atteruatum*	Thabye	Tree
●		*Syzygium cymosum*	Thabye-kyetter	Small tree
●		*Syzygium fastigiatum*	Taung-thabye	Small tree
●		*Syzygium gramde*	Thabye-gyi	Tree
●		*Syzygium gratum*	Thabye-pauk-pauk	Tree
●		*Syzygium inophyllum*	Thabye-satche	Tree
●		*Syzygium kurzii*	Thabye-nyo	Tree
●		*Syzygium oblatum*	Thabye-ni	Tree
●	Myrtaceae	*Syzygium pachyphyllum*	Thabye-cho	Tree
●		*Syzygium Polyanthum*	Malaga	Tree

●		*Syzygium praecox*	Sun-thabye Than-thabye	Tree
●		*Syzygium pseudolaetum*	Kabey	Tree
●		*Syzygium subrufum.*	Tawgyi-gan gaw	Tree
●		*Syzygium thumra*	Taw-thabye	Tree
●	Dipterocarpaceae			
●		*Syzygium cumini*	Tame	Tree
●		*Syzygium helferi*	Mataw	Tree
●		*Psidium guajava*	Malaka	Small tree
●	Passifloraceae	*Adenia Cardiophylla*	Kyet-hin Kha-nwe	Creeper
●	Papaveraceae	*Papaver somniferum*	Bein	Herb
●	Rhamnaceae	*Ziziphus oenopila Mill*	Supauk-pin	Shrub
●		*Ziziphus rugosa Lam.*	Tawzi	Small tree
●	Rhizophoraceae	*Carallia brachiate*	Yat	Tree
●	Rubiaceae	*Gardenia jasminoides*	Zizawa	Shurb
●		*Mussaenda Luteola*	Ywet-hla pan	Shurb
●		*Randia exaltata*	Kaw	Tree
●	Rutaceae	*Acgle marmelos*	Okshit	Tree
●		*Citrus hystry*	Shauk-cho	Small tree
●	Rutaceae	*Citrus sinensis*	Leinmaw	Small tree
●		*Glycosmis cyanocarpa*	Ma-baw	Shrub
●		*Glycosmiz parkinsonii*	Ma-baw	Shrub
●		*Hesperethusa crenulata*	Thi-ha-ya zar	Small tree
●	Sapotaceae	*Manilkara hexandra*	Khayay	Tree
●	Solanaceae	*Capsicum annuum*	Nga-yok	Climber/ creeper
●	Sterculiaceae	*Helicteres hirsuta*	Sega-gyi	Shrub
●		*Helicteres isora*	Ting kyut	Shrub
●		*Heritiera javanica*	Kanzo	Tree
●	Sterculiaceae	*Sterculia coccinea*	Shaw-ah	Small tree
●		*Scaphium saphigenum*	Shaw	Tree
●	Symplocaceae	*Symplocos racemosa*	Pya	Small tree
●	Theaceae	*Grewia acuminate*	Thayaw	Shrub

•	Tiliaceae	*Microcos calophyolla*	Mayan-bo	Small tree
•		*crocos paniculata*	Mya-yar	Small tree
•	Verbenaceae	*Duranta repens*	Bp-ka daw Myet-hkon	Shrub
•		*Tectona grandis*	Kyun	Tree
•	Viscaceae	*Viscum articulatum*	Thit lon	Tree

Table 35 List of recorded vegetation of Herbal Plants in Project area

No	**Type**	**Family**	**Scientific name**	**Common name**	**Habitat Type**
	Monocotyledon	Burmanniaceae	*Burmannia candida*	Tabindaing	Saprophytie Herb
			Germainia lanipes	Germany Pin-myet.	Grass
		Poaceae	*Erianthus hookeri*	Mwe-gyi	
		Smilacaceae	*Smilax perfoliata*	Sein-nabaw	
		Iridaceae	*Crocus sativius*	Gon-ga-man	
	Dicotyleton	Aegiceratacea e	*Madhuca Longifolia*	Kan- zaw	Tree
		Asteraceae	*Chromolaena odrata*	Bezat	Shrub
			Eclipta alba	Kyeit-hman	Herb
			Cassia angustifolia	Pwegaing	Shrub
			Sapium insigne	Taung-ka-la	Tree
		Rhizophoraceae	*Carallia brachiate*	Yat	
			Hesperethusa crenulata	Thi-ha-ya zar	Small tree
			Adenanthera pavonina L.	Ywe	Tree

A. *Sonneratia caseolaris* B. *Avicennia marina* C. *Rhizophora apiculata*

D. *Avicennia alba* E. *Bruguiera cylindrical* F.*Rhizophora mucronata*

Figure 15. Recorded mangrove species from indirect impact area of the project

Figure 16 Overview plantation of Indirect and Direct Impact Zone Project Area

3.7 SOCIO-ECONOMIC COMPONENTS

Socio-economic factors are lifestyle components and measurements of both financial viability and social standing. They directly influence social privilege and levels of financial independence. Factors such as health status, income, environment and education are studied by sociologists in terms of how they each affect human behaviors and circumstances income and livelihoods.

3.7.1 Living conditions

The surrounding area of Zegami tin mine includes the villages namely Wettoe, Zeami, Pantaung, North Shwedu, South Shwedu, Anyin, Nyaungbeee, Maunghlaw (Upper), Maunghlaw (Lower) and Taungpu. Total number of households for each village is presented in the following table and pie chart. With a total of 1244 households in all villages, Maunghlaw, Anyin and Nyaungbe are largest villages among all the villages and Shwedu is the smallest village with total house hold of 25.

Table 36. Household Numbers in the Study Area

Sr.	Village	Total Households
1	Zegami	178
2	Shwedu	25
3	Wettoe	60
4	Taungpu	93
5	Pantaung	78
6	Nyaungbee	240
7	Anyin	280
8	Maunghlaw	290
Total		1244

Figure 17 Household Numbers in the Study Area

The average family size in the study area is depicted in the following table and chart. It can be clearly seen that average family size of the area is higher than that of Union which is 4.4. According to the study, the most populated villages are Zegami and Nyaungbee with average family size of 5.7 and the lowest village is Taungpu with average family size of 5.01. For the whole study area, average family size is about 5.6

person per household which is remarkably higher than the family sizes of Myanmar (4.4).

Table 37. Average Family Size in the Study Area

Village	Total House Hold	Population	Avg: Family Size
Anyin	49	273	5.5714
Maunghlaw	30	190	6.3333
Nyaungbee	55	313	5.6909
Pantaung	42	229	5.4523
Taug Pu	51	256	5.0196
Wettoe	37	200	5.4054
Zegami	55	314	5.7090
Total	319	1775	5.5974
Union			4.4

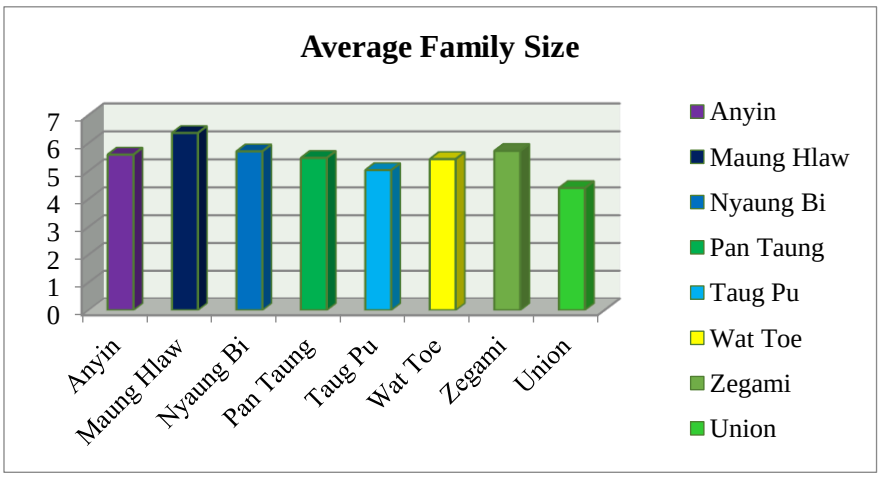


Figure 18. Average Family Size in the Study Area

3.7.2 Employment

3.7.2.1 Dependency Ratio

Income is money that an individual or business receives in exchange for providing a good or service or through investing capital. Income is consumed to fuel day-to-day expenditures. Most people age 65 and under receive the majority of theirincome from a salary or wages earned from a job.

The total dependency ratio tells the proportion of the population not in the work-force who are 'dependent' on those of working-age, it's a calculation which groups those aged under 15 with those over 65 years as the 'dependents' and classifying those aged 15-64 years as the working-age population. Dependency ratio is a measure of the portion of a population which is composed of dependents (people) who are too young or too old to work). The dependency ratio is equal to the number of individuals aged below 15 or above 64 divided by the number of individuals aged 15 to 64, expressed as a percentage.

The percentage of children (Age under 15 years) = 30.00 %

The older population (aged 65+) = 5.40 %

The working-age population (Age 15-64 years) = 64.20 %

Dependency ratio $= \frac{(30.0+5.4)}{64.2} \times 100$

= 55.14%

Table 38. Age Group Distribution in the Study Area

Age Group	Frequency	Percent
<5	140	7.9
5 to 15	401	22.6
16 to 64	1140	64.2
>64	96	5.4
Total	1777	100.0

3.7.2.2 Age Group and Occupation

According to the Age Group Distribution Table, the percentage of working force age group is 64.2 and the dependent age group is 35.4 in the study area. According to the chart depicted below, the study area has a good ratio of working force age group. Plenty of working force can lead to the good income of the area.

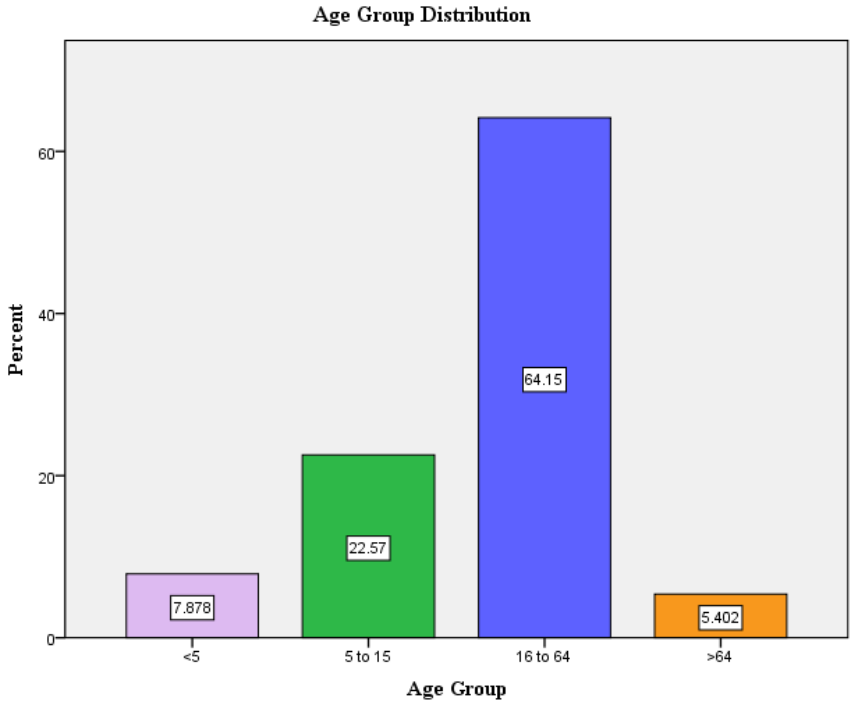


Figure 19. Age Group Distribution in the Study Area

Occupation distributions of the working force according to age group are described in the following pie chart. Most of the workers are working in agriculture and daily wages with a total of 64 percent of all kinds of occupation. Being a region close to the Andaman Sea and having plenty of rivers and creeks, fishing is a kind of popular occupation with 15 percent of total occupation. All the rest of occupations are from private and government sectors.

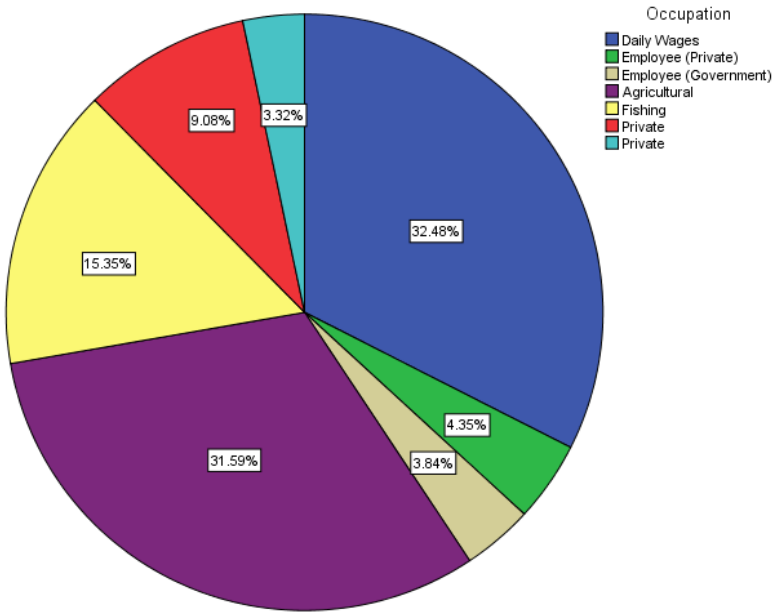


Figure 20. Occupation Distribution in the Study Area

Table 39. Occupation Frequency Table in the Study Area

Occupation	Frequency	Percent
Daily Wages	254	14.3
Employee (Private)	34	1.9
Employee (Government)	30	1.7
Agricultural	247	13.9
Fishing	120	6.8
Private	71	4.0
Private	26	1.5
Schooling	457	25.7
Dependent	538	30.3
Total	1777	100.0

The table above shows the individual occupation in all age groups of the whole population in the study area. The most dominant types of occupation are daily wages and agriculture works. The schooling and dependent age groups occupy 56% of total population in the study area.

3.7.2.3 Educational Attainment

According to the study, most of the people are literate as shown in the pie chart below. 45.3% the people attained only primary level education, 27.69% are learned in

middle schools and 13.79 percent got high school level education. Even University level, graduate and post graduate level can be found.

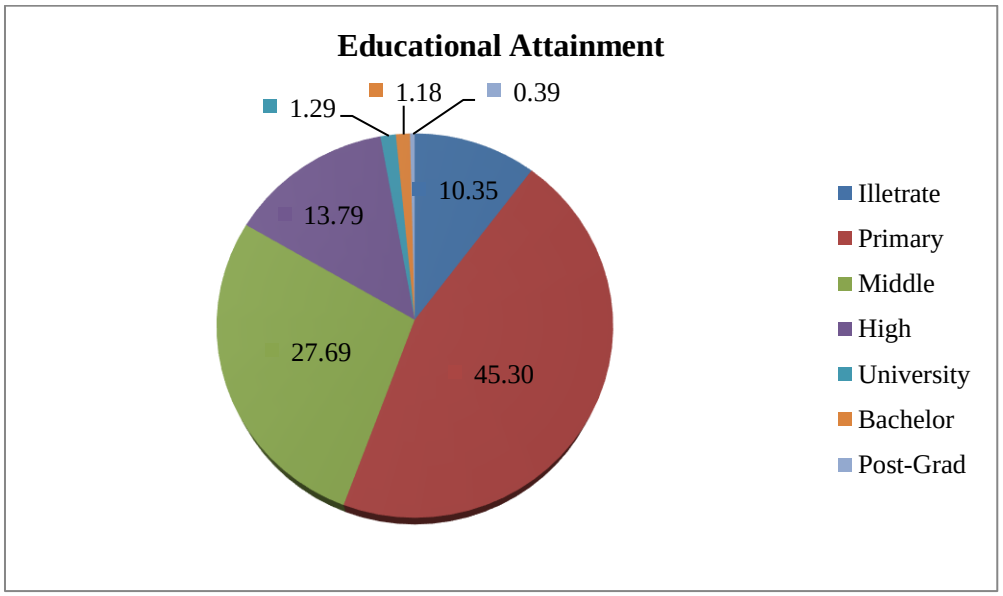


Figure 21. Educational Attainment in the Study Area

It could be noted that the study area has a good literacy rate and Current educational attainment levels show the local community's past education condition. Hospitality and tourism business needs a fair to high level of educational attainment. Background educational attainment of local community shows that the project needs to concentrate capacity building of local community so that they could participate in the development process. Figure (21) and (22) show the educational attainment of local community.

According to the table 40 and Figure 22, the most educated villages are Nyaungbee village which has four Post-Gad degree holders and Maunghlaw village with 10 Bachelor Degree holders. Illiterate count are relatively small compared to total population of the study area.

Table 40. Educational Attainment Frequency Table in the Study Area

Village	Education Level						
	Illetrate	Primary	Middle	High	University	Bachelor	Post-Grad
Anyin	27	133	82	25	5	1	1

Maunghlaw	19	53	41	59	6	10	1
Nyaung B	14	121	106	65	3	0	4
Pantaung	31	111	52	32	3	0	0
Taungpu	39	115	69	28	2	4	0
Wettoe	18	115	56	9	1	1	1
Zegami	36	157	86	27	3	5	0
Total	184	805	492	245	23	21	7

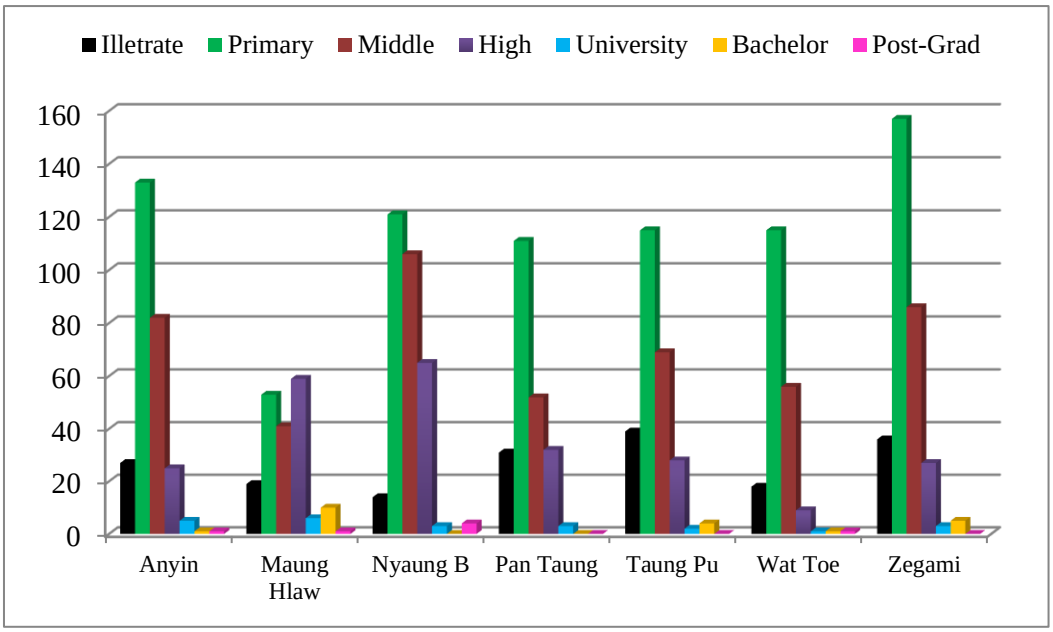


Figure 22. Educational Entertainment for each village in the Study Area

3.8 PUBLIC HEALTH COMPONENTS

The HIA study, focusing the project area and its vicinity, includes nine villages which are Nyaungbee, Zegami, Pantaung, Taungpu, Anyin, Wettoe, Maunghlaw (upper), Maunghlaw (lower), Shwedu.

In Myanmar, baseline health information resides in public health surveillance systems maintained by the department of health. Myanmar public health agencies routinely report public health surveillance data at the statewide or regional level. These agencies do not report village or community level data to avoid privacy violations and problems with statistical analysis when case numbers are small. Hospital data described in HIA study is based on the latest official publicity report from the Ministry of Health, Myanmar.

3.8.1 Mortality and Morbidity

Baseline health studies were conducted through a survey of 320 households. According to this, the most common chronic disease or conditions were hypertension, diabetes mellitus, respiratory disease, heart disease, gout, rheumatoid arthritis, eye diseases. Concerning the suffering sickness within 2 months, the most common complaints were flu, diarrhea, and gastrointestinal disease. Regarding the question of treatment taken as outpatients at clinics or hospital including accident or injury, the cases noted were flu, hypertension, diabetes mellitus, heart disease, stroke, gastrointestinal diseases, diarrhea, dengue, motor cycle accident, eye disease, and respiratory tract infection. In terms of death of household members within 2 years, the cause of death reported were stroke, cirrhosis of liver, carcinoma of lung. Regarding the hospitalized cases among household members within 1 year, the complaints were diarrhea, pneumonia, hepatitis, heart disease, road traffic accident, hypertension, diabetes mellitus, stroke, snake bite. TB, appendicitis, gastritis, goiter, myoma of uterus, carcinoma of the stomach, DHF, hematemesis, knee pain, back pain, kidney disease, and fracture neck of femur.

Table 41 Summary of the issues of the adjacent community (9 villages)

No. of people who	**Name of village**								
	NB	**ZGM**	**PT**	**TP**	**AN**	**WT**	**MH (U)**	**MH (L)**	**SD**
-took treatment as outpatients at health center, clinics or hospitals including accidents or injury within 2 months	16	18	8	11	2	7	1	2	4

-Suffering chronic diseases Hypertension									
Respiratory disease	10	1	6	3	3	7	2	2	1
Diabetes mellitus	1	-	1	1	-	2	-	1	1
Heart disease	4	1	-	1	1	1	1	-	-
Stroke	10	1	6	1	1	2	-	-	-
Kidney disease	2	1	-	-		-	1	-	-
Gastric ulcer	1	-	-	-	-	-	-	-	-
Rheumatoid Arthritis	5	-	2	-	-	-	-	1	-
Eye disease	1	-	-	1	-	-	-	-	-
Anaemia	-	2	-	1	-	1	-	-	-
Goitre	2	-	-	-	-	-	-	-	-
Liver disease	-	-	1	1	-	-	-	-	-
Musculoskeletal disease	-	-	-	-	1	-	-	-	-
	2	-	-	1	-	2	-	-	1
Hospitalization within 1 years	13	10	4	9	6	5	4	4	1
Death within 2 years	-	5	5	-	-	3	1	-	-

NB=Nayng Bee, ZGM=Zegami, PT=Pantaung, TP=Taungpu, AN=Anyinn
WT=Wettoe, MH (U) =Maunghlaw (upper), MH (L)= Maunghlaw (Lower)
SD=Shwedu
Source: Interviews

3.8.2 Occurrence of Diseases, Accidents and Injuries

In 2013, there were road traffic accident morbidity rate of 3.6 (per 1000 Population) and mortality rate of 5.5 (per 100,000 Population) in this region. The leading cause of non –transportation related fatalities were farm injuries and assaults about morbidity rate of 1.9 and 0.7 (per 1000 Population) and mortality rate of 1.6 and1.5 (per 100,000 Population) respectively. In case of poisoning, it showed morbidity rate of 0.1 (per 1000 Population) and mortality rate of 0.7 (per 100,000 Population). Concerning data for fall from height and drowning cases, it showed that the morbidity

rate of 0.6 and 0.1 (per 1000 Population) and mortality rate of 1.6 and 8.7 (per 100,000 population) respectively. According to the data of Maunghlaw hospital (2016), there were 15 cases of motor vehicles accident and injury, 3 cases of farm injury, 4 cases of fall from height, 4 cases of burn and scald and 1 case of suicide.

Table 42. Indicators for prevention of Accidents and Injuries (2013)

Regions	Road Traffic Accident Morbidity rate per 1000 population	Road Traffic Accident Mortality rate per 100,000 population
Tanintharyi	3.6	5.5
Union	2.2	6.6

3.8.3 Social Health Determinants

The HIA team uses both health outcome data and health determinant data to describe the social determinants and establish baseline health information for this health effect category. An outcome is a health event that has actually occurred while a determinant is a setting or context that strongly influences health status. For example, for outcome, it contains report of maternal and child health, suicide rates, substance abuse rates and other serious illness and death rate parameters as general indicators of physical and social well-being. For health determinant, it includes general demographics, family structure, economic status, and educational attainment.

Table 43. Indicators for mental health

Region	**Psychosis**	**Depress-ion**	**Anxiety neurosis**	**Alcohol Dependence**	**Epilepsy**	**Mental retardation**
Tanintharyi	0.18	0.33	0.04	0.92	0.12	0.08
Union	0.07	0.05	0.05	0.78	0.03	0.05

3.8.3.1 Maternal and Child Health

Maternal and child health is a dynamic field that aims to improve the health of women, children, youth and entire families and communities. Ministry of health cooperates with Myanmar Maternal and Child Welfare Association, UN agencies and

other international and local non -governmental association to provide health care services for the reduction of maternal mortality, infant mortality and under-five mortality.

According to Annual Hospital Administrative Statistics of Kyunsu 25 beded hospital in 2013, total number of livebirths was 98, total number of stillbirths was 1 and abortions was 8. Similarly, station hospital of Sakanthit (Kyunsu) reported the annual hospital statistics as follow, total number of livebirths 31, total number of stillbirths 2 , total number of abortions 4 respectively. Maunghlaw station hospital was opened in May 2016 and the data from this hospital indicated that the total number of admission case with pregnancy was 69 in 2016.

Table 44. Indicators for maternal, newborn and child health care activities (2013)

Regions	%of under 5 children with severe dehydration	%of under 5 children with ARI	%of newborn receiving breastfeeding within 1 hour of birth	%of newborn care coverage
Tanintharyi	1.0	14.4	86.8	83.3
Union	2.0	13.5	76.1	74.1

3.8.3.2 Suicide rate

A sound mind in a sound body has been recognized as a social ideal for many centuries. WHO expert committee on mental health expressed that “Mental health is influenced by both biological and social factors. It is not a static condition but subject to variations and fluctuations of degree; changes in social and physical environment. The social and environmental factors associated with mental ill health comprises worries, anxieties, emotional stress, tension, frustration, poverty, industrialization, urbanization, changing family structure, population mobility, economic insecurity, rejection, neglect and the like. The social environment not only determines the individual’s attitudes but also provides the framework within which mental health is formulated. Suicide can function as one indicator of mental health wellness in a population.

3.8.3.3 Substance abuse

Drug is defined as any substance that, when taken into the living organisms, may modify one or more of its functions (WHO). Drug abuse is defined as self-administration of drug for non-medical reasons, in quantities and frequencies which may impair an individual's ability to function effectively, and which may result in social, physical, or emotional harm. Substance abuse influences many health outcomes such as accident and injuries, chronic diseases, mental health problems etc. substance abuse includes illegal drugs (eg, marijuana, opioids, and cocaine), alcohol addiction and binge drinking.

3.8.3.4 Economic Indicators

Economic status may create a powerful context for human health and improved income is generally thought to be associated with improved community health outcomes. There are many indicators such as rate of population increase, per capita GNP, level of unemployment, dependency ratio, literacy rates, family size, and housing, per capita calorie availability. Detailed information regarding economic indicators, employment condition, education status, family size etc is mentioned in the SIA report.

4 PROJECT DESCRIPTION AND ALTERNATIVE SELECTION

4.1 PROJECT BACKGROUND

Zegami Tin Mining Project is to be developed and established for extraction and marketing of tin concentrates from the Zegami tin deposit where preliminary information collected indicated the sizable occurrence of an economic tin deposit. Zegami tin deposit is situated in Kyunsu Township, Tanintharyi Region, Myanmar (location map attached). Myanmar Asia Zone Activities Mining Co. Ltd., appointed its associate company A&M Myanmar Co., Ltd., a company incorporated in Myanmar to develop the Zegami tin deposit. In accordance with the procedure as stipulated in Myanmar Mines Law (2015), A&M on 8 April 2013 applied an exploration permit for the area measuring approximately 650 acres. With the approval of the Ministry of Natural Resources and Environmental Conservation (formerly Ministry of Mines) the company A&M received Mineral Exploration Permit No.0076, Dated 1 April 2014 and entered into an Exploration and Feasibility Study Agreement with Department of Geological Survey and Mineral Exploration on 24 April 2014.

A&M executed the exploration activities in accordance with the terms of the Exploration agreement since then. A&M completed 74 bore holes covering an area of approximately 182 hectares and other related exploration activities to determine the occurrence of tin deposit as to its tonnage, grade and essential geological data related thereto. Feasibility study followed immediately after the exploration works were completed.

4.2 LOCATION, OVERVIEW MAP AND SITE LAYOUT MAPS

The mine project, covering 356.38 acres is located in Zegami Village Tract, Kyunsu Township, Myeik District, Tanintharyi Region. Reference is made as One Inch Map No.95L/11.

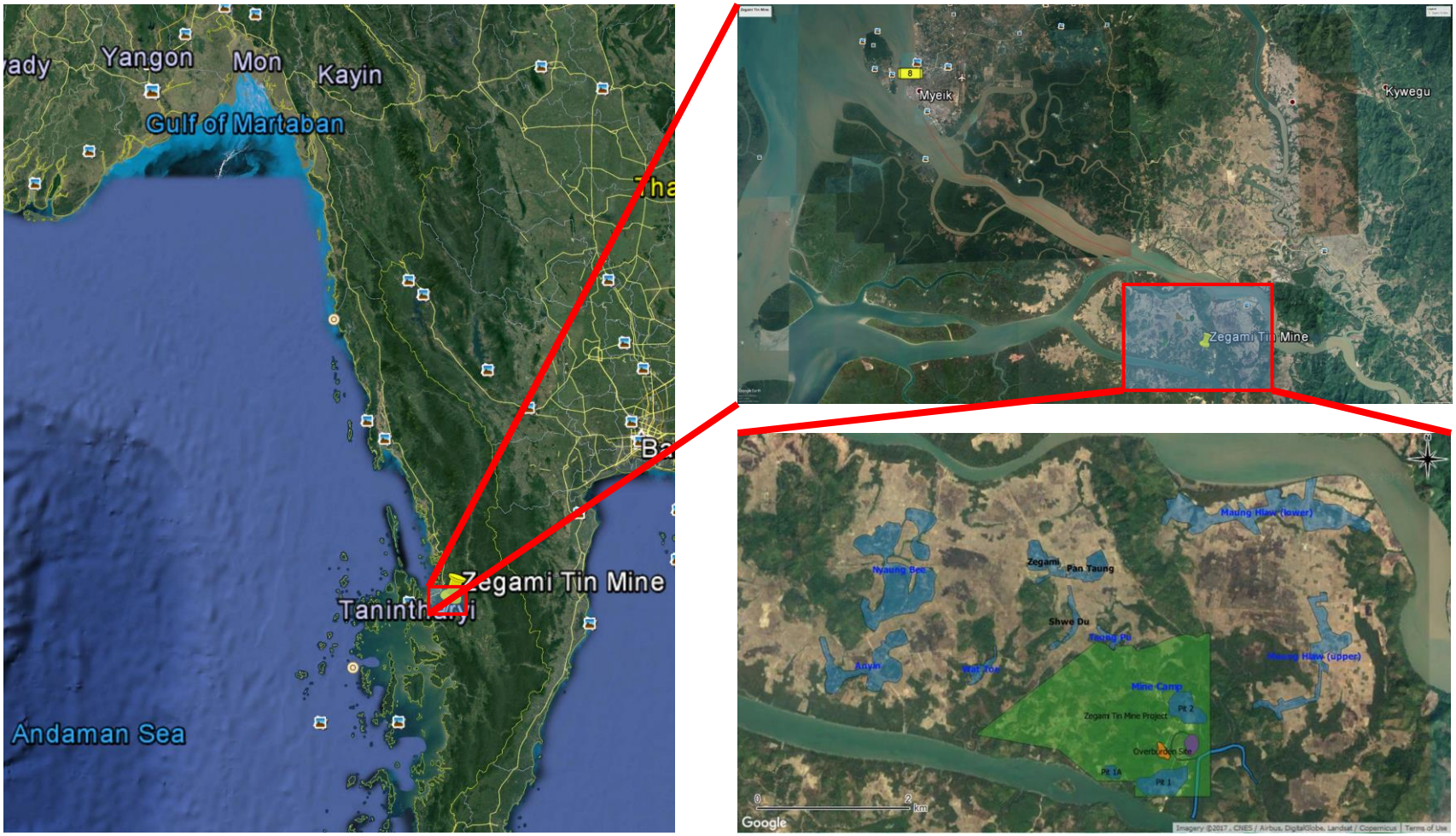


Figure 23. Location Map of Zegami Tin Mine Project

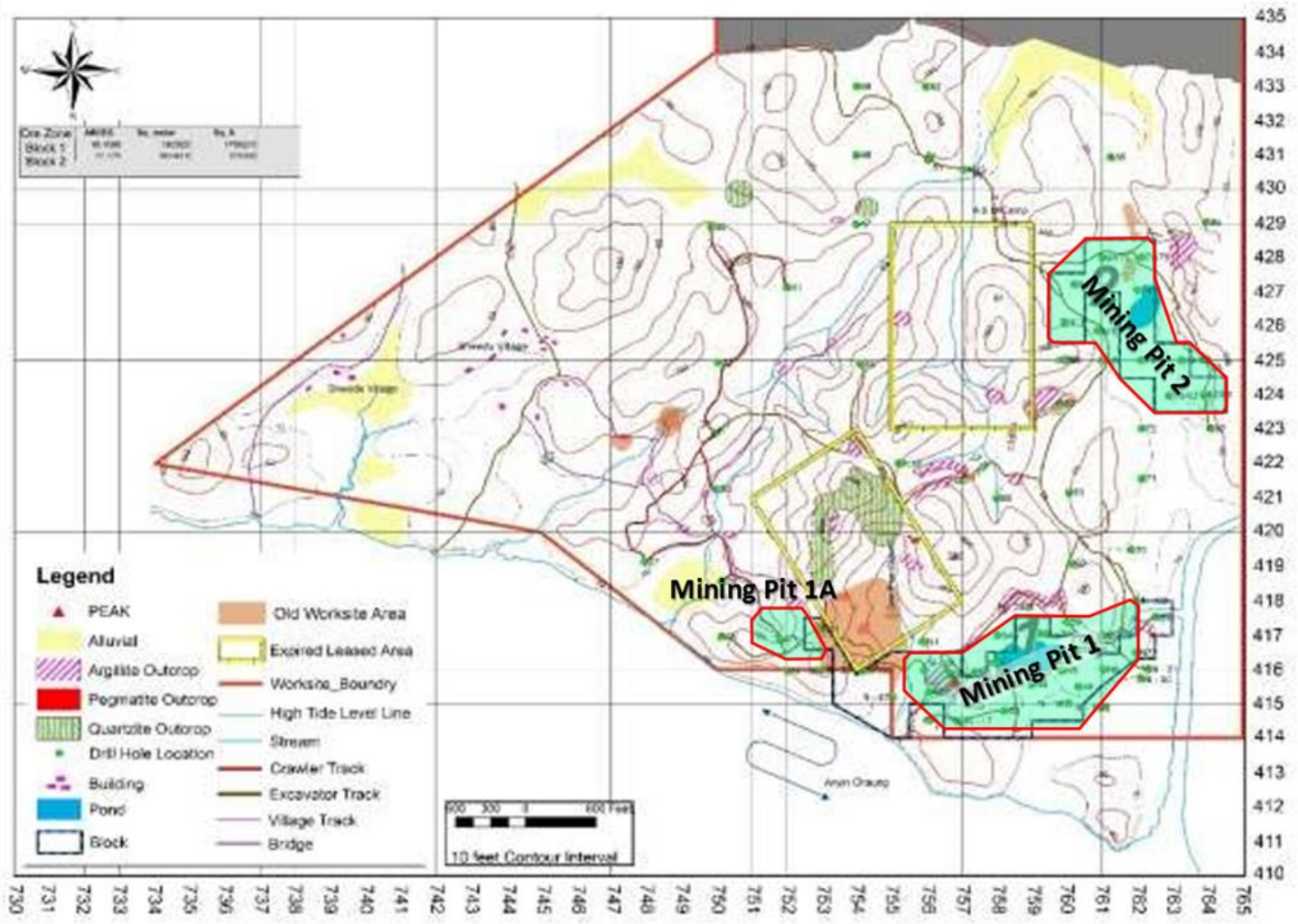


Figure 24 Site Layout Map of the Project

Table 45 Project Information

Sr.	Particular	Information
1	Type of Project	Tin Mining
2	Location of Project	Zegami Village Tract, Kyunsu Township, Myeik District, Tanintharyi Region
6	Capital Investment	$ 2.4 Millions
7	Fuel requirement	7,700 liters per day
8	Electricity requirement	480 kW
9	Water requirement	425 cubic meters per hour

Table 46 List of Equipment

Sr.	Process	Equipment	Quantity
1.	Ore mining	Excavator	2
		Dump Truck	6
2.	Waste removal	Excavator	1
		Dump Truck	2

4.3 PROJECT DEVELOPMENT AND IMPLEMENTATION TIME SCHEDULES

At the first stage of the Project the Company applied the Permit for Exploration and Feasibility Study and to undertake exploration works and feasibility study accordingly. It is the legal requirement that the Environmental Impact Assessment must be done and the EIA report must accompany with the application for Production Permit. A&M therefore facilitated to conduct the EIA report for submitting the application for Production Permit. At present, the EIA has been completed and the report is submitted herewith.

A&M prepared the time schedule for Project implementation to be completed within 7 months after the signing of Production Sharing Permit and acquiring the Large Scale Mineral Production Permit on the same date.

4.4 DESCRIPTION OF THE PROJECT

Project Size: The project covers an area of 1.4423 sq.km (356.38 acres) which constitutes deposit proper Block 1 and Block 2, mineral processing plant site, residential quarters for labors, office buildings, industrial buildings, material supply stores, internal access roads, tailing dump and other auxiliary structures. Yearly production is targeted at 200.88 tons of tin concentrates assaying a minimum of 70 % metallic tin content.

Figure 25. Existing Mine Camp (November, 2017)

4.4.1 Pre-construction

Table 47. Preconstruction Phase Project Information

Size	1.4423 sq.km (356.83 acres)
Installations	N/A
Technology	N/A
Infrastructure	N/A
Production processes	Site clearing
Use of materials and resources	Human(workers), Heavy Machinery
Generation of waste, emissions and disturbances	Dust, Solid waste, Noise and Vibration

4.4.2 Construction

Table 48. Construction Phase Project Information

Size	1.4423 sq.km (356.83 acres)*
Installations	Access Roads, Industrial Buildings, Residential Buildings
Technology	Standard Practice
Infrastructure	Mine camp, Mineral Dressing Plant, Jetty, Storage,
Production processes	As Per Project Process Design

Use of materials and resources	Human(workers), Heavy Machinery
Generation of waste, emissions and disturbances	Dust, Solid waste, Waste water

* Out of the total area 650 acres initially applied at the beginning, only 356.83 acres will be occupied for active mining operations pending acquisition of areas for Block B and Block C.

4.4.2.1 Jetty and other infrastructure

A Jetty is essential in order to use the marine transport for project operations. Access road to Jetty from Project area and intervillage access roads will be promoted in order to assist better communication for local people and project related transport matters. Residential quarters for labors and all essential infrastructures will be established accordingly along with the development stages of the Project.

4.4.3 Operation

Table 49. Operation Phase Project Information

Size	Tin concentrates 200.88 tonnes per year
Installations	Mining pits and waste disposal area Mineral processing plant Water storage pond Tailing retention pond Other infrastructure facilities (bridge, road, work site boundary, pond, A&M camp, temporary overburden dumping area, water intake, discharge and recirculation, earth bund)
Technology	Open pit dry mining method
Infrastructure	Jetty, Mine camp, Mine site
Production processes	Mining, Mineral Processing
Use of materials and resources	Standard Mining and Mineral Processing Equipments and Machinery

Generation of waste, emissions and disturbances	Dust, Noise and Vibration, Solid Waste, Waste water, Tailings

4.4.3.1 Mining

4.4.3.1.1 Overview and Production Plan

The open pit dry mining method is selected for the development and exploitation of ore Blocks 1 and 2 in which separate earth moving equipment fleets will be used for ore and waste excavation, hauling and dumping.

The proposed average tin production is 200 tonnes concentrate per year. Since mining operation is based on selective mining where higher grade ores will be mined first, monthly volumes of ore mined during the initial months of the operations will be less than the later months as grade of the ore are getting lower necessitating mining larger volume of ore. Table 50 below shows the proposed mining statistics and production plan for the entire project life.

During the initial stage of production, ore will be processed using gravity separation equipment to produce saleable grade tin-in-concentrates whilst other heavy minerals will recovered and stockpiled for future processing using additional separation equipment such as magnetic separators and high tension separators.

4.4.3.1.2 Mining Area

Out of the 650 acres granted to A&M as per the Exploration and Feasibility Permit, A&M has decided to relinquish 199 acres to the Government as the exploration works in that area proved of doubtful economic value for mining.

A&M will maintain 451 acres including Blocks B and C, for development and mining. Further drilling will be carried at a later stage once status of Blocks B and C is clear and A&M strongly believe that ore reserves will increase significantly once Blocks B and C is accessible for exploration.

The location and size of mining pits, waste disposal area, mineral processing plant, water storage pond, tailing retention pond and other infrastructure facilities are shown in Fig(26) and Fig(27) below:-

Table 50. Proposed Mining Statistics for A&M Zegami Tin Mine

FINAL 17 Years Production	**Cashflow statement Zegami Minesite**				**Ministry Format**														**TOTAL**
Year	1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Month in operation	6	6	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
Production																			
Pre Volume Mined (,000 Cu-m)	100	100	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	3560
Average Tin content Kg/m3 Sn 72%	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	
Tin Concentrate 65% (Recovery 90%) MT	83.7	83.7	200.88	200.88	200.88	200.88	200.88	200.88	200.88	200.88	200.88	200.88	200.88	200.88	200.88	200.88	200.88	200.88	3381.48
Tin in Metal (Recovery--%) MT	58.7574	58.7574	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	141.01776	2373.79896
Tin Metal Price US$/MT	18000	18000	18500	19000	19500	20000	20500	21500	21000	21000	21000	21000	21000	21000	21000	21000	21000	21000	n/a
Revenue US$	$1,057,633.20	$1,057,633.20	$2,608,828.56	$2,679,337.44	$2,749,846.32	$2,820,355.20	$2,890,864.08	$3,031,881.84	$2,961,372.96	$2,961,372.96	$2,961,372.96	$2,961,372.96	$2,961,372.96	$2,961,372.96	$2,961,372.96	$2,961,372.96	$2,961,372.96	$2,961,372.96	$48,510,109.44
Royalty 4%	$42,305.33	$42,305.33	$104,353.14	$107,173.50	$109,993.85	$112,814.21	$115,634.56	$121,275.27	$118,454.92	$118,454.92	$118,454.92	$118,454.92	$118,454.92	$118,454.92	$118,454.92	$118,454.92	$118,454.92	$118,454.92	$1,940,404.38
Mine Closure Fund 2% of Production	$21,152.66	$21,152.66	$52,176.57	$53,586.75	$54,996.93	$56,407.10	$57,817.28	$60,637.64	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$970,202.19
CSR Fund 2% of Production	$21,152.66	$21,152.66	$52,176.57	$53,586.75	$54,996.93	$56,407.10	$57,817.28	$60,637.64	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$59,227.46	$970,202.19
Revenue after MCF + CSR	$1,015,327.87	$1,015,327.87	$2,504,475.42	$2,572,163.94	$2,639,852.47	$2,707,540.99	$2,775,229.52	$2,910,606.57	$2,842,918.04	$2,842,918.04	$2,842,918.04	$2,842,918.04	$2,842,918.04	$2,842,918.04	$2,842,918.04	$2,842,918.04	$2,842,918.04	$2,842,918.04	$46,569,705.06
Revenue after Royalty 4%	$973,022.54	$973,022.54	$2,400,122.28	$2,464,990.44	$2,529,858.61	$2,594,726.78	$2,659,594.95	$2,789,331.29	$2,724,463.12	$2,724,463.12	$2,724,463.12	$2,724,463.12	$2,724,463.12	$2,724,463.12	$2,724,463.12	$2,724,463.12	$2,724,463.12	$2,724,463.12	$44,629,300.68
Share RevenueME2 --%	$214,064.96	$214,064.96	$528,026.90	$566,947.80	$581,867.48	$622,734.43	$638,302.79	$697,332.82	$681,115.78	$681,115.78	$681,115.78	$681,115.78	$681,115.78	$681,115.78	$681,115.78	$681,115.78	$681,115.78	$681,115.78	$10,874,499.95
Company --%	$758,957.58	$758,957.58	$1,872,095.37	$1,898,042.64	$1,947,991.13	$1,971,992.36	$2,021,292.16	$2,091,998.47	$2,043,347.34	$2,043,347.34	$2,043,347.34	$2,043,347.34	$2,043,347.34	$2,043,347.34	$2,043,347.34	$2,043,347.34	$2,043,347.34	$2,043,347.34	$33,754,800.73
Company Net Revenue																			
Operation Cost																			
Mining Cost US$	$53,000.00	$53,000.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$127,200.00	$2,141,200.00
Mineral Processing cost	$17,627.22	$17,627.22	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$42,305.33	$712,139.69
Freight/insurance cost	$6,000.00	$6,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$204,000.00
Salaries and overhead cost (Admin Cost)	$150,000.00	$150,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$300,000.00	$5,100,000.00
Total Operation cost	$226,627.22	$226,627.22	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$481,505.33	$8,157,339.69
Gross Operation Profit	$532,330.36	$532,330.36	$1,390,590.05	$1,416,537.31	$1,466,485.81	$1,490,487.03	$1,539,786.84	$1,610,493.14	$1,561,842.01	$1,561,842.01	$1,561,842.01	$1,561,842.01	$1,561,842.01	$1,561,842.01	$1,561,842.01	$1,561,842.01	$1,561,842.01	$1,561,842.01	$25,597,461.05
Capital Cost																			
Dead Rent																			
Signature Bonus																			
Guarantee	$150,000.00																		
Excavator, Pumps Sluices																			
processing plant																			
Vehicles	$1,811,684.45																		
Generator and Welding Equipment																			
Office Equipment and Communication Sets	Please see Capex for Detailed costing																		
Total Capital cost																			
Development Cost (Exploration & Feasibility)	$2,400,000.00																		$2,400,000.00
Finance Cost (6% interest pa of 70% of total Capex over 3 years)	$38,045.37	$38,045.37	$76,090.75	$76,090.75															
Corporate Tax																			
Taxable profit																			
Taxation (30% Corporate Tax)	0	0	0	0	0	0.00	$461,936.05	$483,147.94	$468,552.60	$468,552.60	$468,552.60	$468,552.60	$468,552.60	$468,552.60	$468,552.60	$468,552.60	$468,552.60	$468,552.60	$5,630,610.04
Cash Outflow	-$3,867,399.46	$494,284.99	$1,314,499.30	$1,340,446.57	$1,466,485.81	$1,490,487.03	$1,077,850.79	$1,127,345.20	$1,093,289.41	$1,093,289.41	$1,093,289.41	$1,093,289.41	$1,093,289.41	$1,093,289.41	$1,093,289.41	$1,093,289.41	$1,093,289.41	$1,093,289.41	
Net Cashflow	**-$3,867,399.46**	**-$3,373,114.47**	**-$2,058,615.17**	**-$718,168.61**	**$748,317.20**	**$2,238,804.23**	**$3,316,655.01**	**$4,444,000.21**	**$5,537,289.62**	**$6,630,579.03**	**$7,723,868.44**	**$8,817,157.85**	**$9,910,447.26**	**$11,003,736.67**	**$12,097,026.08**	**$13,190,315.49**	**$14,283,604.90**	**$15,376,894.31**	

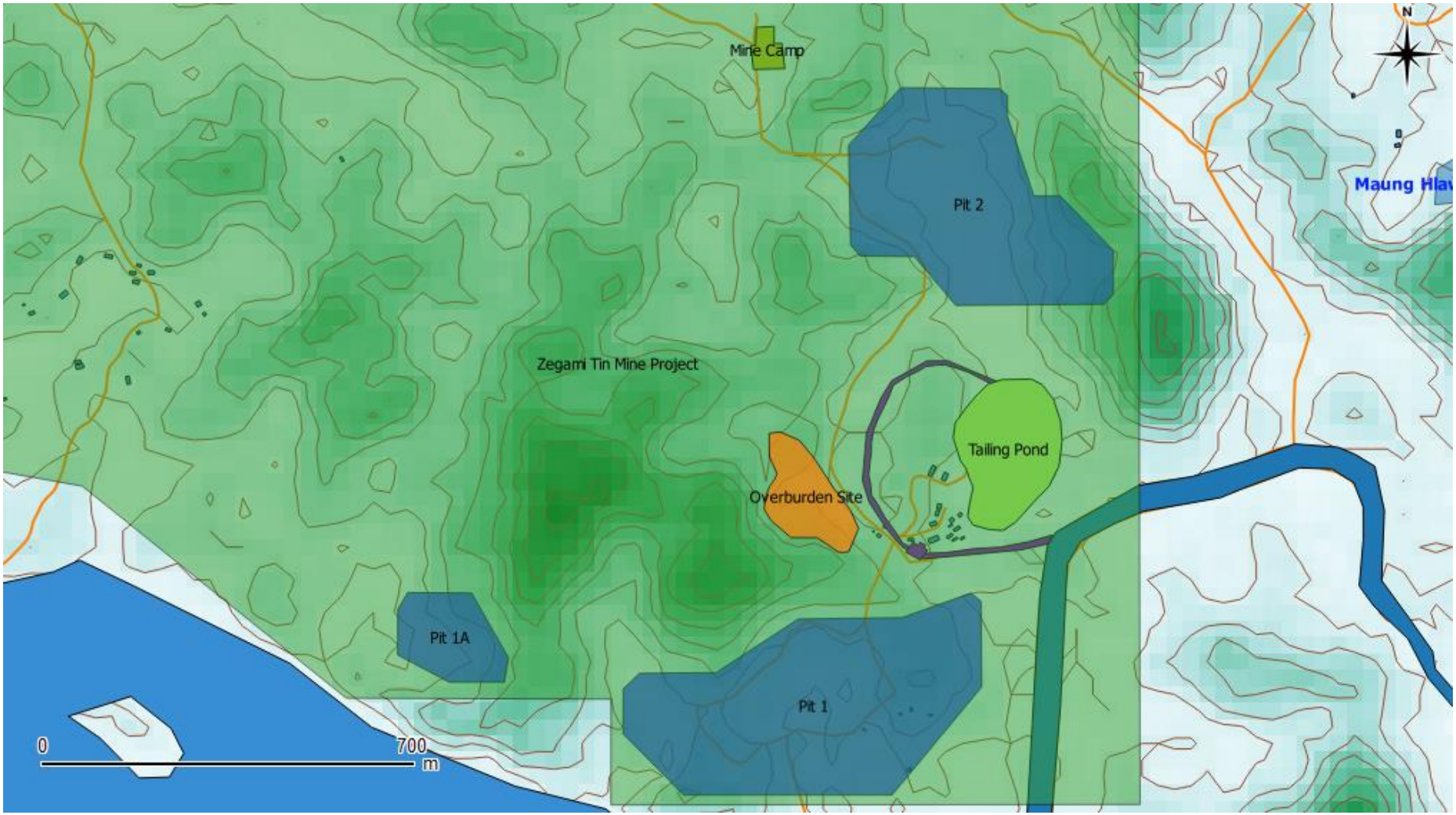


Figure 26 Map showing proposed layout of Mining Pit 1, 1A and 2

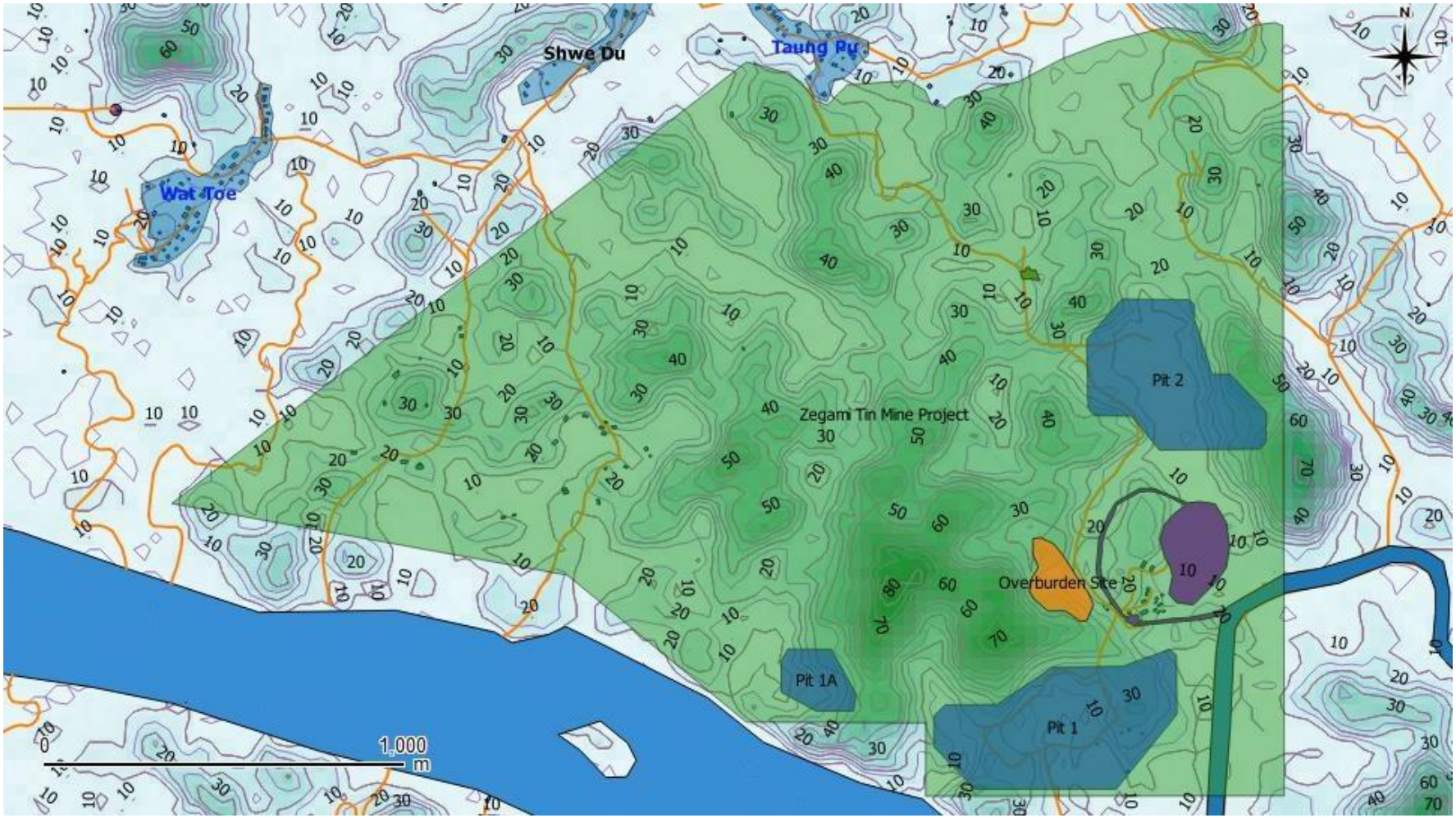


Figure 27 Topographic map of project area

4.4.3.1.3 Choice of Mining Area.

In order to apply selective mining method and adhering to the regulations as prescribed in the Myanmar Mines Law, A&M has selected the mining area based on prevailing situations of deposit occurrence and free from old worked out area.

4.4.3.1.4 Mining Method

Open pit dry mining method with selective mining is proposed for the development and exploitation of ore Blocks 1 and 2. Excavators are to be used at the designed surveyed benches 5 meters wide and 4.5 meters high whereas haulage to the feed stockpile area located at the mineral processing plant is to be done by dump trucks. Overall pits slope of 45˚ shall be maintained to ensure slope stability and haulage road width is designed at 10 meters.

Having a stripping ratio of 1:3.5 it is proposed that one fleet comprising one excavator and two dump trucks will be employed for waste removal and another fleet comprising two excavators and six dump trucks will be used for ore mining and haulage. One general utility fleet will also be reserved for waste removal or ore mining to ensure continuous operation.

4.4.3.1.5 Pit Parameters

Excavation work will closely be monitored to ensure the designed pit parameters are maintained and adhered to safety and slope stability. Main parameters adopted for mine pit design (Figure 28) are as follows:

a) 100 m safety zone between maximum pit limit and edge of any permanent water source is maintained.
b) 30 m safety zone between pit limit and any other third parties' area or boundary has been applied.
c) Overall pit slopes of 45 degree will be maintained.
d) Working benches of 5 m wide with height of 4.75 m will be implemented for excavation of ore and waste to ensure slope stability and achievement of the overall pit slope of 45 degree.
e) Haul road of 10 m wide will be used inside the mining pits for safer hauling and maneuverability

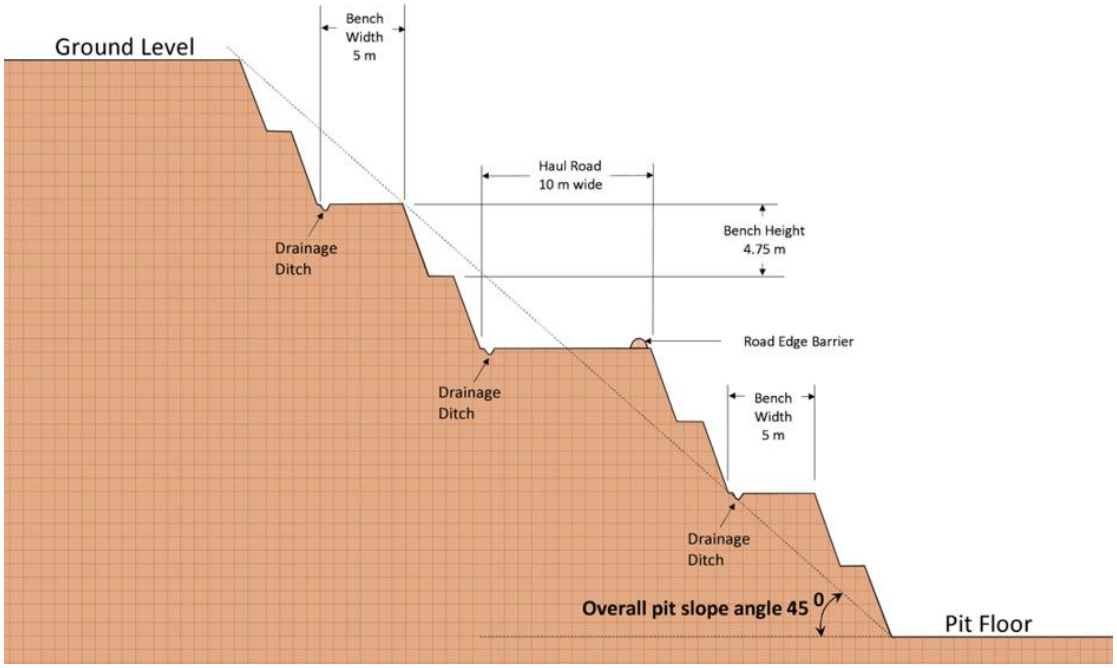


Figure 28: Schematic Diagram of the Proposed Pit Design

4.4.3.1.6 Working System, Production Scale and Service Life of Mine

Normal working hours at the mine pit work site will be 10 hours during daylight from 0700 hours to 1700 hours in two gangs. High intensity flood lights will be used in case of extended working hours.

Mineral processing plant will work two shifts, i.e., from 0700 hours to 2300 hours. Sufficient amount of daily run-off mine ore will be kept ready for plant operation.

Mining is proposed to start at Mining Pit 1 as it is the largest and richest pit with the lowest waste to ore ratio. After exhaustion of ore in Mining Pit 1, mining activity will be carried out in Mining Pit 1A and finally in Mining Pit 2.

Initially, a survey team headed by field geologists will survey the pit to delineate the pit boundary in order to excavate out and dump the topsoil, overburden and other waste materials into the temporary waste disposal area to expose the ore underneath. During the top soil removal, fertile top soil will be checked and dumped separately to be re-used for revegetation in mine rehabilitation process at the mine closure stage. All other waste and overburden materials will progressively be backfilled into the mined out pit.

Heavy minerals associated with tin will be recovered at the final stage of processing tin concentrates. This heavy mineral stockpile will further be processed with

multi-stage magnetic separators and high tension separators in future when sufficient fund have been generated to finance the investment on the additional mineral processing equipment.

Tailing disposal area will be located as close as possible to the palong (sluice) in order that tailings can flow by gravity. A tailing pump will be employed to pump out the tailings away from the discharge end of the palong into the mined out area. An excavator or bulldozer will be used eventually for better tailing control.

Average targeted tin production is about 200 tonnes concentrate per year. Actual tin production will be determined from the actual weight of final concentrates produced and their grades. The amount of ore and waste shall be determined by surveying. Monthly productions based on surveyed ore volume excavated and their grades will be compared with the actual productions based on weight of concentrates produced to determine the performance (i.e., metallurgical recovery factor) of the whole operation. If the recovery factor falls below 95%, necessary adjustments or modifications shall be carried out to the mining or mineral processing operations to improve system performance and minimize tin losses in the tailings. With the proposed production scales, it is anticipated that the mine life is 17 years.

4.4.3.1.7 Metallurgical Process

The mineralogy of a pegmatite is in most cases dominated by some form of feldspar, often with mica and usually with quartz, being altogether “granitic” in character. Tin (cassiterite), tantalum and niobium (columbine, tantalite, niobite) and tungsten (scheelite, wolframite) minerals are the major economic minerals found in pegmatite in association with spodumene, lepidolite and tourmaline. Most of these economic and associated minerals have certain physical properties such as specific gravity, magnetic property and surface conductivity which can be exploited for their separation and beneficiation. High grade cassiterite concentrates can be obtained by application of conventional metallurgical methods based on physical property of minerals which includes gravity separation such as (jigs, palong, shaking tables, etc), magnetic separation such as (low intensity Magnetic Separators, High intensity Magnetic Separators) , High Tension Electrostatic separators. Commonly associated minerals in pegmatite having close specific gravity but different magnetic and

electrostatic properties with cassiterite include wolframite, zircon, xenotime, monazite, ilmenite, tantalite, columbite etc.

Ore will be washed and slurrified with high pressure water jets from a set of monitors at the feed stockpile area. The slurry will then be treated by 10-lanes of 4ft.x100 ft wooden sluice boxes (palong) to get sluice box concentrates. Further processing by means of jigs, shaking tables and Willoughby boxes will produce saleable tin concentrate containing 72% metallic tin.

The proposed mineral processing flowsheet depicting mining and related operations is shown in Figure 29.

4.4.3.2 Auxiliary Services

4.4.3.2.1 Repair and Maintenance

Maintenance workshop will be provided at the mine camp for mechanical and electrical maintenance of earth moving equipment, dump trucks, motors, other mine vehicles as well as for general maintenance of mine camp and other infrastructure facilities.

Most of fast moving, critical and long-lead spares and wear parts will be checked and appropriate stock levels for these items shall be maintained at the mine stores to minimize down time.

4.4.3.2.2 Transportation

Zegami and the nearby villages in the environ are situated on a land mass sandwiched between Anyin creek and Tanintharyi river which is a major inland river in the Tanintharyi coastal region. As the mine site is situated at the banks of Anyin creek, the geographical situation of Zegami lends itself to rely on the riverine transport by Tanintharyi river through Anyin creek as the only and best mode of transport of goods and persons. The existing jetty in the area is fit for ordinary villagers' everyday social communication and a jetty suitable enough for the business needs of Zegami tin mine is essential for linkage with Myeik and beyond. Propeller fitted engine driven small motorized boats of approximately 2 tons capacity will be used in the Tanintharyi river for normal transport matters to shuttle to and fro between the mine and Myeik. A 50 ton capacity crane will be employed during the implementation period of the project. Four wheel driven pickups, motor bikes and trailer attached tractors will be used for

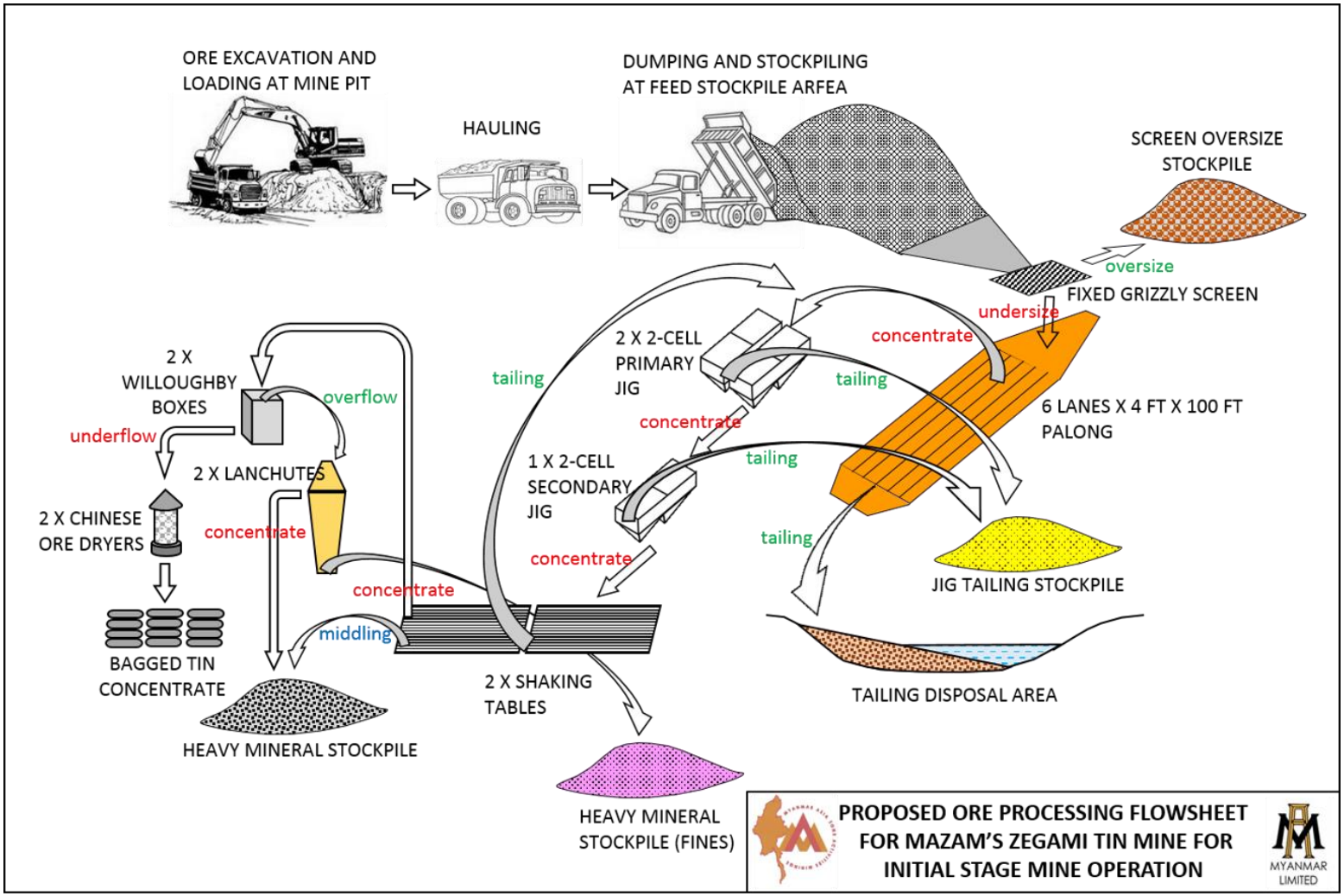


Figure 29. Proposed Mineral Processing Flowsheet

inland intervillage transport of persons and goods. Monthly production of tin concentrates packed in polypropylene bags each weighing 25 kilograms will be shipped to Myeik by chartered cargo vessels to undergo direct export formalities or to be handed over to the contracted buyer under agreed terms.

4.4.4 Mine Reclamation and Closure Plan (MRCP)

Along with the progress of the production operations which includes management of the previously worked out areas in order that those areas are compatible with surrounding environment. Mine decommissioning and closure is the process of shutting down the operation so that the area is left in a safe and stable condition, which is consistent with the surrounding environment, and does not need ongoing maintenance.

4.4.5 Decommissioning

In order not to leave adverse effects for the future generations, decommissioning is vital in the life cycle of the mine. If decommissioning and closure are not undertaken in a planned and effective manner, the site may continue to be hazardous and a source of pollution for many years to come in the project area and its environs. The overall objective of mine closure is to prevent or minimize adverse long-term environmental impacts, and to create the agreed beneficial land use objectives.

1. Workforce Decommissioning

   Total workforce requirement at mine site is 151 and office staff is 9. Workforce decommissioning will be started at mine life 17 years. As the nature of mining business requires continuous works on exploration in order to maintain the production level and maximize the utilization of various mining equipment and machinery, there is some possibility to extend the operations depending upon discovery of workable deposits in the nearby area. Work force will have to be entirely terminated in case there is no discovery of workable deposit.

2. Structural Decommissioning

   All above ground structure will be scraped down unless the authority and stakeholders would like to occupy the old structures in some way or the

other. Normally the nature of operation consists of the ditch lines, weirs, water sumps, and other manmade structures. These structures should be leveled down, filled, or removed in order to attain original situation.

4.4.6 Closure and post-closure

A&M will perform the mine reclamation as early as practicable on progressive basis as outlined in the attached Mine Reclamation and Closure Plan of the Feasibility Study Report by A&M. The aim of the reclamation and closure is to restore the disturbed areas and mined out land to resemble the pre-mining state or to achieve the target post-mining land use as agreed by the Government through systematic and effective backfilling, re-contouring, revegetation, reinstatement, monitoring and control processes and at the same time minimize impact to environment.

The Mine Reclamation and Closure Plan (MRCP) is a document, prepared by A&M that contains and describes all of studies and plans related to closure and reclamation of the mine site and all of the related mine facilities. The MRCP shall address the physical stability, chemical stability and shall always state clearly the objective of the future land use to be achieved from the reclamation. Also, the MRCP shall present a list of alternatives and rationale for selecting the preferred reclamation activities; long term local community values, among other items, shall also be considered.

4.4.6.1 Mine Reclamation and Closure Plan (MRCP) Stages

There will be three stages of MRCPs to be developed by the Company:-

a) Preliminary MRCP

A Preliminary MRCP shall be prepared prior to the actual construction of the mine site. It shall be developed in conjunction with initial mine planning and shall relate to the environmental assessment of the project. It is therefore, based to some degree on assumed future conditions. Community participation shall be an important aspect of the plan.

b) Interim MRCP

Interim MRCPs shall be developed during the production stages of the mine. One or more Interim MRCPs shall be prepared through the operating life of the mine as required by the Government law and regulations. Interim MRCPs shall be updated

when there is a significant change to the mine plan, or according to key milestones in the mine life.

The general purpose of the Interim MRCP is to update preceding plans according to the current mine operating plan, updated or renewed community values, or advances in mine reclamation technology. Interim Reclamation Plans provide conceptual detail on the reclamation of mine components which will not be closed until near the end of the mining operations, and operational detail for components which are to be progressively reclaimed earlier in the mine life. The Interim MRCP shall include increased detail and more specific closure criteria regarding reclamation components as these become available and as those areas of the mine are developed (e.g. rock piles that are completed or reclamation test studies that have been conducted).

c) Final MRCP

A Final MRCP shall be prepared and approved at the end of mine life during the mine closure stage or before a scheduled permanent closure or immediately after an unplanned closure and shall provide detailed descriptions of the proposed reclamation activities. The general purpose of the Final MRCP is to provide complete details, usually for regulatory approval, regarding the proposed reclamation activities such that they can be subsequently implemented. The Final MRCP itself may include a schedule for updates to the plan while the work is being implemented.

4.4.6.2 Reclamation schedule

Additionally, the company shall also prepare two other documents that are of importance to the reclamation process after completion of reclamation process such as;

a) The Reclamation Completion Report

b) The Performance Assessment Report

These stages of reclamation planning and reporting illustrate how they might relate to progressive reclamation process to be carried out during the mine operating life.

Progressive reclamation is anticipated to be started in Year 3 of mining operations when ore reserves at the pit depletes and the pit is available for reclamation. Overburden and waste material stockpiles and tailings materials will be used as backfill in the mined out areas.

Subject to the government requirement, all permanent structures and buildings shall be demolished and removed unless the buildings are required to remain as they are by the authority.

4.4.6.3 Financial assurances for reclamation and closure

A&M recognizes that certain financial assurances need to be given to the Government as a form of guarantee for effective performance of mine reclamation and closure. To meet this requirement, A&M proposes that a sinking fund be established by the Government for this purpose. A&M agrees that in addition to the production sharing, additional percentages from the company's profit and the total amount of the sinking fund shall be agreed by the Government authority prior to finalizing the commencement of progressive reclamation work.

It was observed that majority of mines elsewhere presented the conceptual plan of reclamation and closure which are being updated accordingly with the progress of production operations, were not faithfully realized in due course. A& M committed itself to fulfill the obligations in this respect.

4.5 COMPARISON AND SELECTION OF THE PREFERRED ALTERNATIVES

One of the main tasks in exploitation of mineral deposits is to select a method suitable for the deposit specific features. A number of project alternatives were assessed before accepting the current project description. These related to the location of surface infrastructure such as the plant, tailings pond, waste dump, the mining method (hydraulic mining, dredge mining and mechanical mining); the processing of ore at the plant and water supply and effluent disposal.

4.5.1 Description of the Selected Mining Methods

Commonly used mining methods in similar type of ore bodies should be visited in view of technical, economic, social and environmental aspects for acquiring similar performance in order to get a fair justification on the selected mining method.

4.5.1.1 Gravel pump mining method

In gravel pump mining method which is very common in alluvial deposits, the efficiency of the operation depends on the character of the tin bearing ground. The high

stripping ratio, the tenacity of pegmatite ground, and the distance the slurry transported along the slurry pipelines are important parameters determining the efficiency of operation. When the tin is occurring in the pegmatite veins, the sticky nature of pegmatite clay called for very strong pressure of water to break the clay balls of pegmatite to set the cassiterite grains free. It is a common practice to build wooden palongs as near to the monitor working face as practicable in order to get a high mining recovery. The longer the slurry pipe the higher the horse power to pump the slurry towards the grizzly for feeding the palongs.

For distances longer than 200 meters multi stage pumping become essential which significantly increases the operating cost to get satisfactory efficiency. In contrast, the transport of ore is done by dump trucks in the dry mining method more effectively. Where the tin bearing layer is low and lying near the water table the working face can be over flooded during the heavy rains endangering the workers and gravel pumps. Heavy repair and maintenance have to follow-up after such over floods wasting away the productive working hours for dewatering the work face. Depending on the nature of deposit as to its physical composition containing high amount of conglomerates the wear and tear rate of liner doors, impellers and gravel pumps and slurry pumps is high thereby increasing the relevant operating cost.

The hydraulic monitors are the main equipment for disintegrating the ore bearing ground as well as undertaking primary separation of ore and waste, the efficiency of monitors are higher near the working face which in turn is more dangerous to workers due to wall collapse. The palong concentrates are fed to the mineral processing plant for further upgrading. Gravel pump mining method takes shorter start up time and higher operating cost than the dry mining method as it needs a minimum of site preparation works once a favorable topography is chosen for setting up the palong and gravel pump pit.

4.5.1.2 Dredging

Tin bucket dredges are very common in low lying rich alluvial deposits of tin. The method is suitable for working in areas where mechanical maintenance facilities are favorable. Own facility for maintenance shall have to be set up for smooth non interrupted operation of bucket dredges. Initial investment cost is rather high in contrast to other alternative mining methods. The sticky nature of the tin bearing deposit and the effect of tidal shoreline will greatly influence the choice of a suitable size of dredge.

4.5.1.3 Underground mining

It is OSHE's opinion that the underground mining method is not suitable for this type of ore deposit as the tin mineralization in the pegmatite veins is lying near the surface, and the host rock is not strong for self supporting. As Zegami area is situated in the low land just only a few meters above sea level at the hills, it is not practical to design the underground mine plan in which dewatering will be the main problem rather than the extraction of commercially viable tin veins.

4.5.2 Choice of Selected Mining Method

Open-pit is one of the most common mining methods used when the ore bodies are large and located near the surface. Hydraulic Mining with Gravel pump method is another practical mining technique used for near-surface ore bodies and it is especially suited for alluvial deposits. A&M Myanmar Limited has proposed the Open Pit Mining method (Mechanical Dry Mining) for exploitation of the ore reserves at Zegami as it is more practical, safer and technically and commercially more viable than other mining methods. The reasons for selecting the preferred option are briefly outlined below.

1. Spatial characteristics and physical and geologic characteristics of the deposit: As ore bodies are located on or near the surface and due to physical nature of the ore, open pit dry mining method is practical and most commonly used as earth moving equipment can easily and efficiently be used to mine ore bodies as well as overburden.
2. Overburden waste materials: In open pit mining method, overburden can efficiently be removed and dumped/kept at specific waste dump areas (i.e. stripping operation) for use during rehabilitation stage when the mine is closed. Selective mining and flexibility of mine operations are more favorable for this option.
3. Ore transportation: Average distance between ore bodies and processing plant is about 600 m. Dump trucks can haul the ores from the open pit to the processing plant at an average distance of 600 m efficiently by mechanical dry mining method.
4. Safety to workers and equipment: The overall slope of pit wall can be maintained at 45^{o} or more to ensure slope stability and as such minimizing the risk of wall collapsing. Hence open pit mining method is comparatively

safe for the workers and equipment because wall-collapse or cave-in can be prevented.

5. Possibility for selective mining: Selective mining can be done easily as excavators and dump truck can efficiently be used for the extracting high and low grades ore zones as well as separating waste zones from ore zones.
6. Economic viability: Capital cost can be higher than hydraulic mining cost if all earth moving equipment (EME) such excavators, bulldozers and dump trucks are purchased. Substantial capital cost savings can be achieved if EME is rented or purchased through leasing arrangement. Operating cost is comparatively lower compared to other mining methods.

In contrast to the other alternative mining methods, given topographic conditions, security of spare supply, limited availability of skilled labors, and environmental impacts of the project, the Open Pit Mining method (Mechanical Dry Mining) selected by the A&M best suits for a viable operation in Zegami Project Area.

5 IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

To identify the potential environmental and social impacts of the project, project activities were correlated with environmental and social receptors and their interactions were identified for potential environmental and social impacts. EIA team finds out twenty four key environmental and social impacts of the project on its environment. These impacts are described in this section of the report.

5.1 IMPACT AND RISK ASSESSMENT METHODOLOGY

Rating matrix method is used to assess the significance level of the identified environmental and social impacts of the Zegami Tin Mine Project on its environment. There are five parameters considered for the activities of the project and the consequences resulted from the said activities. System of rating is described in detail as follows.

Table 51. Severity of Consequence

Severity	Rating
Insignificant/ non-harmful	1
Small/ potential harmful	2
Significant/ slightly harmful	3
Great/ harmful	4
Disastrous/ deadly harmful	5

Table 52. Duration of the Consequence

Duration	Rating
Up to One Month	1
Up to One Year	2
Up to Ten Year	3
More than 10 year	4
Permanent	5

Table 53. Spatial Scope of the Consequence

Spatial Scope	Rating
Activity specific	1
Within right of way	2
Local area	3
National	4
Global	5

Table 54. Frequency of Activity

Frequency	Rating
Annual or less	1
Bi-annual	2
Monthly	3
Daily Intermittence	4
Daily Continuous	5

Table 55 Probability of Activity

Probability	Rating
Almost impossible	1
Highly unlikely	2
Unlikely	3
Possible	4
Definitely	5

Table 56. Significance Rating Matrix

Activity (Frequency + Probability)	Consequence (Severity + Spatial Scope + Duration)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 57. Significance Levels

Sr.	Color Code	Value	Rating
1		1-25	Very Low
2		26-50	Low
3		51-75	Low-Medium
4		76-100	Medium-High
5		101-125	High
6		126-150	Very High

5.2 IMPACT AND RISK IDENTIFICATION, ASSESSMENT AND MITIGATION

In this section of the report, anticipated impacts of the Zegami Tin Mine project are identified by an activity/receptor matrix, assessed with rating matrix and mitigation measures for the identified impacts are delineated.

5.2.1 Pre-construction

5.2.1.1 Impact Identification

Table 58. Impact Identification Table

		PRECONSTRUCTION		
		LAND ACQUISITION	CAMPING	EXPLORATION
PHYSICAL	AIR			
	WATER		Domestic wastewater	
	LAND		Site preparation, domestic waste	
SOCIAL				Conflict with plantation owner
SOCIOECONOMICS			Food and other supply, Job opportunity	Compensation for plantation
HEALTH				
CLIMATE CHANGE				

There are five distinct impacts in the pre-construction phase of the project which are:

1. Domestic wastewater from mine camp
2. Waste from site preparation
3. Solid waste from mine camp
4. Conflict with plantation owner in exploration
5. Job opportunities in camp and exploration

5.2.1.2 Impact characterization

Characteristics of the impacts are evaluated based on eight particular basis, five of which are used in the assessment of the significance level of the impacts.

Table 59. Impact Characterization Table

IMPACTS	CHARACTERISTICS							
	Nature	**Impact Source**	**Impact Receptor**	**Severity**	**Duration**	**Spatial Scope**	**Frequency**	**Probability**
Domestic wastewater from mine camp	Negative	Mine camp	Water	Insignificant	Project Life	Local	Daily	Possible
Waste from site preparation	Negative	Solid Waste	Land	Insignificant	Less than 1 Year	Site	Once	Possible
Solid waste from mine camp	Negative	Solid Waste	Near Village	Insignificant	Project Life	Site	Daily	Possible
Conflict with plantation owner in exploration	Negative	Exploration	Plantation owner	Significant	Once	Site	Once	Possible
Job opportunities in camp and exploration	Positive	General workers	Near villagers	Insignificant	Project Life	Local	Once	Possible

5.2.1.3 Impact Assessment

Assessment of the identified impacts are carried out with rating matrix method the detail of which are shown in the previous part of this chapter. The assessment results are shown in following table.

Table 60. Impact Assessment Table

Sr.	Impact	Severity	Duration	Spatial Scope	Frequency	Probability	Total Rating	Significance Level
1	Mine camp wastewater	1	4	2	5	4	63	Low-Medium
2	Solid waste	1	4	2	5	4	63	Low-Medium
3	Job opportunities	1	4	3	1	4	40	Low
4	Conflict with plantation owner	3	1	2	1	4	30	Low
5	Site preparation waste	1	2	2	1	4	25	Very Low

5.2.1.4 Impact Mitigations

Following mitigation measures are formulated to prevent, reduce, or compensate the effect of the impacts caused by the project activities. Detail plan for management actions, implementation and follow-up of the impact mitigations are delineated in EMP chapter.

Table 61. Impact Mitigations Table

Sr.	Impact	Mitigation/Enhancement Measures
1	Mine camp wastewater	(1) Providing a settling pond of about (10,000) ft^3 at the designated location (2) Providing a sand filtration unit at the discharge of the settling pond (3) Carrying out weekly maintenance work for sand filtration unit (4) Carrying out annual maintenance work for settling pond

		(5) Monitoring the quality of all liquid waste streams discharged from the site to ensure compliance with NEQG standards (6) The pre-treatment of oil and grease containing effluents from canteens by the use of a grease trap prior to discharge into settling pond
2	Solid waste from mine camp	(1) Providing adequate waste bins (2) Providing waste pit and systematically dumping waste only in pit (3) The waste pit must be located and designed in such a way so as to minimize the risk of contamination of ground water resources; (4) All employees will be informed of correct waste management procedures (5) Soil contaminated with hydrocarbon should be immediately removed and disposed of as hazardous waste. (6) Providing adequate number of sanitary worker
3	Job opportunities	(1) Local people must be prioritized for employment (2) Advertisement must be made for every recruitment in village administrator office and other public places (3) Recruitment and plant operation must be done in accordance with labour and employment laws
4	Conflict with plantation owner	(1) Conduct adequate negotiation prior to operation (2) Notify respective plantation owners prior to operation
5	Site preparation waste	(1) Systematically compiling site preparing waste to prevent them from disrupting natural drainages (2) Site Preparation wastes such as bushes will be reused as fuel

5.2.2 Construction

5.2.2.1 Impact Identifications

Table 62. Impact Identification Table

		CONSTRUCTION				
		JETTY CONSTRUCTION	ROAD CONSTRUCTION	MINE TOWN	DRESSING PLAN	TAILING SITE
PHYSICAL	AIR		Dust			Dust
	WATER	Erosion, Sedimentation	Natural drainage, Sedimentation	Domestic wastewater		Natural drainage
	LAND		Road track	Site preparation		Site preparation
BIOLOGICAL	FLORA		Road track	Site clearing		Site clearing
	FAUNA			Site clearing		Site clearing
SOCIAL			Conflict with plantation owner	Job opportunity		Conflict with plantation owner
SOCIOECONOMICS			Compensation for plantation	Food and other supply		Compensation for plantation

There are seven distinct impacts in the construction phase of the project which are:

1. Dust from road and tailing site constructions
2. Sedimentation from site runoff water
3. Domestic wastewater from mine town
4. Destruction of natural drainage from road and tailing site constructions
5. Loss of flora and fauna in site clearing
6. Conflict with plantation owner in site clearing works
7. Job opportunities in construction works (and supply chain)

5.2.2.2 .Impact Characterization

Characteristics of the impacts are evaluated based on eight particular basis five of which are used in the assessment of the significance level of the impacts.

Table 63. Impact Characterization Table

IMPACTS	CHARACTERISTICS							
	Nature	**Impact Source**	**Impact Receptor**	**Severity**	**Duration**	**Spatial Scope**	**Frequency**	**Probability**
Dust from road and tailing site constructions	Negative	Construction dust	Worker Plantations	Significant	Up to 1 year	ROW	Daily intermittence	Possible
Sedimentation from site runoff water	Negative	Runoff water in raining season	Drainage	Significant	Project Life	Local	Daily in raining season	Possible
Domestic wastewater from mine town	Negative	Domestic Wastewater from mine camp	Water regime	Significant	Project Life	Local	Daily intermittence	Possible
Destruction of natural drainage from road and tailing site constructions	Negative	Construction road & tailing site	Natural drainage	Significant	Up to 1 year	ROW	Once	Unlikely
Loss of flora and fauna in site clearing	Negative	Site clearing	Biodiversity Regime	Small	Project Life	Project Site	Once	Possible

Conflict with plantation owner in site clearing works	Negative	Site clearing on 3 pits	Plantation owners on 3 pits	Significant	Up to 1 year	Local	Once	Unlikely
Job opportunities in construction works (and supply chain)	Positive	Construction works	Nearby villagers	Insignificant	Project Life	Local	Once	Possible

5.2.2.3 Impact Assessment

Assessment of the identified impacts is carried out with rating matrix method the detail of which are shown in the previous part of this chapter. The assessment results are shown in following table.

Table 64. Impact Assessment Table

Sr.	Impact	Severity	Duration	Spatial Scope	Frequency	Probability	Total Rating	Significance Level
1	Dust from road and tailing site constructions	3	2	2	4	4	56	Low-Medium
2	Sedimentation from site runoff water	3	4	3	4	4	80	Medium–High
3	Domestic wastewater from mine town	3	4	3	4	4	80	Medium–High
4	Destruction of natural drainage from road and tailing site constructions	3	2	2	1	2	21	Very Low
5	Loss of flora and fauna in site clearing	2	4	2	1	4	40	Low
6	Conflict with plantation owner in site clearing works	3	2	3	1	3	32	Low
7	Job opportunities in construction works (and supply chain)	1	4	3	1	4	40	Low

5.2.2.4 Impact Mitigations

Following mitigation measures are formulated to prevent, reduce, or compensate the effect of the impacts caused by the project activities. Detail plan for management actions, implementation and follow-up of the impact mitigations are delineated in EMP chapter.

Table 65. Impact Mitigations Table

Sr.	Impact	Mitigation/Enhancement Measures
1	Dust from road and tailing site constructions	(1) Water sprays at area to be cleared, to be graded, unpaved haulage road (2) Ensure travel distance between clearing area and topsoil piles are at a minimum. (3) Ensure exposed areas remain moist through regular water spraying during dry, windy periods
2	Sedimentation from site runoff water	(1) Access and haul roads will have gradients and surface treatment to limit erosion, and road drainage systems will be provided (2) Re-vegetation of disturbed areas will be performed immediately following application of the growth medium to avoid erosion (3) A drainage ditch will be built around dump area which will be connected to tailing ponds (4)Direct water away from disturbed areas
3	Domestic wastewater from mine town	(1) Carrying out weekly maintenance work for sand filtration unit (2) Carrying out annual maintenance work for settling pond (3) Monitoring the quality of all liquid waste streams discharged from the site to ensure compliance with NEQG standards (4) The pre-treatment of oil and grease containing effluents from canteens by the use of a grease trap prior to discharge into settling pond (5) Spills must be cleaned up and remediated immediately after occurrence.
4	Destruction of natural drainage from road and tailing site constructions	(1) Site infrastructure such as roads and fences should be aligned with the natural drainage lines to minimize additional erosion. (2) Natural drainage lines must not be obstructed or otherwise interfered with. (3) Erosion should be monitored over the entire site and, where initial indications of erosion are detected, appropriate remedial measures must be taken as soon as possible

5	Loss of flora and fauna in site clearing	(1) Layout of the access road to use existing roads and paths wherever possible. (2) Demarcating the construction area and ensure that the vegetation on the other side of these "barriers" is not disturbed. (3) Areas within the project area that are not required during mining should be demarcated as no-go areas and conserved. (4) Prevent mining employees from harvesting plants for personal use, firewood or charcoal within the project area. (5) Monitor the project area for any new invasive plant species eradicate alien plants as they appear.
6	Conflict with plantation owner in site clearing works	(1) Conduct adequate negotiation prior to construction (2) Notify respective plantation owners prior to construction
7	Job opportunities in construction works (and supply chain)	(1) Local people must be prioritized for employment (2) Advertisement must be made for every recruitment in village administrator office and other public places (3) Recruitment and plant operation must be done in accordance with labour and employment laws

5.2.3 Operation

5.2.3.1 Impact Identification

Table 66. Impact Identification Table

		OPERATION				
		SITE CLEARING	TOP SOIL REMOVAL	MINING	DRESSING	TAILING OPERATION
PHYSICAL	AIR	Noise, Dust, …	Noise, Dust, …	Noise, Dust, …	Noise, Dust, …	Noise
	WATER	Sedimentation	Sedimentation		Waste water	Waste water
	LAND		Land form	Land form	Tailing	Tailing
BIOLOGICAL	FLORA	Loss of flora				Aquatic flora
	FAUNA	Loss of habitat				Aquatic fauna
SOCIOECONOMICS		Compensation for plantation, Economic Displacement				
HEALTH				OSH,CSH	OSH,CSH	OSH,CSH

Majority of project impacts will occur upon the operation of the project. There are nine distinct impacts in the operation phase of the project which are:

1. Noise from operation works
2. Dust from operation works
3. Sedimentation from site runoff water
4. Waste water from dressing plant and tailing site
5. Tailing waste
6. Loss of flora and fauna in site clearing works
7. Economic displacement
8. OSH
9. CSH

5.2.3.2 Impact Characterization

Characteristics of the impacts are evaluated based on eight particular basis five of which are used in the assessment of the significance level of the impacts.

Table 67. Impact Characterization Table

IMPACTS	CHARACTERISTICS							
	Nature	**Impact Source**	**Impact Receptor**	**Severity**	**Duration**	**Spatial Scope**	**Frequency**	**Probability**
Noise from operation works	Negative	Site clearing, Top soil removal, Mining, Dressing, Tailing operation	Workers	Significant	Project Life	Activity Specific	Daily continuous	Possible
Dust from operation works	Negative	Site clearing, Top soil removal, Mining, Dressing	Workers	Significant	Project Life	Project Compound	Daily intermittence	Possible
Sedimentation from site runoff water	Negative	Site clearing, Top soil removal	Drainage	Significant	Project Life	Local	Daily in rainy season	Possible
Waste water from dressing plant and tailing site	Negative	Dressing, Tailing operation	Drainage	Significant	Project Life	Local	Daily	Unlikely

Tailing waste	Negative	Tailing	Land	Significant	Project Life	Tailing site	Daily intermittence	Possible
Loss of flora and fauna in site clearing works	Negative	Site clearing	Biodiversity	Small	Project Life	Operation Area	Once	Possible
Economic displacement	Negative	Mining	Villager	Significant	Project Life	Local	Once	Possible
OSH	Negative	Mining	Workers	Significant	Project Life	Within right of way	Daily	Possible
CSH	Negative	Transportation	Near Villagers	Significant	Project Life	Local	Daily	Possible

5.2.3.3 Impact Assessment

Assessment of the identified impacts are carried out with rating matrix method the detail of which are shown in the previous part of this chapter. The assessment results are shown in following table.

Table 68. Impact Assessment Table

Sr.	Impact	Severity	Duration	Spatial Scope	Frequency	Probability	Total Rating	Significance Level
1	Noise from operation works	3	4	1	5	4	72	Low-Medium
2	Dust from operation works	3	4	3	5	4	90	Medium-High
3	Sedimentation from site runoff water	3	4	3	4	4	80	Medium–High
4	Waste water from dressing plant and tailing site	3	4	3	5	4	90	Medium-High
5	Tailing waste	3	4	1	4	4	64	Low- Medium
6	Loss of flora and fauna in site clearing works	2	4	3	2	3	45	Low
7	Economic displacement	3	4	3	1	4	50	Low
8	OSH	3	4	2	5	4	81	Medium-High
9	CSH	3	4	3	5	4	90	Medium-High

5.2.3.4 Impact Mitigations

Following mitigation measures are formulated to prevent, reduce, or compensate the effect of the impacts caused by the project activities. Detail plan for management actions, implementation and follow-up of the impact mitigations are delineated in EMP chapter.

Table 69. Impact Mitigations Table

Sr.	Impact	Mitigation/Enhancement Measures
1	Noise from operation works	(1) Regular maintenance of machinery (2) Providing necessary PPE for workers at high noise area (3) Supervising regular use of PPE at high noise area
2	Dust from operation works	(1) Water sprays at area to be cleared, graded and unpaved haulage road (2) Ensure travel distance between clearing area and topsoil piles are at a minimum. (3) Freshly graded areas to be kept to a minimum. (4) Ensure exposed areas remain moist through regular water spraying during dry, windy periods.
3	Sedimentation from site runoff water	(1) Access and haul roads will have gradients and surface treatment to limit erosion, and road drainage systems will be provided (2) Re-vegetation of disturbed areas will be performed immediately following application of the growth medium to avoid erosion (3) A drainage ditch will be built around dump area which will be connected to tailing ponds (4) Direct water away from disturbed areas
4	Waste water from dressing plant and tailing site	(1) Recycling supernatant from tailing pond to Palaung to minimize the amount of make-up water (2) The quality of mine effluent streams discharged to the Anyin Creek will be treated to meet the applicable effluent discharge guideline values in Section 2.7.2 of NEQG (3) Water pumped from mine workings must be appropriately treated to remove metals and increase pH before discharge into the river. (4) The quality of effluent must be regularly and frequently monitored, the reasons for any non-conformances must be investigated as soon as they come to light and measures put in place to rectify them. (5) Mine water and surface run-off from the mining areas should be detained in sedimentation ponds before the clear surface water is allowed to flow into the adjacent drainage lines or streams.

		(6) Contaminated runoff waters coming from hazardous areas such as concentrator plant, mineral stock-piling, concentrates, mine tailings accumulation areas are to be drained and treated before being disposed of at the discharge point.
5	Tailing waste	(1) The tailings facility must be sited in a location such that in the event of failure, pollution of soil and water as well as physical risk to communities is minimized. (2) The integrity of the waste rock dump and tailings facility must be inspected regularly by suitably qualified personnel throughout the life of the mine. (3) Access to waste rock dump will be restricted as far as practical and all local communities will be informed of the potential risks associated with these facilities through site notices and community meetings. (4) Regular monitoring of water quality around the waste rock dumps.
6	Loss of flora and fauna in site clearing works	(1) Layout of the access road to use existing roads and paths wherever possible. (2) Demarcating the mining area and ensure that the vegetation on the other side of these "barriers" is not disturbed. (3) Areas within the project area that are not required during mining should be demarcated as no-go areas and conserved. (4) Prevent mining employees from harvesting plants for personal use, firewood or charcoal within the project area. (5) Monitor the project area for any new invasive plant species eradicate alien plants as they appear.
7	Conflict with plantation owner	(1) Conduct adequate negotiation prior to operation (2) Notify respective plantation owners prior to operation
8	Economic displacement	(1) Ensure that existing access routes to natural resources are not affected as far as possible. (2) Farmers Development Programme (FDP) should be developed with the intent of assisting residents increase agricultural production in their locality. (3) Local people must be prioritize for job opportunities

		(4) Workers involved in the construction phase should be incorporated as much as possible as the permanent staff for the operational phase.
9	OSH	(1) Procedure and guidelines on the health, safety and environment management system provided by A&M Myanmar Ltd must be followed completely (2) Labour accommodation units to be properly planned to avoid overcrowded living conditions. (3) As part of the labour recruitment policy, all labour to undergo a pre-employment health screening assessment. (4) Train employees to not urinate or defecate in open water sources. (5) Provide a healthy balanced diet to the workforce. (6) Strengthen partnerships with the local health authorities in the area.
10	CSH	(1) Implementation of a speed limit in mine site and villages for vehicles from mine site (2) Delivery vehicles will not be overloaded and loads will be securely fastened. Within each vehicle, an emergency response plan which specify the actions required of the driver in the event of an accident will be provided. (3) Support of a health post in the area that could benefit most of the PACs (Project Affected Communities). (4) Prior to the development and implementation of any healthcare assistance programme, local leaders, health authorities and the Government must be consulted to ensure the effectiveness of the assistance in the area. (5) A clinic at the mining site itself should offer on-site occupational and emergency services to cater for its workforce. (1) Strengthen partnerships with local health authorities and NGOs. (6) Develop an awareness campaign both for communicable- and non-communicable diseases and prevention strategies. This campaign should be aimed both at the workforce and also the wider PACs.

5.2.4 Decommissioning

5.2.4.1 Impact Identifications

Table 70. Impact Identifications Table

		DECOMMISSION	
		WORKFORCE DEMOMMISSIONING	MACHINERY DECOMMISSIONING
PHYSICAL	AIR		
	WATER		
	LAND	Waste	Waste
BIOLOGICAL	FLORA		
	FAUNA		
SOCIAL			
SOCIOECONOMICS			
HEALTH			
CLIMATE CHANGE			

1. Solid waste from decommission works

5.2.4.2 Impact Characterization

Characteristics of the impacts are evaluated based on eight particular basis five of which are used in the assessment of the significance level of the impacts.

Table 71. Impact Characterization Table

IMPACTS	**CHARACTERISTICS**							
	Nature	**Impact Source**	**Impact Receptor**	**Severity**	**Duration**	**Spatial Scope**	**Frequency**	**Probability**
Solid waste	Negative	Decommissioning works	Soil	Insignificant	Project Life	Local	Daily	Possible

5.2.4.3 Impact Assessment

Assessment of the identified impacts are carried out with rating matrix method the detail of which are shown in the previous part of this chapter. The assessment results are shown in following table.

Table 72. Impact Assessment Table

Sr.	Impact	Severity	Duration	Spatial Scope	Frequency	Probability	Total Rating	Significance Level
1	Solid waste	4	4	1	4	4	72	Low-Medium

5.2.4.4 Impact Mitigations

Following mitigation measures are formulated to prevent, reduce, or compensate the effect of the impacts caused by the project activities. Detail plan for management actions, implementation and follow-up of the impact mitigations are delineated in EMP chapter.

Table 73. Impact Mitigations Table

Sr.	Impact	Mitigation/Enhancement Measures
1	Solid waste	(1) Remove all above-ground structures, including all hazardous materials storage facilities (2) Remove any areas of contaminated soils (3) Empty and clean out water storage tanks and ponds (4) Waste from structural decommissioning must be segregated into recyclable, reusable, and landfill wastes (5) Systematically piled up or landfill decommissioning waste so as to prevent them from disrupting ground water or natural drainages

5.2.5 Closure and post-closure

5.2.5.1 Impact Identifications

Table 74. Impact Identifications Table

		CLOSURE AND POST CLOSURE	
		REFILLING	REPLANTATION
PHYSICAL	AIR	Noise, Dust, …	
	WATER		
	LAND	Refilling	
BIOLOGICAL	FLORA		
	FAUNA		
SOCIAL			
SOCIOECONOMICS			
HEALTH			
CLIMATE CHANGE			

Majority of project impacts will occur upon the operation of the project. There are two distinct impacts in the closure and post-closure phase of the project which are:

1. Dust from refilling works
2. Landform change by refilling

5.2.5.2 Impact Characterization

Characteristics of the impacts are evaluated based on eight particular basis five of which are used in the assessment of the significance level of the impacts.

Table 75. Impact Characterization Table

IMPACTS	CHARACTERISTICS							
	Nature	**Impact Source**	**Impact Receptor**	**Severity**	**Duration**	**Spatial Scope**	**Frequency**	**Probability**
Dust from refilling works	Negative	Refilling Topsoil	Workers	Insignificant	Project Life	Local	Daily	Possible
Landform change by refilling	Negative	Refilling	Land	Insignificant	Less than 1 Year	Site	Once	Possible

5.2.5.3 Impact Assessment

Assessment of the identified impacts are carried out with rating matrix method the detail of which are shown in the previous part of this chapter. The assessment results are shown in following table.

Table 76. Impact Assessment Table

Sr.	Impact	Severity	Duration	Spatial Scope	Frequency	Probability	Total Rating	Significance Level
1	Dust from refilling works	4	4	1	4	4	72	Low-Medium
2	Landform change by refilling	3	4	3	5	4	90	Medium-High

5.2.5.4 Impact Mitigations

Following mitigation measures are formulated to prevent, reduce, or compensate the effect of the impacts caused by the project activities. Detail plan for management actions, implementation and follow-up of the impact mitigations are delineated in EMP chapter.

Table 77. Impact Mitigation Table

Sr.	Impact	Mitigation/Enhancement Measures
1	Dust from refilling works	(1) Water sprays area carrying out filling and grading operations (2) Water sprays unpaved haulage roads as dust suppression measure
2	Landform change by refilling	(1) Refill all the mined out pit in accordance with MRCP (2) Top soil must be refilled back at the surface (3) Re-vegetate the entire site

6 CUMULATIVE IMPACT ASSESSMENT

6.1 FUTURE DEVELOPMENT

Project site is mostly surrounded by cashew plantations. Two villages which are Taungpu and Shwedu are adjacent to project. Foreseeable future development will mainly be infrastructure (road) in nearby villages.

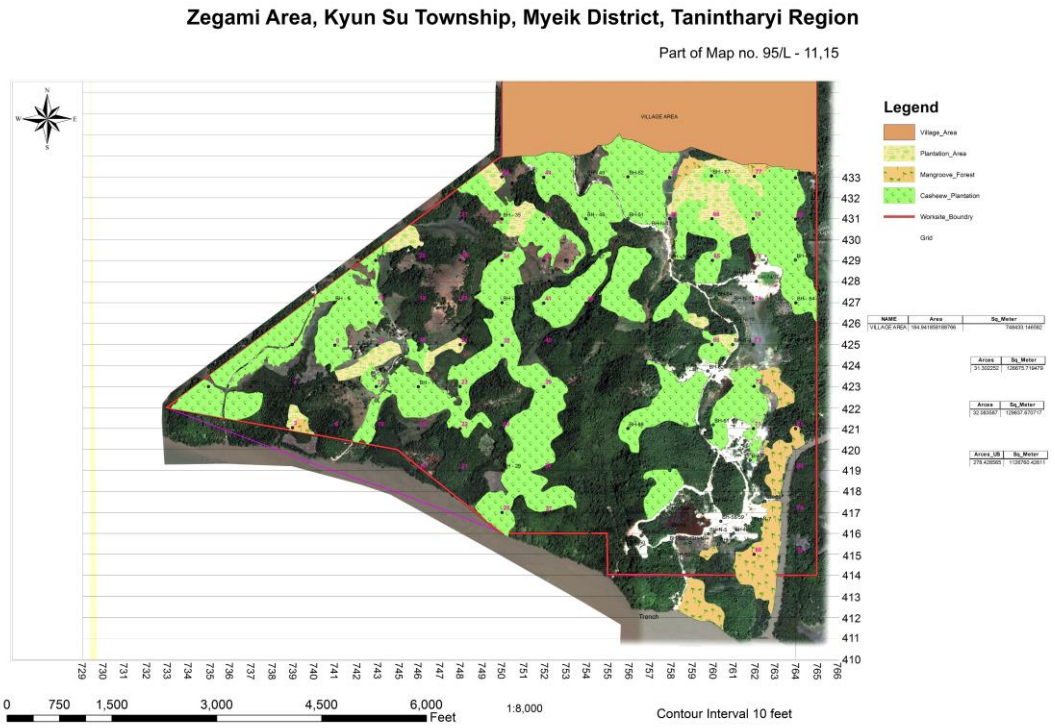


Figure 30. Cashew Nut Plantations in Exploration Area

There are two blocks of Tin Mine owned by a private company called Pyae Shan Paing. But the mines are closed and no activities could be found. No future development information could be available regarding to this mine.

6.2 POTENTIAL CUMULATIVE IMPACTS

Only activity that could create cumulative nature of impacts is Pyae Shan Paing mining development. Since the mine is currently not starting operation, EIA study for the mine has to be conducted and environmental management plan must be implemented as in current mine. So, it could be reasonably expected that emissions and

discharge of pollutants from that mine is at least in compliance with NEQG guideline values.

For Zegami Tin Mine project, following assessment for project related impacts in light of cumulative impact is conducted.

6.2.1 Cumulative Impact on Air Quality

Factors that can impair air quality are dust emission and noise. Effect of dust emission on environment is dust fall out on nearby plantations. Given that the area is high intensity of rainfall and mitigation measures are to be implemented for dust suppression, impact of dust on surrounding environment is expected to be not in cumulative nature. No special mitigation measure except from those delineated in EMP is expected to be needed. Effect of noise will mainly impact mine workers, but nearby fauna species will also have to be impacted. But, naturally, fauna species will move from areas that are unsuitable for survival due to disturbances. So, no accumulation could occur by noise on fauna.

6.2.2 Cumulative Impact on Water Quality

Factors that can impact water quality are generation of domestic and mine waste water. But according to mining plans, water will be settled and reused in mineral processing operation, virtually no water could be discharged but only make up water has to be needed. So, mine water discharge could not occur and only domestic waste water from mine camp will be discharged. Given that the project area is surrounded by water regime, Tanintharyi River in north, Maunghlaw creek in east, and Anyin creek in South, discharged domestic waste water which is treated accordingly as delineated in EMP is expected to be no threat to water environment. No special mitigation measure except from those delineated in EMP is expected to be needed for cumulated water quality impact.

6.2.3 Cumulative Impact on Land

Most prominent impact from mining is impact on land by the change of landform. Most of the extruded portions of the land are leveled out and cut opened generally. Zegami Tin Mine project prepared a systematic Mine Reclamation and Closure plan which includes plans for refilling and replantation of mined out area.

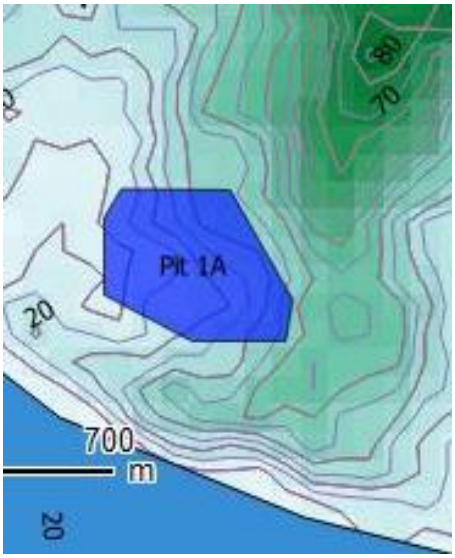


Figure 31. Pit 1A and Surrounding Landform

North-east of pit 1A has the highest local peak with over 80 m, and at the east and south-east has a 60 m hill. Pit 1A exists on an area lies between 15m and 40m at the west of which is lowest and rise up at the east. The pit is located at the west edge of highest local peak and pit area does not cover peak and majority of the hill. So the location of the pit does not disrupt the local landform as most part of the hill will remain intact.

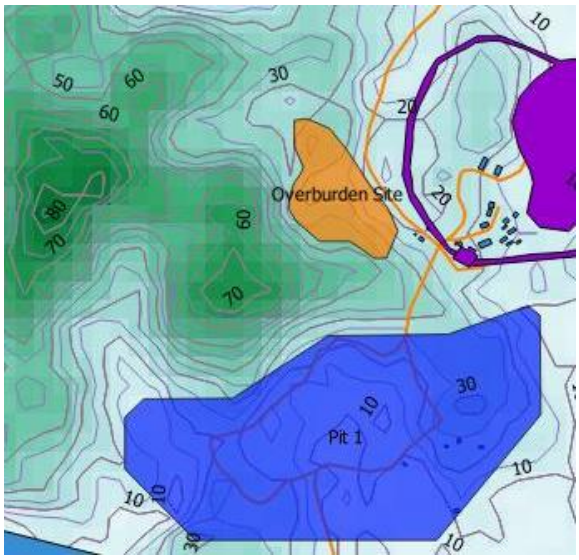


Figure 32. Pit 1 and Surrounding Landform

Most part of the Mining Pit 1 lies on virtually flat area. Only south-west edge of the pit is at the bank of a small 30m hill. So, the land form at the pit after refilling will create no change in landform.

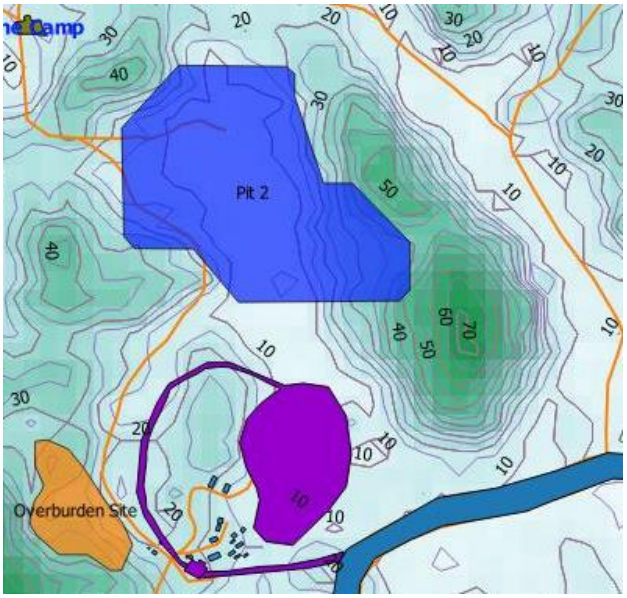


Figure 33. Pit 2 and Surrounding Landform

Mining 2 lies at the middle of three small mounds. Majority area of the pit is a flat 30m plain. Small portions at south-west, north-west and east edges are in contact with the mounds. Since the pit will include only small portions at the edges of the mounds, no prominent landform change will occur from the pit.

According to the analysis results of the three mining pits, surrounding landforms and MRCP, following results could be found:

(a) No major hill or mound is included in the pit areas.

(b) Only edges of the pits are in contact with small mounds

(c) MRCP includes refilling and replantation of the mining pits

So, no major landform change could occur from Zegami Tin Mine project and no special mitigation measure could be needed.

7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 PROJECT DESCRIPTION BY PROJECT PHASE

Myanmar Asia Zone Mining Co. Ltd. (MAZAM) obtained approval to carry out exploration work at the area in the vicinity of Zegami village, Kyunsu Township, Myeik District in Tanintharyi Region following signing of an exploration agreement between Department of Geological Survey and Mineral Exploration, Ministry of Mines and MAZAM on 24 April 2014. MAZAM appointed its associate company A&M Myanmar Co. Ltd. (A&M), a company incorporated in Myanmar to perform exploration over the Area.

Based on the findings of exploration, which proved the occurrence of about 2900 long tons of tin, MAZAM decided to establish a mine project for production of tin in accordance with the prevailing laws of Myanmar. Under Myanmar Mines Law, A&M shall have to acquire a Large Scale Mineral Production Permit for the deposit by fulfilling all legal requirements thereupon. Undertaking an Environmental Impact Assessment for the project area is the essential prerequisite for the implementation. Following activities consist of the project implementation phase by phase.

Table 78. Phase by Phase Project Activities

Pre-construction	Construction	Operation	Decommission	Closure and Post-closure
Land acquisition	Jetty construction	Site clearing	Workforce decommissioning	Refilling
Camping	Road construction	Top soil removal	Machinery decommissioning	Replantation
Exploration	Mine Town building	Mining		
	Dressing Plan	Mineral Dressing		
	Tailing Site	Tailing operation		

7.2 SUMMARY OF IMPACTS AND MITIGATION MEASURES

7.2.1 Summary of Impacts

There are a total of twenty-four significant impacts by the project. Significance level of the impacts are shown in the following tables.

Table 79. Impact Ratings without MEMs

Sr.	Impact	Severity	Duration	Spatial Scope	Frequency	Probability	Total Rating	Significance Level
PRE-CONSTRUCTION								
1	Mine camp wastewater	1	4	2	5	4	63	Low-Medium
2	Solid waste	1	4	2	5	4	63	Low-Medium
3	Job opportunities	1	4	3	1	4	40	Low
4	Conflict with plantation owner	3	1	2	1	4	30	Low
5	Site preparation waste	1	2	2	1	4	25	Very Low
CONSTRUCTION								
1	Destruction of natural drainage from road and tailing site constructions	3	2	2	1	2	21	Very Low
2	Sedimentation from site runoff water	3	4	3	4	4	80	Medium – High
3	Domestic wastewater from mine town	3	4	3	4	4	80	Medium – High
4	Dust from road and tailing site constructions	4	4	1	4	4	56	Low-Medium
5	Loss of flora and fauna in site clearing	2	4	3	2	3	40	Low
6	Conflict with plantation owner in site clearing works	4	1	3	1	4	32	Low

7	Job opportunities in construction works (and supply chain)	1	4	3	1	4	40	Low
OPERATION								
1	Dust from operation works	3	4	3	5	4	90	Medium-High
2	Waste water from dressing plant and tailing site	3	4	3	5	4	90	Medium-High
3	CSH	3	4	3	5	4	90	Medium-High
4	OSH	3	4	2	5	4	81	Medium-High
5	Sedimentation from site runoff water	3	4	3	4	4	80	Medium – High
6	Noise from operation works	4	4	1	4	4	72	Low-Medium
7	Tailing waste	3	4	1	4	4	64	Low-Medium
8	Loss of flora and fauna in site clearing works	2	4	3	2	3	45	Low
9	Economic displacement	3	4	3	1	4	40	Low
DECOMMISSION								
1	Solid waste	4	4	1	4	4	72	Low-Medium
CLOSURE AND POST-CLOSURE								
1	Landform change by refilling	3	3	3	5	4	81	Medium-High
2	Dust from refilling works	3	3	3	5	4	81	Low-Medium

Table 80. Impact Ratings with MEMs

Sr.	Impact	Severity	Duration	Spatial Scope	Frequency	Probability	Total Rating	Significance Level
PRE-CONSTRUCTION								
1	Mine camp wastewater	1	4	2	4	3	49	Low
2	Solid waste	1	4	2	4	3	49	Low
3	Job opportunities	2	4	3	2	4	54	Low-Medium
4	Conflict with plantation owner	2	1	2	1	3	20	Very-Low
5	Site preparation waste	1	2	2	1	3	20	Very Low
CONSTRUCTION								
1	Destruction of natural drainage from road and tailing site constructions	2	2	2	1	2	18	Very Low
2	Sedimentation from site runoff water	3	4	3	3	4	70	Low-Medium
3	Domestic wastewater from mine town	2	4	3	4	4	72	Low-Medium
4	Dust from road and tailing site constructions	3	4	1	3	3	48	Low
5	Loss of flora and fauna in site clearing	2	4	2	1	2	24	Very-Low
6	Conflict with plantation owner in site clearing works	2	1	3	1	3	24	Very-Low
7	Job opportunities in construction works (and supply chain)	2	4	3	2	4	54	Low-Medium
OPERATION								
1	Dust from operation works	2	4	3	5	3	72	Low-Medium
2	Waste water from dressing plant and tailing site	3	3	3	5	3	72	Low-Medium

3	CSH	2	4	3	4	4	72	Low-Medium
4	OSH	3	4	2	4	4	72	Low-Medium
5	Sedimentation from site runoff water	2	4	3	4	4	72	Low-Medium
6	Noise from operation works	3	4	1	3	3	48	Low
7	Tailing waste	3	4	1	3	3	48	Low
8	Loss of flora and fauna in site clearing works	1	3	2	1	3	24	Very Low
9	Economic displacement	2	3	3	1	2	24	Very Low
DECOMMISSION								
1	Solid waste	3	4	1	3	3	48	Low
CLOSURE AND POST-CLOSURE								
1	Landform change by refilling	3	3	3	4	4	72	Low-Medium
2	Dust from refilling works	3	3	3	4	4	72	Low-Medium

All the significance levels of anticipated impacts with and without MEMs could be summarized as in the following table.

Table 81. Summary of Impact Significance With/Without MEMs

Sr.	**Impact**	**Without Mitigation**		**With Mitigation**	
		Rating	**Significance**	**Rating**	**Significance**
Pre-Construction					
1	Mine camp wastewater	63	Low-Medium	49	Low
2	Solid waste	63	Low-Medium	49	Low
3	Job opportunities	40	Low	54	Low-Medium
4	Conflict with plantation owner	30	Low	20	Very-Low
5	Site preparation waste	25	Very Low	20	Very Low

Construction					
1	Destruction of natural drainage from road and tailing site constructions	21	Very Low	18	Very Low
2	Sedimentation from site runoff water	80	Medium–High	70	Low-Medium
3	Domestic wastewater from mine town	80	Medium–High	72	Low-Medium
4	Dust from road and tailing site constructions	56	Low-Medium	48	Low
5	Loss of flora and fauna in site clearing	40	Low	24	Very-Low
6	Conflict with plantation owner in site clearing works	32	Low	24	Very-Low
7	Job opportunities in construction works (and supply chain)	40	Low	54	Low-Medium
Operation					
1	Dust from operation works	90	Medium-High	72	Low-Medium
2	Waste water from dressing plant and tailing site	90	Medium-High	72	Low-Medium
3	CSH	90	Medium-High	72	Low-Medium
4	OSH	81	Medium-High	72	Low-Medium
5	Sedimentation from site runoff water	80	Medium –High	72	Low-Medium
6	Noise from operation works	72	Low-Medium	48	Low
7	Tailing waste	64	Low- Medium	48	Low
8	Loss of flora and fauna in site clearing works	45	Low	24	Very Low
9	Economic displacement	40	Low	24	Very Low

Decommissioning					
1	Solid waste	72	Low-Medium	48	Low
Closure and Post-closure					
1	Landform change by refilling	81	Medium-High	72	Low-Medium
2	Dust from refilling works	81	Low-Medium	72	Low-Medium

7.2.2 Summary of Mitigation Measures

Table 82. Summary of MEMs

Sr.	Impact	Mitigation
Pre-Construction		
1	Mine camp wastewater	(1) Providing a settling pond of about (10,000) ft^3 at the designated location (2) Providing a sand filtration unit at the discharge of the settling pond (3) Carrying out weekly maintenance work for sand filtration unit (4) Carrying out annual maintenance work for settling pond (5) Monitoring the quality of all liquid waste streams discharged from the site to ensure compliance with NEQG standards (6) The pre-treatment of oil and grease containing effluents from canteens by the use of a grease trap prior to discharge into settling pond
2	Solid waste from mine camp	(1) Providing adequate waste bins (2) Providing waste pit and systematically dumping waste only in pit (3) The waste pit must be located and designed in such a way so as to minimize the risk of contamination of ground water resources; (4) All employees will be informed of correct waste management procedures (5) Soil contaminated with hydrocarbon should be immediately removed and disposed of as hazardous waste. (6) Providing adequate number of sanitary worker
3	Job opportunities	(1) Local people must be prioritized for employment

		(2) Advertisement must be made for every recruitment in village administrator office and other public places (3) Recruitment and plant operation must be done in accordance with labour and employment laws
4	Conflict with plantation owner	(1) Conduct adequate negotiation prior to operation (2) Notify respective plantation owners prior to operation
5	Site preparation waste	(1) Systematically compiling site preparing waste to prevent them from disrupting natural drainages (2) Site Preparation wastes such as bushes will be reused as fuel
Construction		
1	Dust from road and tailing site constructions	(1) Water sprays at area to be cleared, to be graded, unpaved haulage road (2) Ensure exposed areas remain moist through regular water spraying during dry, windy periods
2	Sedimentation from site runoff water	(1) Access and haul roads will have gradients and surface treatment to limit erosion, and road drainage systems will be provided (2) A drainage ditch will be built around dump area which will be connected to tailing ponds (3)Direct water away from disturbed areas
3	Domestic wastewater from mine town	(1) Carrying out weekly maintenance work for sand filtration unit (2) Carrying out annual maintenance work for settling pond (3) Monitoring the quality of all liquid waste streams discharged from the site to ensure compliance with NEQG standards (4) The pre-treatment of oil and grease containing effluents from canteens by the use of a grease trap prior to discharge into settling pond
4	Destruction of natural drainage from road and tailing site constructions	(1) Site infrastructure such as roads and fences should be aligned with the natural drainage lines to minimize additional erosion. (2) Natural drainage lines must not be obstructed or otherwise interfered with. (3) Erosion should be monitored over the entire site and, where initial indications of erosion are detected, appropriate remedial measures must be taken as soon as possible
5	Loss of flora and fauna in site clearing	(1) Layout of the access road to use existing roads and paths wherever possible. (2) Demarcating the construction area and ensure that the vegetation on the other side of these “barriers” is not disturbed.

		(3) Areas within the project area that are not required during mining should be demarcated as no-go areas and conserved. (4) Prevent mining employees from harvesting plants for personal use, firewood or charcoal within the project area. (5) Monitor the project area for any new invasive plant species eradicate alien plants as they appear.
6	Conflict with plantation owner in site clearing works	(1) Conduct adequate negotiation prior to operation (2) Notify respective plantation owners prior to operation
7	Job opportunities in construction works (and supply chain)	(1) Local people must be prioritized for employment (2) Advertisement must be made for every recruitment in village administrator office and other public places (3) Recruitment and plant operation must be done in accordance with labour and employment laws
Operation		
1	Noise from operation works	(1) Regular maintenance of machinery (2) Providing necessary PPE for workers at high noise area (3) Supervising regular use of PPE at high noise area
2	Dust from operation works	(1) Water sprays at area to be cleared, graded and unpaved haulage road (2) Ensure exposed areas remain moist through regular water spraying during dry, windy periods.
3	Sedimentation from site runoff water	(1) Access and haul roads will have gradients and surface treatment to limit erosion, and road drainage systems will be provided (2) Re-vegetation of disturbed areas will be performed immediately following application of the growth medium to avoid erosion (3) A drainage ditch will be built around dump area which will be connected to tailing ponds (4) Direct water away from disturbed areas
4	Waste water from dressing plant and tailing site	(1) Recycling supernatant from tailing pond to Palaung to minimize the amount of make-up water (2) The quality of effluent must be regularly monitored, the reasons for any non-conformances must be investigated as soon as they come to light and measures put in place to rectify them. (3) Contaminated runoff waters coming from hazardous areas such as concentrator plant, mineral stock-piling, concentrates, mine tailings accumulation areas are to be drained and treated before being disposed of at the discharge point.

5	Tailing waste	(1) The tailings facility must be sited in a location such that in the event of failure, pollution of soil and water as well as physical risk to communities is minimized. (2) The integrity of the waste rock dump and tailings facility must be inspected regularly by suitably qualified personnel throughout the life of the mine. (3) Access to waste rock dump will be restricted as far as practical and all local communities will be informed of the potential risks associated with these facilities through site notices and community meetings. (4) Regular monitoring of water quality around the waste rock dumps.
6	Loss of flora and fauna in site clearing works	(1) Layout of the access road to use existing roads and paths wherever possible. (2) Demarcating the mining area and ensure that the vegetation on the other side of these "barriers" is not disturbed. (3) Areas within the project area that are not required during mining should be demarcated as no-go areas and conserved. (4) Prevent mining employees from harvesting plants for personal use, firewood or charcoal within the project area. (5) Monitor the project area for any new invasive plant species eradicate alien plants as they appear.
7	Economic displacement	(1) Ensure that existing access routes to natural resources are not affected as far as possible. (2) Farmers Development Programme (FDP) should be developed with the intent of assisting residents increase agricultural production in their locality. (3) Local people must be prioritize for job opportunities (4) Workers involved in the construction phase should be incorporated as much as possible as the permanent staff for the operational phase.
8	OSH	(1) Procedure and guidelines on the health, safety and environment management system provided by A&M Myanmar Ltd must be followed completely (2) Labour accommodation units to be properly planned to avoid overcrowded living conditions. (3) As part of the labour recruitment policy, all labour to undergo a pre-employment health screening assessment. (4) Train employees to not urinate or defecate in open water sources.

		(5) Provide a healthy balanced diet to the workforce. (6) Strengthen partnerships with the local health authorities in the area.
9	CSH	(1) Implementation of a speed limit in mine site and villages for vehicles from mine site (2) Delivery vehicles will not be overloaded and loads will be securely fastened. Within each vehicle, an emergency response plan which specify the actions required of the driver in the event of an accident will be provided. (3) Support of a health post in the area that could benefit most of the PACs (Project Affected Communities). (4) Prior to the development and implementation of any healthcare assistance programme, local leaders, health authorities and the Government must be consulted to ensure the effectiveness of the assistance in the area. (5) A clinic at the mining site itself should offer on-site occupational and emergency services to cater for its workforce. (1) Strengthen partnerships with local health authorities and NGOs. (6) Develop an awareness campaign both for communicable- and non-communicable diseases and prevention strategies. This campaign should be aimed both at the workforce and also the wider PACs.
Decommissioning		
1	Decommissioning Solid waste	(1) Remove all above-ground structures, including all hazardous materials storage facilities (2) Remove any areas of contaminated soils (3) Empty and clean out water storage tanks and ponds (4) Waste from structural decommissioning must be segregated into recyclable, reusable, and landfill wastes (5) Systematically piled up or landfill decommissioning waste so as to prevent them from disrupting ground water or natural drainages
Closure and Post-closure		
1	Dust from refilling works	(1) Water sprays area carrying out filling and grading operations (2) Water sprays unpaved haulage roads as dust suppression measure
2	Landform change by refilling	(1) Refill all the mined out pit in accordance with MRCP (2) Top soil must be refilled back at the surface (3) Re-vegetate the entire site

7.3 MANAGEMENT AND MONITORING SUB-PLANS BY PROJECT PHASE

7.3.1 Management Actions

Table 83. Management Actions for Impact Mitigation

Sr.	Impact	Mitigation	Management Actions
Pre-Construction (19)			
1	Mine camp wastewater	(1) Providing a settling pond of about (10,000) ft^3 at the designated location	-Excavating a 10000 ft^3 earth pond -Digging inlet drainage from camp to settling pond - Digging outlet drainage from settong pond
		(2) Providing a sand filtration unit at the discharge of the settling pond	-Providing a (10ft x 10ft x 5 ft) sand filtration unit at the discharge of the settling pond at the location
		(3) Carrying out weekly maintenance work for sand filtration unit	-Carrying out weekly maintenance work for sand filtration unit
		(4) Carrying out annual maintenance work for settling pond	Carrying out annual maintenance work for settling pond
		(5) Monitoring the quality of all liquid waste streams discharged from the site to ensure compliance with NEQG standards	-Monitoring waste water quality at the discharge of sand filtration unit on monthly basic
		(6) The pre-treatment of oil and grease containing effluents from canteens by the use of a grease trap prior to discharge into settling pond	-Installing a grease trap at the discharge point of canteen -Monitoring waste water quality at the discharge of sand filtration unit on monthly basic
2	Solid waste from mine camp	(1) Providing adequate waste bins	-Providing 6 nos. of 1100 liter waste bins
		(2) Providing waste pit and systematically dumping waste only in pit	-Providing a waste pit of 1000 ft^3 -Regular checking of waste pit -Daily disposal of liters to empty waste bin

		(3) The waste pit must be located and designed in such a way so as to minimize the risk of contamination of ground water resources;	-Providing impermeable bedding at waste pit -Locating waste pit at least 100 m away from wells
		(4) All employees will be informed of correct waste management procedures	-Systematic waste management methods must be notified with flyers and board within mine camp -Checking workplace daily for waste management
		(5) Soil contaminated with hydrocarbon should be immediately removed and disposed of as hazardous waste.	- Regular inspection of hydrocarbon soil contamination - Immediately removal and disposal of contaminated soil if occur
		(6) Providing adequate number of sanitary worker	- Assign adequate numbers of sanitary workers from 6 nos of general workers
3	Job opportunities	(1) Local people must be prioritized for employment	-Adding in notification letter that local people will be prioritized from employment -Appointing local people for all the unskilled labour post -Providing on-job training for appointed local people
		(2) Advertisement must be made for every recruitment in village administrator office and other public places	-Preparing a notification letter for recruitment -Printing and posting notification letter in village administer office and at least four other public places in every village
		(3) Recruitment and plant operation must be done in accordance with labour and employment laws	-Carrying out monthly management review on overall plant operation
4	Conflict with plantation owner	(1) Conduct adequate negotiation prior to exploration	-Acquiring information about plantation owners - Conducting adequate negotiation prior to exploration -Providing compensation for effected plantation owners as negotiated -Distributing contact person name and phone number to nearby villages

		(2) Notify respective plantation owners prior to operation	- Notifying respective plantation owners prior to operation at least 7 days ahead.
5	Site preparation waste	(1) Systematically compiling site preparing waste to prevent them from disrupting natural drainages	-Location waste dump site at least 100 m from natural drainage -Systematically compiling site preparing waste to prevent them from disrupting natural drainages
		(2) Site Preparation wastes such as bushes will be reused as fuel	- Reusing Site Preparation wastes such as bushes as fuel in canteen
Construction (25)			
1	Dust from road and tailing site constructions	(1) Water sprays at area to be cleared, to be graded, unpaved haulage road	-Providing a truck with water spray tank -Spraying necessary places with water -Checking workplace daily
		(2) Ensure exposed areas remain moist through regular water spraying during dry, windy periods	- Checking workplace daily -Water spraying at exposed areas in dry and windy periods as necessary
2	Sedimentation from site runoff water	(1) Access and haul roads will have gradients and surface treatment to limit erosion, and road drainage systems will be provided	-Paving access roads and haulage roads with graval -Providing road drainage alongside all roads
		(2) A drainage ditch will be built around dump area which will be connected to tailing ponds	-Construction of drainage around dump area -Connecting the drainage with tailing pond by drainage
		(3)Direct water away from disturbed areas	- Construction of earth dike around disturbed areas
3	Domestic wastewater from mine town	(1) Carrying out weekly maintenance work for sand filtration unit	-Carrying out weekly maintenance work for sand filtration unit
		(2) Carrying out annual maintenance work for settling pond	Carrying out annual maintenance work for settling pond

		(3) Monitoring the quality of all liquid waste streams discharged from the site to ensure compliance with NEQG standards	-Monitoring waste water quality at the discharge of sand filtration unit on monthly basic
		(4) The pre-treatment of oil and grease containing effluents from canteens by the use of a grease trap prior to discharge into settling pond	-Installing a grease trap at the discharge point of canteen -Monitoring waste water quality at the discharge of sand filtration unit on monthly basic
4	Destruction of natural drainage from road and tailing site constructions	(1) Site infrastructure such as roads and fences should be aligned with the natural drainage lines to minimize additional erosion.	- Systematic design of access roads and haulage roads in align with natural drainage lines -Construction of roads in align with natural drainage lines
		(2) Natural drainage lines must not be obstructed or otherwise interfered with.	-Providing necessary culvert at crossing with natural drainages -Natural drainage must be rebuilt if they are obstructed
		(3) Erosion should be monitored over the entire site and, where initial indications of erosion are detected, appropriate remedial measures must be taken as soon as possible	-Regular inspection of the project area for erosion -Construction of retaining wall at necessary places to prevent erosion
5	Loss of flora and fauna in site clearing	(1) Layout of the access road to use existing roads and paths wherever possible.	-Using the existing roads for access and haulage roads
		(2) Demarcating the construction area and ensure that the vegetation on the other side of these “barriers” is not disturbed.	- Construction of demarcation around mining pits and mine camp -Construction of sign boards at the edges of restricted area
		(3) Areas within the project area that are not required during mining should be demarcated as no-go areas and conserved.	- Construction of demarcation around mining pits and mine camp -Construction of sign boards at the edges of restricted area
		(4) Prevent mining employees from harvesting plants for personal use, firewood or charcoal within the project area.	-Providing sign boads prohibiting havaresting of fire wood within project areas -Regular inspection of project area

		(5) Monitor the project area for any new invasive plant species eradicate alien plants as they appear.	- Weekly inspection of project area for invasive plant - Eradication of invasive plant if occurs
6	Conflict with plantation owner in site clearing works	(1) Conduct adequate negotiation prior to operation	- Conducting adequate negotiation prior to construction -Providing compensation for effected plantation owners as negotiated -Distributing contact person name and phone number to nearby villages
		(2) Notify respective plantation owners prior to operation	- Notify respective plantation owners prior to construction at least 7 days ahead
7	Job opportunities in construction works (and supply chain)	(1) Local people must be prioritized for employment	-Adding in notification letter that local people will be prioritized from employment -Appointing local people for all the unskilled labour post -Providing on-job training for appointed local people
		(2) Advertisement must be made for every recruitment in village administrator office and other public places	-Preparing a notification letter for recruitment -Printing and posting notification letter in village administrator office and at least four other public places in every village
		(3) Recruitment and plant operation must be done in accordance with labour and employment laws	-Carrying out monthly management review on overall mine operation
Operation (44)			
1	Noise from operation works	(1) Regular maintenance of machinery	-Carrying out annual overall maintenance work -Checking workplace daily
		(2) Providing necessary PPE for workers at high noise area	-Providing 77 earmuffs for workers at high noise area
		(3) Supervising regular use of PPE at high noise area	-Checking workplace daily

2	Dust from operation works	(1) Water sprays at area to be cleared, graded and unpaved haulage road	-Spraying necessary places with water truck -Checking workplace daily
		(2) Ensure exposed areas remain moist through regular water spraying during dry, windy periods.	- Checking workplace daily -Water spraying at exposed areas in dry and windy periods as necessary
3	Sedimentation from site runoff water	(1) Access and haul roads will have gradients and surface treatment to limit erosion, and road drainage systems will be provided	-Paving access roads and haulage roads with graval -Providing road drainage alongside all roads
		(2) Re-vegetation of disturbed areas will be performed immediately following application of the growth medium to avoid erosion	-Setting up a nursery for revegetation -Replantation according to MRCP
		(3) A drainage ditch will be built around dump area which will be connected to tailing ponds	-Construction of a drainage around dump area -Connecting the drainage with tailing pond by a drainage
		(4) Direct water away from disturbed areas	- Construction of earth dike around disturbed areas
4	Waste water from dressing plant and tailing site	(1) Recycling supernatant from tailing pond to Palaung to minimize the amount of make-up water	- Recycling supernatant from tailing pond to Palaung to minimize the amount of make-up water - Regular checking of recycle water channel
		(2) The quality of effluent must be regularly monitored	- Monitoring the quality of all liquid waste streams discharged from the site regularly
		(3) Contaminated runoff waters coming from hazardous areas such as concentration plant, mineral stock-piling, concentrates, mine tailings accumulation areas are to be drained and treated before being disposed of	-Construction of drainages around concentration plant, stock piling areas -Connecting the drainage with tailing pond
5	Tailing waste	(1) The tailings facility must be sited in a location such that in the event of failure,	- Siting the tailings facility at minimum risk area proposed in feasibility report

		pollution of soil and water as well as physical risk to communities is minimized.	
		(2) The integrity of the waste rock dump and tailings facility must be inspected regularly by suitably qualified personnel throughout the life of the mine.	-Daily inspection of waste rock dump
		(3) Access to waste rock dump will be restricted as far as practical and all local communities will be informed of the potential risks associated with these facilities through site notices and community meetings.	-Providing fences around tailing area -Providing sign boards warning the hazards associated with tailing site
		(4) Regular monitoring of water quality around the waste rock dumps.	- Weekly analysis of waste water from waste rock dump at mine site lab -Analysis of waste water from waste rock dump at external lab once per three months
6	Loss of flora and fauna in site clearing works	(1) Layout of the access road to use existing roads and paths wherever possible.	-Using the existing roads for access and haulage roads
		(2) Demarcating the mining area and ensure that the vegetation on the other side of these "barriers" is not disturbed.	- Construction of demarcation around mining pits and mine camp -Construction of sign boards at the edges of restricted area
		(3) Areas within the project area that are not required during mining should be demarcated as no-go areas and conserved.	- Construction of demarcation around mining pits and mine camp -Construction of sign boards at the edges of restricted area
		(4) Prevent mining employees from harvesting plants for personal use, firewood or charcoal within the project area.	-Providing sign boads prohibiting havaresting of fire wood within project areas -Regular inspection of project area

		(5) Monitor the project area for any new invasive plant species eradicate alien plants as they appear.	- Weekly inspection of project area for invasive plant - Eradication of invasive plant if occurs
7	Economic displacement	(1) Ensure that existing access routes to natural resources are not affected as far as possible.	-Using the existing roads shown in fig xx for access and haulage roads
		(2) Farmers Development Programme (FDP) should be developed with the intent of assisting residents increase agricultural production in their locality.	- Drafting a farmer development in collaboration with local farmers -Implementation of FDP -Regular monitoring and modification of FDP
		(3) Local people must be prioritize for job opportunities	-Adding in the notification letter that local people will be prioritized for employment -Appointing local people for all the unskilled labour post -Providing on-job training for appointed local people
		(4) Workers involved in the construction phase should be incorporated as much as possible as the permanent staff for the operational phase.	-Putting in advertisement that workers involved in construction phase will be prioritized
8	OSH	(1) Procedure and guidelines on the health, safety and environment management system provided by A&M Myanmar Ltd must be followed completely	-Carrying out systematic implementation of HSE management system with the HSE officer
		(2) Labour accommodation units to be properly planned to avoid overcrowded living conditions.	- Providing adequate labour accommodation units
		(3) As part of the labour recruitment policy, all labour to undergo a pre-employment health screening assessment.	- Providing a pre-employment health screening assessment for all employee -Providing annual medical check-up for all employee
		(4) Train employees to not urinate or defecate in open water sources.	-Providing at least 5 toilets for workers -Educating employees not to urinate or defecate in open water sources

		(5) Provide a healthy balanced diet to the workforce.	- Provide a healthy balanced diet to the workforce at canteen by consulting with medical/health assistance from the mine clinic
		(6) Strengthen partnerships with the local health authorities in the area.	- Carrying out regular meeting with local health staffs, health authorities and local NGO
9	CSH	(1) Implementation of a speed limit in mine site and villages for vehicles from mine site	-Providing 5 distinct speed limit sign boards -Checking workplace daily -Monitoring and control of vehicles for speed limit
		(2) Delivery vehicles will not be overloaded and loads will be securely fastened. Within each vehicle, an emergency response plan which specify the actions required of the driver in the event of an accident will be provided.	- Setting rules for road and vehicle safety -Notifying drivers about road and vehicle safety rules -Regular inspection of road and vehicle safety measures
		(3) Support of a health post in the area that could benefit most of the PACs (Project Affected Communities).	-Discussion with local communities for providing support for a health post -Providing support for a health post in the area that could benefit most of the PACs
		(4) Prior to the development and implementation of any healthcare assistance programme, local leaders, health authorities and the Government must be consulted to ensure the effectiveness of the assistance in the area.	- Carrying out regular meeting with local health staffs, health authorities and local NGO
		(5) A clinic at the mining site itself should offer on-site occupational and emergency services to cater for its workforce.	- Providing a clinic with a medical/health assistance at mine site
		(6) Strengthen partnerships with local health authorities and NGOs.	- Carrying out regular meeting with local health staffs, health authorities and local NGO

		(7) Develop an awareness campaign both for communicable- and non-communicable diseases and prevention strategies. This campaign should be aimed both at the workforce and also the wider PACs.	-Providing awareness training for workers annually -Providing awareness training in eight villages bi-annually -Providing aids for local health facilities for awareness raising in local communities
Decommissioning (5)			
1	Decommissioning Solid waste	(1) Remove all above-ground structures, including all hazardous materials storage facilities	-Removing all above ground structures at mine camp and mineral processing plant
		(2) Remove any areas of contaminated soils	-Inspection of all the project area for contaminated soil -Removing any areas of contaminated soils if occur
		(3) Empty and clean out water storage tanks and ponds	- Emptying and cleaning out water storage tanks and ponds
		(4) Waste from structural decommissioning must be segregated into recyclable, reusable, and landfill wastes	-Segregating solid wastes from decommissioning -Disposal of landfill waste at designated site
		(5) Systematically piled up or landfill decommissioning waste so as to prevent them from disrupting ground water or natural drainages	-Systematic landfilling of decommissioning waste
Closure and Post-closure (5)			
1	Dust from refilling works	(1) Water sprays the area while carrying out filling and grading operations	-Assigning watering truck -Carrying out watering with watering truck -Supervising watering and dust emission daily
		(2) Water sprays unpaved haulage roads as dust suppression measure	-Assigning watering truck -Carrying out watering with watering truck -Supervising watering and dust emission daily
2		(1) Refill all the mined out pit in accordance with MRCP	-Refilling mined out pit

	Landform change by refilling	(2) Top soil must be refilled back at the surface	- Refilling top soil at the refilled surface
		(3) Re-vegetate the entire site	-Setting up a nursery for revegetation - Re-vegetating at the refilled surface according to MRCP

Table 84. Implementation Plan for EMP

Sr.	Management Action	Frequency	Start	End/ Duration	Cost (Ks)	Respon-sibility
1	Excavating a 10000 ft^3 earth pond, digging inlet and outlet drainage	Once	Starting from construction phase	1 week	300000	MM
2	Providing a (10ft x 10ft x 5 ft) sand filtration unit at the discharge of the settling pond	Once	After pond digging	1 week	100000	MM
3	Carrying out weekly maintenance work for sand filtration unit	Weekly	Starting from construction phase	Project life	100,000/yr	MD
4	Carrying out annual maintenance work for settling pond	Annually	Starting from construction phase	Project life	100,000/yr	MD
5	Monitoring waste water quality at the discharge of sand filtration unit and other places on monthly basic	Monthly	Starting from construction phase	Project life	1,200,000/yr	SC
6	Installing a grease trap at the discharge point of canteen	Once	Starting from construction phase	1 week	100000	MM
7	Providing 6 nos. of 1100 liter waste bins	Once/3 yrs	Starting from construction phase	Project life	1,800,000/3yr	MD
8	Providing a waste pit of 1000 ft^3 with impermeable bedding at least 100 m away from wells and natural streams	Once	Starting from construction phase	1 week	300000	MD
9	Carrying out weekly inspection works (invasive plant,	Weekly	Starting from construction phase	Project life	-	HSE

10	Carrying out daily inspection works (waste, waste pit, dust, noise, erotion, waste rock dump, hydrocarbon spill)	Daily	Starting from construction phase	Project life	-	HSE
11	Carrying out monthly management review on overall project operation	Monthly	Starting from operation phase	Project life	-	MM
12	Daily disposal of liters to empty waste bin	Daily	Starting from construction phase	Project life	-	HR
13	Systematic waste management methods must be notified with flyers and board within mine camp	Once	Starting from construction phase	Project life	100000/yr	HR
14	Assign adequate numbers of sanitary workers from 6 nos of general workers	Daily	Starting from construction phase	Project life	-	HR
15	Preparing a notification letter for recruitment and adding in notification letter that local people will be prioritized from employment	Once	When recruitment start	1 day	-	HR
16	Printing and posting notification letter in village administer office and at least four other public places in every village	Once	Starting from construction phase	Project life	-	HR
17	Appointing local people for all the unskilled labour post	-	Starting from construction phase	Project life	-	HR
18	Providing on-job training for appointed local people	-	Starting from operation phase	Project life	-	HR
19	Acquiring information about plantation owners	Once	At the beginning of preconstruction phase	1 month	-	MM
20	Conducting adequate negotiation with plantation owners	Once	At the beginning of preconstruction phase	1 month	-	MM

21	Distributing contact person name and phone number to nearby villages	Once	At the beginning of preconstruction phase	Project life	-	HR
22	Notifying respective plantation owners prior to operation at least 7 days ahead.	Once	At the beginning of preconstruction phase	Project life	-	HR
23	Systematically compiling waste to prevent them from disrupting natural drainages	Daily	At the beginning of preconstruction phase	Project life	-	MM
24	Reusing Site Preparation wastes such as bushes as fuel in canteen	Daily	At the beginning of preconstruction phase	Project life	-	HSE
25	Providing a truck with water spray tank	Once	Starting from construction phase	Project life	4,000,000	MM
26	Spraying necessary places with water	Daily	At the beginning of preconstruction phase	Project life	-	MD
27	Paving access roads and haulage roads with graval	Once	Starting from construction phase	Project life	1,000,000/yr	MD
28	Providing road drainage alongside all roads	Once	Starting from construction phase	6 months	600,000	MD
29	Construction of a drainage around dump area and connecting the drainage with tailing pond by drainage	Once	In construction phase	1 month	600,000	MS
30	Construction of earth dike around disturbed areas	Once	In construction phase	1 month	300,000	MD

31	Systematic design of and construction of access roads and haulage roads in align with natural drainage lines	Once	In construction phase	1 month	1,000,000	MD
32	Providing necessary culvert at crossing with natural drainages	Once	In construction phase	1 month	1,000,000	MD
33	Construction of retaining wall at necessary places to prevent erosion	Once	In construction phase	1 month	1,000,000	MD
34	Construction of demarcation around mining pits and mine camp	Once	In construction phase	1 month	1,000,000	MD
35	Construction of sign boards at the edges of restricted area	Once/3 yrs	In construction phase	1 week	300,000/3yr	MD
36	Providing sign boads prohibiting havaresting of fire wood within project areas	Once/3 yrs	In construction phase	1 week	300,000/3yr	MM
37	Carrying out annual overall maintenance work	Annually	Starting from operation	Project Life	2,400,000/yr	MD
38	Providing 77 earmuffs for workers at high noise area	Bi-Annually	Starting from operation	Project Life	1,000,000/yr	MD
39	Setting up a nursery for revegetation	Once	Starting from operation	Project life	As per MRCP	HSE
40	Replantation according to MRCP	Once	Starting from operation	Project life	As per MRCP	HSE
41	Construction of a drainage around dump area and connecting the drainage with tailing pond	Once	In construction phase	1 week	300000	MD
42	Recycling supernatant from tailing pond to Palaung to minimize the amount of make-up water	Continuously	Starting from operation	Project life	-	MPM

43	Construction of drainages around concentration plant, stock piling areas and connecting the drainage with tailing pond	Once	In construction phase	1 month	300000	MD
44	Siting the tailings facility at minimum risk area proposed in feasibility report	Once	In construction phase	1 week	-	MS
45	Providing fences around tailing area	Once/3 yrs	In construction phase	1 week	300000/3 yrs	MS
46	Providing sign boards warning the hazards associated with tailing site	Once/3 yrs	In construction phase	1 week	120000/3 yrs	HSE
47	Weekly analysis of waste water from waste rock dump at mine site lab	Weekly	In operation phase	Project life	600000/yr	SC
48	Analysis of waste water from waste rock dump at external lab once per three months	Once/3 months	In operation phase	Project life	800000/yr	SC
49	Using the existing roads for access and haulage roads	Once	Starting from construction phase	Project life	-	MD
50	Drafting a farmer development in collaboration with local farmers	Once	In operation phase	1 month	-	MM
51	Implementation of FDP	Continuously	In operation phase	Project life	As per CSR	MM
52	Regular monitoring and modification of FDP	Continuously	In operation phase	Project life	-	MM
53	Carrying out systematic implementation of HSE management system with the HSE officer	Continuously	Starting from construction	Project life	-	HSE
54	Providing adequate labour accommodation units	Once	Starting from construction	Project life	-	MM
55	Providing a pre-employment health screening assessment for all employee	Once	Starting from construction	Project life	-	HSE

56	Providing annual medical check-up for all employee	Annually	Starting from construction	Project life	-	HSE
57	Providing at least 5 toilets for workers	Once	Starting from construction	Project life	1000000/yr	HSE
58	Educating employees not to urinate or defecate in open water sources	Annually	Starting from construction	Project life	-	HSE
59	Provide a healthy balanced diet to the workforce at canteen by consulting with medical/health assistance from the mine clinic	Continuously	Starting from construction	Project life	-	HSE
60	Carrying out regular meeting with local health staffs, health authorities and local NGO	Once/3 months	Starting from construction	Project life	200000/yr	HSE
61	Providing speed limit sign boards within project areas	Once/3 yrs	In operation phase	Project life	150000/3 yr	MD
62	Monitoring and control of vehicles for speed limit	Continuously	Starting from construction	Project life	-	HSE
63	Setting rules for road and vehicle safety	Once	Starting from construction	Project life	-	HSE
64	Notifying drivers about road and vehicle safety rules	Once	Starting from construction	Project life	-	HSE
65	Regular inspection of road and vehicle safety measures	Weekly	Starting from construction	Project life	-	MD
66	Discussion with local communities for providing support for a health post	Once	In operation phase	1 week	-	HSE
67	Providing support for a health post in the area that could benefit most of the PACs	Once	In operation phase	Project life	As per CSR	HSE

68	Providing a clinic with a medical/health assistance at mine site	Once	In operation phase	Project life	-	HSE
69	Providing awareness training for workers annually	Annually	In operation phase	Project life	100000/yr	HSE
70	Providing awareness training in eight villages bi-annually	Bi-annually	In operation phase	Project life	100000/yr	HSE
71	Providing aids for local health facilities for awareness raising in local communities	Bi-annually	In operation phase	Project life	200000/yr	HSE
72	Removing all above ground structures at mine camp and mineral processing plant in decommissioning	Once	decommissioning	1 month	-	MD
73	Emptying and cleaning out water storage tanks and ponds	Once	decommissioning	1 month	-	MD
74	Segregating solid wastes from decommissioning	Once	decommissioning	1 month	-	MD
75	Systematic landfilling of decommissioning waste	Once	decommissioning	1 month	-	MD
76	Refilling mined out pit	Once	Starting from operation phase	Project life	-	MM
77	Refilling top soil at the refilled surface	Once	Starting from operation phase	Project life	-	MM

MM = Mine Manager MD = Maintenance Manager SC = Senior Chemist HSE = HSE Officer

HR = Human Resource Manager MS = Mine Superintendent MPM = Mineral Processing Manager

7.3.2 Monitoring Plan

Environmental monitoring programs for this project will be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Environmental monitoring activities will be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the project.Monitoring frequency are set to be sufficient

to provide representative data for the parameter being monitored. Monitoring will be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data will be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken.

Table 85. Environmental Monitoring Programme

Sr.	Management Actions	Monitoring	Parameter	Location	Frequency	Method	Responsi-bility
1	Carrying out weekly maintenance work	Maintenance record	- Yes/No	-	Weekly	Inspection	MD
2	Carrying out annual maintenance work for settling pond	Maintenance record	- Yes/No	-	Weekly	Inspection	MD
3	Waste water quality monitoring at the discharge of sand filtration unit	Waste water quality	NEQG	Fig 3	Monthly	Lab analysis	SC
4	Providing 6 nos. of 1100 liter waste bins	Waste bin	-Numbers -Conditions	Project area	Monthly	Inspection	MD
5	Carrying out weekly inspection works	Inspection record	-invasive species -erosion -spills -road	Project area	Weekly	Inspection	MD
6	Carrying out daily inspection works	Inspection record	waste, waste pit, dust, noise,erotion, waste rock dump	Project area	Daily	Inspection	MD

7	Carrying out monthly management review on overall project operation	Review meeting	meeting minutes	-	Monthly	Inspection	MM
8	Appointing local people for all the unskilled labour post	Unskilled labour	Local people	Employment list	Monthly	Inspection	HR
9	Spraying necessary places with water for dust supression	Water spraying	Dust emission	Project area	Weekly	Inspection	MD
10	Paving access roads and haulage roads with graval	Road paving	Gravel paving	Project roads	Monthly	Inspection	MD
11	Construction of demarcation	Pits and camp demarcation	Fences	Pits and camp boundary, tailing	Monthly	Inspection	MD
12	Construction of sign boards	Sign boards	-Restricted area -Fire wood cutting restriction -Hazardous area -Speed limit	Project area	Monthly	Inspection	HSE
13	Carrying out annual overall maintenance work	Maintenance work	Maintenance record	-	Annually	Inspection	MD
14	Providing 77 earmuffs for workers at high noise area	Earmuffs	-Number -Conditions	-	Monthly	Inspection	HSE
15	Setting up a nursery for revegetation	Nursury	-Yes/No -Condition	-	Monthly	Inspection	MD
16	Replantation according to MRCP	Replantation	-Yes/No -Area -No of plants	Mined-out and refilled pit area	Monthly	Inspection	MD

			-Conditions				
17	Construction of a drainage	Drainages	-Yes/No -Condition	-Dump area -Concentration plant -Stock piling	Monthly	Inspection	MD
18	Weekly analysis of waste water from tailing at mine site lab	Water quality	NEQG	Tailing pond	Weekly	Lab analysis	SC
19	Analysis of waste water from waste rock dump at external lab once per three months	Water quality	NEQG	Tailing pond	Quarterly	Lab analysis	SC
20	Implementation of FDP	FDP	-Yes/No -Progress	-	Monthly	Inspection	MM
21	Providing adequate labour accommodation units	Labour accommodation	-Adequacy -Condition	Workers quaters	Monthly	Inspection	HSE
22	Providing annual medical check-up for all employee	Medical checkup	-Yes/No -Records	Clinic	Annually	Inspection	HSE
23	Providing at least 5 toilets for 161 workers	Toilet	-Numbers -Condition	Project area	Monthly	Inspection	HSE
24	Carrying out regular meeting with local health staffs, health authorities and local NGO	Health meeting	-Meeting minutes	-	Monthly	Inspection	HSE
25	Providing a clinic with a medical/health assistance at mine site	Mine site clinic	-Yes/No -Condition	Mine site	Monthly	Inspection	HSE
26	Providing health awareness trainings	Health awareness training	-Yes/No -Records	-Workers -Villages	Bi-annually	Inspection	HSE

27	Structural decommissioning	Strctural Decommissioning	-Structures -Landfills	Project area	Once after decommis-sioning	Inspection	MD
28	Refilling mined out pit	Refilling	-Yes/No -Area -Condition	Mined out pits	Monthly	Inspection	MM
29	Refilling top soil at the refilled surface	Top soil	-Yes/No -Area -Condition	Refilled area	Monthly	Inspection	MM

MM = Mine Manager MD = Maintenance Manager SC = Senior Chemist HSE = HSE Officer

HR = Human Resource Manager

7.3.3 Environmental Monitoring Team

An Environmental Monitoring Team shall be established for successful implementation of the environmental management plan. The project proponent is responsible for complete implementation of the EMP. Proponent shall carry out environmental monitoring programme which is part of the EMP and the monitoring report will be distributed to the participants of the monitoring team. Implementation of CSR programme will also be facilitated with the participation of the monitoring team. Local community could communicate with the project for environmental affairs through the monitoring team. The objectives of the Environmental Monitoring Team are as follows:

(a) To release information on the implementation of EMP for local community continuously

(b) To distribute information on environmental monitoring to local community

(c) To create a proper communication channel between the project and local community relating to environmental affairs

(d) To insert a check and balance action for the management of fund and aids provided by the CSR programme

The team mainly consists of representatives from the project and local communities. The representatives from local communities must be elected by respective local communities by themselves.

Table 86. Environmental Monitoring Team

Sr.	Representative	Number
Project Management		
1	Managing Director	1
2	HR/Admin Director	1
3	Operations and Technical Director	1
4	Commercial Manager	1
5	Finance Director	1
6	Mine Manager	1
Local Community		
1	Village Administrator (Zegami)	1
2	Elected villager (Zegami)	2
3	Village Administrator (Shwedu)	1
4	Elected villager (Shwedu)	2
5	Village Administrator (Wettoe)	1
6	Elected villager (Wettoe)	2
7	Village Administrator (Taungpu)	1

8	Elected villager (Taungpu)	2
9	Village Administrator (Pantaung)	1
10	Elected villager (Pantaung)	2
11	Village Administrator (Nyaungbee)	1
12	Elected villager (Nyaungbee)	2
13	Village Administrator (Anyin)	1
14	Elected villager (Anyin)	2
15	Village Administrator (Maunghlaw)	1
16	Elected villager (Maunghlaw)	2

7.3.3.1 Roles and Responsibilities

(a) The team will act as a communication channel between the project and local community

(b) Proponent will provide aids from CSR programme through the local representatives from the team

(c) Proponent must disseminate monitoring report to local community through representatives from government departments and local communities

(d) Proponent will distribute notification for recruitment in local community widely with the help of local representatives

(e) The team will coordinate between local representatives and the project so that the project could participate in social, cultural and religious events of local community

(f) Proponent must contact with the team after summarization of annual net profit so that contribution could be made for CSR programme

(g) General meeting of the team must be held at least once in (12) months to modify policy, roles and responsibilities of the Environmental Monitoring Team

7.4 CORPORATE SOCIAL RESPONSIBILITY (CSR)

The project will provide two percent of its production for carrying out CSR programs in local communities. Educational sector, health sector, social affairs, economic sector, infrastructural sector, disaster aid programmes for Zegami, Shwedu, Wettoe, Taungpu, Pantaung, Nyaungbee, Anyin, Maunghlaw and other nearby villages around the project will be included in CSR programmes. Generally, local communities which are directly related with project implementation must be included in CSR programme. CSR programme will be executed in coordination with the local community and administrative bodies. Programmes for employers such as social

welfare, health care, educational aid, and professional development trainings must also be included in CSR programme.

A CSR Committee will be set up which has to decide the prioritization of all the categories and also decide on the allocation of revenue to each category. Proponent's recommendation is to prioritize the categories that will bring the greatest benefits that can be achieved quickly, once the project commences. Among the categories, waste management and potable water are of the highest priority to improve the living conditions and wellbeing of the people in local communities.

Each category will require a study and planning of a detailed CSR project timeline that will span the life of the mine. At the end of the mine life, the planned and agreed CSR projects will be completed.

A&M plan to implement the CSR programme as a chance for providing additional employment, where some categories will have permanent staffs who will handle day to day operation of the CSR programme.

From the experiences in the area, a great deal of community education is required for improving the living standards and general development of the communities. The CSR committee will set quarterly targets (3 months) and progress is to be reviewed at each quarterly Committee Meeting.

7.5 PROJECTED BUDGETS

Table 87. Overall budget for implementation of the EMP

Sr.	Management Actions	Budget
1	Excavating a 10000 ft^3 earth pond, digging inlet and outlet drainage	300000
2	Providing a (10ft x 10ft x 5 ft) sand filtration unit at the discharge of the settling pond	100000
3	Carrying out weekly maintenance work for sand filtration unit	100,000/yr
4	Carrying out annual maintenance work for settling pond	100,000/yr
5	Monitoring waste water quality at the discharge of sand filtration unit and other places on monthly basic	1,200,000/yr
6	Installing a grease trap at the discharge point of canteen	100000
7	Providing 6 nos. of 1100 liter waste bins	1,800,000/3yr (600000/yr)
8	Providing a waste pit of 1000 ft^3 with impermeable bedding at least 100 m away from wells and natural streams	300000
9	Systematic waste management methods must be notified with flyers and board within mine camp	100000/yr

10	Providing a truck with water spray tank	4,000,000
11	Paving access roads and haulage roads with graval	1,000,000/yr
12	Providing road drainage alongside all roads	600,000
13	Construction of a drainage around dump area and connecting the drainage with tailing pond by drainage	600,000
14	Construction of earth dike around disturbed areas	300,000
15	Systematic design of and construction of access roads and haulage roads in align with natural drainage lines	1,000,000
16	Providing necessary culvert at crossing with natural drainages	1,000,000
17	Construction of retaining wall at necessary places to prevent erosion	1,000,000
18	Construction of demarcation around mining pits and mine camp	1,000,000
19	Construction of sign boards at the edges of restricted area	300,000/3yr (100000/yr)
20	Providing sign boads prohibiting havaresting of fire wood within project areas	300,000/3yr (100000/yr)
21	Carrying out annual overall maintenance work	2,400,000/yr
22	Providing 77 earmuffs for workers at high noise area	1,000,000/yr
23	Construction of a drainage around dump area and connecting the drainage with tailing pond	300000
24	Construction of drainages around concentration plant, stock piling areas and connecting the drainage with tailing pond	300000
25	Providing fences around tailing area	300000/3 yrs (100000/yr)
26	Providing sign boards warning the hazards associated with tailing site	120000/3 yrs (40000/yr)
27	Weekly analysis of waste water from waste rock dump at mine site lab	600000/yr
28	Analysis of waste water from waste rock dump at external lab once per three months	800000/yr
29	Providing at least 5 toilets for workers	1000000/yr
30	Carrying out regular meeting with local health staffs, health authorities and local NGO	200000/yr
31	Providing speed limit sign boards within project areas	150000/3 yr
32	Providing awareness training for workers annually	100000/yr
33	Providing awareness training in eight villages bi-annually	100000/yr
34	Providing aids for local health facilities for awareness raising in local communities	200000/yr
Total One Time Cost		10,900,000
Total Recurring Cost		9,990,000/yr

7.6 TRAINING, AWARENESS AND COMPETENCE

This plan describes the provisions of training to ensure that any people working for or on behalf of the company involved in the activities covered by the scope of the EMP are properly trained to carry out their assigned duties in a manner that will not cause deviation from company environmental policy.

This procedure applies to EMP related training for staff and any persons working for or on behalf of A&M Myanmar involved in the activities covered by the scope of the EMP. A&M Myanmar will ensure that all people performing tasks for or on behalf of the organization, which includes temporary staff and remote workers, have had an appropriate assessment for their potential to cause a significant environmental impact and the associated competence required.

The Departmental Managers shall ensure that people working for or on behalf of the company within the scope of EMP are competent on the basis of appropriate education, training or experience. The Deputy General Managers (DGMs) shall identify training needs for people working for or on behalf of the company to ensure individual competence to implement the EMP effectively.

Table 88. Training Requirement

Sr.	Training Topics	Trainee	Duration
1	OSH Training	Supervisors, Operators, Workers and Security	40 hours
2	EMP Training	Managers, Assistant Managers, Engineer Department, Supervisors, Operators and Workers	40 hours
3	Emergency Response Training	All employee	16 hours
4	First Aid Training	All employee	20 hours
5	Health Training	All employee	40 hours

For each staff of A&M Myanmar, the DGM shall establish, implement and maintain a Training Record of any type of EMP related training received. Where a

training course is undertaken internally, names of the attendants shall be recorded in the Training Attendance Record.

7.7 COMMUNICATION

This plan ensures a consistent and efficient approach to internal communication and external complaints relating to the environment. The procedure applies to all documents established under the EMP of A&M Myanmar. The documents under the EMP include but are not limited to:

- EIA Report
- Mitigation Measures and Management Actions
- Environmental Monitoring Programme
- EMP Forms, Checklists and Guidelines
- Registers of Legal and Other Requirements
- External documents including legislation, professional guides and code of practices, etc.

7.7.1 Responsibility

- The General Manager (GM) is responsible for dealing with complaints.
- The DGM1 (Admin) is responsible for ensuring that all communications relating to the environment are processed correctly.
- All staffs are responsible for putting forward suggestions on environmental matters.

7.7.2 External Communications

Communications to be handled according to this procedure include correspondence, conservations and meeting with relevant interested parties. The person receiving the communication shall be noted the time and date, relevant address/telephone number and details of communication. Details shall be passed to the DGM1 (Admin) who will deter Factory the response and whether the corrective action is required. If the communication is significant, the DGM1 (Admin) shall inform the GM as soon as possible. An initial response shall be provided within two weeks. The DGM1 (Admin) shall be responsible for maintaining records, responses and corrective action in a separate file designated for that purpose.

7.7.3 Internal Communications

The primary means of communication is through team briefings, supported as appropriate by use of notice boards and memos. Suggestions for environmental improvements are made through the company suggestion schemes.

7.8 DOCUMENT MANAGEMENT

This procedure describes the control system for preparing, approving, distributing, revising and updating documents that are required under the Environmental Management Plan (EMP).

This procedure applies to all documents established under the EMP of A&M Myanmar. The documents under the EMP include but are not limited to:

- Impact Mitigation
- Management Actions
- Environmental Monitoring Programme
- EMP Forms, Checklists and Guidelines
- Registers of Legal and Other Requirements
- External documents including legislation, professional guides and code of practices, etc.

7.8.1 Responsibility

7.8.1.1 Managing Director

The GM shall approve and sign all EMP documents, include the Environmental Policy, EIA report, EMP and Other Requirements. In the absence of the GM, the DGM1 (Admin) shall approve and sign the EMP documents.

7.8.1.2 Administration Department (AD)

The AD is responsible for the EMP document control system. The AD shall ensure that only controlled and current copies of documents are used, and distribute the controlled EMP documents to relevant personnel. The AD shall also maintain and update the Master List of Documents.

7.8.1.3 Departmental Managers

Departmental Managers shall review relevant EMP documents and procedures, ensure that their subordinates are familiar with the EMP documents related to them, and report any proposed changes to the EMP documents and forms to the EMP Committee.

7.9 EMERGENCY PREPAREDNESS AND RESPONSE PLAN

This procedure describes the responses in case of emergency or landslide that suddenly occurs in the Mine site compound.

7.9.1 Landslide Preparedness

7.9.1.1. Landslide

The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows**.** Although gravity acting on an over-steepened slope is the primary reason for a landslide, there are other contributing factors:

(a) erosion by rivers, glaciers, or ocean waves create over steepened slopes
(b) rock and soil slopes are weakened through saturation by snowmelt or heavy rains
(c) earthquakes create stresses that make weak slopes fail
(d) earthquakes of magnitude 4.0 and greater have been known to trigger landslides
(e) volcanic eruptions produce loose ash deposits, heavy rain, and debris flows
(f) excess weight from accumulation of rain or snow, stockpiling of rock or ore, from waste piles, or from man-made structures may stress weak slopes to failure and other structures

7.9.1.2 Landslide Warning sign

(a) Springs, seeps, or saturated ground in areas that have not typically been wet before.
(b) New cracks or unusual bulges in the ground, street pavements or sidewalks.
(c) Soil moving away from foundations.
(d) Ancillary structures such as decks and patios tilting and/or moving relative to the main house.

(e) Tilting or cracking of concrete floors and foundations.
(f) Broken water lines and other underground utilities.
(g) Leaning telephone poles, trees, retaining walls or fences.
(h) Offset fence lines.
(i) Sunken or down-dropped road beds.
(j) Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content).
(k) Sudden decrease in creek water levels though rain is still falling or just recently stopped.
(l) Sticking doors and windows, and visible open spaces indicating jambs and frames out of plumb.
(m) A faint rumbling sound that increases in volume is noticeable as the landslide nears.
(n) Unusual sounds, such as trees cracking or boulders knocking together, might indicate moving debris.

7.9.1.3 Areas that are generally prone to landslide hazards

(a) On existing old landslides.
(b) On or at the base of slopes.
(c) In or at the base of minor drainage hollows.
(d) At the base or top of an old fill slope.
(e) At the base or top of a steep cut slope.
(f) Developed hillsides where leach field septic systems are used

7.9.1.4 Areas that are typically considered safe from landslides

(a) On hard, non-jointed bedrock that has not moved in the past.
(b) On relatively flat-lying areas away from sudden changes in slope angle.
(c) At the top or along the nose of ridges, set back from the tops of slopes

7.9.1.5 What to Do if You Suspect Imminent Landslide Danger

(a) Contact your local fire, police, or public works department. Local officials are the best persons able to assess potential danger.

(b) Evacuate. Getting out of the path of a landslide or debris flow is your best protection.

(c) Curl into a tight ball and protect your head if escape is not possible.

7.9.1.6 What To Do Before a Landslide

(a) Do not build near steep slopes, close to mountain edges, near drainage ways, or natural erosion valleys.

(b) Get a ground assessment of your property.

(c) Contact local officials, state geological surveys or departments of natural resources, and university departments of geology. Landslides occur where they have before, and in identifiable hazard locations. Ask for information on landslides in your area, specific information on areas vulnerable to landslides, and request a professional referral for a very detailed site analysis of your property, and corrective measures you can take, if necessary.

(d) Learn about the emergency-response and evacuation plans for your area. Develop your own emergency plan for your family or business.

7.9.1.7 What To Do After a Landslide

(a) Stay away from the slide area. There may be danger of additional slides.

(b) Listen to local radio or television stations for the latest emergency information.

(c) Watch for flooding, which may occur after a landslide or debris flow. Floods sometimes follow landslides and debris flows because they may both be started by the same event.

(d) Check for injured and trapped persons near the slide, without entering the direct slide area. Direct rescuers to their locations.

(e) Help a neighbor who may require special assistance - infants, elderly people, and people with disabilities. Elderly people and people with disabilities may require additional assistance. People who care for them or who have large families may need additional assistance in emergency situations.

(f) Look for and report broken utility lines and damaged roadways and railways to appropriate authorities. Reporting potential hazards will get the utilities turned off as quickly as possible, preventing further hazard and injury.

(g) Check the building foundation, chimney, and surrounding land for damage. Damage to foundations, chimneys, or surrounding land may help you assess the safety of the area.

(h) Replant damaged ground as soon as possible since erosion caused by loss of ground cover can lead to flash flooding and additional landslides in the near future.

(i) Seek advice from a geotechnical expert for evaluating landslide hazards or designing corrective techniques to reduce landslide risk. A professional will be able to advise you of the best ways to prevent or reduce landslide risk, without creating further hazard

7.9.1.8 Flood Preparedness

7.9.1.8.1 Overview

This section deals with technical guidelines on various measures to be taken to minimize the adverse impacts of floods before, during and after they happen. These include flood management actions such as flood preparedness measures, response operations, recovery and rehabilitation, and mitigation measures. It would facilitate the understanding of planners working in the region, and set the thematic scope of flood risk reduction program to be developed/updated/revised, in terms of what kind of preparedness measures to be considered, response to be organized, recovery and rehabilitation visualized, and mitigation measures proposed.

7.9.1.8.2 Objectives

- Understand various flood preparedness measures to ensure better response and consider how to organize these at the provincial and district levels.
- Define flood emergency response mechanisms with regard to the roles and responsibilities of the provincial and district authorities.

7.9.1.8.3 Main Concepts

Flood Preparedness describes a wide range of activities identified and planned well in advance of floods, in order to reduce potential impacts on the community, economy and other resources. These include general disaster preparedness activities such as raising awareness, early warning, preparation for evacuation and shelter, flood

reduction methods and implementation of an emergency response plan, etc. Preparedness activities determine specific actions and delegate roles and responsibilities to various government departments, disaster management organizations and volunteer groups. All in all, the preparedness phase enables planners to identify the various needs required to respond to and cope with the floods.

Flood Response refers to emergency activities undertaken during the flood situations to minimize negative impacts of floods. Flood Response contains two major components: emergency operations and logistics management. The effectiveness of flood response is based on how clearly the roles and responsibilities are outlined in the FPP and understood by the key players who will perform the action during emergency.

Flood recovery and rehabilitation aims to restore normality and help people return to their original (pre-flood) social and economic engagements.

Flood Mitigation measures are usually undertaken with long term perspective to reduce the overall risks of floods. They can be and should be integral parts of all flood risk reduction activities, from preparedness to response to rehabilitation measures. These can be both structural and non-structural. The structural measures refer to construction and management of dykes, dams, reservoirs, irrigation system, raised house platforms, flood proof house designs, etc. The non-structural measures consist of capacity building and training of stakeholders, planning, public awareness raising, and changing/rescheduling of crop calendar, etc.

Table 89. Flood Preparedness and Response

Flood Preparedness	Flood Response
The ability to predict, respond to and cope with the effect of floods.	Emergency operations to minimize the negative impact of flood on the community.
Recovery and Rehabilitation	Flood Mitigation
Activities designed to bring communities and other resources back to normalcy.	Long term measures undertaken to reduce the overall risks of floods.

7.9.1.8.4 Flood Response Operations

The effectiveness of flood response is based on the following key components:a. Effective Coordination: Extensive coordination among all agencies taking part in

emergency response activities dictate the success of any emergency response operations, guaranteeing minimum overlap of roles and responsibilities and maximum effective utilization of available resources. A focal agency should be deployed as the principal coordinating body.

b. Effective Logistics Management: It is critical in any disaster situation to quickly identify the resources needed, i.e., the response team, equipment and commodities, as well as mobilizes and transports them to the right place at the right time. Two major elements to make it happen are:

Time assessment and deployment list: A prioritized list of the most critical resource requirements developed in advance of an event.

Movement coordination: Acquiring transportation services and coordinating the transportation flow of resources in and around the flooded area using the prioritized list; continuously reporting on the movement of all transported resources into, within and out of the flood area; monitoring the flood s effect on transportation systems and resolving routes or destination issues.

Level of Responsiveness of the Community: The more aware the community is of the risks they face with regards to flooding and the actions to be taken, the more effective and significant the impact of the emergency response will be.

Flood response should be implemented along clearly demarcated roles and responsibilities outlined in the FPP and understood by the key players who will perform the recommended actions during an emergency.

Emergency management requires coordination and cooperation between the national, provincial, district and commune level actors. Information plays a key role in deciding the scale of response and deployment of resources. Often, a flood response system fails due to lack of understanding between various stakeholders and lack of coordination between the main response agencies such as the Military and Police, Information Management department, and the local disaster management authorities.

Key activities of flood emergency response are described below:

a) Flood Monitoring During flood response, a state of panic and chaos may prevail. This can be addressed by creating an efficient flood monitoring system at local levels. Flood monitoring enables up-to the-minute flood information for the disaster management practitioners at the local level, equipping them with the tools for efficient execution of real time emergency operations. Time sensitive activities such as generation of

flood warnings, evacuation of vulnerable populations to safe areas, and deployment of search and rescue teams, rely upon up-to-date information, including the latest water level at a particular point in the river.

b) Forecasting and Early Warning Dissemination As mentioned in the preparedness measures section of this chapter, flood warning messages should be appropriate and easily understood by the community and the officials who will perform response activities. They are formulated from the real time situation (information provided through flood monitoring, flood referencing, etc.).

c) Safe Area and Temporary Shelter Management In order to offer safe areas to the flood affected people in their situation of insecurity, prior identification of high ground areas, which are safe for temporary refuge during the flood, is regarded as one of the most important activities in Part 1 of this chapter. When the flood is at its peak, with vulnerable communities relocated to safer areas, management of these areas becomes imperative.

The first step is to ensure the essential materials are available. The local disaster management authorities, together with NGOs and voluntary groups, should mobilize the acquisition and transportation of tents, tarpaulins, and mobile houses to safe areas. It is also important to establish minimum standards and basic facilities such as food, drinking water, and sanitation facilities at the safe areas. Water purification systems should also be considered and installed at the temporary shelter sites.

Security is an important concern for the evacuated people; women particularly are vulnerable to sexual harassment. The local disaster management authorities must provide security measures with the help of the police, military or commune police to warrant security and safety in the safe areas. Child care is another important issue at the temporary shelter as many drowning cases are reported from families evacuated to safe areas.

7.9.1.8.5 Healthcare and Medical Operations

In many areas, the deployment of first aid teams sometimes precedes that of the Searchand-Rescue Teams, in attending to injured people and animals. The Search-and-Rescue Team should have medical personnel with them, who are able to perform first aid. During floods, drowning is the main cause of death and some of the first aid principles for drowning are explained in the box First Aid for Drowning. Every safe shelter should have a first aid kit, prescription medicines, and medical facilities to cater for specific medical needs during emergencies. As previously mentioned in Chapter 5 of this Manual, a special team

7.10 MANAGEMENT REVIEW

This plan describes the review of EMP and monitoring results of A&M Myanmar's EMP to ensure that the Management Actions and Procedures are fully satisfied with the minimum side effects to the environment.

The Mine Manager shall work with the BOD and Department Managers to define monitoring requirements and evaluation of compliance, and has the overall responsibility for ensuring that the requirements of this procedure are implemented.

The Mine Manager of Zegami Tin Mine will be the responsible person of management review process. He shall be supported by the BOD, departmental managers and various functional heads. The Mine Manager shall report the overall review of EMP to the MD.

8 PUBLIC CONSULTATION AND DISCLOSURE

8.1 OBJECTIVE

In order to acquire public opinion on the implementation of the Zegami Tin Mine project at Tanintharyi Region, public consultation works were done by firstly disclosing relevant project information in local community. Public consultation and information disclosure works for Zegami Tin Mine project were carried out with the following objectives:

(a) To disseminate the project information, benefits and disadvantages of the project to general public so that they could understand the trade-offs;

(b) To be able to gain meaningful contribution of informed public; and

(c) To achieve greater trust of general public with the project proponent by disseminating relevant information.

8.2 PUBLIC CONSULTATIONMETHODOLOGY AND APPROACH

8.2.1 Personal Interviews

Personal interviews with local authorities from the eight villages around project area were exercised to collect their opinion and suggestion. Then, interested persons from local community were consulted by firstly disseminating project information to them and then acquiring their comments and suggestions. Consultation work includes household data survey process where a questionnaire was used to collect socioeconomic data. Consultation was also done in household data survey by requesting comment and suggestion of the interviewee on the project.

8.2.2 Sample Size Calculation

Sample size calculation for the survey was based on Cochran formula with a confidence level of 95% and targeted confidence interval of 5%. The Cochran's formula is given as:

$$n = \frac{\frac{t^2 PQ}{d^2}}{1 + \frac{1}{N}\left(\frac{t^2 PQ}{d^2} - 1\right)}$$

Where, n = sample size

t = 1.96 for 95% confidence level

P, Q = 0.5

d = 0.05 for 5% confidence interval

N = Total household number

Table 90. Sample Size Calculation Results

Sr.	Village	Total Household	Required Sample Size	Actual Sample Size
1	Zegami	178	42	54
2	Shwedu	25	6	9
3	Wettoe	60	14	38
4	Taungpu	93	22	42
5	Pantaung	78	18	42
6	Nyaungbee	240	57	55
7	Anyin	280	66	49
8	Maunghlaw	290	69	30
Total		1244	294	319

There were about 1244 household in eight villages with a required sample size of 294 households. A total of 319 households were sampled as could be seen in the following table. Actual confidence interval after sampling is 4.7%.

8.2.3 Open Discussion

An agenda was provided for open discussion with local people and representatives from EIA team and project proponent in public meetings which were collectively held for Zegami Tin Min project at Basic Education Primary School of Zegami Village, Tanintharyi Region. Results from the open discussion session of the public meeting are shown in later section.

8.2.4 Information Disclosure

(a) Presentation

Representatives from project proponent and EIA teams gave presentations about their respective scope of works before general public in both public meetings.

(b) Translated Executive Summery

After the draft EIA report was compiled, executive summary of the report was translated into Myanmar ant the translated documents were delivered to local people and local authorities for their review and comments. The translated summary delivered to local people is attached in Annex.

8.3 PUBLIC CONSULTATION MEETINGS

First public meeting for releasing project information to general public requesting their comments and suggestions on the project was carried out on 7thApril, 2015 at Basic Education Primary School of Zegami Village, Tanintharyi Region. There were about (158) people from local community, employees from the project, representatives from the project and representative from OSHE Services Co., Ltd. attended the public meeting and participated in open discussion.

Second public meeting for releasing EIA study results to general public requesting their comments and suggestions was carried out on 30thJuly, 2017 at the same venue. There were about (130) people from local community employees from the project, representatives from the project and representative from OSHE Services Co., Ltd. attended the public meeting and participated in open discussion

8.4 SUMMARY OF CONSULTATIONS AND ACTIVITIES UNDERTAKEN

8.4.1 Initial Consultations

EIA team held eight consultation meetings for Zegami Tin Mine Project. Including the villages are Zegami, Shwedu, Wettoe, Taungpu, Pantaung, Nyaungbee, Anyin, Maunghlaw villages EIA team explained the about of EIA study and project information and achieved the villages' basic data. Project information and EIA process were explained to the villages' administrator. Achieved the basic data are as follows

Table 91. Initial Consultation Data

Sr.	Particulate	Fact							
1	Village Name	Zegami	Shwedu	Wettoe	Taungpu	Pantaung	Nyaungbee	Anyin	Maunghlaw
2	Administrator Name	U Oo Soe Oo	U Han Myint Aung	U Aung Lin	U Han Myint Aung	U Myo Hwe	U Zin Myo Oo	U Zaw Win	U Thein Lwin
3	No. of Household	178	25	60	93	78	240	280	290
4	No. of Family	189	26	NA	99	92	NA	NA	NA
5	Total Population	930	142	NA	514	469	NA	NA	NA
6	Male total	460	70	NA	269	238	NA	NA	NA
7	Female total	470	72	NA	245	231	NA	NA	NA
8	Under 18 male	186	22	NA	106	118	NA	NA	NA
9	Under 18 female	159	25	NA	104	100	NA	NA	NA
10	Over 18 male	274	48	NA	163	119	NA	NA	NA
11	Over 18 female	311	47	NA	141	132	NA	NA	NA
12	School	Basic Education Primary School (Zegami)	Basic Education Primary School (Shwedu)	-	Basic Education Primary School (Shwedu)	-	Basic Education High School (Nyaungbee)	Basic Education High School	
13	Amount of Teacher	10	7	-	7	-	-	11	
14	Male student	257	-	-	47	-	-	-	

15	Female student	116	-	-	65	-	-	-	
16	Hospital	-	-	-	-	-	-	-	
17	Clinic	1	-	-	-	-	1	-	
18	No of Doctor	-	-	-	-	-	H.A	-	
19	No of nurse	-	-	-	-	-	H.P	-	
20	No of obstetrician	--	-	-	-	-	1	-	
21	No of additional obstetrician	2	1	1	1	1	-	1	
22	No of monasteries	-	-		1	-	1	2	
23	No of church	-	-	-	-	-	-	-	
24	No of mosque	1	-	-	-	1	-	-	
25	No of Hindu temple	-	-	-	-	-	-	-	
26	NGO/ INGO	Yes	Yes	-	Yes	Yes	-	-	
27	Electricity	-	-	-	-		-		
28	Water	Tube well	Tube well	5 (Open Well)	Tube Well	Open well	Open Well	Open Well	
29	Rare of water	-	Yes	Rare in summer	Rare in summer	Yes	Rare in summer	Yes	
30	Flood	-	-	-	-	-	-	-	
31	Knowledge on Project Information	Yes	No	No	No	No	-	No	

8.4.2 Results of Consultations

Discussions of the local people in the first public meeting could be summarized as follows.

1. Discussed that damages occur to local people as local plantations are destroyed by mines
2. Discussed that conclusion could be made as severe impacts occur on environment based on the example of other mines
3. Requested to prioritize local people for job opportunity
4. Requested to carry out health care and welfare for workers
5. Requested to carry out project with transparency and accountability
6. Damages occurred to local plantation in exploration works. Requested to make prior negotiation with plantation owners for future activities.
7. Requested to carry out CSR activities such as road and drinking water for local communities

Discussions in the second public meeting are:

(1) There is no advice for modification as the presentations are thorough and complete

(2) Local communities are expected to be developing if the project is implemented

(3) Requested to carry out development programmes for local communities

(4) Requested to create plantations for local community on refilled mined-out area

(5) Requested to carry out road infrastructure development programmes in accordance with the requirement of local people

(6) Requested to carry out Mining activities within the boundary of permitted area

(7) Requested to consider for the benefit of local people with the matter that some previous projects took legal action against local people for performing artisanal mining activities on waste rock dumps

(8) Requested to aid machinery supply for upgrading Zegami-Nyaungbeee rural road as CSR

(9) Requested to make negotiation with plantation owners existed on mining block

(10) Requested to prioritize local people for job opportunities

(11) Suggested to keep trees from cutting as far as possible for the prevention of air pollution

(12) Suggested to dump waste rock systematically, to prevent them from falling into natural waterways, and to find alternative actions if impacts occur in spite of doing protection

(13) Requested to carry out mining activities by avoiding harming water wells of local people and to carry out the activities far from those wells

(14) Requested the project to fulfill the commitments and requested to know the plans for the fulfillment of the commitment

Representative from A&M Myanmar gave the following responses;

(1) As the company is a JV company, monitoring programmes are tight. As the nature of the project, concerned department will be monitoring the project by forming a team consisting representatives from No. (2) Mining Enterprise and other departments.

(2) Request for allowing local people for artisanal mining at waste rock dump will be granted with necessary arrangements. Safety arrangements are required as the dump site area is a hazardous area

(3) Recruitments will be made by posting notifications publicly in local communities via local village admins

Representative from OSHE gave the following responses;

(1) Monitoring programme must be implemented with a monitoring team consisting representatives from local communities

(2) CSR programmes must be implemented by discussing with local representatives of monitoring team for the benefit of local communities

(3) At least three responsible representatives from the project must be included in the monitoring team together with local village admins and elected local representatives from each village

(4) Monitoring team shall take check and balance actions on the fulfilment of the commitments of the project

8.5 DISCLOSURE

8.5.1 Presentation in Public Meeting

Following activities were performed to disseminate the information relating to the project and EIA works for general public in various stages of EIA works.

(1) Representative from the project performed a presentation

(2) . Representative from OSHE gave a presentation

(3) . Representative from OSHE gave a presentation

(4) Representative from the project performed a presentation

(5) . Representative from project in second public meeting

(6) Representative from OSHE in second public meeting

(7) Representative from OSHE delineated Biodiversity in second

8.5.2 Public Comments and Suggestion

(a) Suggestion letters in which general public can put their comments and suggestions for the project were delivered in first public meeting

(b) Open discussion and consultation works were exercised in both public meetings

Table 92. Comments and Suggestions from Local Community

Sr.	Topic	Frequency	Percentage	Simplified
1	Land Acquisition	7	2.61	Land 15.29
2	Land and Plantation Compensation	23	8.58	
3	Economic Displacement	1	0.37	
4	Impact on Nearby Plantation	10	3.73	
5	Environmental impact	6	2.24	Impacts 7.47
6	Destruction of natural drainage	5	1.87	
7	Worried from Experience	1	0.37	
8	Mine rehabilitation	1	0.37	
9	Information release	5	1.87	
10	Transparency in Recruitment	2	0.75	
11	Job Opportunity	73	27.24	Job 30.23
12	Development Opportunity	8	2.99	
13	CSR (Drinking Water)	40	14.92	CSR

14	CSR (Electricity)	15	5.60	47.01
15	CSR (Road)	28	10.45	
16	CSR (Education)	13	4.85	
17	CSR (Religion)	4	1.49	
18	CSR (Health)	26	9.70	
Total		268	100.00	100.00

Table 93. Simplified Issues

Sr.	Topic	Percentage
1	Land & Plantation Related Issues	15.29
2	General Issues	7.47
3	Job & Development Opportunities	30.23
4	CSR	47.01
Total		100.00

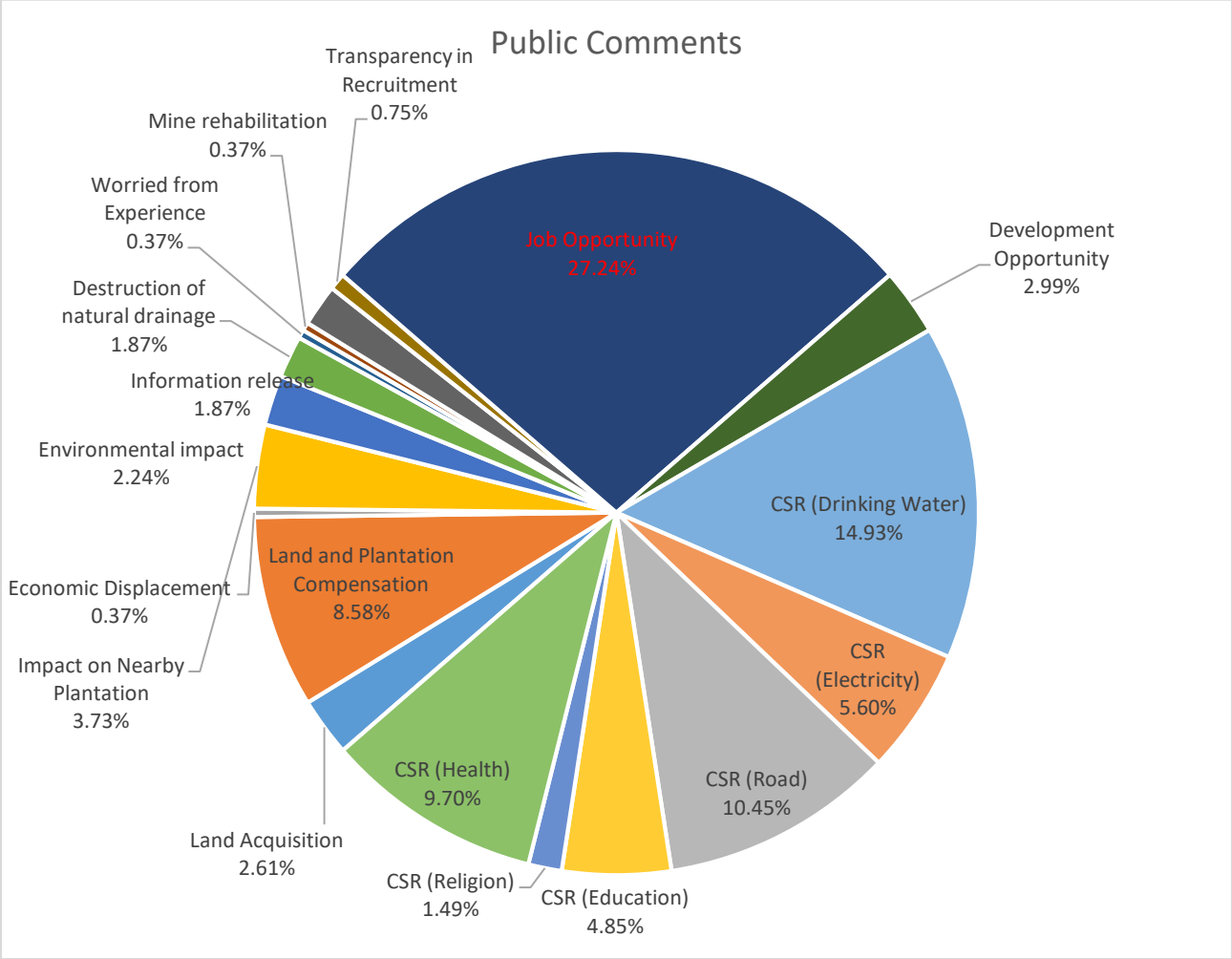


Figure 34. Summarized Public Comments and Suggestions

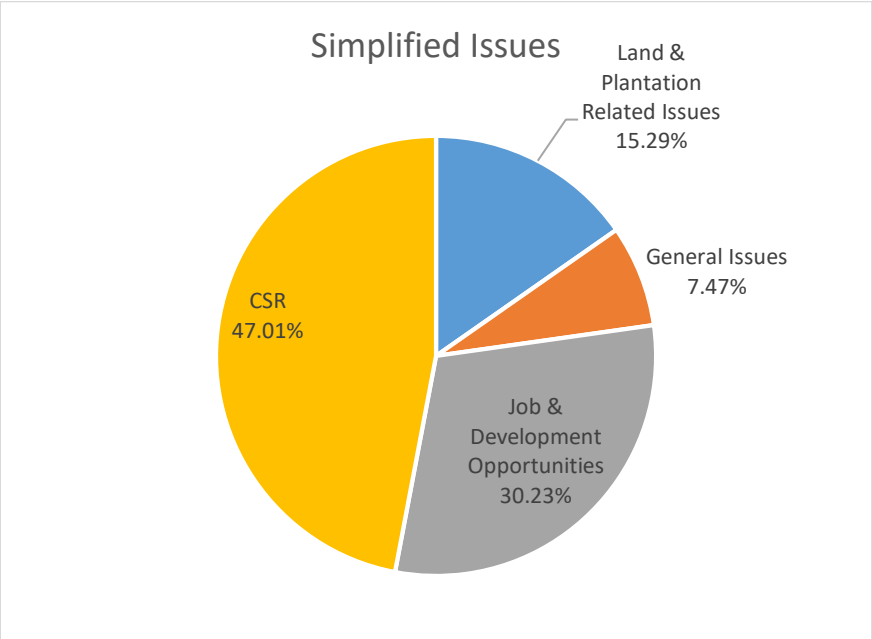


Figure 35. Simplified Public Comments and Suggestions

8.5.3 Dissemination of Results from EIA Studies

(a) Executive summary of draft EIA reports translated into Myanmar was delivered to general public meeting

(b) Translated executive summary was also delivered to ward administration offices so that community could be freely accessible

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APPENDIX-A FIRST PUBLIC MEETING

ပထမအကြိမ် လူထုတွေ့ဆုံပွဲ

လုပ်ငန်း : **ဧကမိ သတ္တုတွင်း စီမံကိန်း**

နေ့ရက် : **၈.၄.၂၀၁၅**

နေရာ : **တွဲဘက်အခြေခံပညာ အလယ်တန်းကျောင်း၊ ဧကမိကျေးရွာ**

တွေ့ဆုံပွဲ စတင်ချိန် : **နံနက် (၉း၀၀) နာရီ**

ပါဝင်ဆွေးနွေးသူများ

စဉ်	အမည်	အလုပ်အကိုင်	အဖွဲ့အစည်း
၁	ဦးတင်ဝင်း	အထွေထွေမန်နေဂျာ	A&M Myanmar
၂	ဦးစိုးမြင့်အောင်	အကြီးတန်းဘူမိဗေဒ	A&M Myanmar
၃	ဦးစန်းညွန့်	အုပ်ချုပ်မှု ဒါရိုက်တာ	OSHE
၄	ဦးစိုးမြင့်	ဒါရိုက်တာ	OSHE
၅	ဦးကျော်ဇင်လတ်	Consultant	OSHE
၆	ဒေါက်တာဆွေဆွေမာ	Consultant	OSHE
၇	ဒေါက်တာဆုဝေမွန်	Consultant	OSHE

- လူထုတွေ့ဆုံပွဲသို့ ဧကမိ၊ ပန်းတောင်၊ တောင်ပု၊ ရွှေဒူး၊ ညောင်ဘီး ကျေးရွာများမှ ရပ်မိရပ်ဖများ၊ ကျွန်းစုမြို့နယ်မှ ဌာနဆိုင်ရာများ၊ A&M Myanmar မှ တာဝန်ရှိသူများ၊ OSHE Services မှ တာဝန်ရှိသူများ အပါအဝင် စုစုပေါင်း (၁၆၇) ဦးခန့် တက်ရောက်ခဲ့ကြပါသည်။

အစီအစဉ်

၁။ အခမ်းအနား ဖွင့်လှစ်ကြောင်း ကြေညာခြင်း

၃။ OSHE Services မှ အုပ်ချုပ်မှု ဒါရိုက်တာ ဦးစန်းညွန့်က ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း လုပ်ငန်းဆိုင်ရာများကို ရှင်းလင်းတင်ပြခြင်း

၄။ OSHE Services မှ ဒါရိုက်တာ ဦးစိုးမြင့်က လူမှုရေးဆိုင်ရာ ထိခိုက်မှု ဆန်းစစ်ခြင်း လုပ်ငန်းဆိုင်ရာများကို ရှင်းလင်းတင်ပြခြင်း

၅။ OSHE Services မှ ဒါရိုက်တာ ဦးကျော်ဇင်လတ်က ဘူမိဗေဒဆိုင်ရာ လေ့လာမှု လုပ်ငန်းဆိုင်ရာများကို ရှင်းလင်းတင်ပြခြင်း

၅။ ကြွရောက်လာသူများနှင့် သက်ဆိုင်ရာ တာဝန်ရှိသူများ အပြန်အလှန် မေးမြန်း ဆွေးနွေးခြင်း

၆။ A&M Myanmar မှ အကြီးတန်း ဘူမိဗေဒ ဦးစိုးမြင့်အောင်က နှုတ်ဆက်ကျေးဇူးတင်စကား ပြောကြားခြင်း

၇။ အခမ်းအနား ပြီးမြောက်ကြောင်း ကြေညာခြင်း

ဆွေးနွေးချက်များ

ဦးကိုလေး(ရတောင်)

၁။ သတ္တုတွင်းများသည် ဒေသခံများ၏ စိုက်ခင်းများ ပျက်စီးရပါသောကြောင့် ဒေသခံများ နစ်နာရပါကြောင်း

၂။ အနီးအနားတွင်ရှိသော သတ္တုတွင်းများသည် ဥပမာအရ သဘာဝပတ်ဝန်းကျင်ကို အလွန်ထိခိုက်ပါကြောင်း

၃။ ဒေသခံများကို အလုပ်အကိုင်ဦးစားပေးစေ လိုပါကြောင်း

၄။ ဝန်ထမ်းများအတွက် ကျန်းမာရေးစောင့်ရှောက်မှု၊ လူမှုဖူလုံရေးလုပ်ငန်းများ ပြုလုပ်ပေးစေလိုပါကြောင်း

၅။ သတ္တုတစ်တန်ရဲ့ ၅%ကို ဖွံ့ဖြိုးရေးလုပ်ငန်းများ လုပ်ဆောင်ပေးပါက ဒေသတွေအများကြီး ဖွံ့ဖြိုးတိုးတက်လာမည် ဖြစ်ပါကြောင်း

၆။ ပွင့်လင်းမြင်သာမှု၊ တာဝန်ယူမှု၊ တာဝန်ခံမှုရှိစွာ ဆောင်ရွက်စေလိုပါကြောင်း

ဦးစိုးမြင့်အောင် (A&M Myanmar)

(၁) EIA/SIA လုပ်ဆောင်မှုများကို လုပ်ဆောင်သူ ရှားပါးပါကြောင်း

(၂) ဦးကိုလေး ဆွေးနွေးချက်များသည် အမှန်တွေ့ချည်း ဖြစ်သောကြောင့် အားလုံးကိုလက်ခံပါကြောင်း

(၃) EIA/SIA ရလာဒ်တွေကို အကောင်းဆုံးဖြစ်အောင် ဆောင်ရွက်သွားမည် ဖြစ်ပါကြောင်း

ဦးသန်းတင့် (တောင်ပု)

(၁) စမ်းသပ်မှုကာလမှာ သီးနှံများ ပျက်စီးသောကြောင့် ဥယျာဉ်ပိုင်ရှင်များ နစ်နာရပါကြောင်း

(၂) နောင်မှာဆက်လက် လုပ်ဆောင်မှုများကို ဥယျာဉ်ပိုင်ရှင်များထံမှ အရင်ခွင့်တောင်း တိုင်ပင်စေလိုပါကြောင်း

ဦးတင်ဝင်း (A&M Myanmar)

(၁) အကြောင်းမကြားခဲ့မိတာ တောင်းပန်ပါကြောင်း

(၂) နောင်လုပ်မည့်နည်းစဉ်များတွင် ထိခိုက်နစ်နာမည့် နည်းစဉ်များ မပါဝင်သောကြောင့် ထိခိုက်မှု မရှိအောင် အတတ်နိုင်ဆုံး ဆောင်ရွက်ပေးမည် ဖြစ်ပါကြောင်း

(၃) သတ္တုတွင်း မဖြစ်မြောက်ခင် ကတည်းက ရပ်ရွာဖွံ့ဖြိုးတိုးတက်ရေးအတွက် ဆောင်ရွက်ပေးခဲ့ပါကြောင်း၊ ရေ၊ မီး၊ ကျန်းမာရေး အစီအစဉ်များလည်း ရှိသေးပါကြောင်း

(၄) သတ္တုတစ်တန်ရဲ့ ၅%ကို ဖွံ့ဖြိုးရေးလုပ်ငန်းများ လုပ်ဆောင်ပေးစေလိုမှုတွင် နိုင်ငံတော်အနေဖြင့် တစ်နေရာတည်း ကွက်လုပ်၍ မရပဲ ဝေခွဲ၍ လုပ်နေရသောကြောင့် နှေးကွေးနေရတာ ဖြစ်ပါကြောင်း

ဦးဇော်ဝင်း (အညင်း)

(၁) ယခုမိုင်းသည် အခြားမိုင်းများနှင့် မတူပဲ ကောင်းမည်ထင်ပါကြောင်း

(၂) အများကိုယ်စား ဒေသ၏ လိုအပ်ချက်များကို ဆွေးနွေးတင်ပြသွားမည် ဖြစ်ပါကြောင်း

ဦးအိုင်ယု (ပန်းတောင်)

(၁) အလုပ်အကိုင် အခွင့်အလမ်းရမည်ဟု မျှော်လင့်ပါကြောင်း

(၂) လယ်ယာမြေများ ထိခိုက်နစ်နာမှာ စိုးရိမ်ပါကြောင်း

(၃) ပညာရှင်များ အနေဖြင့် မထိခိုက်အောင် ထိခိုက်မှု အနည်းဆုံးဖြစ်အောင် အကြံပြုပေးစေ လိုပါကြောင်း

ကိုမျိုးလှိုင် (ဧကမိ ထန်းတော)

(၁) လမ်းပန်းဆက်သွယ်ရေး နှင့် သောက်ရေသုံးရေများ မလုံလောက်သေးသောကြောင့် ဆက်လုပ်ပေးစေ လိုပါကြောင်း

(၂) စိုက်ပျိုးမြေပိုင်ရှင်များ နစ်နာခဲ့ပါက ညှိနှိုင်း ဖြေရှင်းပေးစေလိုပါကြောင်း

(၃) အလုပ်ခန့်ရာတွင် ဒေသခံများကို ဦးစားပေးခန့် ထားပေးစေ လိုပါကြောင်း

(၄) ဦးတင်ဝင်း (A&M Myanmar)

(၁) စက်ယန္တယားကြီးများ သယ်ယူပို့ဆောင်ရာတွင် စိုက်ပျိုးမြေတွေ့ မထိခိုက်အောင် စနစ်တကျ လမ်းကြောင်း ရွေးချယ်ဆောင်ရွက်မည် ဖြစ်ပါကြောင်း

(၂) အလုပ်အကိုင် အခွင့်အလမ်းများအတွက် ဒေသခံများကို ဦးစားပေး ခန့်ထားပေးမည် ဖြစ်ပါကြောင်း

(၃) လယ်ယာမြေများကို မထိခိုက်အောင် ရထားသောမြေထဲက လယ်ယာမြေ (၁၉၉) ဧရိယာကို ပြန်လည်စွန့်လွှတ်ထားပါကြောင်း

ဆွေးနွေးပွဲပြီးဆုံးချိန် :နေ့လည် ၁၁: ၃၀

APPENDIX-B FIRST PUBLIC MEETING (SUGGESTION)

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
၁	ဇေကမိးတွေ့ရှိ ခဲမဖြူ သတ္တုတွင်းမှ ထုတ်ယူသည့် ကမ္ဘာအတွင်း ဒဏ်ရာ အတွက် ပတ်သက်၍ ရေရှည်အတွက် အဆင်ပြေမှုရှိစေရန်
၂	ကုမ္ပဏီ လူမှုပတ်ဝန်းကျင် အတွင်း ဆုံးရှုံးမှု၊ ထိခိုက်မှုရှိလာပါက အကြံပြုပါသည်။
၃	ဒေသခံ အတွင်း သတ်မှတ်ပြီး ပုံစံအတိုင်း ယာဉ် ထွက်ခွင့် ရယူပြီး ထိုကဲ့သို့ ရယူခြင်းမရှိဘဲ ပေးထားခဲ့ခြင်းကို
၄	ဒေသ အတွင်း ကျေးရွာ

လက်မှတ် - .....

အမည် - .....

ဆက်သွယ်ရန်လိပ်စာ - .....

.....

ဖုန်း - .....

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ရက်စွဲ။ ၇ ။ ၄ ။ ၂၀၁၅

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
၁	ရေးကဲ့ရေးမှာ သတ္တုတွင်းလုပ်ကိုင်စဉ်အတွင်း လိုအပ်သော ခံယူချက်များ၊ ကျင့်ဝတ်များ၊ လုပ်ထုံးလုပ်နည်းများ ကောင်းစွာ သိရှိနားလည်ပါ။
၂	စည်းကမ်းချက်များ၊ ဥပဒေများ၊ စည်းမျဉ်းများ၊ မျက်နှာပြင်များ ကျိုးကြောင်းဆင်ခြင်စဉ်းစား ဆွေးနွေးလုပ်ဆောင်ပါ။
၃	မည်သည့်အခြေအနေမျိုးတွင်မဆို အချင်းချင်း အပြန်အလှန် ယုံကြည်မှုရှိစေရန် ကြိုးပမ်းဆောင်ရွက်ပါ။

လက်မှတ် -

အမည် -

ဆက်သွယ်ရန်လိပ်စာ -

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
၁	ဒေသခံပြည်သူများနှင့် သတ္တုတွင်းစီမံကိန်းလုပ်ငန်းအဖွဲ့အစည်းတို့ အကြား ပွင့်လင်းမြင်သာသော ဆက်ဆံရေးကို ထိန်းသိမ်းသွားရန် လိုအပ်ပါသည်။
၂	လုပ်ငန်းကြောင့် ဒေသခံများ၏ အိမ်ခြေအိမ်ယာ၊ စိုက်ကွင်းများ ထိခိုက်ပျက်စီးမှုရှိပါက လျော်ကြေးပေးချေမှုကို တရားမျှတစွာ ဆုံးဖြတ်ပေးသင့်ပါသည်။
၃	ဒေသခံများနှင့် ပူးပေါင်းဆောင်ရွက်ရာတွင် ကျေးရွာအုပ်စု၊ ကျေးရွာအဆင့်ဖြစ်စေ ကိုယ်စားပြုအဖွဲ့ကို ဖွဲ့စည်းပေးသင့်ပါသည်။
၄	ဒေသခံများ အလုပ်အကိုင်အခွင့်အလမ်းများ ရရှိနိုင်ရေးအတွက် ဦးစားပေးခန့်အပ်ခြင်း၊ ပညာရေးနှင့် ကျွမ်းကျင်မှုမြှင့်တင်ရေးတို့ကို ဆောင်ရွက်ပေးသင့်ပါသည်။

လက်မှတ် -

အမည် -

ဆက်သွယ်ရန်လိပ်စာ -

ဖုန်း -

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
၁-	ဇေကမိကျေးရွာတစ်ဝိုက်လွှင့်ကျွဲရွာစားစေ့ခြင်းတို့ကြောင့်သိနားလည်သဘောထားရန်အကြောင်းကြားခြင်း။
၂-	ဒေသခံအလုပ်သမားများကိုဦးစားပေးခန့်ထားပေးရန်။ အကူအညီတောင်းခံလာပါက ပံ့ပိုးကူညီပေးရန်။

လက်မှတ် -

အမည် -.....

ဆက်သွယ်ရန်လိပ်စာ -.....

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
၁/	ရေကန်ဒေသခံပြည်သူလူထုနဲ့ ကျေးရွာနေရပ်ရှိ ကြီးကြပ်ခံတပ်ဖွဲ့နဲ့ ပူးပေါင်းဆောင်ရွက်ပေးသင့်ပါတယ်။ အထောက်အကူပြုမှုများစွာ ရရှိမှုပေါ်မှာ မူတည်ကြောင်း ပြောပြပါရစေ။
၂/	အသေးစိတ်အချက်အလက်များသာ ဖြစ်သင့်သလောက် ပိုမိုရရှိနိုင်ကြောင်း ပြောပြပါရစေ။

လက်မှတ် - ဂျာ. မိုးဒွာ

အမည် - ဒေါ်ဂျာ မိုးဒွာ

ဆက်သွယ်ရန်လိပ်စာ - ဇေဂိုးကမိုးကြယ်ကျေးရွာ၊ ပြည်

စဉ်းမြို့နယ်

ဖုန်း -

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ရက်စွဲ။ ။ 7.4.2015

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စဉ်	အကြံပြုချက်
၁။	~~ဇေ~~ ဇေ:ကမိကျေးရွာ တစ်ရွာလုံး ကျန်းမာရေး ပြဿနာမြောက်ပြားစွာ ဆရာဝန်မရှိခြင်း ကယ်လို့ ဆရာဝန်တစ်ဦး ခြင်းပေး၊ မယ်ဆိုလျှင် ပြီးရွာအတွက် အစောကြီးမှာ ရွာရမည်မဟုတ်ပါသည်။
၂။	အလုပ်အကိုင်မရှိသူများဖြင့် အလုပ်အကိုင်တစ်ခု ခြင်းပါရန် အကြံပြုပါသည်။

လက်မှတ် - Khing

အမည် - မဇေယျာခိုင်

ဆက်သွယ်ရန်လိပ်စာ - ဇေ:ကမိကျေးရွာကျန်းမာရေးဌာနမှူးရယ်

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ဖုန်း - 09-31742190

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
၁	ဒေသခံ ကျေးရွာများ ရှိပါသလား၊ ရှိပါက ဘာဝန်ဆောင်မှုများ ပေးနိုင်ပါသလဲ။
၂	အလုပ်အကိုင်အခွင့်အလမ်းများ ရှိပါသလဲ။

လက်မှတ် - ဦးယဉ် -

အမည် -ဒေါ်မြင့်ဦးယဉ်.....

ဆက်သွယ်ရန်လိပ်စာ -ဒေသခံကျေးရွာ ဆွေမြို့ ရပ်ကွက်

.....

ဖုန်း -.....

OSHE Services Co., Ltd.

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ရက်စွဲ။ 7 ။ 4 ။ 2015

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စဉ်	အကြံပြုချက်
၁,	ဖောင်းကားခဲကွေ့ကြီးတစ်ခုလုံး ဆက်ဝန်တည်ခဲ့ပေး ခဲ့ပေးပါရန် တောင်းခံပါသည်၊ အကြံပြုပါသည်၊
၂,	အလုပ်အကိုင်အခွင့်အလမ်းကို ခဲ့ပေးပါရန် တောင်းခံပါသည်၊ အကြံပြုပါသည်

လက်မှတ် - ဖိုးဖိုးသန့်

အမည် - ဒေါ်ဖိုးဖိုးသန့်

ဆက်သွယ်ရန်လိပ်စာ - ဖောင်းကားခဲကွေ့ အနီးရှိ ရွာမြို့နယ်၊

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ဖုန်း - .....

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ရက်စွဲ။ ။ 7 · 4 · 2015

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စဉ်	အကြံပြုချက်
၁။	ဇေကမိ ကျွန်တော်တို့ ကျေးရွာဒေသများမှာ ဘုရားဝတ်မှုကို ဦးစားပေးကြပြီး ဆရာဆိုလျှင် စကားတစ်ခွန်းပြောပေးမယ် မည်မှာ အကြံပြုပါသည်။
၂။	အလုပ်အကိုင်မရှိသဖြင့် အလုပ်အကိုင်တစ်ခုပေး ပါရန် အကြံပြုပါသည်။
၃။	ဇေကမိကျေးရွာတွင်သောက်သုံးရေခဲကို ခဲရသဖြင့်ရေမြှုပ် ကိုပေးပါရန် အကြံပြုပါသည်။

လက်မှတ် - ဒွန်း

အမည် -...ဒေါ်နွဲ့ဒိန်းဆော်.....

ဆက်သွယ်ရန်လိပ်စာ -...ဇေကမိကျေးရွာကြီးရပ်ကွက်.....

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ဖုန်း -...09-333819401.....

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ရက်စွဲ။ ။ 7 . 4 . 2015

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စဉ်	အကြံပြုချက်
၁။	ဒေးကမီကွာတစ်ကွာလုံး ကျွန်းမာရေးဆရာဝန်အဖြစ် ဆရာဝန်တစ်ဦးပေး မထိုက်တဲ့အပြင် ဂျပန်ကွာကတွက် တောက်လှုပ်ရှားစည်ကားအောင်ပြုပါသည်။
၂။	အလုပ်ကကိုဒေတိုသဖြင့် အလုပ်ကကိုတစ်ဦးပေးပါရန် အကြံပြုပါသည်။
၃။	ဒေးကမီကျေးကွာတွင်ရောလိုသဖြင့် ကူညီပေးရန်အတွက် [redacted] အကြံပြုပါသည်။

လက်မှတ် - ဦး

အမည် -.....နေမျိုးဦး.....

ဆက်သွယ်ရန်လိပ်စာ -.....ဒေးကမီကျေးကွာ ကျွန်းမာရေးဌာနမှ ဆရာဝန်.....

.....

ဖုန်း -.....09-33307115.....

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
၁။	ဇေကမိရွာတစ်ရွာလုံးကျန်းမာရေးပြဿနာရှိပြီးဆရာဝန် မရှိဒေသဖြစ်ပါတယ်ဆရာဝန်တစ်ဦးဦးပေးမယ်ဆိုရုံဖြင့်ရွာ ကျန်းမာရေးစောင့်ရှောက်ဆောက်ရွက်နိုင်မှုများစွာရရှိမှာ မဟုတ်မှာစိုးကြောင့်ပါသည်။
၂။	အလုပ်သမားကိုဖွဲ့စည်းလမ်းမျဉ်းရှိရန်လည်းလုပ်ကိုင် ခြင်းပါဆယ်မှာစောင့်ကြည့်ပါသည်။

လက်မှတ် - ဖြူ

အမည် ဒေါ်မြတ်မြတ်စိုး

ဆက်သွယ်ရန်လိပ်စာ - ကျောက်ရုံပြို့ ရပ်ကွက်အမှတ် (၁) ဖြူ

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
၁။	ကျေးကျေးဇူးတင်ပါတယ် လုံခြုံကျန်းမာရေးနဲ့ ပတ်သက်ပြီး အရေးကြီးပါတယ် ဆရာဝန်ပြီး သွားပါတယ် ခေါ်ဆောင်သွားပါတယ် ဒါပေမဲ့ အရေးပေါ်ဆေးခန်းကို ခေါ်ဆောင်သွားပါတယ် ဒါပေမဲ့ အရေးပေါ်ဆေးခန်းကို ခေါ်ဆောင်သွားပါတယ်
၂။	အလုပ်အကိုင်မှုဝင်ငွေ အခွင့်အလမ်းတစ်ခုဖြစ်ပေါ်စေပါတယ် အကြံပြုပါသည်။

လက်မှတ် - သန့်ဇင်းသန့်ဇင်းဝေ

အမည် - ဒေါ်စိန်သန့်ဇင်းသန့်ဇင်းဝေ

ဆက်သွယ်ရန်လိပ်စာ - ဇေကမိကေ့ပ်ရှာကျွန်းစုမြို့နယ်

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ဖုန်း - .....

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ရက်စွဲ။ 7 ။ 4 .2015

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စဉ်	အကြံပြုချက်
၁။	ဝေဒနာခံစားရသူများ၏ မိသားစုဝင်များအား ရေရှည်တွင် အကူအညီပေးရန် ရှိပါသည်။ ဆရာဝန်များ ခေတ္တနေရာသာမက ဆရာဝန်တစ်ဦးချင်းစီ ပုံမှန်ပြောင်းလဲသွားနိုင်ရန် ဆုံးဖြတ်ချက်ပေးနိုင်သော အာဏာရှိသူများကို ဒဏ်ခတ်ပြစ်တင်ရန် လိုအပ်ပါသည်။
၂။	အသက်ပျောက်ဆုံးမှုဖြစ်ပွားပါက ဖြစ်ပွားသည့်နေရာတွင် ချက်ချင်းသတင်းပို့ရန် လိုအပ်ပါသည်။

လက်မှတ် - ဖောဝင်း

အမည် - ဦးဖောဝင်း

ဆက်သွယ်ရန်လိပ်စာ - ဝေဒနာခံစားရသူများ၏ ကျေးရွာ ရပ်ကွက်အသေးစိတ်

ဖုန်း -

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ရက်စွဲ။ ။ 7.4.2015

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စဉ်	အကြံပြုချက်
၁။	ဇေးကမိကျေးရွာတစ်ခွာလုံး ကျန်မာရေး ပြဿနာရှိဖို့ ဆရာဝန် မရှိစေချင်၊ ကမ္ဘာကျော်ဆရာဝန်တစ်ဦး ချမေးပါ။ မယ်ဆိုလျှင် ငါ့ကို အစောကြီး အဝေးကြီးကမှ မှာစရာမရှိဟု အကြံပေးပါသည်။
၂။	အလုပ်အကိုင်မရှိသဖြင့် အလုပ်အကိုင်တစ်ခုချပေးပါ ဟု အကြံပေးပါသည်။

လက်မှတ် - ဝင်းဆိုး

အမည် -ဒေါ်စန်းဝင်း

ဆက်သွယ်ရန်လိပ်စာ -ဇေးကမိကျေးရွာကျောင်းဆရာမ

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
၁	ရေရှိရေး၊
၂	ဒေသခံသတ္တုတွင်းဒုက္ခသည်ရေး၊
၃	လမ်းသွားလာရေးအဆင်ပြေရေး၊
၄	မျိုးနွယ်ဒေသ ဝန်းကျင်ရေး၊
၅	ပျံသန်းမှုလုံခြုံရေးအဆင်ပြေရေး၊
၆	ရေသင်္ဘောဆိပ်ကမ်း အဆင်ပြေရေး၊
၇	အာရုံခံကိရိယာများ အဆင်ပြေရေး၊

လက်မှတ် -

အမည် -ရဲမိုးရဲရေး

ဆက်သွယ်ရန်လိပ်စာ -ရေးကမိကျေးရွာ
တောင်တောရိုး

ဖုန်း -

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
၁	ကျေးရွာဘိုရွာ
၂	ဒဲလှမြူးသတ္ထုတွင်းစီမံကိန်းမှုဆိုင်
၃	လေထု သဘာဝပျက်စီး
၄	ကျန်းမာရေးဆိုင်ရာ ထိခိုက်မှု
၅	မြေအောက်ရေအရင်းအမြစ်
၆	ရေသန့်ကျေးဆောက်ပေးရန်
၇	အလုပ်ကိုယူ၊ ရည်အခင်းပေးရန်

လက်မှတ် -

အမည် -.....

ဆက်သွယ်ရန်လိပ်စာ -.....

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
၁	ရေရှိရေး
၂	လူထုဘဏ္ဍာဆက်သွယ်ရေး
၃	လူထုဘဏ္ဍာအဖွဲ့ရေး
၄	ဒုက္ခရောက်သောသူများ
၅	ကောင်းသည့်အတွက် ကျေးဇူးတင်ရှိ

လက်မှတ် -

အမည် -.....ဝေငယ်.....

ဆက်သွယ်ရန်လိပ်စာ -.....ရေနောက်ဖို.....

.....တောင်ငူ.....

ဖုန်း -.....

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စဉ်	အကြံပြုချက်
	ကျွန်တော်တို့ကျေးရွာအနီးတွင်ဖြစ်ပေါ်မည့်-
	၁/ မြေရိုင်းရေး၊
	၂/ ရေရိုင်းရေး၊
	၃/ လယ်မြေစိုက်ပျိုးရေး၊
	၄/ ကျန်းမာရေးစောင့်ရှောက်မှုများ၊

လက်မှတ် -

အမည် -.....

ဆက်သွယ်ရန်လိပ်စာ -.....

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
၁	ရေရှိရေး၊
၂	လျှပ်စစ်ရှိရေး၊
၃	လမ်းအဆက်သွယ်ကောင်းရေး၊
၄	ဒုက္ခသည်ကျေးရွာဆောက်ပေးရေး၊
၅	အလုပ်အကိုင်အခွင့်အလမ်းများပေးရေး၊

လက်မှတ် -

အမည် -.....ခင်သန္တာလွင်.....

ဆက်သွယ်ရန်လိပ်စာ -.....ရွှေကမိ.....

.....ထန်းတောရွာ.....

ဖုန်း -.....

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
၁	ရေရှည်တိုရော
၂	လမ်းဘေးဆောက်အုံပေါ်ရော
၃	ကျေးရွာသစ်ခေါက်ပေါ်ရော
၄	ဖုံးကွယ်ကျင်ဆောက်ပေါ်ရော

လက်မှတ် -

အမည် -.....

ဆက်သွယ်ရန်လိပ်စာ -.....

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ 7.4.2015

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စဉ်	အကြံပြုချက်
	အခြား ကုမ္ပဏီများ
	ယဉ်ကျေးမှုဆိုင်ရာ ကျင့်ဝတ်များ
	စသည်ဖြင့် ပါဝင်ပါသည်

လက်မှတ် -

အမည် -.....

ဆက်သွယ်ရန်လိပ်စာ -.....

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
၁	သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းမှ ဒေသခံလယ်သမားများထံမှ အလုပ် ကျွံကျန် လစ်ပမ်းပင်းဆက် အွန်လိုင်းစကားဝိုင်း မွန်ကျန်

လက်မှတ် -

အမည် -.....

ဆက်သွယ်ရန်လိပ်စာ -.....

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
၁	ရေးကျခဲ့ လေ့လာခဲ့ကြပါတဲ့ အလေ့ပါရှင် ယခုပေးပါ ရောက်ရောဝန်ထမ်းဖြစ်ခဲ့ ဖော်ပါသည်။

လက်မှတ် ဦးမျိုးဝင်း

အမည် -.....

ဆက်သွယ်ရန်လိပ်စာ -.....

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
	သတ္တုတွင်း စီမံကိန်း လုပ်ငန်း ဖြစ် ဆောင်ရွက်သော အခါ အလေး အထား ထားရှိ ရမှာ ဘာတွေ ရှိပါသလဲ
	လမ်း ပန်း ဆက် သွယ်ရေး စသော အခြေခံ အဆောက် အအုံ

လက်မှတ် -

အမည် -.....

ဆက်သွယ်ရန်လိပ်စာ -.....

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ 7 . 4 . 2015 - အင်္ဂါနေ့

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
	ကျနော်တောတို့ ဇေးကမိကျေးရွာအပျိုစဉ်ဟာ ၊ ကျွဲမွာရေး ၊ ယမ်းသာရေး ၊ စီးပွားရေး အများကြီးပဲ. အားလုံးတဲ့ ကျေးရွာ ဖြစ်ပါတယ်.. ဒါကြောင့် ကျနော်တောတို့ ဇေးကမိကျေးရွာ ဒေသခံတို့ ကျွဲမွာရေး ၊ ယမ်းသာရေး ၊ စည်းပွားရေး - စသည်တို့ကို ဖြင့် ဖိုးမြိုး တိုးတက်သော ကျေးရွာ အဖြစ် ဖြည့်ဖွဲ့ ပေးစေချင်ပါတယ် -

လက်မှတ် -

အမည် - ကျော်စိုးအောင်

ဆက်သွယ်ရန်လိပ်စာ - ဘားဒီဘာဂီဝင်း ကျွဲစခန်းနယ်

ဇေးကမိ ကျေးရွာ ယမ်းတောင်ကုပ်ကွက်

ဖုန်း - * 09258026038 *

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ရက်စွဲ။ ။ 7 . 4 . 2015 ခုနှစ်ရက်

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စဉ်	အကြံပြုချက်
	ဇေးကမိကျေးရွာ အမြဲတမ်း သတ္တုတွင်း စီမံကိန်း စတင် ဆောင်ရွက်ခြင်းကြောင့်. ဇေးကမိကျေးရွာ အတွင်းရောတိုင်ကြသော ယူကိုင်းစေ့ ယူဖျိုး တာယာ ဖွဲ့ခြား ပဲနှံ့. ဘားကိုး . အမှုမ်းလေး စေအုင်ပါ။

လက်မှတ် -

အမည် -ဖျိုးအောင်

ဆက်သွယ်ရန်လိပ်စာ -မန်းတောင်ကုပ်

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
	ဇေကမိ ဒေသခံ ပြည်သူ ပြည်သား များ ရဲ့ ဘဝ အဆင့်အတန်း တိုးတက်ကောင်းမွန်စေရန် ကုမ္ပဏီ ဘက်မှ ဦးစွာ ဆောင်ရွက်ပေးသင့်သော အချက်များ ဖြစ်ပါသည်။

လက်မှတ် -

အမည် -ဦးစိုးမြင့်

ဆက်သွယ်ရန်လိပ်စာ -ဇေကမိ ဒေသခံ ပြည်သူ

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ဖုန်း -.....

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ရက်စွဲ။ ။ ၇ . ၄ . ၂၀၁၅

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စဉ်	အကြံပြုချက်
၁။ ၂။ ၃။	ကျွန်ုပ်တို့သည် ခဲမံကိုရှာဖွေ မွေးထုတ်ခြင်း၊ ပြုပြင်ခြင်း၊ ပါဝင်သော ကျွန်ုပ်တို့၏ ဘဝများကို ခဲဓာတု၏ အန္တရာယ်များမှ ကာကွယ်ရန် စီမံကိန်း မွေးထုတ်သည့် ကာလအတွင်း ခဲမံကိုနှင့် ဆက်စပ်သော အန္တရာယ်များကို ဖော်ထုတ်ခြင်း၊ ကာကွယ်ခြင်း နှင့် ကျွန်ုပ်တို့၏ ကျန်းမာရေးကို စီမံခန့်ခွဲသွားမည်ဖြစ်ကြောင်း အသိပေးတိုက်တွန်းအပ်ပါသည်။

လက်မှတ် -

အမည် -.....မသိကိုကိုဦး.....

ဆက်သွယ်ရန်လိပ်စာ -.....ဇေကမိ ခဲမဖြူ.....

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
	တနေ့တာ ရိုက်ကွင်းဒေသတွင်း ကျွန်းစုခြုံ နေထိုင်ကြသော ပြည်သူများ ကျွန်းတွင်း၌ လက်ရှိ အသုံးပြုနေသော ဓလေ့ထုံးစံ လုပ်ငန်းခွင်များ ဖော်ထုတ်ခွင့်ရခြင်း အတွက် ကျေးဇူးတင်ကြောင်း ပြောကြားခဲ့ပါတယ်

လက်မှတ် - [signature]

အမည် -ရီးတောင့်လွင်

ဆက်သွယ်ရန်လိပ်စာ -ဓလေ့ထုံးစံများဆိုင်ရာ ပြည်သူများ

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
၁။	သင်တို့ကုမ္ပဏီ၏ ဝန်ထမ်းသစ် သစ်ပင်စိုက်မှု အားထုတ်မှုကို မြင်တွေ့ရပါသည်။
၂။	လျှပ်စစ်သုံးစွဲမှုကို လျော့ချနိုင်ရန် ဆောက်လုပ်ရေးကို ဖြစ်နိုင်သမျှ ထိန်းသိမ်းပေးပါရန်။
၃။	ကျွန်တော်တို့ ဒေသခံများ ပြည်သူများအား ကူညီပြုစုပေးပါရန်။

လက်မှတ် -

အမည် -

ဆက်သွယ်ရန်လိပ်စာ -

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
၁.	ဇေကမိခဲမြေလုပ်ကွက်တွင် ရှိတဲ့ ပျက်စီးသော ရေမြှုပ်သစ်ပင် တန်ဖိုးရှိသော သစ်ပင်များကို ခုတ်ထုံးသူ တောင်ယာလုပ်သော သူတို့အား ကာလတန်ဖိုးငွေကို ပေးဆောင်ရန်။
၂.	သတ္တုတွင်းစီမံကိန်းစွန့်ပစ်ရာ အမှိုက်များအား ဖယ်ရှားရန် စီစဉ်ဆောင်ရွက်ပေးရန်။
၃.	လုပ်ငန်းဆောင်ရွက်ရာတွင် ရှိရှိသမျှသော အကျိုးအမြတ်တရပ်ပြုစေရ။ ပျက်စီးဆုံးရှုံးမှုများ (၁) ပညာရေး (၂) လမ်းပန်းဆက်သွယ်ရေး (၃) ရေရှိရေး - ကူညီပံ့ပိုးပေးရန် ဖိုးလေးဆိုပါတယ်။

လက်မှတ် -

အမည် -ခိုင်သက်နိုင်ဦး

ဆက်သွယ်ရန်လိပ်စာ -ဇေကမိ-ကန်ရပ်ရွာ

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
၁/	၁၁ တွင်းကျောက်မှုန်များ ဖြစ်ပေါ်စေမှုမှာ အဘိုးကြီးဖြစ်သည့်

လက်မှတ် .....

အမည် -.....

ဆက်သွယ်ရန်လိပ်စာ -.....

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ . .

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စဉ်	အကြံပြုချက်
၁	သတ္တုတွင်း ကူးမြောက်တွင်မြနယ်သူများ ခိုက်မိပြီး ထားသည့် နှစ်ဂုဏ်သိမ်းပင်များ၊ ဇေတီခိုက်ဝေဂုဏ်.
၂	ပြနယ်သူများ ဂုဏ်ခိုက်ထား သည့်ရေကတွင်. သတ္တု. များ ကူးမြောက်ခြင်း သေပဆုံးရင်. သစ်ပင်ပျိုင်ဂုဏ် နှင့်- တွေ့ဆုံပြီး ~~အ~~ နှစ်ခိုး နှစ်ဖက်. ညှိနှိုင်းအဖြေ ရှာပြီးမှ ကူးမြောက်ခြင်းပါသည်.
၃	~~ရေနှင့်~~ တဖက်နှင့် တဖက်. ညှိညှိနှိုင်းနှိုင်း သာဂုဏ်ညှိနှိုင်းပါသည်.

လက်မှတ် -

အမည် -.....

ဆက်သွယ်ရန်လိပ်စာ .....

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္ထုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
	[illegible]

လက်မှတ် -

အမည် -[illegible]

ဆက်သွယ်ရန်လိပ်စာ -[illegible]

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ 7.4.2015

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စဉ်	အကြံပြုချက်
	ဇေးကမိကျေးရွာ ခဲမဖြူသတ္တုစီမံကိန်းအောင်မြင်ရေးပြဿနာ အဆုံးတော့ငြိတာတော်ယ်။ ကျွန်းမာရေး၊ လူမှုရေး၊ လမ်းပန်းဆက်သွယ်ရေး၊ ဂိုဂိုပို ဖြည့်သူလူထု၊ အိုးရိယာဆင်းရဲသား၊ စီမံကိန်းမူပေါင်းစုံ စီမံလုပ်ကိုင်ရှိ ဖို့ မိမိဒေသခံပေါ်စေဝင်ငွေမယ် အိုရင် ရှိဖို့ သစ်ပင်ဆက်၊ အိုရင် ဥက်ဟာကျေးပေးဆောက်ဖို့ ဖြေင့်ဖြစ်မယ် အိုရင် အကြံပြုပါသည်။

လက်မှတ် - ဘဘိုး ခဲ

အမည် - ဒေါ်ဘဘိုး ခဲ

ဆက်သွယ်ရန်လိပ်စာ -...ဇေးကမိကျေးရွာ ကျွန်းစုကြီးမယ်

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
	ဇေကမိ ကျေးရွာ ခဲ, မြေဖြူ သတ္တုတွင်း စီမံကိန်း၏ စီးပွားရေးလှုပ်ရှားမှုကြောင့် ဖြစ်ပေါ်လာမည့် သက်ရောက်မှုများ

လက်မှတ် -

အမည် .....

ဆက်သွယ်ရန်လိပ်စာ -.....

.....

ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
	ကောင်းကျိုးရှိမည့်အစီအမံများ ချမှတ်ပေးခြင်း၊ လူပင်းဒေသ-ယွန်းကြေးသည်လုပ်ငန်းများအတွက် ရေကျဉ်းမြောင်းကြီးများ၊ ဆည်မြောင်းများ ဖောက်လုပ်ပေးခြင်း၊ ကျန်းမာရေးဆိုင်ရာ အခမဲ့ဆေးကုသမှုများ ပြုလုပ်ပေးခြင်း၊ ကစီးရင်းခံကုမ္ပဏီ ရှေ့နေများ ခန့်ထားပေးခြင်း၊ ကျောင်းများ ဖွင့်လှစ်ပေးခြင်း၊ ကျောင်းသုံးပစ္စည်းများ ထောက်ပံ့ပေးခြင်း၊ ကစီးရင်းခံကုမ္ပဏီ ရှေ့နေများ ခန့်ထားပေးခြင်း၊ ကျောင်းများ ဖွင့်လှစ်ပေးခြင်း၊ ကျောင်းသုံးပစ္စည်းများ ထောက်ပံ့ပေးခြင်း၊

လက်မှတ် -

အမည် -

ဆက်သွယ်ရန်လိပ်စာ -

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ဖုန်း -

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ရက်စွဲ။ ။ 7 . 4 . 2015

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စဉ်	အကြံပြုချက်
၁။	ဒေးကမိကျေးရွာတွင်အိုးထိုးသဖြင့် ကူးစက်ရောဂါကာကွယ်ပေးရန် အကြံပြုသည်။
၂။	ဒေးကမိကျေးရွာတွင်ရေထိုးပါသဖြင့် ထောက်မံကူညီပေးရန်အကြံပြုပါသည်။
၃။	ဒေးကမိရွာတွင်အကျိုးကျေးဇူးရှိစေရန် ဆရာဝန်ကိုယ်တိုင်ကြီးကြပ်ပေးရန်နှင့် ဆရာဝန်တစ်ဦးချင်းစီ ပူပေးမယ်အစီအမံများဖြင့် ရွာအတွက် ထောက်ကူပေးရန် အကြံပြုပါသည်။

လက်မှတ် - ရွာ

အမည် - ဒေါ်တင်ရွှေ

ဆက်သွယ်ရန်လိပ်စာ - ဒေးကမိကျေးရွာ ကျန်းမာရေးအဖွဲ့

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ဖုန်း -.....

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ရက်စွဲ။ ။ . .

ဇေကမိ ခဲမဖြူ သတ္တုတွင်း စီမံကိန်းလုပ်ငန်းနှင့် ပတ်သက်၍ အကြံပြုလိုသည်များ ရှိပါက ရင်းနှီးပွင့်လင်းစွာ အကြံပြုရေးသားပေးပါရန် မေတ္တာရပ်ခံ အပ်ပါသည်။

စဉ်	အကြံပြုချက်
	ဒေသခံလယ်ကွင်းကို ခဲဖြူတူးတဲ့အခါ ရွာ ကာကာဆန့်စေ့၊ ပေးပြီး အသုံးပြုပါ

လက်မှတ် - ထိုးမှုန်

အမည် - ဒေါ်ခိုင်ခိုင်စိုး

ဆက်သွယ်ရန်လိပ်စာ - .....

.....

ဖုန်း - 09 449 872824

APPENDIX-C SECOND PUBLIC MEETING

ဒုတိယအကြိမ် လူထုတွေ့ဆုံပွဲ

လုပ်ငန်း : **ဧကမိ သတ္တုတွင်း စီမံကိန်း**

နေ့ရက် : **၃၀.၇.၂၀၁၇**

နေရာ : **တွဲဘက်အခြေခံပညာ အလယ်တန်းကျောင်း၊ ဧကမိကျေးရွာ**

တွေ့ဆုံပွဲ စတင်ချိန် : **မွန်းလွဲ ၁:၁၅**

ပါဝင်ဆွေးနွေးသူများ

စဉ်	အမည်	အလုပ်အကိုင်	အဖွဲ့အစည်း
၁	ဦးတင်ဝင်း	အထွေထွေမန်နေဂျာ	A&M Myanmar
၂	ဦးစိုးမြင့်	ဒါရိုက်တာ	OSHE
၃	ဒေါက်တာကျော်နိုင်ဦး	အကြံပေး ပညာရှင်	OSHE

- လူထုတွေ့ဆုံပွဲသို့ ဧကမိ၊ ပန်းတောင်၊ တောင်ပု၊ ရွှေဒူး၊ ညောင်ဘီး ကျေးရွာများမှ ရပ်မိရပ်ဖများ၊ ကျွန်းစုမြို့နယ်မှ ဌာနဆိုင်ရာများ၊ A&M Myanmar မှ တာဝန်ရှိသူများ၊ OSHE Services မှ တာဝန်ရှိသူများ အပါအဝင် စုစုပေါင်း (၁၃၀) ဦးခန့် တက်ရောက်ခဲ့ကြပါသည်။

အစီအစဉ်

၁။ အခမ်းအနား ဖွင့်လှစ်ကြောင်း ကြေညာခြင်း

၂။ A&M Myanmar မှ အထွေထွေမန်နေဂျာ ဦးတင်ဝင်းက အဖွင့် နှုတ်ခွန်းဆက်စကား ပြောကြားခြင်း

၃။ OSHE Services မှ ဒါရိုက်တာ ဦးစိုးမြင့်က ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းလုပ်ငန်းမှ တွေ့ရှိချက်များကို ရှင်းလင်းတင်ပြခြင်း

၄။ OSHE Services မှ အကြံပေးပညာရှင် ဒေါက်တာ ကျော်နိုင်ဦးက ဇီဝမျိုးစုံမျိုးကွဲဆိုင်ရာ လေ့လာမှု လုပ်ငန်းမှ တွေ့ရှိချက်များကို ရှင်းလင်းတင်ပြခြင်း

၅။ ကြွရောက်လာသူများနှင့် သက်ဆိုင်ရာ တာဝန်ရှိသူများ အပြန်အလှန် မေးမြန်း ဆွေးနွေးခြင်း

၆။ A&M Myanmar မှ အထွေထွေမန်နေဂျာ ဦးတင်ဝင်းက နှုတ်ဆက်ကျေးဇူးတင်စကား ပြောကြားခြင်း

၇။ အခမ်းအနား ပြီးမြောက်ကြောင်း ကြေညာခြင်း

ဆွေးနွေးချက်များ

ဦးသန်းဆွေ (ဇေကမိ)

၁။ တင်ပြချက်များမှာ ပြည့်စုံပါကြောင်း၊ အထူးတလည် ပြင်ဆင်အကြံပြုရန် မရှိပါကြောင်း

၂။ စီမံကိန်းဖြစ်လာလျှင် ဒေသဖွံ့ဖြိုးလာမယ်လို့ မျှော်လင့်ပါကြောင်း

၃။ စီမံကိန်း ဖြစ်မြောက်လျှင် ဒေသဖွံ့ဖြိုးရေး လုပ်ငန်း များ လုပ်ဆောင်ပေးစေလိုပါကြောင်း

၄။ လူမှုစီးပွား တာဝန်သိအစီအစဉ် (CSR) တွင် မိုင်းပြန်ဖို့ထားသောနေရာ၌ အများပိုင် စိုက်ခင်းများ ထူထောင်ပေးစေလိုပါကြောင်း

ဦးခင်မောင်ဝင်း (ညောင်ဘီး)

၁။ လမ်းပန်းဆက်သွယ်ရေး ကောင်းအောင်လုပ်ရာမှာ ဒေသခံများ လိုအပ်ချက်နှင့် ကိုက်ညီအောင်၊ ဒေသခံများအတွက် အသုံးဝင်အောင် ဆောင်ရွက်ပေးစေလိုပါကြောင်း

၂။ မိုင်းလုပ်ငန်းများ လုပ်ကိုင်ရာတွင် သတ်မှတ်ခွင့်ပြုဧရိယာတွင်သာ စနစ်တကျလုပ်ကိုင်စေလိုပါကြောင်း

၃။ ယခင် စီမံကိန်းများတွင် စွန့်ပစ်မြေစာပုံ၌ ဒေသခံများ တပိုင်တနိုင် ခဲကျင်မှုကို ဥပဒေကြောင်းအရ အရေးယူမှုများ ရှိခဲ့ဖူးသဖြင့် အဆိုပါကိစ္စများကို ဒေသခံများအကျိုးအတွက် ပြန်လည် သုံးသပ်စေလို ပါကြောင်း

၄။ ဒေသဖွံ့ဖြိုးရေးလုပ်လျှင် ဇေကမိ–ညောင်ဘီးလမ်း ပြုပြင်ရာတွင် စက်ယန္တယားများ ကူညီပေးစေလိုပါကြောင်း

ဦးစိုးမြင့် (တောင်ပု)

၁။ သတ္တုရှိတဲ့နေရာက စိုက်ကွင်းပိုင်ရှင်တွေနဲ့ နှစ်ဦးနှစ်ဖက် ညှိနှိုင်းမှုများ လုပ်စေလိုပါကြောင်း

၂။ အလုပ်အကိုင် ခန့်ထားရာတွင် ဒေသခံများကို ဦးစားပေးစေလိုပါကြောင်း

ဦးမျိုးသန့်တင် (ဒုတိယမြို့နယ် အထွေထွေ အုပ်ချုပ်ရေးမှူး– ကျွန်းစုမြို့နယ်)

၁။ လေထုမညစ်ညမ်းအောင် အပင်တွေကို တတ်နိုင်သလောက် မခုတ်စေလို ပါကြောင်း

၂။ မြေသားတွေကို စနစ်တကျ စွန့်ပစ်ရန်၊ ချောင်းထဲမြောင်းထဲ မပိတ်အောင် စွန့်ပစ်ရန်နှင့် ထိခိုက်မှု ရှိလာလျှင် လုပ်ဆောင်မည့် အခြားနည်းလမ်းများ ရှာဖွေမှုများ လုပ်ဆောင်ထားစေလိုပါကြောင်း

၃။ ရွာရေတွင်းရေကန်တွေကို မထိခိုက်အောင် ဆောင်ရွက်ရန်နှင့် ရေတွင်းရေကန်များနှင့် ဝေးသည့်နေရာများတွင်သာ လုပ်ငန်းဆောင်ရွက်ရန် အကြံပြုပါကြောင်း

ရဲမှူးတင်ထွန်းအောင် (ကျွန်းစုမြို့နယ် ရဲတပ်ဖွဲ့စခန်း)

၁။ စီမံကိန်းအနေဖြင့် ယခုဖော်ပြထားသည့် ကတိကဝတ်များကို လိုက်နာ အကောင်အထည်ဖော်စေလိုပါကြောင်း၊ အကောင်အထည်ဖော်မှု သေချာစေရန် မည်သို့စီမံထားသည်ကိုလည်း သိလိုပါကြောင်း

ဦးစိုးမြင့် (OSHE)

၁။ ဒေသခံများပါဝင်သည့် စောင့်ကြည့်အဖွဲ့ဖွဲ့စည်းကာ စီမံကိန်းအကောင်အထည်ဖော်မှုကို စဉ်ဆက်မပြတ် စောင့်ကြည့်ကြပ်မတ်သည့် အစီအစဉ်ကို အကောင်အထည် ဖော်ရမည် ဖြစ်ပါကြောင်း

၂။ CSR ကို စောင့်ကြည့်အဖွဲ့တွင် ပါဝင်သည့် ဒေသခံ ကိုယ်စားလှယ်များနှင့် တိုင်ပင်ညှိနှိုင်းကာ ဒေသအကျိုးရှိအောင် အသုံးချရမည် ဖြစ်ပါကြောင်း

၃။ စောင့်ကြည့်အဖွဲ့ ဖွဲ့စည်းပုံတွင် စီမံကိန်းမှ အဓိကတာဝန်ရှိသူ အနည်းဆုံး (၃) ဦး ပါဝင်ရမည် ဖြစ်ပြီး ဒေသခံကျေးရွာများမှ ကျေးရွာ အုပ်ချုပ်ရေးမှူးနှင့် အများသဘောတူ ခန့်အပ်ထားသည့် ရွာခံ ကိုယ်စားလှယ်များ ပါဝင်ရမည် ဖြစ်ပါကြောင်း

၄။ ကတိကဝတ်များ အကောင်အထည် ဖော်၊ မဖော်ကို စောင့်ကြည့်အဖွဲ့က စောင့်ကြည့်ပြီး အကောင်အထည်ပေါ်အောင်၊ သွေဖည်မှုမရှိအောင် စောင့်ကြည့်ထိန်းသိမ်းရမည် ဖြစ်ပါကြောင်း

ဦးတင်ဝင်း (A&M Myanmar)

၁။ ဖက်စပ်ကုမ္ပဏီ ဖြစ်သည့်အတွက် စောင့်ကြပ်ကြည့်ရှုသည့် အစီအစဉ်များမှာ တင်းကြပ်ပါကြောင်း။ လုပ်ငန်းသဘာဝအရ အမှတ် (၂) သတ္တုတွင်းလုပ်ငန်းနှင့် ဌာနဆိုင်ရာများ ပါဝင်သည့် အဖွဲ့ကို သီးခြားဖွဲ့စည်းပြီး ဌာနဆိုင်ရာကလည်း သီးသန့်စောင့်ကြည့်နေမည် ဖြစ်ပါကြောင်း

၂။ စွန့်ပစ်မြေစာများမှ ဒေသခံများ တပိုင်တနိုင် လုပ်ကိုင်လိုမှုများကို ဒေသခံများ အဆင်ပြေအောင် စီမံပေးမည်ဖြစ်ပါကြောင်း။ စွန့်ပစ်မြေစာပုံမှာ အန္တရယ်ရှိသည့်နေရာဖြစ်သည့်အတွက် ဒေသခံများ ဘေးအန္တရယ်ကင်းရှင်းရေးအတွက် အစီအမံများ လိုပါကြောင်း

၃။ အလုပ်အကိုင်ကိုလည်း အုပ်ချုပ်ရေးမှူးများမှ တဆင့် အများသိအောင် ကြော်ငြာများ ဖြန့်ဝေခေါ်ယူကာ ခန့်ထားမည် ဖြစ်ပါကြောင်း

ဆွေးနွေးပွဲ ပြီးဆုံးချိန်း : ညနေ ၄:၀၀ နာရီ

ပုံ (၁) ဧကမိကျေးရွာမှ ဦးသန်းဆွေ ဆွေးနွေးစဉ်

ပုံ (၂) ညောင်ဘီးကျေးရွာမှ ဦးခင်မောင်ဝင်း ဆွေးနွေးစဉ်

ပုံ (၃) တောင်ပုကျေးရွာမှ ဦးစိုးမြင့် ဆွေးနွေးစဉ်

ပုံ (၄) ကျွန်းစုမြို့နယ် ဒုတိယ မြို့နယ် အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာနမှ ဦးမျိုးသက်တင် ဆွေးနွေးစဉ်

ပုံ (၅) ကျွန်းစုမြို့နယ် ရဲတပ်ဖွဲ့ မှဦးမျိုးသက်တင် ဆွေးနွေးစဉ်

ပုံ (၆) OSHEမှ ဦးစိုးမြင့် ဆွေးနွေးစဉ်

ပုံ (၇) A&M မှ ဦးတင်ဝင်း ဆွေးနွေးစဉ်

APPENDIX-D TRANSLATED EXECUTIVE SUMMARY

A&M MYANMAR LIMITED

ဧကမိသတ္တုတွင်းစီမံကိန်း

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း

အနှစ်ချုပ်အစီရင်ခံစာ

ပြုစုသူ

OSHE SERVICES COMPANY LIMITED

ဇူလိုင်လ၊ ၂၀၁၇ ခုနှစ်

မာတိကာ

၁။ နိဒါန်း 1

၂။ရည်ရွယ်ချက် 1

၃။လေ့လာရေးလုပ်ငန်းများ 2

၄။ ဥပဒေရေးရာ သုံးသပ်ချက် 2

၅။ စီမံကိန်းလုပ်ငန်းစဉ်များ 3

(၁) သတ္တုတူးယူခြင်း 3

(၂)သတ္တုသန့်စင်ခြင်းနည်းစဉ်များ 3

(၃) ရေလိုအပ်ချက် 3

(၄) လျှပ်စစ်ဓါတ်အားလိုအပ်ချက် 4

(၅) သတ္တုတွင်းနှင့် အခြားအခြေခံ အဆောက်အအုံများ 4

၆။ ပတ်ဝန်းကျင်အခြေအနေ 4

(၁)ရေအရည်အသွေး 4

(၂) ဆူညံသံများ 4

(၃) ပတ်ဝန်းကျင်ဆိုင်ရာ ဘူမိဗေဒ 5

(၄)ဇီဝမျိုးစုံမျိုးကွဲများ 5

(၅) ကျန်းမာရေး 6

၇။ သက်ရောက်မှုများနှင့် လျော့ချ ကုစားရန် နည်းလမ်းများ 6

၈။ ပတ်ဝန်းကျင်ရေးရာစောင့်ကြည့်အဖွဲ့ 12

၉။ လူမှုစီးပွါးတာဝန်သိအစီအစဉ် (CSR) 14

၁၀။ လူထုတွေ့ဆုံပွဲ 14

၁၁။ နိဂုံး 15

အနှစ်ချုပ်အစီရင်ခံစာ

၁။ နိဒါန်း

မြန်မာအေးချုံအက်တစ်ဗစ်တီးစ်မိုင်းနင်း ကုမ္ပဏီလီမိတက် (MAZAM) သည် ၂၀၁၄ ခုနှစ် ဧပြီလ တွင် တနသာရီတိုင်း၊ မြိတ်ခရိုင်၊ ကွဲန်းစုမြို့နယ်၊ ဧကမိကျေးရွာ အနီးရှိ မြေရိယာ (၆၅၀) ဧကတွင် ခါတ်သတ္တု စမ်းသပ်တိုင်းတာရန်နှင့် ဖြစ်မြောက်နိုင်စွမ်း လေ့လာရန် ခွင့်ပြုမိန့် ရရှိခဲ့ပါသည်။ စမ်းသပ်တိုင်းတာမှုများ ပြုလုပ်ပြီးနောက် ကနဦး စုံစမ်းစစ်ဆေးမှုများအရ ယင်းဒေသတွင် ခဲမဖြူ တန်ချိန် (၂၉၀၀) ကျော် ထုတ်ယူနိုင်မည်ဟု ခန့်မှန်းတွက်ချက်ရရှိသဖြင့် A&M သည် ခဲမဖြူ သတ္တုတူဖော်ရေး စီမံကိန်းကို တည်ဆဲဥပဒေများနှင့် အညီ အကောင်အထည်ဖော် ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ A&M Myanmar Co. Ltd. သည် MAZAM ၏ တွဲဘက်ကုမ္ပဏီဖြစ်ပြီး နိုင်ငံခြား ရင်းနှီးမြှုပ်နှံမှု ပါဝင်သည့် ဖက်စပ်ကုမ္ပဏီတစ်ခုအနေဖြင့် အကြီးစား ခါတ်သတ္တု ထုတ်လုပ်ခွင့် လိုင်စင် ရရှိနိုင်ရန်အတွက် မြန်မာ့ သတ္တုတွင်း ဥပဒေနှင့်အညီ ဆောင်ရွက်လျက် ရှိပါသည်။

ဤစီမံကိန်းလုပ်ငန်းအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း (EIA) လုပ်ငန်းများကို OSHE Services Co. Ltd. မှ ၂၀၁၅ ခုနှစ် မတ်လ မှ စတင်၍ ၂၀၁၇ခုနှစ် ဇူလိုင်လအထိ ဆောင်ရွက်ခဲ့ပြီး လုပ်ငန်းများကို ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဥပဒေ ၂၀၁၂၊ ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး နည်းဥပဒေ ၂၀၁၅ နှင့် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း လုပ်ထုံးလုပ်နည်း၂၀၁၅ ပါ ပြဋ္ဌာန်းချက်များအတိုင်း လိုက်နာဆောင်ရွက် ထားပါသည်။

၂။ရည်ရွယ်ချက်

ဧကမိ ခဲမဖြူသတ္တု တူးဖော်ရေး စီမံကိန်းဆိုင်ရာ ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း (EIA) လုပ်ငန်းစဉ်၏ ရည်ရွယ်ချက်များမှာ စီမံကိန်းဖော်ဆောင်သူ နှင့် စီမံကိန်းခွင့်ပြုမည့် အာဏာပိုင် အဖွဲ့အစည်းတို့အား စီမံကိန်းနှင့်သက်ဆိုင်သည့် သဘာဝ ပတ်ဝန်းကျင် နှင့် လူမှု ပတ်ဝန်းကျင် သက်ရောက်မှုများ၊ နောက်ဆက်တွဲ သက်ရောက်မှု (ကောင်းကျိုး၊ ဆိုးကျိုး) များကို ထင်ရှားသိရှိ နိုင်စေရန်၊ စီမံကိန်းအတွက် တိကျသေချာသော ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်များ ချမှတ်စေနိုင်ရန်တို့ ဖြစ်ပါသည်။

စီမံကိန်းလုပ်ငန်းရပ် များ၏ ဥပဒေနှင့်ညီညွတ်မှု ရှိ/မရှိ အကဲဖြတ်ရန်၊ စီမံကိန်းတည်ရှိရာ ဒေသ၏ နောက်ခံလူမှုစီးပွားအခြေအနေများ၊ ပတ်ဝန်းကျင် ဆိုင်ရာများကို လေ့လာသုံးသပ်ရန်၊ စီမံကိန်းဆိုင်ရာ အချက်အလက်များကို အများပြည်သူအား ထုတ်ဖော်ပြသကာ ဆွေးနွေးညှိနှိုင်းခြင်း၊ အကြံပြုချက် ရယူခြင်း များ ဆောင်ရွက်ရန်၊ စီမံကိန်းကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် ပတ်ဝန်းကျင်နှင့် လူမှုစီးပွါး သက်ရောက်မှု များကို လေ့လာတွက်ဆရန်၊ ဆိုးကျိုးသက်ရောက်မှုများကို လျော့ချကုစားရန် နည်းလမ်းများ၊ ကောင်းကျိုး သက်ရောက်မှုများကို ဆပ်ပါးမြှင့်တင်ရန် နည်းလမ်းများ ရှာဖွေဖော်ထုတ်ရန် ဟူသည့် ရည်ရွယ်ချက်များဖြင့် ဧကမိ ခဲမဖြူသတ္တု တူးဖော်ရေး စီမံကိန်းလုပ်ငန်းအတွက် ပတ်ဝန်းကျင် ထိခိုက်မှု ဆန်းစစ်ခြင်း (EIA) လုပ်ငန်းများကို ဆောင်ရွက်ခဲ့ပါသည်။

၃။လေ့လာရေးလုပ်ငန်းများ

ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ငန်းစဉ်များကို စီမံကိန်းတည်ရှိရာ အနီးပတ်ဝန်းကျင် ကျေးရွာများဖြစ်သော ဧကမိကျေးရွာ ၊ ဝက်တိုးကျေးရွာ၊ တောင်ပုကျေးရွာ၊ ပန်းတောင်ကျေးရွာ၊ ညောင်ဘီး ကျေးရွာ၊ အညင်ကျေးရွာ နှင့် မောင်းလှော်ကျေးရွာ တို့ကိုအခြေပြုဆောင်ရွက်ခဲ့ ကြပါသည်။ လေ့လာရေး လုပ်ငန်းစဉ်တွင် ပါဝင်သည့် လုပ်ငန်းရပ်များမှာ ကနဦးလေ့လာမှု၊ နယ်ပယ်အတိုင်းအတာ သတ်မှတ်ခြင်း၊ လူထုပါဝင်ဆောင်ရွက်ရေးလုပ်ငန်းများ၊ အသေးစိတ် အချက်အလက်များ တိုင်းတာကောက်ယူခြင်း၊ သက်ရောက်မှု ဖော်ထုတ်ခြင်း နှင့် အကဲဖြတ်ခြင်း၊ အစီရင်ခံစာမူကြမ်း ပြုစုခြင်း၊ တွေ့ရှိချက်များကို အများပြည်သူအား ထုတ်ဖော်ခြင်း နှင့် အပြီးသတ်အစီရင်ခံစာ ပြုစုခြင်းတို့ ဖြစ်ကြပါသည်။

၄။ ဥပဒေရေးရာ သုံးသပ်ချက်

ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း ပညာရှင်အဖွဲ့ သည် စီမံကိန်း လုပ်ငန်းရပ်များအား ဥပဒေနှင့် ညီညွတ်မှု ရှိ/ မရှိ သက်ဆိုင်ရာ တည်ဆဲဥပဒေ များနှင့် တိုက်ဆိုင်စစ်ဆေးခဲ့ပါသည်။ အဖွဲ့ မှ တိုက်ဆိုင် စစ်ဆေးခဲ့သည့် ဥပဒေအချို့မှာ မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှု ဥပဒေ၊ ရပ်ကွက်သို့မဟုတ် ကျေးရွာအုပ်စု အုပ်ချုပ်ရေး ဥပဒေ၊ မြန်မာ့သတ္တုတွင်းဥပဒေ နှင့် အခြားသက်ဆိုင်ရာဥပဒေ များ ဖြစ်ကြပါသည်။

၅။ စီမံကိန်းလုပ်ငန်း အကြောင်းအရာပါ ဖော်ပြချက်

(၁) သတ္တုတူးယူခြင်း

သတ္တုတူးဖော်မည့် ဧရိယာ (ခန့်မှန်း ၃၅၆.၃၈ ဧက)မှ တစ်လလျှင် သန့်စင်ပြီးသတ္တု ၁၆.၅ တန်နှုန်းဖြင့် ၁၇ နှစ် ထုတ်ယူရရှိမည်ဟု စီမံကိန်းအဆိုပြုသူမှ မျှော်မှန်းထားပါသည်။ ယင်းဧရိယာ တွင် သတ္တုသိုက်လုပ်ကွက် နှစ်နေရာပါဝင်မည်ဖြစ်ပြီး စုစုပေါင်း သတ္တုရိုင်းတန်ချိန်ပေါင်း ၃၃၈၁.၄၈ တန်ခန့် ထုတ်ယူရရှိမည် ဖြစ်ပါသည်။ သတ္တုတူးဖော်ရာတွင် ဘေးအန္တရာယ်ကင်းစင်ရေးအတွက် မြစ်၊ ချောင်း၊ စိမ့်စမ်းများ နှင့် သတ္တုတူးဖော်မည့် ဧရိယာကြားတွင် မီတာ (၁၀၀) အကွာအဝေးထားကာ တူးဖော်ထုတ်လုပ်မည် ဖြစ်ပါသည်။

တူးဖော်ရရှိသော သတ္တုကြမ်းများကို သတ္တုသန့်စင်ခြင်းလုပ်ငန်းများ မလုပ်ဆောင်မီ သတ္တုကြမ်းများစုဆောင်းရာနေရာသို့ ပို့ဆောင်ပါသည်။ အပေါ်ယံမြေသားများ၊ သတ္တုကြမ်း မပါဝင်သော မြေစာများ နှင့် စွန့်ပစ်ပစ္စည်း များကိုမူ စွန့်ပစ်မြေစာ စုပုံရာနေရာသို့ ပို့ဆောင် စွန့်ပစ်ပါသည်။ သတ္တုကြမ်းများတူးဖော်စုပုံရန်တွက် မြေတူးစက် နှစ်စီး နှင့် မြေသယ်ယာဉ် ခြောက်စီး စီပါဝင်သော အဖွဲ့ငယ် နှစ်ဖွဲ့ အသုံးပြုပြီး၊ စွန့်ပစ်မြေစာများ သယ်ယူ၊ ပို့ဆောင် စုပုံရန် အတွက် အဖွဲ့ငယ် တစ်ဖွဲ့ (မြေတူးစက် တစ်စီး နှင့် မြေသယ်ယာဉ် နှစ်စီး) ဖြင့်လုပ်ဆောင်မည် ဖြစ်ပါသည်။

(၂)သတ္တုသန့်စင်ခြင်းနည်းစဉ်များ

တူးဖော်ရရှိသောသတ္တုရောမြေစာများကို သန့်စင်ရန်အတွက် မြေစာများ ကိုမျောစင်တွင် ဖိအားမြင့် ရေပန်းများဖြင့် ဖျော်ချပြီး မျောတိုက်သန့်စင်ပါသည်။ ထိုတစ်ပိုင်းသန့်စင်ပြီးသော သတ္တုကြမ်းများ ကို အဆင့်မြင့်သန့်စင်နည်းစဉ်များ ကိုသုံးကာ အသင့်ရောင်းချနိုင်သော ခဲမဖြူ ၆၅ ရာခိုင်နှုန်းကျော် ပါဝင်သည့် သန့်စင်ပြီးသတ္တုများကို ထုတ်လုပ်ပါသည်။

(၃) ရေလိုအပ်ချက်

သတ္တုသန့်စင်ခြင်းနည်းစဉ်များလုပ်ဆောင်ရန်အတွက် စုစုပေါင်းရေပမာဏ လိုအပ်ချက်မှာ တစ်နာရီ လျှင် ၄၂၅ ကုဗမီတာ လိုအပ်မည်ဖြစ်ပါသည်။ လိုအပ်သောရေပမာဏကို နီးစပ်ရာမြစ်၊ ချောင်းများမှ ရေချိုသိုလှောင်ကန်သို့ မြောင်းများသွယ်တန်းကာ ရယူသုံးစွဲမည်ဖြစ်ပါသည်။ မြစ်၊ ချောင်းများ ရေနည်းပါးသော ကာလများတွင် အဆင်ပြေမှုရှိစေရန် ရေစုပ်စက်များကို အသင့်တပ်ဆင်ထားရှိမည်

ဖြစ်ပါသည်။ မိုးတွင်းကာလ ရေကြီး၊ ရေလျှံမှုများ ကာကွယ်ရန်အတွက် ၁၀ လက်မ/ ၁၂ လက်မ ရေစုပ်စက်များ တပ်ဆင်ထားရှိမည် ဖြစ်ပါသည်။

(၄) လျှပ်စစ်ဓါတ်အားလိုအပ်ချက်

စီမံကိန်း အတွက် လျှပ်စစ်ဓါတ်အားလိုအပ်ချက်မှာ ၄၈၀ ကီလိုဝပ် ဖြစ်ပါသည်။ ၎င်းလိုအပ်သော လျှပ်စစ်ဓါတ်အားကို ကိုယ်ပိုင် ဒီဇယ်အင်ဂျင်သုံး လျှပ်စစ်ဓါတ်အားထုတ်စက်မှ ထုတ်ယူမည် ဖြစ်ပါသည်။

(၅) သတ္တုတွင်းနှင့် အခြားအခြေခံ အဆောက်အအုံများ

လက်ရှိ မြေမျက်နှာသွင်ပြင် အနေအထားအရ စီမံကိန်းနေရာသို့ ကုန်းလမ်းဖြင့် သယ်ယူပို့ဆောင်ရေးမလုပ်ဆောင်နိုင်ပါ။ ရေလမ်းသယ်ယူပို့ဆောင်ရေးအတွက် ဆိပ်ခံတံတားသည် မ ရှိမဖြစ်လိုအပ်ပါသည်။ ယခုလက်ရှိကာလတွင် တူးဖော်ရေးလုပ်သားများ၊ ဝန်ထမ်းများ နေထိုင်ရန် အတွက်နှင့် ရုံးလုပ်ငန်းများအတွက် အဆောက်အဦးများ ဆောက်လုပ်ထားပြီး၊ လိုအပ်သလို ထပ်မံတိုးချဲ့ ဆောက်လုပ်မည် ဖြစ်ပါသည်။

၆။ ပတ်ဝန်းကျင်အခြေအနေ

(၁)ရေအရည်အသွေး

စီမံကိန်းဒေသပတ်ဝန်းကျင်၏ ရေအရည်အသွေး ကို သိရှိနိုင်ရန်အတွက် မြေအောက်ရေ နမူနာ ရှစ်ခုနှင့် မြေပေါ်ရေ နမူနာ ရှစ်ခု ကောက်ယူခဲ့ပါသည်။ ရေနမူနာကောက်ယူမည့် နေရာရွေးချယ်ရာတွင် စီမံကိန်းနေရာ ၏မြေမျက်နှာသွင်ပြင် အနေအထား၊ ရေစီးကြောင်းများ တည်ရှိရာအနေအထား၊ စိုက်ပျိုးမြေများနှင့် နီးစပ်မှု အခြေအနေ၊ ရေနူတ်မြောင်းများ နှင့် ရေဆိုးစွန့်ပစ်ရာနေရာများ သာမက ရေဆိုးဝင်ရောက်ပျံနှံ့ သည့် ဧရိယာများပေါ်တွင်ပါ အခြေခံကာ နေရာရွေးချယ်မှုပြုလုပ်ခဲ့ပါသည်။ ကောက်ယူရရှိခဲ့သော ရေနမူနာများကို ISO Tech ဓါတ်ခွဲခန်းသို့ ပို့ဆောင် စမ်းသပ်စစ်ဆေး စေခဲ့ပါသည်။

(၂) ဆူညံသံများ

စီမံကိန်းနေရာနှင့် စီမံကိန်းပတ်ဝန်းကျင်နေရာများ၏ ဆူညံသံများကို သိရှိနိုင်ရန် ဆူညံသံတိုင်းတာခြင်းလုပ်ငန်းများကို နေရာ (၁၀) နေရာတွင် တိုင်းတာမှုများ ပြုလုပ်ခဲ့ပါသည်။ တိုင်းတာရရှိသော ရလဒ်များအရ စီမံကိန်း ဧရိယာ၏ နောက်ခံ ဆူညံသံမှာ ၃၅ ဒက်ဆီဘယ် မှ ၅၅ ဒက်ဆီဘယ် အကြားတွင် ရှိပြီး၊ စီမံကိန်း ဧရိယာ ပတ်ဝန်းကျင်ရှိ ကျေးရွာများ၏ နောက်ခံ ဆူညံသံမှာ ၅၅ဒက်ဆီဘယ် နှင့် ၆၀ ဒက်ဆီဘယ်ကြားတွင်ရှိပါသည်။

(၃) ပတ်ဝန်းကျင်ဆိုင်ရာ ဘူမိဗေဒ

စီမံကိန်းဧရိယာနှင့် ဧကမိ ကျေးရွာသည် တနင်္သာရီမြစ်နှင့် အညင်ချောင်း ကြားတွင် တည်ရှိသော ကျွန်းပေါ်တွင် တည်ရှိပြီး၊ ၎င်းကျွန်းသည် စုစုပေါင်း ဧရိယာ (၆၂) စတုရန်းမိုင်ခန့် ကျယ်ဝန်းပါသည်။ ကျွန်းပေါ်ရှိ တောင်စဉ်တောင်တန်းများသည် ယေဘူယအားဖြင့် မြောက်မှတောင် သို့လည်းကောင်း၊ အနောက်မြောက်မှ အရှေ့တောင် သို့လည်းကောင်း သွယ်တန်းလျက်ရှိပါသည်။ ယင်းဒေသ၏ အမြင့်ဆုံးနေရာသည် ပင်လယ်ရေမျက်နှာပြင်အထက် (၄၄၁) ပေမြင့်၍ စီမံကိန်းဧရိယာ အတွင်းရှိ အမြင့်ဆုံးနေရာသည် ပင်လယ်ရေမျက်နှာပြင်အထက် အမြင့်ပေ (၃၂၀) ပေမြင့် ပါသည်။ ကျွန်းပေါ်တွင် တောင်စဉ်တောင်တန်းနှစ်ခု မျက်နှာချင်းဆိုင် သွယ်တန်းလျက် ရှိသဖြင့် လှိုဏ်များ၊ ချောက်များ ဖြစ်ပေါ်နေပြီး မြေပြန့်လွင်ပြင် နည်းပါးပါသည်။ တောင်တန်းများတွင် သီဟိုဠ်ခေတ်ပင်များ စိုက်ပျိုးကြပြီး၊ မြေပြန့်ဒေသများတွင် ကောက်ပဲသီးနှံ များ စိုက်ပျိုးကြပါသည်။ ကျွန်းပေါ်ရှိ ချောင်းများ အားလုံးသည် ဒီရေဝင်ချောင်းများ ဖြစ်ကြပြီး၊ ရာသီဥတုမှာ ပူနွေးစိုစွတ်သော ရာသီဥတုဖြစ်ပါသည်။ မိုးများသောဒေသ ဖြစ်ပြီး မိုးတွင်းကာလ ဖြစ်သော မေလမှ အောက်တိုဘာလ အတွင်းတွင် မိုးရေချိန် (၂၀၀)လက်မ ခန့်အထိ ရွာသွန်းတတ်ပါသည်။

(၄)ဇီဝမျိုးစုံမျိုးကွဲများ

စီမံကိန်းပတ်ဝန်းကျင်ရှိ သဘာဝပတ်ဝန်းကျင်အတွက်သာမက ဈေးကွက်အရပါ အဘိုးတန်ရှားပါး ဇီဝမျိုးစုံ၊မျိုးကွဲများ ဖြစ်သော သစ်ပင်၊ပန်းမန်များနှင့် သတ္တဝါများကို စာရင်းပြုစုနိုင်ရန်အတွက် ဧပြီလ (၁၀) ရက်နေ့မှ (၁၈) ရက်နေ့အထိ ကွင်းဆင်းလေ့လာခဲ့ကြပါသည်။ ထိုကဲ့သို့ ကွင်းဆင်းလေ့လာရာတွင် သစ်ပင်၊ ပန်းမန်မျိုးစိတ်များနှင့် သတ္တဝါများ၏မျိုးစိတ်များကို တွေ့ရှိရာ နေရာအလိုက် မှတ်သားခြင်း၊ နမူနာရယူစုဆောင်းခြင်း၊ ဓါတ်ပုံရိုက်မှတ်တမ်းတင်ခြင်း စသည်တို့ကို ဆောင်ရွက်ခဲ့ပါသည်။ စာရင်းပြုစုရာတွင် တိုက်ရိုက်သက်ရောက်မှုဖြစ်နိုင်သော စီမံကိန်းဧရိယာ အတွင်းရှိ ဇီဝမျိုးစုံ၊မျိုးကွဲများ၊ သိယ်ဝိုက်သက်ရောက်မှုဖြစ်နိုင်သော စီမံကိန်းဧရိယာ အနီး ပတ်ဝန်းကျင် ဒေသများရှိ ဇီဝမျိုးစုံ၊မျိုးကွဲများဟူ၍ ပြည့်စုံစွာ စာရင်းပြုစုခဲ့ကြပါသည်။

လက်ရှိကွင်းဆင်းလေ့လာ ပြုစုထားသောစာရင်းများအရ စုစုပေါင်း သာမန်အပင် မျိုးစိတ်ပေါင်း (၁၉၃) မျိုး၊ ဆေးဘက်ဝင်အပင်မျိုးစိတ်ပေါင်း (၁၃)မျိုး၊ အင်းဆက်မျိုးစိတ်ပေါင်း (၄၉)မျိုး၊

ရေချိုငါးမြို့စိတ်ပေါင်း (၄၀) မြို့၊ တွားသွားသတ္တဝါမြို့စိတ်ပေါင်း (၁၈)မြို့၊ ငှက်မြို့စိတ်ပေါင်း (၅၂) မြို့ နှင့် နို့တိုက်သတ္တဝါမြို့စိတ်ပေါင်း (၁၉) မြို့တွေ့ရှိရပါသည်။

(၅) ကျန်းမာရေး

စီမံကိန်းဒေသရှိ ကျန်းမာရေးထိခိုက်မှု ဆန်းစစ်ခြင်း များကို ၂၀၁၅ခုနှစ် ဧပြီလ (၈)ရက်နေ့မှ (၁၅)ရက်နေ့ထိ စီမံကိန်းဒေသပတ်ဝန်းကျင်ကျေးရွာများတွင် ကွင်းဆင်းဆောင်ရွက်ခဲ့ကြပါသည်။ ထိုသို့ လုပ်ဆောင်ရာတွင် ကနဦး အဆင့်အနေဖြင့် ကျန်းမာရေး အခြေအနေများကို စစ်တမ်းကောက်ခြင်း၊ ရရှိလာသော ရလဒ်များနှင့် ဖြစ်ပေါ်နိုင်သော ကျန်းမာရေးထိခိုက်နိုင်မှုများကို ပေါင်းစပ်၊ ခွိုင်းထိုးစဉ်းစားခြင်း၊ ထို့နောက် အဓိက သက်ရောက်နိုင်မှုများကို ဖော်ထုတ်ခြင်းများကို လုပ်ဆောင် ခဲ့ကြပါသည်။ ကျန်းမာရေးထိခိုက်မှု ဆန်းစစ်ခြင်း လုပ်ငန်းစဉ်သည် ကျန်းမာရေး ကောင်းကျိုးသက်ရောက်မှုများကို ပိုမို ဖြစ်ထွန်းစေရန်နှင့် ကျန်းမာရေးဆိုးကျိုး သက်ရောက်မှု များကို တားဆီး၊ လျှော့ချရန်အတွက် ရည်ရွယ်ဆောင်ရွက်ခဲ့ပါသည်။ ကျန်းမာရေး အခြေအနေများကို စစ်တမ်းကောက်ယူရာတွင် လက်ရှိကျန်းမာရေး အခြေအနေများသာမက၊ လူမှု စီးပွါး စစ်တမ်းများကိုပါ ကောက်ယူ ၍ ၎င်းရလဒ်များကိုပါ ထည့်သွင်းစဉ်းစားခဲ့ကြပါသည်။

၇။ သက်ရောက်မှုများနှင့် လျှော့ချ ကုစားရန် နည်းလမ်းများ

စဉ်	သက်ရောက်မှုများ	ကုစားရန်နည်းလမ်းများ
အကြိုတည်ဆောက်ခြင်း		
၁။	သတ္တုတွင်းစခန်းမှ စွန့်ပစ်ရေများ ထွက်ရှိခြင်း	(၁) သတ်မှတ်ထားသည့် နေရာတွင် (၁၀၀၀၀) ကုဗမီတာရှိသည့် အနည်ထိုင်ကန် တည်ဆောက်ခြင်း (၂) အနည်ထိုင်ကန် အထွက်တွင် သဲစစ်စနစ်တစ်ခု တည်ဆောက်ခြင်း (၃) သဲစစ်ကန်အား အပတ်စဉ် သန့် ရှင်း ရေး ပြုလုပ်ခြင်း (၄) အနည်ထိုင်ကန်အား နှစ်စဉ် သန့်ရှင်းရေး ပြုလုပ်ခြင်း (၅) ချောင်း အတွင်းသို့စွန့်ပစ်သည့် ရေများကို NEQG စံသတ်မှတ်ချက်အတိုင်း လိုက်နာဆောင်ရွက်မှု ရှိမရှိ စောင့်ကြည့်စစ်ဆေးခြင်း (၆) စားဖိုဆောင်မှ ဆီများနှင့် အညစ်အကြေးများကို အကြိုသန့်စင်ပြီးမှ အညစ်အကြေးစွန့်ပစ်ကန်အတွင်းသို့ စွန့်ပစ်ခြင်း

၂။	သတ္တုတွင်း စခန်းမှ အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းများ ထွက်ရှိခြင်း	(၁) လုံလောက်သော အမှိုက်ပုံးများထားရှိခြင်း (၂) အမှိုက်ကျင်းထားရှိပြီး အမှိုက်များကို အမှိုက်ကျင်း အတွင်း၌သာ စွန့်ပစ်ခြင်း (၃) အမှိုက်ကျင်းတည်ဆောက်ရာတွင် မြေအောက် ရေအရင်းမြစ်ကို မထိခိုက်စေသည့် နေရာ၊ ဒီဇိုင်းဖြင့် တည်ဆောက်ခြင်း (၄) ဝန်ထမ်းများအား စွန့်ပစ်ပစ္စည်းများအား သတ်မှတ်ထားသည့် အတိုင်း စနစ်တကျ စွန့်ပစ်ကြရန် ညွှန်ကြားထားခြင်း (၅) မြေဆီလွှာ ညစ်ညမ်းမှုဖြစ်ပေါ်ပါက ချက်ချင်း တူးထုတ်ဖယ်ရှားပြီး အန္တရာယ်ရှိ ပစ္စည်းအဖြစ် သတ်မှတ်၍ စနစ်တကျစွန့်ပစ် ခြင်း (၆) သန့်ရှင်းရေး လုပ်သားများ အလုံအလောက် ခန့်အပ်ထားရှိခြင်း
၃။	အလုပ်အကိုင် အခွင့်အလမ်း	(၁) အလုပ်အကိုင် ခန့်ထားရန်အတွက် ဒေသခံများကို ဦးစားပေးခြင်း (၂) အလုပ်အကိုင်ခန့်ထားရန် လိုအပ်ပါက ဒေသခံများ သိရှိနိုင်ရေး အတွက် ရပ်ကွက် အုပ်ချုပ်ရေးမှူးရုံးများနှင့် အများပြည်သူများ မြင်နိုင်မည့် နေရာများတွင် ကြော်ငြာများ ဖြန့်ဝေခြင်း (၃) အလုပ်အကိုင်ခန့်ထားရာတွင် တည်ဆဲ အလုပ်အကိုင်နှင့် အလုပ်သမားရေးရာ ဥပဒေများ နှင့် အညီလိုက်နာဆောင်ရွက်ခြင်း
၄။	သတ္တုရှာဖွေရေး လုပ်ငန်းများတွင် စိုက်ခင်းပိုင်ရှင်များနှင့် ပဋိပက္ခဖြစ်ခြင်း	(၁) သတ္တုတူးဖော်ရေးလုပ်ငန်းများ မလုပ်ဆောင်မီ စိုက်ခင်းပိုင်ရှင်များနှင့် လုံလောက်သော ညှိနှိုင်းမှုများ ပြုလုပ်ခြင်း (၂) သတ္တုတူးဖော်ရေး လုပ်ငန်းများ မလုပ်ဆောင်မီ သက်ဆိုင်သည့် စိုက်ခင်းပိုင်ရှင်များသို့ လိုအပ်သည့် အကြောင်းကြားစာများ ပေးပို့ အကြောင်းကြားခြင်း
၅။	မြေပြင်ရှင်းလင်းခြင်းမှ စွန့်ပစ်ပစ္စည်းများ ထွက်ရှိခြင်း	(၁) သဘာဝ ရေစီးကြောင်းများ ပိတ်ဆို့ပျက်စီးမှု မှ ကာကွယ်ရန် မြေပြင်ရှင်းလင်းခြင်းမှ ရရှိလာသော အမှိုက်များကို စနစ်တကျ စုပုံထားခြင်း (၂) မြေပြင်ရှင်းလင်းခြင်းမှ ရရှိလာသော သစ်ကိုင်း သစ်ခက်များအား လောင်စာ အဖြစ် ပြန်လည် အသုံးပြုခြင်း
	တည်ဆောက်ခြင်း	
၁။	ဖုန်နှင့်အမှုန်အမွှားများ ထွက်ရှိခြင်း	(၁) ရှင်းလင်းခြင်း လမ်းဖောက်ခြင်း မြေညှိခြင်းများ ပြုလုပ်မည့်နေရာများကို ရေဖြန်းခြင်း (၂) ရှင်းလင်းမည့် နေရာနှင့် မြေပုံမည့် နေရာများ၏ အကွာအဝေးကို ခရီးအတိုဆုံးဖြစ်အောင်ထားရှိခြင်း (၃) ခြောက်သွေ့ချိန် နှင့် လေတိုက်ချိန်များတွင် ဖုန်မထစေရန် ရေဖြန်းပေးခြင်း
၂။	နုန်းတင်ခြင်း	(၁) လမ်းများတွင် တိုက်စားမှု မဖြစ်စေရန် မျက်နှာပြင်မြေသား ကျစ်လစ်အောင် ပြုလုပ်ခြင်းများ အပြင် လမ်းဘေး ဝဲယာတွင် ရေနုတ်မြောင်းများ ထည့်သွင်း တည်ဆောက်ခြင်း

		(၂) တူးဖော်ပြီးစီးသည့်နေရာများတွင် ဖို့မြေများကို တိုက်စားမှုမှကာကွယ်ရန် အတွက် အပင်များပြန်စိုက်ခြင်း (၃) မြေစာပစ်မည့် နေရာပတ်လည်တွင် ရေနုတ်မြောင်းဖောက်လုပ်ပြီး ၄င်း ရေနုတ်မြောင်းကို စွန့်ပစ်ကန်နှင့်ဆက်သွယ်ထားခြင်း (၄) တူးဆွပြုပြင်ထားသော မြေနေရာများတွင် ရေများဖြတ်သန်းစီးဆင်းမှု မရှိအောင် လမ်းကြောင်းလွှဲခြင်း
၃။	သတ္တုတွင်းစခန်းမှ စွန့်ပစ်ရေများ ထွက်ရှိခြင်း	(၁) သဲစစ်ကန်အား အပတ်စဉ် သန့် ရှင်း ရေး ပြုလုပ်ခြင်း (၂) အနည်ထိုင်ကန်အား နှစ်စဉ် သန့်ရှင်းရေး ပြုလုပ်ခြင်း (၃) စွန့်ပစ် ရေများကို NEQG စံသတ်မှတ်ချက်များနှင့် ညီညွတ်မှု ရှိမရှိ စောင့်ကြည့်စစ်ဆေးခြင်း (၄) စားဖိုဆောင်မှ ဆီများနှင့် အညစ်အကြေးများကို အကြိုသန့်စင်ပြီးမှ အညစ်အကြေးစွန့်ပစ်ကန်အတွင်းသို့ စွန့်ပစ်ခြင်း (၅) စက်ဆီများ ယိုဖိတ်မှုကြောင့် မြေဆီလွှာ ညစ်ညမ်းမှု ဖြစ်ပေါ်ပါက ချက်ချင်း ရှင်းလင်းဖယ်ရှားခြင်း
၄။	သဘာဝရေစီးကြောင်းများ ပိတ်ဆို့နိုင်ခြင်း	(၁) စီမံကိန်းတွင်ပါဝင်သော လမ်းများနှင့် အကာအရံများ သည် သဘာဝ ရေစီးကြောင်းများအားထပ်မံ ထိခိုက်ခြင်း၊ တိုက်စားခြင်း မဖြစ်ပေါ်အောင် တည်ဆောက်ခြင်း (၂) သဘာဝ ရေစီးကြောင်းများကို ပိတ်ဆို့မှု မဖြစ်စေခြင်း (၃) လုပ်ငန်းခွင်ဧရိယာ တစ်ခုလုံးတွင် တိုက်စားမှုများကို စောင့်ကြည့်၍ တိုက်စားမှုများ စတင်ဖြစ်ပေါ်ပါက သင့်တော်သော အရေးယူဆောင်ရွက်မှုများ အမြန်ပြုလုပ်ခြင်း
၅။	အပင်များ ခုတ်ထွင်ရှင်းလင်းခြင်း	(၁) ကုန်ထုတ်လမ်းများကို ရှိရင်းစွဲလမ်းများအား တတ်နိုင်သမျှ အသုံးပြုခြင်း (၂) လုပ်ငန်းခွင်ဧရိယာကို ခြံခတ်ပြီး ခြံစည်းရိုးပြင်ပရှိ အပင်များအား ထိခိုက်မှု မရှိအောင် ထိန်းသိမ်းခြင်း (၃) မိုင်းလုပ်ငန်း ဆောင်ရွက်ရာတွင် မပါဝင်သော စီမံကိန်းဧရိယာ များကို မဖြတ်သန်း ရနေရာများအဖြစ် သတ်မှတ်၍ ထိခိုက်ပျက်စီးမှု မရှိအောင် ထိန်းသိမ်းခြင်း (၄) မိုင်းလုပ်သားများအား လုပ်ငန်းခွင် ဧရိယာအတွင်းမှ သစ်ပင်များကို တစ်ကိုယ်ရေသုံးအတွက် ထင်း၊ မီးသွေးများအဖြစ် အသုံးပြုခြင်းကို တားမြစ်ထားခြင်း (၅) လုပ်ငန်းခွင်ဧရိယာအတွင်း ဒေသမျိုးရင်းမဟုတ်သည့် အပင်မျိုးစိတ်သစ်များ ပေါက်ရောက်မှုရှိမရှိကို စောင့်ကြည့်ပြီး ပေါက်ရောက်လာပါက ရှင်းလင်းဖယ်ရှားခြင်း
၆။	သတ္တုရှာဖွေရေး လုပ်ငန်းများတွင်	(၁) သတ္တုတူးဖော်ရေးလုပ်ငန်းများ မလုပ်ဆောင်မီ စိုက်ခင်းပိုင်ရှင်များနှင့် လုံလောက်သော ညှိနှိုင်းမှုများ ပြုလုပ်ခြင်း

	စိုက်ခင်းပိုင်ရှင်များနှင့် ပဋိပက္ခဖြစ်ခြင်း	(၂) သတ္တုတူးဖော်ရေး လုပ်ငန်းများ မလုပ်ဆောင်မီ သက်ဆိုင်သည့် စိုက်ခင်း ပိုင်ရှင်များသို့ လိုအပ်သည့် အကြောင်းကြားစာများ ပေးပို့ အကြောင်းကြားခြင်း
၇။	အလုပ်အကိုင် အခွင့်အလမ်း	(၁) အလုပ်အကိုင် ခန့်ထားရန်အတွက် ဒေသခံများကို ဦးစားပေးခြင်း (၂) အလုပ်အကိုင်ခန့်ထားရန်လိုအပ်ပါက ဒေသခံများ သိရှိနိုင်ရေး အတွက် ရပ်ကွက်အုပ်ချုပ်ရေးမှူးရုံးများနှင့် အများပြည်သူများ မြင်နိုင်မည့် နေရာများတွင် ကြော်ငြာများ ဖြန့်ဝေခြင်း (၃) အလုပ်အကိုင် ခန့်ထားရာတွင် တည်ဆဲ အလုပ်အကိုင်နှင့် အလုပ်သမားရေးရာ ဥပဒေများ နှင့် အညီလိုက်နာဆောင်ရွက်ခြင်း
လုပ်ငန်းလည်ပတ်ဆောင်ရွက်ခြင်း		
၁။	လုပ်ငန်းလည်ပတ်စဉ် ဆူညံသံထွက်ရှိခြင်း	(၁) စက်ယန္တရားများအား ပုံမှန်စစ်ဆေး ထိန်းသိမ်း မှုများပြုလုပ်ခြင်း (၂) အသံဆူညံသော လုပ်ငန်းခွင်တွင် လုပ်သားများအတွက် လိုအပ်သော အကာအကွယ် ပစ္စည်းများထောက်ပံ့ခြင်း (၃) အသံဆူညံသော လုပ်ငန်းခွင်တွင် လိုအပ်သော အကာအကွယ် ပစ္စည်းများကို လုပ်သားများ ပုံမှန်အသုံးပြုရန် ကြပ်မတ်ခြင်း
၂။	ဖုန်နှင့်အမှုန်အမွှားများ ထွက်ရှိခြင်း	(၁) ရှင်းလင်းခြင်း လမ်းဖောက်ခြင်း မြေညှိခြင်းများ ပြုလုပ်မည့်နေရာများကို ရေဖြန်းခြင်း (၂) ရှင်းလင်းမည့် နေရာနှင့် မြေပုံမည့် နေရာများ၏ အကွာအဝေးကို ခရီးအတိုဆုံး ဖြစ်အောင်ထားရှိခြင်း (၃) ခြောက်သွေ့ချိန် နှင့် လေတိုက်ချိန်များတွင် ဖုန်မထစေရန် ရေဖြန်းပေးခြင်း
၃။	နုန်းတင်ခြင်း	(၁) လမ်းများတွင် တိုက်စားမှု မဖြစ်စေရန် မျက်နှာပြင်မြေသား ကျစ်လစ်အောင် ပြုလုပ်ခြင်းများ အပြင် လမ်းဘေး ဝဲယာတွင် ရေနုတ်မြောင်းများ ထည့်သွင်း တည်ဆောက်ခြင်း (၂) တူးဖော်ပြီးစီးသည့် နေရာများတွင် ဖို့မြေများကို တိုက်စားမှုမှကာကွယ်ရန် အတွက် အပင်များပြန်စိုက်ခြင်း (၃) မြေစာပစ်မည့် နေရာပတ်လည်တွင် ရေနုတ်မြောင်းဖောက်လုပ်ပြီး ၄င်း ရေနုတ်မြောင်းကို စွန့်ပစ်ကန်နှင့်ဆက်သွယ်ထားခြင်း (၄) တူးဆွပြုပြင်ထားသော မြေနေရာများတွင် ရေများ ဖြတ်သန်းစီးဆင်းမှု မရှိအောင် လမ်းကြောင်းလွှဲခြင်း
၄။	သတ္တုသန့်စင်ခြင်းမှ စွန့်ပစ်ရေများ ထွက်ရှိခြင်း	(၁) အနည်ထိုင်ကန်မှ အပေါ်ရေကြည်များကို မျောစင်တွင် ပြန်လည် အသုံးပြုခြင်းဖြင့် ရေသုံးစွဲမှုလျှော့ချခြင်း (၂) အညင်းချောင်းအတွင်းသို့ စွန့်ပစ်မည့် စွန့်ပစ်ရေအား NEQG မှ သတ်မှတ်တန်ဖိုးများနှင့် အညီ သန့်စင်ပြီးမှ စွန့်ပစ်ခြင်း (၃) သတ္တုတွင်းလုပ်ငန်းများမှ စွန့်ထုတ်သောရေကို သတ်မှတ်အရည်အသွေး ရောက်အောင် သန့်စင်ပြီးမှ စွန့်ပစ်ခြင်း

		(၄) စွန့်ပစ်ရေ အရည်အသွေးကို ပုံမှန် စောင့်ကြည့်၍ သတ်မှတ်ချက်နှင့် မကိုက်ညီမှုများ တွေ့ရှိပါက အမြန်ဆုံး ပြုပြင်ဆောင်ရွက်ခြင်း (၅) သတ္တုတွင်းဧရိယာများမှ ရေကို နီးစပ်ရာသဘာဝရေစီးကြောင်းများ မြစ်ချောင်းများ အတွင်းသို့ မစွန့်ပစ်မီ အနည်ထိုင်ကန်များအတွင်း ပထမဦးစွာ ထည့်သွင်း၍အနည်ထိုင်စေခြင်း
၅။	စွန့်ပစ် မြေစာပုံ	(၁) စွန့်ပစ်မြေစာပုံကို မတော်တဆမှုများ ဖြစ်ပွားလျှင် မြေထုရေထု နှင့် ပတ်ဝန်းကျင် အပေါ်ထိခိုက်နိုင်ခြေ နည်းပါးသည့်နေရာတွင်သာ ရွေးချယ်ထားရှိခြင်း (၂) စွန့်ပစ်မြေစာပုံ ကောင်းမွန်ခိုင်မာမှုကို တက်ကျွမ်းနားလည်သူများ ဖြင့် ပုံမှန်စစ်ဆေးခြင်း (၃) စွန့်ပစ်မြေစာပုံသို့ ဝင်ထွက်သွားလာမှုကို ကန့်သတ်တားမြစ်ပြီး ဖြစ်ပေါ်နိုင်သည့် အန္တရာယ်များအား လူအများသိရှိနိုင်ရန် သတိပေးဆိုင်းဘုတ် စိုက်ထူခြင်း၊ ဆွေးနွေးပွဲများဖြင့် အသိပေးခြင်းများ ပြုလုပ်ခြင်း (၄) စွန့်ပစ်မြေစာပုံအနီးတွင် ရေအရည်အသွေး တိုင်းတာစစ်ဆေးမှုများ ပုံမှန် ပြုလုပ်ခြင်း
၆။	စခန်းနေရာပြင်ဆင်ခြင်း အတွက် အပင်များ ခုတ်ထွင်ရှင်းလင်းခြင်း	(၁) ကုန်ထုတ်လမ်းများကို ရှိရင်းစွဲလမ်းများအား တတ်နိုင်သမျှ အသုံးပြုခြင်း (၂) လုပ်ငန်းခွင်ဧရိယာကို ခြံခတ်ပြီး ခြံစည်းရိုးပြင်ပရှိ အပင်များအား ထိခိုက်မှု မရှိအောင် ထိန်းသိမ်းခြင်း (၃) မိုင်းလုပ်ငန်း ဆောင်ရွက်ရာတွင် မပါဝင်သော စီမံကိန်းဧရိယာ များကို မဖြတ်သန်း ရနေရာများအဖြစ် သတ်မှတ်၍ ထိခိုက်ပျက်စီးမှု မရှိအောင် ထိန်းသိမ်းခြင်း (၄) မိုင်းလုပ်သားများအား လုပ်ငန်းခွင် ဧရိယာအတွင်းမှ သစ်ပင်များကို တစ်ကိုယ်ရေသုံးအတွက် ထင်း၊ မီးသွေးများအဖြစ် အသုံးပြုခြင်းကို တားမြစ်ထားခြင်း (၅) လုပ်ငန်းခွင်ဧရိယာအတွင်း ဒေသမျိုးရင်းမဟုတ်သည့် အပင်မျိုးစိတ်သစ်များ ပေါက်ရောက်မှုရှိမရှိကို စောင့်ကြည့်ပြီး ပေါက်ရောက်လာပါက ရှင်းလင်းဖယ်ရှားခြင်း
၇။	စိုက်ခင်းပိုင်ရှင်များနှင့် ပဋိပက္ခဖြစ်ခြင်း	(၁) သတ္တုတူးဖော်ရေးလုပ်ငန်းများ မလုပ်ဆောင်မီ စိုက်ခင်းပိုင်ရှင်များနှင့် လုံလောက်သော ညှိနှိုင်းမှုများ ပြုလုပ်ခြင်း (၂) သတ္တုတူးဖော်ရေး လုပ်ငန်းများ မလုပ်ဆောင်မီ သက်ဆိုင်သည့် စိုက်ခင်း ပိုင်ရှင်များသို့ လိုအပ်သည့် အကြောင်းကြားစာများ ပေးပို့ အကြောင်းကြားခြင်း

၈။	စီးပွားရင်းမြစ် ဆုံးရှုံးခြင်း	(၁) ဒေသခံများ သဘာဝရင်းမြစ် ထုတ်ယူသုံးစွဲရာ လမ်းများကို တတ်နိုင်သမျှ မထိခိုက်အောင် ထိန်းသိမ်းခြင်း (၂) ဒေသခံတောင်သူများ ဖွံ့ဖြိုးတိုးတက်အောင် ကူညီထောက်ပံ့ပေးနိုင်မည့် တောင်သူလယ်သမား ဖွံ့ဖြိုးတိုးတက်ရေး ဆိုင်ရာ အစီအမံများ အကောင်ထည်ဖော် ဆောင်ရွက်ခြင်း (၃) အလုပ်အကိုင်ခန့်ထားရာတွင် ဒေသခံများအား ဦးစားပေးခြင်း (၄) ကနဦးလုပ်ငန်းများတွင် ပါဝင်ခဲ့သည့် လုပ်သားများအား သတ္တုတူးဖော်ရေး လုပ်ငန်းတွင် ခန့်ထားပါဝင်စေခြင်း
၉။	လုပ်သားပြည်သူ ကျန်းမာရေးနှင့် လုပ်ငန်းခွင်ဘေးအန္တရာယ် ကင်းရှင်းရေး	(၁) ကျန်းမာရေး၊ ဘေးအန္တရာယ်ကင်းရှင်းရေး နှင့် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု စနစ်များကို သတ်မှတ်ထားသည့် နည်းလမ်းများနှင့် လမ်းညွှန်ချက်များအတိုင်း A&M Myanmar Ltd မှ အပြည့်အဝ လိုက်နာဆောင်ရွက်ခြင်း (၂) အလုပ်သမားများအတွက် နေရာထိုင်ခင်းများကို မွန်းကြပ်သိပ်သည်းမှုများ မဖြစ်ပေါ်အောင် သင့်တင့်မျှတစွာ စီစဉ်ထားရှိခြင်း (၃) အလုပ်ခန့်ထားခြင်းမပြုမီ လုပ်သားများအား ကျန်းမာရေး စစ်ဆေးမှုများ ပြုလုပ်ပေးခြင်း (၄) လုပ်သားများအား မြစ်ကမ်း၊ ချောင်းကမ်းတွင် ကျင်ကြီးကျင်ငယ် မစွန့်ရန် အသိပညာပေးခြင်း (၅) စားဖိုဆောင်တွင် အာဟာရညီညွတ်မှုတသည့် အစားအသောက်များ စီမံပေးခြင်း (၆) ဒေသတွင်းရှိ ကျန်းမာရေးနှင့် သက်ဆိုင်သည့် ဌာနဆိုင်ရာများနှင့် ပူးပေါင်းဆောင်ရွက်ခြင်း
၁၀။	အများပြည်သူ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး	(၁) သတ္တုတွင်းမှ ယာဉ်များကို သတ္တုတွင်းရေယာနှင့် ကျေးရွာများအတွင်း သတ်မှတ်မိုင်နှုန်းဖြင့်သာ မောင်းနှင်သွားလာရေး ကြပ်မတ်ခြင်း (၂) မော်တော်ယာဉ်များအား ဝန်ပိုတင်ဆောင်မှု မပြုရေးနှင့် ဝန်စည်စလယ်များအား မြဲမြံအောင် တုပ်နှောင်တင်ဆောင်ခြင်း (၃) အရေးပေါ်အခြေအနေတွင် လုပ်ဆောင်ရမည့် အချက်များကို စီမံချက်များ ရေးဆွဲပြီး မော်တော်ယာဉ်တိုင်းတွင် ထားရှိခြင်း (၄) ဒေသခံများအား အကျိုးပြုနိုင်မည့် ကျန်းမာရေး ဝန်ထမ်းများအား ကျန်းမာရေးဆိုင်ရာ အထောက်အပံ့များ ပံ့ပိုးခြင်း (၅) ကျန်းမာရေးဆိုင်ရာ ကူညီထောက်ပံ့မှုများမပြုမီ ဒေသခံများနှင့် သက်ဆိုင်ရာ အစိုးရဌာနများနှင့် တိုင်ပင်ဆွေးနွေးခြင်း (၆) လုပ်သားများအတွက် ဆေးပေးခန်းတစ်ခုကို သတ္တုတွင်းစခန်းတွင် ထားရှိခြင်း

		(၇) ဒေသဆိုင်ရာ ကျန်းမာရေးတာဝန်ခံများ အစိုးရမဟုတ်သော အဖွဲ့အစည်းများနှင့် ပူးပေါင်းဆောင်ရွက်ခြင်း (၈) လုပ်သားများနှင့် ဒေသခံများအတွက် ကူးစက်တတ်သောရောဂါများ၊ မကူးစက်သော ရောဂါများအား အသိပညာပေးမှုများပြုလုပ်ခြင်း
ရပ်နားခြင်း		
၁။	လုပ်ငန်းဖျက်သိမ်းရာမှ စွန့်ပစ် ပစ္စည်းများ ထွက်ရှိခြင်း	(၁) မြေပြင်ပေါ်ရှိ အန္တရာယ်ရှိသော ပစ္စည်းများ၊ အသုံးအဆောင် ပစ္စည်းများ နှင့် အဆောက်အဦးများအား ဖယ်ရှားခြင်း (၂) မြေဆီလွှာညစ်ညမ်းမှု ဖြစ်ပေါ်သည့် နေရာများအား တူးဖယ်ရှင်းလင်းခြင်း (၃) ရေလှောင်ကန်များ၊ ရေကန်များအား ရေဖောက်ထုတ်ပြီး ဆေးကြော သန့်ရှင်းမှုများ ပြုလုပ်ခြင်း (၄) ဖျက်သိမ်းရာမှ ထွက်ရှိလာသည့် အမှိုက်များကို ပြန်လည်အသုံးပြု၍ ရမည့်ပစ္စည်းနှင့် မရမည့်ပစ္စည်းများ အဖြစ် အမျိုးအစားခွဲခြားခြင်း (၅) ဖျက်သိမ်းရာမှ ထွက်ရှိလာသည့် အမှိုက်များကို စနစ်တကျစုပုံခြင်း သို့မဟုတ် မြေဖို့ခြင်း
ပိတ်သိမ်းခြင်းနှင့်ပိတ်သိမ်းပြီး		
၁။	ဖုန်နှင့်အမှုန်အမွှားများ ထွက်ရှိခြင်း	(၁) မြေဖို့ခြင်း မြေညှိခြင်း လုပ်ငန်းများဆောင်ရွက်သော နေရာများတွင် ရေဖြန်းခြင်း (၂) ရှင်းလင်းခြင်း လမ်းဖောက်ခြင်း မြေညှိခြင်းများ ပြုလုပ်မည့်နေရာများကို ရေဖြန်းခြင်း
၂။	မြေမျက်နှာသွင်ပြင် ပြောင်းလဲခြင်း	(၁) သတ္တုတွင်းပိတ်သိမ်းမှု အစီအစဉ် အတိုင်း သတ္တုတွင်းကို ပြန်ဖို့ခြင်း (၂) အပေါ်ယံမြေဆီလွှာများအား ပြန်လည် ဖြည့်တင်းပေးခြင်း (၃) သဘာဝ ပေါက်ပင်များ ပြန်လည် စိုက်ပျိုးပေးခြင်း

၈။ ပတ်ဝန်းကျင်ရေးရာစောင့်ကြည့်အဖွဲ့

ဧကမိသတ္တုတူးဖော်ရေးစီမံကိန်း၏ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ် (Environmental Management Plan) ကိုအောင်မြင်စွာ ဆောင်ရွက်နိုင်ရန် အတွက် ပတ်ဝန်းကျင်ရေးရာစောင့်ကြည့်အဖွဲ့ကို ဖွဲ့စည်းရန် လိုအပ်မည် ဖြစ်ပါသည်။ စောင့်ကြည့်အဖွဲ့တွင် ဌာနဆိုင်ရာ ကိုယ်စားလှယ်များ၊ ဒေသခံ ကိုယ်စားလှယ်များနှင့် စီမံကိန်းလုပ်ငန်းရှင် ကိုယ်စားလှယ်များ ပါဝင်သင့်ပါသည်။

ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်ကို အပြည့်အဝ အကောင်အထည်ဖော်ဆောင်ရွက်ရန် လုပ်ငန်းရှင်တွင် တာဝန်ရှိပါသည်။ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်၏ အစီတ်အပိုင်းတစ်ရပ်ဖြစ်သော ပတ်ဝန်းကျင်ရေးရာစောင့်ကြည့်တိုင်းတာရေး အစီအစဉ် (Environmental Monitoring Programme)ကို လုပ်ငန်းရှင်က လိုက်နာဆောင်ရွက်ကာ တိုင်းတာတွေ့ရှိချက် အစီရင်ခံစာများကို ပတ်ဝန်းကျင်ရေးရာ စောင့်ကြည့်အဖွဲ့ မှ အဖွဲ့ဝင်ကိုယ်စားလှယ်များထံ မိတ္တူပေးပို့ရမည်ဖြစ်ပါသည်။ လူမှုစီးပွါးတာဝန်သိ အစီအစဉ် (Corporate Social Responsibility) အနေဖြင့် စီမံကိန်းမှ ဒေသခံများအတွက် ပေးအပ်သော ကူညီထောက်ပံ့မှုများကို စောင့်ကြည့်အဖွဲ့မှနေ၍ ဒေသခံကိုယ်စားလှယ်များမှတဆင့် ဒေသခံများထံသို့ ပေးအပ်ရမည်ဖြစ်ပါသည်။ ပတ်ဝန်းကျင်ရေးရာနှင့်သတ်ဆိုင်သော အကြောင်းတစ်စုံတစ်ရာ ပေါ်ပေါက်ပါက ဒေသခံများအနေဖြင့် စောင့်ကြည့်အဖွဲ့ မှ အဖွဲ့ဝင်ဒေသခံကိုယ်စားလှယ် များမှ တစ်ဆင့် စီမံကိန်းနှင့် ဆက်သွယ်ဆောင်ရွက်နိုင်မည်ဖြစ်ပါသည်။

ပတ်ဝန်းကျင်ရေးရာစောင့်ကြည့်အဖွဲ့ ၏ ရည်ရွယ်ချက်များမှာ-

(က) စီမံကိန်း၏ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်အား လိုက်နာဆောင်ရွက်မှု အခြေအနေများကို ဒေသခံများ စဉ်ဆက်မပြတ် သိရှိနိုင်ရန်၊

(ခ) ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြည့်တိုင်းတာရေး အစီအစဉ်မှ တိုင်းတာတွေ့ရှိချက် အစီရင်ခံစာများကို ဒေသခံများသိရှိနိုင်ရန်၊

(ဂ) ပတ်ဝန်းကျင်ရေးရာနှင့် စပ်ဆိုင်သော အကြောင်းကိစ္စများအတွက် အပြန်အလှန် ဆက်သွယ် ဆောင်ရွက်နိုင်ရန်၊

(ဃ) လူမှုစီးပွား တာဝန်သိ အစီအစဉ်အရ ပေးအပ်သည့် ကူညီထောက်ပံ့မှုများကို စနစ်တကျ စီမံခန့်ခွဲမှုများကို စောင့်ကြည့်ထိန်းကြောင်းနိုင်ရန်၊တို့ဖြစ်ကြပါသည်။

ပတ်ဝန်းကျင်ရေးရာ စောင့်ကြည့်အဖွဲ့တွင် အဓိကအားဖြင့် စီမံကိန်းမှ တာဝန်ရှိသူများနှင့် ဒေသခံကိုယ်စားလှယ်များ ပါဝင်ပါသည်။ ဒေသခံ ကိုယ်စားလှယ်များကို သက်ဆိုင်ရာ ကျေးရွာအလိုက် ရွာခံများက အများသဘောတူ ရွေးချယ်ပေးပြီး ထည့်သွင်းဖွဲ့စည်းရန် ဖြစ်ပါသည်။

၉။ လူမှုစီးပွါးတာဝန်သိအစီအစဉ် (CSR)

စီမံကိန်းကနှစ်စဉ် ထုတ်လုပ်မှု အမြတ်၏ (၂) ရာခိုင်နှုန်းကို လူမှုစီးပွါးတာဝန်သိ အစီအစဉ်အတွက် အသုံးပြုမည်ဖြစ်ပါသည်။ လူမှုစီးပွါး တာဝန်သိအစီအစဉ်အတွက် စီမံကိန်း၏ သက်ရောက်ခံ ဧရိယာအတွင်း ကျရောက်နေသည့် ကျေးရွာများ၏ ပညာရေး ကဏ္ဍ၊ ကျန်းမာရေးကဏ္ဍ၊ စီးပွါးရေးကဏ္ဍ၊ အခြေခံအဆောက်အဦးကဏ္ဍ၊ သဘာဝဘေးအန္တရာယ် ကူညီထောက်ပံရေးကဏ္ဍ များတွင် ဒေသခံများ၊ ဒေသဆိုင်ရာ အုပ်ချုပ်ရေး အဖွဲ့အစည်းများနှင့် တိုင်ပင်ညှိနှိုင်းကာစဉ်ဆက်မပြတ် ပါဝင်ဆောင်ရွက်သွားရန် ဖြစ်ပါသည်။ စီမံကိန်းက မိမိတို့ ဝန်ထမ်းများ သက်သာချောင်ချိရေး၊ ကျန်းမာရေးစောင့်ရှောက်မှု၊ ပညာရေးဆိုင်ရာ ကူညီပံပိုးမှု၊ အရည်အသွေးဖွံ့ဖြိုးတိုးတက်ရေးဆိုင်ရာ သင်တန်းများပေးခြင်း စသည်တို့ကိုလည်း လူမှုစီးပွါးတာဝန်သိ အစီအစဉ်တွင် ထည့်သွင်းဆောင်ရွက်မည်ဖြစ်ပါသည်။

၁၀။ လူထုတွေ့ဆုံပွဲ

ပထမအကြိမ်တွေ့ဆုံပွဲကို ၂၀၁၅ခုနှစ်၊ ဧပြီလ (၇)ရက်နေ့တွင် စီမံကိန်းဒေသရှိ ဇေကမိကျေးရွာ၊ အခြေခံမူလတန်းကျောင်းတွင် ပြုလုပ်ကျင်းပခဲ့ပါသည်။ လူထုတွေ့ဆုံပွဲသို့ စီမံကိန်းပတ်ဝန်းကျင်ရှိ ကျေးရွာများမှ ဒေသခံများ၊ စီမံကိန်းမှတာဝန်ရှိသူများ၊ ဝန်ထမ်းများ၊ OSHE Services Co. Ltd. မှ တာဝန်ရှိသူများအပါအဝင် စုစုပေါင်း (၁၅၈) ဦးတက်ရောက်ခဲ့ပြီး သက်ဆိုင်ရာ တာဝန်ရှိသူများနှင့် ဆွေးနွေးမှုများပြုလုပ်ခဲ့ပါသည်။ ထို့အပြင် လူမှုစီးပွါး စစ်တမ်းများကောက်ခံရာတွင်လည်း ဒေသခံများနှင့် တိုင်ပင် ဆွေးနွေးမှုများကို လုပ်ဆောင်ခဲ့ကြပါသည်။ ရရှိလာသော ဒေသခံများ၏ သဘောထားများ၊ ဆွေးနွေးမှုများကို အောက်ပါဇယားအတိုင်း အမျိုးအစားခွဲထားပါသည်။

စဉ်	အကြောင်းအရာ	ရာခိုင်နှုန်း
၁	မြေ၊ စိုက်ပျိုးမြေများနှင့် သက်ဆိုင်ရာများ	၁၅.၂၉
၂	ယေဘုယျအကြောင်းအရာများ	၇.၄၇
၃	အလုပ်အကိုင်အခွင့်အလမ်းများနှင့် သက်ဆိုင်ရာများ	၃၀.၂၃
၄	လူမှုစီးပွါး တာဝန်သိအစီအစဉ် နှင့် သက်ဆိုင်ရာများ	၄၇.၀၁
စုစုပေါင်း		၁၀၀.၀၀

၁၁။ နိဂုံး

- စီမံကိန်းလုပ်ငန်းစဉ်ကို အပိုင်း (၅)ပိုင်းခွဲ၍ လေ့လာရာတွင် စီမံကိန်းမှ သက်ရောက်နိုင်သော သက်ရောက်မှု ကောင်းကျိုး၊ဆိုးကျိုးများစုစုပေါင်း (၂၆) ချက် ဖော်ထုတ်တွေ့ရှိပါသည်။ ဆိုးကျိုး သက်ရောက်မှု များကို လျှော့ချကုစားရန် နည်းလမ်းများ၊ ကောင်းကျိုးသက်ရောက်မှုများကို ဆပ်ပါးမြှင့်တင်ရန် နည်းလမ်းများ ကိုလည်း ဖော်ထုတ်ထားပါသည်။
- ပတ်ဝန်းကျင်ရေးရာ စောင့်ကြည့်ရေးနှင့် စီမံခန့်ခွဲမှု အစီအစဉ်များ ပြုလုပ်ဆောင်ရွက်နိုင်မည့် ပတ်ဝန်းကျင်ရေးရာစီမံခန့်ခွဲမှု အစီအမံများကိုလည်း ချမှတ်ပေးထားပါသည်။
- ချမှတ်ပေးထား ပတ်ဝန်းကျင်ရေးရာစီမံခန့်ခွဲမှု အစီအမံများအတိုင်း လိုက်နာဆောင်ရွက်ပါက ယခုစီမံကိန်းသည် သတ်မှတ်ကာလအတွင်း စဉ်ဆက်မပြတ် ဖွံ့ဖြိုးတိုးတက်သော စီမံကိန်းတစ်ခု အဖြစ်လုပ်ဆောင်နိုင်မည်ဟု မျှော်မှန်းထားပါသည်။

APPENDIX-E -BIODIVERSITY REPORT

BIODIVERSITY AND BIOSAFTY ASSESSMENT REPORT FOR EIA ZEGAMI TIN MINE

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1. INTRODUCTION

The proposed area of Zegami tin mine that occupied 704 acres approximately locates Kyunsu Township, Tanintharyi region. It consists of Zegami village in northern, Maung Hlaw village in eastern, Thazinmyit village in southern and Anyin village in western sides respectively. Direct impact area of mine project and indirect impact area that is 7 km closer to the project had been surveyed for floral diversity (plantation) and the second is diversity of fauna (animals). Impacts on biodiversity would be safe or reduced by the proposed mitigation measures of this report.

Sparsely woody type of rain forest and mangrove from the bank of both sides of Anyin creek along direct and indirect impact areas of the project is the peculiar habitat for faunal diversity. The directed impact area of the mine project is partially fragmented due to the exploitation of the old mine and clearance of the current issue, tin mine project. Conducting with the project, clearance of plantation for construction, driving vehicles for transportation of instruments using in mine, releasing wastes from tilling produced from the project, cutting and using the plantation for fire wood of mine workers, etc may occur in the project area and nearby. Losing habitats and microhabitat will impact negatively to biodiversity of direct and indirect impact areas. Besides negative impacts of tailing containing mine wastes of tin production of project sites, so many factors such as noise pollution, air and water borne pollutants may also interfere the habitats and the rich of terrestrial and aquatic biodiversity in the indirect impact area closer to mine area. Seasonal breeding and feeding habit of fish, reproductive behavior and performances of all other animals roosted in the project area and nearby may be affected by spreading of tailings and producing loud noise that coming from vehicles of field work.

1.1 Purposes of the Project for Zegami tin mine project

- To evaluate the ecosystem that affects the flora and fauna those inhabited in the project area and nearby of the mine project
- To study and record the diversity of flora and fauna of this area
- To identify the recorded flora and fauna with their population assessment
- To assess and reveal the ecological and commercial values of different species of flora recorded from the mining sites and environs

- To identify the potential negative impacts of mine those may affect and threaten to the richness of biodiversity of the project area and nearby
- To recommend the mitigation measures and management plans for safety of flora and fauna diversity of the mining sites and environs

1.2 What is biodiversity

Biodiversity means "the variability among living organisms from all sources including inter alia, terrestrial, marine other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." It is the variety of life on earth at all levels, from genes to worldwide populations of the same species; from communities of species sharing the same small area of habitat to worldwide ecosystems (The Convention on Biological Diversity, CBD).

1.3 Objectives of biodiversity management

Ecosystem, species and genetic diversity are conserved to provide a range of values for human being. Priority is given to ensuring the protection of threatened, declining or endemic ecosystems, ecosystems which play a key role in providing ecosystem services (e.g. flood protection, supply of water and raw materials, genetic resources, etc.) unique habitats, endemic, threatened or declining species. Priorities and targets for biodiversity conservation at international, national, regional and local level are respected, and a positive contribution to achieving these targets is made. Some biodiversity is irreplaceable, for example when a species or habitat is lost which cannot be found anywhere else; in these situations such biodiversity must be protected since it cannot be replaced and may have unknown future values. The persistence of ecosystems and species is promoted by making provision for, and/or maintaining, natural corridors between fragments of a particular ecosystem, and between/along different gradients (e.g. altitude, climatic, landscape, watershed gradients). Habitats which play a vital role in supporting seasonal or migrant species are conserved.

The sustainable use of its components; Life support systems and ecosystem services such as water yield, water purification breakdown of wastes, flood control, storm and coastal protection, soil formation and conservation, sedimentation processes, nutrient cycling, carbon storage and climatic regulation are maintained,

thus safeguarding livelihoods and keeping future options open for human development.

The fair and equitable sharing of benefits arises from the use of genetic resources. Benefits from commercial use of natural resources are shared fairly, giving due consideration to those who have traditionally had access to, and/or knowledge of those resources. The likely needs of future generations, as well as those of current generations, are taken into account (intergenerational needs) (CBD).

2. ENVIRONMENTAL AND SOCIAL IMPACTS OF MINING

2.1 Water resources

Perhaps the most significant impact of a mining project is its effects on water quality and availability of water resources within the project area. Key questions are whether surface and groundwater supplies will remain fit for human consumption, and whether the quality of surface waters in the project area will remain adequate to support native aquatic life and terrestrial wildlife.

2.1.1 Acid mine drainage and contaminant leaching

The answer concerning with potential acid mine will determine whether a proposed mining project is environmentally acceptable. When mined materials are excavated and exposed to oxygen and water, acid can form if iron sulfide minerals are abundant and there is an insufficient amount of neutralizing material to counteract the acid formation. The acid will leach or dissolve metals and other contaminants from mined materials and form a solution that is acidic, high in sulfate, and metal-rich (including elevated concentrations of cadmium, copper, lead, zinc, arsenic, etc.) Leaching of toxic constituents, such as arsenic, selenium, and metals, can occur even if acidic conditions are not present. Ammonia, nitrate and nitrite can also be found in waters at mine sites, from heap leaching and blasting. Acid drainage and contaminant leaching is the most important source of water quality impacts related to metallic ore mining that leads serious threats to water resources. A mine with acid mine drainage has the potential for long-term devastating impact son aquatic life.

2.1.2 Erosion of soils and mine wastes

The potential of soil and sediment eroding into and degrading surface water quality is a serious problem for most mining projects. Erosion can be a major concern because of the large area of land disturbed by mining operations and the large quantities of earthen materials exposed at site. Erosion control must be considered from the beginning of operations through completion of reclamation. Erosion may cause significant loading of sediments to nearby water bodies. The ultimate deposition of the sediment may occur in surface waters or it may be deposited within the floodplains of a stream valley. Historically, erosion and sedimentation processes have caused the build-up of thick layers of mineral fines and sediment within regional flood plains and the alteration of aquatic habitat and the loss of storage capacity within surface waters. The main factors influencing erosion includes the volume and velocity of runoff from precipitation events, the rate of precipitation infiltration downward through the soil, the amount of vegetative cover, the slope length or the distance from the point of origin of overland flow to the point where deposition begins, and operational erosion control structures. Major sources of erosion/sediment loading at mining sites can include open pit areas, heap and dump leaches, waste rock and overburden piles, tailings piles and dams, haul roads and access roads, ore stockpiles, vehicle and equipment maintenance areas, exploration areas, and reclamation areas. A further concern from mining operations may contribute sediments with chemical pollutants, principally heavy metals. When the sulfides in the rock are excavated and exposed to water and air during mining, they form sulfuric acid. This acidic water can dissolve other harmful metal sin the surrounding and may runoff into streams or rivers or leach into groundwater. Acid mine drainage may be released from any part of the mine where sulfides are exposed to air and water, including waste rock piles, tailings, open pits, underground tunnels, and leach pads. (Hard rock Mining and Acid Mine Drainage. http://www.earthworksaction. org/pubs/FS_AMD.pdf)

2.1.3 Tailing impoundments, waste rock, heap leach, and dump leach facilities

The impacts of wet tailings impoundments, waste rock, heap leach, and dump leach facilities on water quality can be severe. These impacts include contamination of groundwater beneath these facilities and surface waters. Toxic substances can leach

from these facilities, percolate through the ground, and contaminate groundwater, especially if the bottom of these facilities is not fitted with an impermeable line.

Tailings (a by-product of metallic ore processing) is a high-volume waste that can contain harmful quantities of toxic substances, including arsenic, lead, cadmium, chromium, nickel, and cyanide (if cyanide leaching is used). Although it is rarely the environmentally-preferable option, most mining companies dispose of tailings by mixing them with water to form slurry.

The resulting waste contains large amounts of water, and generally that can be a threat to wildlife because the ore is usually extracted as slurry. Ultimately, tailing ponds will either dry, in arid climates, or may release contaminated water, in wet climates. In both cases, specific management techniques are required to close these waste repositories and reduce environmental threats. During periods of heavy rain, more water may enter a tailings impoundment than it has the capacity to contain the release of tailings impoundment effluent. Since this effluent can contain toxic substances, the release of this effluent can seriously degrade water quality of surrounding rivers and streams, especially if the effluent is not treated prior to discharge. Wet tailings impoundments may create some of the worst environmental consequences of all industrial accidents. They release large quantities of toxic waters that can kill aquatic life and poison drinking water supplies for many miles downstream of the impoundment. http://www.ret.gov.au/zresources/Documents/LPSDP/BPEMOverview

2.2 Mining projects and air quality

For exploration, development, construction, and operational activities of mine project airborne emissions occur during each stage of the mine cycle. Mining operations mobilize large amounts of material, and waste piles containing small size particles are easily dispersed by the wind. Air quality conditions in a project area are critical to evaluating the potential distribution of air pollutants and their effects in the area of influence. Air pollutants can travel long distances, so baseline air quality information should be considered in relation to meteorological conditions, wind patterns, geological formations, and anything else that might influence the distribution of air pollutants.

Air borne pollutant sources are from

- Particulate matter transported by the wind as a result of transportation of materials, wind erosion, fugitive dust from tailings facilities, stock piles, Waste dumps, haul roads and excavations. Exhaust emissions from mobile sources (cars, trucks, heavy equipment) raise the separticulate levels; and
- Once gas emissions from the combustion of fuels in stationary and mobile sources, explosions, and mineral process indenter the atmosphere, they undergo physical and chemical changes. These pollutants can cause serious effects to people's health and to the environment. Large-scale mining has the potential to contribute significantly to air pollution, especially in the operation phase. All activities during ore extraction, processing, handling, and transport depend on equipment, generators, processes, and materials that generate hazardous air pollutants such as particulate matter, heavy metals, and carbon monoxide, sulfur dioxide, and nitrogen oxides.

The main gaseous emissions are from combustion of fuels in power generation installations, and drying, roasting, and smelting operations. Mobile sources of air pollutants include heavy vehicles used in excavation operations, cars and truck that transport mining materials. The level of polluting emissions from these sources depends on the fuel and conditions of the equipment. Even though individual emissions can be relatively small, collectively these emissions can be of real concern. In addition, mobile sources are a major source of particulate matter, carbon monoxide, and volatile organic compounds that contribute significantly to the formation of ground-level ozone.

2.3 Noise and vibration

Noise pollution associated with mining may include noise from vehicle engines, power generation, and other sources. Cumulative impacts of shoveling, ripping, drilling, blasting, transport, crushing, grinding, and stock-piling can significantly affect wildlife and nearby residents. Vibrations are associated with many types of equipment used in mining operations, but blasting is considered the major source. Vibration has affected the stability of infrastructures, buildings, and homes of people living near large-scale open-pit mining operations. Shocks and vibrations as a result of blasting in connection with mining can lead to noise, dust and collapse of

structures in surrounding inhabited areas. The animal life, on which the local population may depend, might also be disturbed (European Union, 2000).

2.4 Mining projects and soil quality

Mining operations routinely modify the surrounding landscape by exposing previously undisturbed earthen materials. Erosion of exposed soils, extracted mineral ores, tailings, and fine material in waste rock piles can result in substantial sediment loading to surface waters and drainage ways. In addition, spill sand leaks of hazardous materials and the deposition of contaminated windblown dust can lead to soil contamination (European Union). Contaminated soil resulting from windblown dust, and soils contaminated from chemical spills and residues fall into human health and environmental risks. The inherent toxicity of the dust depends upon the proximity of environmental receptors and type of ore being mined. High levels of arsenic, lead, and in windblown dust usually pose the greate strisk. If these materials are misused as fill materials, or namental landscaping, or soil supplements, soils contaminated from chemical spill sand residues at mine sites may pose a direct contact risk.

2.5 Climate change considerations

Mining projects may have the potential to alter global carbon in at least the following ways: Lost CO_2 uptake by forests and vegetation that is cleared. Many large-scale mining projects are proposed in heavily forested areas of tropical regions that are critical for absorbing atmospheric carbon dioxide (CO_2) and maintaining a healthy balance between CO_2 emissions and CO_2 uptake. Some mining projects propose long-term or even permanent destruction of tropical forests. CO_2 emitted by machines (e.g., diesel powered heavy vehicles) involved in extracting and transporting ore. These estimates can be based on the rate of fuel consumption (typically diesel fuel) multiplied by a conversion factor that relates units (typically liters or gallons) of fuel that is consumed and units (typically metric tons) of CO_2 that is emitted. CO_2 emitted by the processing of ore into metal.

2.6 Wildlife

Wildlife comprises all living things that are undomesticated. This includes plants, animals (vertebrates, birds, fish), and other organisms (invertebrates). Baseline

information about wildlife must include a list of wildlife species within the project area and interactions between species.

Plants are one of the most important indicators of environmental conditions because they reflect the overall state of life conditions in an area and the state of all other species in an ecosystem. Plant species should include information about: composition, density, distribution, status, vegetative cover, and dominant, protected, foreign, threatened, and vulnerable species, as well as noticeable effects of human presence in the ecosystem. Some areas have endemic and rare plant species that are of special interest. Inventories of fauna species are more difficult toobtain, but should include: diversity, distribution, and density, including information about the presence of endemic, protected, threatened and endangered species.

3. Purposes of the Project

- To evaluate the fragile environment that affects the flora and fauna those inhabited in the project area and nearby of the mine project
- To study and record diversity of flora and fauna of this area
- To identify the recorded some flora and fauna with their trend of population assessment
- To assess and reveal the ecological and commercial values of different species of flora recorded from the mining sites and environment
- To identify specifically the potential negative impacts of mine those may affect and threaten to the richness of biodiversity of the project area and its vicinity
- To consider the sustainability of flora and fauna of mine project and its vicinity at mine close plan
- To recommend the mitigation measures and management plans for safety of flora and fauna diversity of the mining sites and environs

4. FLORA SURVEY

4.1 Methods for flora Survey

Diversity of plant species (flora) has been recorded in the direct impact area of mining site and indirect impact area of vicinity.

Random study of way point to cover the direct impact and indirect impact area has been designated and navigated by the Global Positioning System (GPS). Recorded vegetation had been categorized into trees, shrubs and herbs according to their size and the nature of stem, the garden vegetation, medicinal plants and wood up to their commercial purposes.

Materials used in flora survey were quadrate and transecting, camera for taking photographs, GPS and different size of plastic boxes for sample collection such as leafs, flowers and fruits those were urgently unidentified and field note books.

Collected data was arranged and entry has been carried in excel work (2010) for assessment of floral diversity after field survey. For the purpose of this EIA boundaries of the study area are to determine the site maps and development plans provided. A "walk-through" survey method was conducted in (10 to 18) April to analyze the presence or absence of ecologically or commercially important species diversity of flora and fauna on the site. Species of flora and fauna were identified on location and selected samples collected and photographed for further verification. Vegetation and variety of their categories were conducted to create a comprehensive plant species list for the vegetation found on direct impact mining site and vicinity to indirect impact area of development site.

4.2 Result and findings for flora

Recorded species of flora have been mentioned with their families and respective habitat type in In the present work 193 species representing 60 families of terrestrial plants and 13 species under 7 families of herbal vegetation with their respective habitats have been recorded. (Table 1-2 and Plate 1 A and B)

Table 1. List of recorded plant species from Zegami Tin Mine Project area

No	Family	Scientific Name	Common Name	Habitat type
1.	Acanthaceae	*Acanthus ebracteatus*	Khaya	Shrub
2.	Aegiceratаceae	*Madhuca Longifolia*	Kan- zaw	Tree
3.	Amaranthaceae	*Aerva Javanica Juss*	On-hnye	Herb
4.	Amaryllidaceae	*Crinum stenophyllum*	Padaing	Herb
5.	Anacardiaceae	*Mangifera caloneura*	Taw-thayet	Tree
6.		*Mangifera factida*	Thayet-pot	Tree
7.		*Spondia pinnata*	Gwe	Tree
8.		*Buchanania florida*	Lunbo	Tree
9.	Annonaceae	*Annona muricata*	Duyin-awza	Small tree
10.		*Canaga odorata*	Saga-sein	Tree
11.		*Polyalthia hookeriana*	Bok	Tree
12.	Apocynaceae	*Alstonia scholaris*	Letpan-ga	Tree
13.		*Plumeria cubra*	Tayok-saga	Small tree
14.	Asclepiadaceae	*Sarcolobus carinatus*	Ka-yu	Climbey creeper
15.		*Sarcolobus globosus*	Ka-yu	Climbey creeper
16.	Asteraceae	*Chromolaena odrata*	Bezat	Shrub
17.		*Eclipta alba*	Kyeit-hman	Herb
18.	Avivenniaceae	*Avicennia alba*	Lame	Tree
19.		*Avicennia officinalis*	Thame-net	Tree
20.	Bignoniaceae	*Heterophragma adenophylla*	Phet-than	Tree
21.		*Oroxylum indicum*	Kyaung-sha	Tree
22.		*Stereopermum fimbriatum*	Than-thit	Tree
23.	Brassicaceae	*Raphanus sativus*	Monla-u	Herb
24.	Capparaceae	*Capparis sepiaria*	Sugauk	Shrub
25.		*Capparis trinervia*	Let maung-new	Climbery creeper

No	Family	Scientific Name	Common Name	Habitat type
26.	Celastraceae	*Kurrimia robusta*	Tagu-bok	Tree
27.	Caricaceae	*Carica papaya*	Thinbaw	Small Tree
28.	Convolvulaceae	*Erycibe citriniflora*	Eikhmwe	Small Tree
29.		*Ipomoea aculeate*	Taung kazue	Creeper
30.	Crassulaceae	*Crypteronia paniculata*	Hmaw-yone	Tree
31.		*Crypteronia pubescens*	Yon	Tree
32.	Cucurbitaceae	*Citrullus lanatus*	Hpaye	Climbery creeper
33.		*Cucurbita moschata*	Hpayon	Climbery creeper
34.		*Cucumis sativus*	Thakha	Climbery creeper
35.	Cacsalpiniaceae	*Bauhinia ornate*	Swedaw-new	Climbery creeper
36.		*Bauhinia pottsii*	Swedaw	Small tree
37.		*Bauhinia Sulphurca*	Swedaw	Tree
38.		*Cassia angustifolia*	Pwegaing	Shrub
39.		*Cassia bicapsularis*	Dan-kywe	Shrub
40.		*Cassia fistula*	Ngu	Tree
41.		*Senna siamea*	Taw-mezali	Tree
42.		*Tamarindus indica*	Magyi	Tree
43.	Dilleniaceae	*Dillenia indica.*	Thabyu	Tree
44.		*Dillenia ornata*	Zin byun	Tree
45.		*Dillenia parviflora*	Kyet-zinbyun	Tree
46.	Dipterocarpaceae	*Dipterocarpus alatus*	Kanyin-byu	Tree
47.		*Dipterocarpus baudii*	Kanyin	Tree
48.		*Dipterocarpus costatus*	Kanyin-ni	Tree
49.		*Dipterocarpus dyeri*	Kanyin	Tree
50.		*Dipterocarpus grandiflorus*	Kanyin-byan	Tree
51.		*Dipterocarpus kerrii*	Sibin	Tree

No	Family	Scientific Name	Common Name	Habitat type
52.		*Dipterocarpus obtusifolius*	Kanyin gok	Tree
53.	Dipterocarpaceae	*Dipterocarpus retusus*	Kanyin-ni	Tree
54.		*Hopea helferi*	Thingan-net	Tree
55.		*Hopca oblongifolia*	Thingan-byan	Tree
56.		*Hopca sangal*	Thingan-pwe	Tree
57.		*Parachorea dusiaudii*	Kadut	Tree
58.		*Shorca gratissima*	U-ban-kaya	Tree
59.		*Shorca cinerca*	Kadut-ni	Tree
60.		*Shorea obtuse*	Thit-ya	Tree
61.		*Vatica dyeri*	Kanyin-Kyaungche	Tree
62.	Ebenaceae	*Diospyros crumentata*	Taung bok	Tree
63.		*Diospyros ferrea*	Mepyaung	Small tree
64.		*Diospyros malabrica*	Yengan-bok	Tree
65.		*Diospyros peregrina*	Yengon-bok	Tree
66.		*Diospyros wallichil*	Palaw	Tree
67.	Elaeocarpaceae	*Elaeocarpus griffithii*	Kalamin kye	Tree
68.		*Elaeocarpus robustus*	Kaya-hmwe	Tree
69.		*Elaeocarpus wallichii*	Thitya-hmwe	Tree
70.	Euphorbiaceae	*Aporusa villosula*	Thit-khauk	Small tree
71.		*Baccourea parviflora*	Kanaso	Small tree
72.		*Emblica officinalis*	Zinbyu	Tree
73.		*Euphorbia antiquorum*	Kun	Small tree
74.		*Macaranga denticulate*	Phet-wun	Small tree
75.		*Macaranga albus*	Phet waing	Tree
76.		*Sapium insigne*	Taung-ka-la	Tree
77.	Fabaceae	*Callerya atropurpurca*	Letzin	Tree
78.		*Desmodium oblongum*	Kyu	Shrub
79.		*Dalbergia paniculata.*	Tapauk	Tree

No	Family	Scientific Name	Common Name	Habitat type
80.		*Dilochos uniflorus*	Pe-bi-zat	Climbery creeper
81.		*Erythrina subumbrans*	Ye-kathit	Tree
82.		*Erythrina variegate*	In-kathit	Tree
83.		*Milletta pachycarpa*	Mi-gyaung new	Climber
84.		*Pterocarpus macrocarpus*	Thit padauk	Tree
85.	Gentianaceae	*Exacum tetragonum*	Pe-deing-nyo	Herb
86.	Hypericaeae	*Calophyllum amocnum*	Tharipi	Tree
87.		*Garcinia choisyana l*	Pala-kye	Tree
88.		*Garcinia heterandra*	Taw-mingut	Tree
89.		*Garcinia merguensis*	Ketmya	Tree
90.		*Garcinia microstigma*	Taung-thaleni	Tree
91.		*Garcinia speciosa*	Palawa	Tree
92.		*Mesua nervosa*	Taung-gan gaw	Tree
93.	Lamiaceae	*Ocimum americanum*	Pin-sein	Herb
94.	Lauraceae	*Cryptocarya griffithian*	Kalak-thiang	Small-tree
95.		*Litsea costalis*	Tagu	Tree
96.		*Litsea elongate*	Tagu-ni	Tree
97.		*Litsea grandis*	Tangu-ni	Tree
98.		*Litsea panamanja*	Tangu-shaw	Tree
99.		*Litsea salicifolia*	Tagu-thain	Tree
100.	Leeaceae	*Leea harbacea*	Thagya-new than	Shurb
101.		*Leea indica*	Ka-let	Shurb
102.		*Leea Pumila*	Ka-let	Shurb
103.	Lythraceae	*Largerstroemia floribunda*	Pyinma	Tree
104.		*Lawsonia alba*	Dan	Shrub
105.	Mangnoliaceae	*Michelia champaea*	Saga	Tree
106.	Malvaceae	*Abclomoschus csculentus*	Yonbede	Shrub

No	Family	Scientific Name	Common Name	Habitat type
107.		*Hibiscus rosa – sinensis*	Khaung-yan	Shrub
108.		*Hibiscus surattensis*	Taw-chin baung	Shrub
109.	Melastomataceae	*Melastoma decemfidum*	Kyet-golay	Shrub
110.		*Melastoma imbricatu*	Kyet-galay	Shrub
111.		*Melastoma malabathricum*	Shame	Shrub
112.	Meliaceae	*Chisocheton divergens*	Thagot	Tree
113.		*Chisocheton grandiflorus*	Thit-ka-dan	Tree
114.		*Sandoricum koetjape*	Thitto	Tree
115.	Mimosaceae	*Abarema bigemina*	Danyin	Tree
116.		*Acacia concinna*	Kinmun-gyin	Climbey Creeper
117.		*Acacia farnesiana*	Nan-lon-kying	Small tree
118.		*Albizia chinensis*	Kayan	Tree
119.		*Adenanthera pavonina*	Ywe	Tree
120.		*Leucaena glauea*	Bawzagaing	Tree
121.		*Mimasa pudica*	Tikayon	Herb
122.		*Parkia leiphylla*	Thit taut	Tree
123.		*Ficus altissima*	Naung-peime	Tree
124.		*Ficus annulata*	Naung-tha phan	Tree
125.		*Ficus glabella*	Ngaung- thabye	Tree
126.		*Ficus hirta*	Kayasha-tha-phan	Small tree
127.		*Ficus hispida*	Kha-aung	Small tree
128.		*Ficus indica.*	Nyaung-thabye	Tree
129.		*Ficus regia*	Sin-thapan	Tree
130.		*Ficus viren*	Nyaung-gyin	Tree
131.	Crassulaceae	*Crypteronia paniculata*	Hmaw-yone	Tree
132.		*Crypteronia pubescens*	Yon	Tree
133.	Hypericaceae	*Garcinia choisyana*	Pala-kye	Tree

No	Family	Scientific Name	Common Name	Habitat type
134.		*Garcinia heterandra*	Taw-mingut	Tree
135.		*Garcinia merguensi*	Ketmya	Tree
136.		*Ficus chartacea*	Tha-phan	Tree
137.		*Ficus hispida*	Kadut	Tree
138.		*Artocarpus heterophyllus*	Peinne	Tree
139.	Myrsinaceae	*Myrsine semiserrat*	Kazaw	Small tree
140.	Myrtaceae	*Eugenia amplexicaulis*	Thabye-ge	Tree
141.		*Eugenia bracteata*	Thabye-hmwe sok	Tree
142.		*Eugenia claviflora*	Thabye-yit pauk	Tree
143.		*Eugenia contracta*	Thabye	Shrub
144.		*Eugenia khasiana*	Thabue-sal chi	Tree
145.		*Eugenia manii*	Thabye-ni	Tree
146.	Myrtaceae	*Eugenia tristis*	Thabye-ga	Tree
147.		*Syzygium angkae*	Mai-wa	Tree
148.		*Syzygium atteruatum*	Thabye	Tree
149.		*Syzygium cymosum*	Thabye-kyetter	Small tree
150.		*Syzygium fastigiatum*	Taung-thabye	Small tree
151.		*Syzygium gramde*	Thabye-gyi	Tree
152.		*Syzygium gratum*	Thabye-pauk-pauk	Tree
153.		*Syzygium inophyllum*	Thabye-satche	Tree
154.		*Syzygium kurzii*	Thabye-nyo	Tree
155.		*Syzygium oblatum*	Thabye-ni	Tree
156.	Myrtaceae	*Syzygium pachyphyllum*	Thabye-cho	Tree
157.		*Syzygium Polyanthum*	Malaga	Tree
158.		*Syzygium praecox*	Sun-thabye Than-thabye	Tree

No	Family	Scientific Name	Common Name	Habitat type
159.		*Syzygium pseudolaetum*	Kabey	Tree
160.		*Syzygium subrufum.*	Tawgyi-gan gaw	Tree
161.		*Syzygium thumra*	Taw-thabye	Tree
162.	Dipterocarpaceae			
163.		*Syzygium cumini*	Tame	Tree
164.		*Syzygium helferi*	Mataw	Tree
165.		*Psidium guajava*	Malaka	Small tree
166.	Passifloraceae	*Adenia Cardiophylla*	Kyet-hin Kha-nwe	Creeper
167.	Papaveraceae	*Papaver somniferum*	Bein	Herb
168.	Rhamnaceae	*Ziziphus oenopila Mill*	Supauk-pin	Shrub
169.		*Ziziphus rugosa Lam.*	Tawzi	Small tree
170.	Rhizophoraceae	*Carallia brachiate*	Yat	Tree
171.	Rubiaceae	*Gardenia jasminoides*	Zizawa	Shurb
172.		*Mussaenda Luteola*	Ywet-hla pan	Shurb
173.		*Randia exaltata*	Kaw	Tree
174.	Rutaceae	*Acgle marmelos*	Okshit	Tree
175.		*Citrus hystry*	Shauk-cho	Small tree
176.	Rutaceae	*Citrus sinensis*	Leinmaw	Small tree
177.		*Glycosmis cyanocarpa*	Ma-baw	Shrub
178.		*Glycosmiz parkinsonii*	Ma-baw	Shrub
179.		*Hesperethusa crenulata*	Thi-ha-ya zar	Small tree
180.	Sapotaceae	*Manilkara hexandra*	Khayay	Tree
181.	Solanaceae	*Capsicum annuum*	Nga-yok	Climber/ creeper
182.	Sterculiaceae	*Helicteres hirsuta*	Sega-gyi	Shrub
183.		*Helicteres isora*	Ting kyut	Shrub
184.		*Heritiera javanica*	Kanzo	Tree

No	Family	Scientific Name	Common Name	Habitat type
185.	Sterculiaceae	*Sterculia coccinea*	Shaw-ah	Small tree
186.		*Scaphium saphigenum*	Shaw	Tree
187.	Symplocaceae	*Symplocos racemosa*	Pya	Small tree
188.	Theaceae	*Grewia acuminate*	Thayaw	Shrub
189.	Tiliaceae	*Microcos calophyolla*	Mayan-bo	Small tree
190.		*Microcos paniculata*	Mya-yar	Small tree
191.	Verbenaceae	*Duranta repens*	Bp-ka daw Myet-hkon	Shrub
192.		*Tectona grandis*	Kyun	Tree
193.	Viscaceae	*Viscum articulatum*	Thit lon	Tree

Table 2. List of recorded vegetation of Herbal Plants in Zegami Tin Mine Project area

No.	Type	Family	Scientific name	Common name	Habitat Type
1.	Monocotyledon	Burmanniaceae	*Burmannia candida*	Tabindaing	Saprophytie Herb
2.			*Germainia lanipes*	Germany Pin-myet.	Grass
3.		Poaceae	*Erianthus hookeri*	Mwe-gyi	
4.		Smilacaceae	*Smilax perfoliata*	Sein-nabaw	
5.		Iridaceae	*Crocus sativius*	Gon-ga-man	
6.	Dicotyleton	Aegicerataceae	*Madhuca Longifolia*	Kan- zaw	Tree
7.		Asteraceae	*Chromolaena odrata*	Bezat	Shrub
8.			*Eclipta alba*	Kyeit-hman	Herb
9.			*Cassia angustifolia*	Pwegaing	Shrub
10.			*Sapium insigne*	Taung-ka-la	Tree

No.	Type	Family	Scientific name	Common name	Habitat Type
11.		Rhizophoraceae	*Carallia brachiate*	Yat	
12.			*Hesperethusa crenulata*	Thi-ha-ya zar	Small tree
13.			*Adenanthera pavonina* L.	Ywe	Tree

A. *Sonneratia caseolaris*

B. *Avicennia marina*

C. *Rhizophora apiculata*

D. *Avicennia alba*

E. *Bruguiera cylindrical*

F.*Rhizophora mucronata*

Plate 1(A). Recorded mangrove species from indirect impact area of the project

Plate 1(B).Overview plantation of Indirect and Direct Impact Zone of Project Area

5. FAUNA SURVEY

5.1 Materials and Methods of Fauna Survey

Field studies of the direct impact area and indirect impact area were designated to record vertebrate species, i.e, fishes, amphibians, reptiles, birds and mammals. Fishery information and data were based on survey with the help of local people and fishermen. The larger fishes and herperto fauna such as frogs and toads were recorded third morphological characters and identified urgently with the aids of field guide. Based on interviews, some species those were difficult to catch had been also recorded as information within short duration of study period. Specimen collection dealt with insects, butterflies, dragonflies and damselflies were caught, identified and some had been carried as voucher specimens to identify later. Direct count method was applied to record and identify the different bird species with the aid of binoculars. Collected voucher specimens had been identified and those of the field were arranged and categorized in respective taxon with references.

5.2 Avifauna

An avifaunal survey conducted in April 13-18, 2015 was proposed to

a) Determine the bird species composition found on and in the vicinity of the proposed development site

b) Identify the potential impacts of the proposed development on the avifauna.

Birds were identified and enumerated according to the Fixed Radius Point Count Census Method which is based on the principle of counting individuals from a defined location and estimating the distance to the individual contact. A point was selected from where all bird contacts (seen and heard) were recorded, and the distance estimated (< 25m or > 25m) for each contact. The procedure was repeated three times for every 10 min (Bibby *et al.*, 1998), before moving to another location within a 100m radius. Avifaunal species observed between point counts were also recorded.

Avifauna identified was ranked according to the following criteria:

DAFOR Scale: D= 9-10; A= 7-8; F= 4-6; O=2-3; R=1

D = dominant, A = abundant, F = frequent, O = occasional, R = rare

Economic Scale Value – this value was based on five components: Status, DAFOR, IUCN rating

Advantages of this method include:

- Ease of observation of the birds and their habitats from a stationary position
- More time available to identify contacts
- Greater opportunity to identify cryptic and skulking species
- Easier to relate bird occurrence to habitat features

This method was used and a total of six (6) points done over a one day period (morning), following the parochial road, as well as along other paths within the area. Notation of species observed between surveys points formed the basis of transects counts for the area.

5.3 Other Fauna

Other animal groups examined on the direct and indirect impacts area were insects, fishes, amphibians, reptiles and small mammals being the most obvious groups observed on the site. Surveys to identify the presence or absence of these groups of animals were conducted through the use of stationary observation sites and walking transects on the property for general identification and utilizing the point count method. Recorded fish species have been studied with the help of fishermen at the aquatic environment closer up to the project area.

The **DAFOR** scale is an internationally recognized abundance scale for counting wildlife and other populations. It evaluates populations either quantitatively or qualitatively by dividing observations according to whether the population item is Dense, Abundant, Frequent, Occasional or Rare in numbers - www.earthdive.com.

5.4 Results and Findings of Fauna

5.4.1 Insect fauna

A total of (49) species of insects including butterflies, dragonflies, damselflies represented with (13) families under the order Lepidoptera and Odonata were collected and identified (Table 3 and 4). Although no endemic or endangered species were recorded the collected species and population size was moderate in the study area.

Table 3. List of dragonfly (order- Odonata) from Zegami Tin Mine Project area

No.	Family	Scientific Name	Common name	Status
1.	Gomphidae	*Ictinogomphous rapax* (Male)	Common club tail	common
2.	Aeshnidae	*Anaciaeschnajaspidea*	Rusty darner	uncommon
3.		*Hemianax epiphiger*	Vagrant darner	common
4.	Libellurdae	*Acisoma panorpoides* (Female)	Trumpet tail	common
5.		*Brachydiplax sobrina*	Marsh hawk.	common
6.		*Brachythemis contaminate* (Male)	Little blue marsh hawks	Locally common
7.		*Crocothemis servilia* (Male)	Ditch jewel	common
8.		*Crocothemis servilia* (Female)	Ruddy marsh skimmer	common
9.		*Diplacodes trivialis* (Male)	Ground skimmer	very common

No.	Family	Scientific Name	Common name	Status
10.		*Diplacodes trivialis* (Female)	Ground skimmer	very common
11.		*Neuurothemis fluvia* (Male)	Fulvous forest skimmer	locally common
12.		*Neurothemis intermedia* (Female)	Ruddy meadow skimmer	locally common
13.		*Neurothemis tullia* (male)	Pied paddy skimmer	locally common
14.		*Neurothemis tullia* (Female)	Pied paddy skimmer	locally common
15.	Cordulegastridae	*Orthetrum pruinosum* (Male)	Crimson – tailed marsh havk	common
16.		*Orthetrum sabina* (Male)	Green marsh hawk	very common
17.		*Orthetrum sabina* (Female)		common
18.		*Potamarcha congener* (Male)	Yellow-tailed ashy skimmer	common
19.		*Rhodothemis rufa* (Male)	Rufous marsh glider	uncommon
20.		*Tramea Limbata* (Female)	Black marsh trotter	locally common

Ictinogomphaus rapax

Anaciaeschna jaspidea

Hemianax epiphiger

Acisoma panarpoides

Brachydiplax sobrina

Brachythemis contaminata

Crocothemis servilia (male)

Crocothemis servilia (female)

Diplocodes trivialis (male)

Diplocodes trivialis (female)

Neurothemis fulvia (male)

Neurothemis intermedia (female)

Neurothemis tullia (male)

Neurothemis tullia (female)

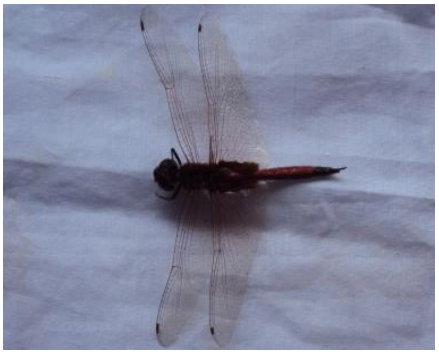
Ortherum pruinosums (female)

Ortherum sabina (male)

Ortherum sabina (female)

Potamarcha congener (male)

Rhodothemis rufa (male)



Tramea limbata (female)

Plate 2. Dragonfly species recorded from Zekami Tin Mine Project area

Table 4. List of Damselfly (Order Odonata) recorded from Zegami Tin Mine Project area

No.	Family	Scientific Name	Common name	Status
1..	Coenagrionidae	*Agriocnemis pygmaea*	Pigmy dartlcy	very common
2.		*Ceragrion auranticum*	Orange morsh dart	very common
3.		*Ceragrion coramandeliamum*	Coromandel marsh dart	very common
4.		*Enallagma parvum*	Azure dartlet	uncommon
5.		*Ischnura aurora*		common
6.		*Ischnura senegalensis*	Senegal golden dartley	Locally common
7.	Lestidae	*Lestes clatus*	Emcrald spread wing	uncommon
8.	Protoneuridae	*Caconeura ramburi*	Coorg bamboo tail	uncommon

Agriocnemispygmaea	*Ceragrionaurantcum*
Cerriagrioncoromandeliamum	*Enallagmaparvum*
Ischnura aurora	*Ischnurasenegalensis*
Lestesclatus	*Caconeuraramburi*

Plate 3. Damselflies species recorded from Zegami Tin Mine Project area

Table.5 List of recorded Butterfly species (order Lepidoptera) from Zegami Tin Mine Project area

No.	Family	Scientific Name	Status
1.	Papilionidae	*Papilio polytes romulus*	VC
2.		*Pachliopta doubledayi*	RC
3.	Pieridae	*Catopsilia Scylla*	C
4.		*Appias lyncisa*	C
5.		*Leptosia nma*	C
6.		*Delias hyparete*	C
7.		*Eurema hecabe*	C
8.		*Hebomoia gloucippe*	C
9.	Nymphalidae	*Junonia almanac*	C
10.		*Junonia atlites*	C
11.		*Neptis Sappho*	UC
12.		*Tanaecia flora*	UC
13.	Satyridae	*Elymnias hypermnestra*	C
14.		*Mycalesis sangaica*	C
15.		*Ypthima Philomela*	UC
16.	Danidae	*Euploea godarta*	C
17.		*Danaus chrysippus*	C
18.		*Parantica aglcoides*	C
19.		*Acraea terpsicore*	C
20.		*Amathusia phidippus*	C
21.	Lycaenidae	*Castalius rosimon*	C

Common (C), Very Common (VC), Uncommon (UC), Rare (R)

(Upperside)

(Underside)

A. *Papilio polytes*

(Upperside)

(Underside)

(B) *Pachliopta doubledayi*

(Upperside)

(Underside)

E. *Appias lyncida*

(Upperside)

(Underside)

F. *Leptosia nina*

(Upperside)

(Underside)

H. *Eurema hecabe*

(Upperside) (Underside)

E. *Neptis sappho*

(Upperside) (Underside)

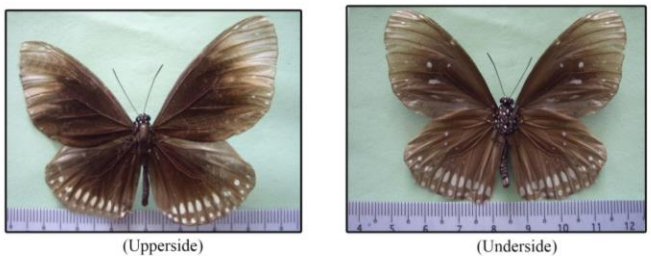
F. *Tanaecia flora*

(Upperside) (Underside)

L. *Mycalesis sangaica*

(Upperside) (Underside)

M. *Ypthima philomela*



(Upperside) (Underside)

N. *Euploea godarti*

(Upperside) (Underside)

Q. *Danaus chrysippus*

(Upperside) (Underside)

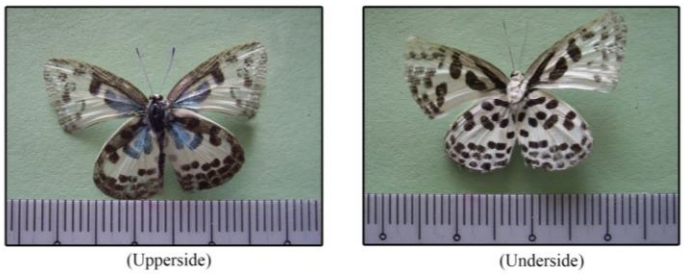
R. *Parantica agleoides*

(Upperside) (Underside)

S. *Acraea terpsicore*

(Upperside) (Underside)

T. *Amathusia phidippus*



(Upperside) (Underside)

A. *Castalius rosimon*

Plate 4. Butterfly species recorded from Zekami Tin Mine Project area

5.4.2 Fishes

Local fishermen near from this project helped for the collection of fish specimens. Total of freshwater (40) fish species included in (22) families under (7) order and those of marine (73) fish species included in (42) families under (22) order were recorded (Table 6 and 7) during study period.

Some larger species could be taken photo and identified in the field survey at fish landing site of Anyin creek where is brackish and marine upto the tide and other small species were collected as specimen voucher and identified later at office of Zegami Tin Mine Project.

Table 6. List of recorded freshwaterfish Species from Zegami Tin Mine Project area

No.	Order	Family	Scientific Name	Common Name	Vernacular Name
1	Osteoglossiformes	Notopteridae	*Notopterus notopterus*	Grey feather back	Nga-phe
2	Annguilliformes	Anguillidae	*Anguilla bicolor*		Nga-Kyauk-pha
3	Cypriniformes	Cyprinidae	*Catla catla*		
4			*Cirrhinus cirrhosis*		
5			*Cirrhinus mrigala*	Mrigal	Nga-gyin
6			*Ctenopharyngodon idellus*		
7			*Cyprinus carpio*		Shwe-war-nga-gyin
8			*Labeo calbasu*		
9			*Labeo rohita*		
10			*Osteobrama alfredianus*		
11			*Osteobrama cotio*		
12		Anabantidae	*Anabas testudineus*	Climbing perch	Nga-byay-ma
13		Belontiidae	*Trichogaster pectoralis*		Gorami-Nga
14		Channidae	*Channa striata*		Nga-yant
15			*Channa punctatus*		Nga-pa-naw

No.	Order	Family	Scientific Name	Common Name	Vernacular Name
16		Mastacembelidae	*Mastocembelus armatus*		Nga-mway-naga
17			*Mastacembelus unicolor*		
18	Perciformes	Mugilidae	*Mugil cephalus*		
19	Cyprinodontiformes	Belonidae	*Xenentadon cancila*	Gar fish	Nga-phaung-yoe
20	Synvranchiformes	Synbranchidae	*Monopterus albus*		
21.			*Puntius sarana*		Nga-khone-ma
22.			*Puntius ticto*		Nga-khone-ma
23.			*Hypophthaimichttys molitrix*		
24.			*Amblyphanyngodon mola*	Mola carplet	Nga-bei-phyu
25.			*Lepidocephalus berdmorei*	Loach	Nga-tha-lae-doe
26.		Bagridae	*Mystus gulio*		
27.			*Mystus vittatus*	Cat fish	Nga-zin-yine
28.			*Rita sacerdotum*		
29.		Siluridae	*Ompok bimaculatus*	Butter catfish	Nga-nu-than
30.			*Wallago attu*	Freshwater shark	Nga-but
31.		Schilbeidae	*Neotropius acutirostis*		Nga-than-jate
32.		Pangasidae	*Pangasius pangasius*		
33.		Susirudae	*Bagarius bagarius*		
34.		Clarridae	*Clarias batrachus*	Walking catfish	Nga-khu
35.		Heteropneustidae	*Heteropneustes fossilis*	Stinging catfish	Nga-gyee
36.	Perciformes	Centropomidae	*Lates calcarifer*		
37.		Sciaenidae	*Johnius bomcensis*		
38.		Cichilidae	*Orechromis niloticus*		
39.		Gobiidae	*Glossogobius giuris*	Tank goby	Kathapoo

No.	Order	Family	Scientific Name	Common Name	Vernacular Name
40.		Gobioididae	*Odontamblyopus rubicundus*		

Notopterus notopterus

Anabas testudineus

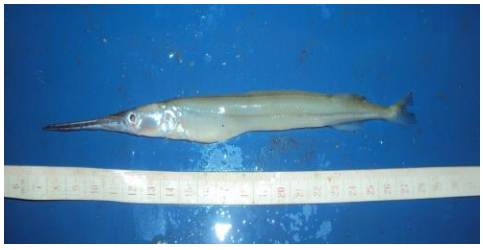
Trichogaster pectoralis

Channa striata

Channa punctatus

Mastocembelus armatus

Mastacembelus unicolor



Xenentadon cancila

Monopterus albus

Puntius sarana

Amblyphanyngodon mola

Lepidocephalus berdmorei

Mystus gulio

Rita sacerdotum

Ompok bimaculatus

Wallago attu

Neotropius acutirostis

Heteropneustes fossilis

Clarias batrachus

Plate 5. Freshwater fish species recorded from Project area

Table 7. List of recorded fish Species of marine and brackish water fish from Zegami Tin MineProject area

No	Order	Family	Scientific Name	Common Name	Vernacular Name
1.	Auguilliformes	Muracenesocidae	*Congresonx talabonoides*	En-Indian pike conger	Nga-Shwe
2.	Clupeiformes	Engraulidae	*Coilia borneensis*	En-Gold spotted grenader anchovy	Mee-Tan-thew
3.			*Stolephorus indicus*	En-Indian anchovy	Nga-ni-tu
4.		Chiroccentridoe	*Chirocentrus dorab*	En-Dorab walf-herring	Nga-da-lwe
5.			*Chirocentrus nudus*	En-white fin wolf-herring	Nga-da-lwe
6.		Clupcidae	*Tenualosa ilisha*	En-Hilsa shad	Nga-tha-lauk
7.			*Ilisha elongate*	En-Elongate ilisha	Nga-zin-bya
8.			*Sardinella gibbosa*	En-Gold stripe sardinella	Nga-kone-nyo
9.	Siluriformes	Arridae	*Arius maculatus*	En-Spotted catfish	Nga-yaung
10.	Aulopiformes	Synodontidae	*Saurda undosquamis*	En-Brush tooth lizard fish	Nga-Pulway
11.	Scorpaceniformes	Platycephalidae	*Cociella crosodila*	En-Crocodile flatheod	Nga-sin-nin
12.	Perciformes	Synodontidae	*Harpadon neterew*	En-Bombay duck	Nga-hnut

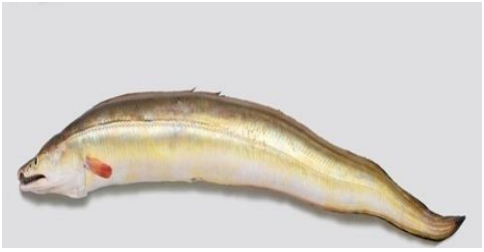
No	Order	Family	Scientific Name	Common Name	Vernacular Name
13.		Serranidae	*Epinephelus areolatus*	En-Arcolate grouper	Kyaut-nga
14.			*Epinephelus*		Kyauk-nga
15.		Sillaginidae	*Sillago sihama*	En-silver sillago	Nga-pul way
16.		Rachycentridae	*Rachycentron canadum*	En-Cobia	Pin-lei-nga-yant
17.		Carangidae	*Carangadies malabaricus*	En-Malobar trevally	Waing-phyu-gyi
18.			*Medalaspis cordyla*	En-Torpeda sead	Pyi-daw-tha
19.			*Scomberoides tala*	En-Barred queenfish	Let-wa
20.			*Scomberoides Lyson*	En-Double spotted queenfish	Let-wa
21.	Perciformes	Carangidae	*Selaroides leptolepis*	En-Yellow stripe scad	Myet-san-kyi
22.			*Serionlina nigrofasciata*	En-Black bandend Travelly	Nga-htaw-bat
23.			*Decapterus macrostoma*	En-Short fin scad	Pann-Zin
24.			*Carangoide scoeruleopinnatus*	En-Blue trevally	Zar-gyan
25.			*Carangoides hedlandensis*	Buumpnose trevally	Zar-gyan
26.			*Gnathanodon speciasus*	En-Golden trevally	Ka-la-ngu
27.			*Elagatis bipinnulata*	En-Rainbow-	Nga-thet-thant

No	Order	Family	Scientific Name	Common Name	Vernacular Name
				runner	
28.			*Caranx ignobilis*	En-Giant trevally	Zar-gyan
29.		Leioganthidae	*Leiognathus equulus*	En-Common pony-fish	Nga-dinn-gar/ Nga-waing
30.			*Leiognathus splendens*	En-Splendid pony	Nga-dinn-gar/ Nga-waing
31.		Lutijanidae	*Lutijanus Lutjanus*	En-Big-eye snapper	Nga-ba-yin
32.			*Lutijanus johnii*	En-common blue stipe snapper	Nga-pa-ni
33.			*Lutijanus vita*	En-Whipfin Brown stipe snapper	Nga-pa-ni
34.		Gerreidae	*Gerres filamentosus*	En-Whipfin silver biddy	Nga-si-ooe
35.			*Pentaprion longimanus*	En-long fin silver biddy	Nga-bae-phyu
36.		Lethrinidae	*Lethrinus lentjan*	En- Pink ear empesor	Nga-wet-sut
37.		Sparidae	*Argyrops spinifer*	En-King soldier bream	Nga-war-nga
38.		Polynemidae	*Eleutheronema tetradactulum*	En-four finger threadfin	Za-yaw-gyi
39.			*Polynemus*	En- stripd	Za-yaw

No	Order	Family	Scientific Name	Common Name	Vernacular Name
			plebeius	thread fin	
40.			*Polynemus indicus*	En-India thread fin	Ka-ku-yan
41.		Sciaenidae	*Chrysochir aurcus*	En-Reever's	Thin-war
				crooker	
42.			*Johnius dussumieri*	En-Bearded croaler	Nga-poke-thin
43.			*Panna microdon*	En-Panna croaker	Nat-ka-daw
44.			*Protonibea diacanthus*	En-Spotted croaker	Ka-tha-myin
45.		Sciaenidae	*Pennahia macrophthalmus*	En-Big head pennah croaker	Gaung-pwa
46.			*Otholithoides biauritus*	En-Bronze croaker	Nat-ka-daw-gyi
47.	Perciformes	Mullidae	*Upeneus sulphureus*	En-Striped goat fish	Kyo-war
48.		Drepanidae	*Drepane punctate*	En-Spotted sickle fish	Nga-pa-lai
49.		Teraponidae	*Terapon theraps*	En-large scaled terapon	Gone-kyarr
50.		Siganidae	*Siganus javus*	En-streaking spine foot	Nga-yan-shar/ Nga-su-than
51.		Sphyraenidae	*Sphyraena jella*	En-Pick handle barracuda	Nga-mwe-doe
52.		Trichiuridae	*Tentoriceps*	En-Crested	Nga-da-gon

No	Order	Family	Scientific Name	Common Name	Vernacular Name
			cristatus	hair tail	
53.			*Rastrelliger brachysoma*	En-Short mackerel	Pa-la-tu
54.			*Rastrelliger faughni*	En-Island mackerel	Pa-La-lan
55.			*Rastrelliger kanagurta*	En-Indian mackerel	Pe-lo-tu
56.		Scombridae	*Scomberomorus commerson*	En-Narrow-barred spanish mackerel	Bee-zin
57.			*Scomberomorus guttatus*	En-Indo-pacific king mackerel	Nga-kun-shut
58.			*Euthynnus affinis*	En-Kawakawa	Nga-mae-lone
59.		Stromateidoe	*Pampus argenteus*	En-Silver pomfret	Nga-moke phyu
60.			*Pampus chinensis*	En-Chinese silver pomfret	Nga-moke phyu
61.	Pleuronectiformes	Psettodidae	*Psettodes crumei*	En-Indian halibut	Shar-gyi
62.	Pleuronectiformes	Cynoglossidae	*Cynoglassus lingua*	En-Long tongue sole	Shar-lay
63.	Tetraodoniformes	Balistidae	*Abalistes stellatus*	En-starry trigger fish	Nga-than
64.		Monacantnidoe	*Aluterus monoceros*	En-Unicorn leather jacket	Nga-hlwar par
65.	Perciformes	Ephippidae	*Ephippus orbis*	En-spade	Sin-na-pu

No	Order	Family	Scientific Name	Common Name	Vernacular Name
				fish	
66.		Kurtidae	*Kurtus indicus*	Nursery fish	Nga-phauk-lauk
67.		Lactariidae	*Lactarius lactarius*	En-False trevally	Nga-tee
68.		Lobotidae	*Lobotes surinamensis*	En-Tripletail	Pin-lei-nga-pyay-ma
69.		Pomadosyidae	*Pomadasyi maculatum*	En-saddle grunt	Nga-gon
70.		Scaridae	*Scarus ghobban*	En-yellow scale parrot fish	Kyet-tu-yway-nga
71.		Scatophagidae	*Scatophagus argus*	En-Spotted scat	Nga-khet
72.		Ephippidae	*Ephippus orbis*	En-Spade fish	Sin-na-pu
73.		Pomadsyidae	*Pomadasys argyreus*	En-Bluecheek silver grunter	Nga-gon



Congresox talabonoides

Coilia borneensis

Chirocentrus nudus

Tenualosa ilisha

Ilisha elongata

Sardinella gibbosa

Arius maculatus

Cociella crocodile

Harpadonnehereus

Epilephelus

Epilephelus

Leiognathus equulus

Leiognathus splendens

Lutjanus lutjanus

Lutjanus johnii

Lutjanus vitta

Carangoides malabaricus

Scomberoides tala

Decapterus macrostoma

Carangoides coeruleopinnatus

Carangoides hedlandensis

Lethrinus lentjan

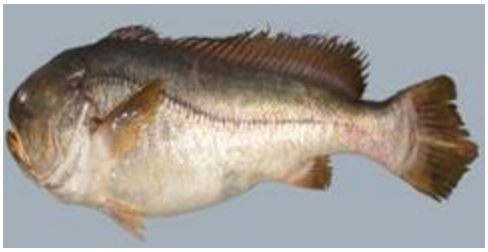
Polydactylus plebeius

Chrysochir aureus

Johnius cf. *dussumieri*

Pennahia macrophthalmus

Otholithoides pama



Otholithoides biauritus

Upeneus sulphurous

Sphyraena jello

Tentoriceps cristatus

Rastrelliger brachysoma

Rastrelliger faughni

Rastrelliger kanagurta

Scomberomorus commerson (juvenile)

Scomberomorus guttatus

Abalistes stellatus

Cynoglossus lingua

Ephippus orbis

Pomadasys argyreus

Scatophagus argus

Plate 6. Marine and brakish water fish species from Anyin Creek

5.4.3 Herpto fauna

A total of (18) species of amphibians and reptiles under (10) families of were recorded and reported (Table. 8). Because of present occurrence within the limited study period, the species and population number is few in project sites. Up to conservation status of IUCN and CITES, all of these species are not serious for extinction.

Table 8. List of recorded Herpto fauna from Zegami Tin Mine Project area

Family	Scientific Name	Common Name	Vernacular Name	Habitat
Bufonidae	*Duttaphrynus melanostictus*	Asian common toad	Phar-pyok	Near pond
	Ingerophrynus macrotis	Large ear toad	Hpar pyok thay	ground
Microhylidae	*Kaloula pulchra*	Banded bull frog	Phar-kyaung	ground
	Microhyla ornate	Ornate narrow mouthed frog	Thé-phar	Near pond
Dicroglossidae	*Fejervarya limnocharis*	Paddy frog	Sar-phar	paddy field
	Hoplobatrachus tigerina	Indian bullfrog	Kaing phar	Mud
	Occidozyga martenii	Round-tongued floating frog		Lowland forest, swamps
	Occidozyga lima	Green puddle frog	Phar -han-lat	Marshes
Rhacophoridae	*Polypedates leucomystax*	Common tree frog	Phar-pyan	tree
Ranidae	*Hylarana erythraea*	Green paddy frog		Paddy feild
Gekkonidae	*Hemidactylus frenatus*	Common house gecko	Eing-myaung	bushes
Agamidae	*Calotes versicolor*	Garden fence lizard	Taut-tat	trunk
	Calotes mystaceus	Blue crested lizard	Poat thin nyo	trunk
Scincidae	*Mabuya multifasciata*	Common sun skink	Kyal-pyar-kinlate-shaw	Storage house
Colubridae	*Xenochrophis piscator*	Chequered keel back	Yal-mwaypyauk-Ma	water
	Ptyas mucosus	Banded rat snake	Lin-mway	field

Elapidae	*Hydrophis caerulescens*	Dwarf sea snake		Marine, brackish water
	Laticauda colubrine	banded sea krait		Marine, brackish water

A. *Duttaphrynus melanostictus*

B. *Hoplobatrachus tigerina*

C. *Kaloulapulchra*

D. *Fejervarya limnocharis*

E. *Polypedates Leucomystax*

F. *Hylarana erythraea*

G. *Occidozyga martenii*

H. *Calotes versicolor*

I. *Ptyas mucosus*

J. *Laticauda colubrina*

Plate 7. Herpto fauna recorded from Project area

5.4.4 Bird species

A total of terrestrial birds of (19) families representing (41) species were identified in direct and indirect impact area of the project sites (Table. 9). Aquatic birds of (6) with (11) species occurring at paddy field nearby and Anyin creek were also described (Table. 10). Their population abundance suh as dominant, abundance, frequent, occasional or rare status was also analysed with DAFOR scale in this work. Although no more tree and just paddy field were present in this area, mangroves support the richness of bird species for their foraging, roosting and nesting habitats. Only one species of aquatic bird *Leptoplilus javanica* (lesser adjunt) was vulnerable (VU) and others were least concern (LC) up to International Union of Conservation Nature (IUCN) red list (Table 9 and 10).

Table.9 List of recorded Bird species from Zegami Tin Mine Project Area

No.	Order name	Family name	Common name	Scientific name	Status				
					D	A	F	O	R
1	Galliformes	Phasianidae	Red Jungle fowl	*Gallus gallus*			*		
2	Falconiformes	Falconidae	Black Kite	*Milvus migrans*			*		
			Brahminy Kite	*Haliastur indus*			*		
			Crested Serpent-Eagle	*Spilornis cheela*				*	
			Shikra	*Accipiter badius*			*		
			Chinese Sparrowhawk	*Accipiter soloensis*			*		
			Eurasian Sparrowhawk	*Accipiter nisus*			*		
3	Columbiformes	Columbidae	Rock Pigeon	*Columba livia*			*		
			Spotted Dove	*Streptopelia chinensis*			*		
			Pink-Necked Green-Pigeon	*Treron vernans*				*	
			Orange-Brasted Green-Pigeon	*Treron bicincta*					
4	Psittaciformes	Psittacidae	Red-Breasted Parakeet	*Psittacula alexandri*			*		
5	Cuculiformes	Cuculidae	Chestnut-Winged Cuckoo	*Clamator coromandus*		*	*		
			Drongo Cuckoo	*Surniculus lugubris*			*		
			Asian Koel	*Eudynamys scolopaeus*			*		
			Green-Billed Malkoha	*Rhopodytes tristis*				*	
			Greater Coucal	*Centropus sinensis*					
6	Strigiformes	Strigidae	Oriental Scops-Owl	*Otus sunia*				*	

No.	Order name	Family name	Common name	Scientific name	Status				
					D	A	F	O	R
7	Apodiformes	Apodidae	Black-Nest Swiftlet	*Aerodramus maximus*			*		
			Edible-Nest Swiftlet	*Aerodramus fuciphaga*			*		
8	Coraciiformes	Alcedinidae	White-Throated Kingfisher	*Halcyon smyrnensis*			*		
			Black-Capped Kingfisher	*Halcyon pileata*			*		
			Common Kingfisher	*Alcedo atthis*				*	
		Coraciidae	Indian Roller	*Coracias benghalensis*			*		
		Meropidae	Chestnut-Headed Bee-Eater	*Merops leschenaulti*			*		
9	Piciformes	Ramphastidae	Lineated Barbet	*Megalaima lineata*	*				
		Picidae	Rufous Woodpecker	*Micropternus brachyurus*			*		
10	Passeriformes	Oriolidae	Black-Naped Oriole	*Oiolus chinensis*			*		
		Monarchidae	Black-Naped Monarch	*Hypothymis azurea*			*		
		Dicruridae	Black Drongo	*Dicrurus macrocercus*		*			
			Ashy Drongo	*Dicrurus leucophaeus*		*			
			Greater Racket-Tailed Drongo	*Dicrurus paradiseus*		*			
		Corvidae	House Crow	*Corvus splendens*			*		
			Racket-Tailed Treepie	*Crypsirina temia*			*		
		Aegithinidae	Common Iora	*Aegithina tiphia*				*	
		Laniidae	Brown Shrike	*Lanius cristatus*			*		
			Grey-Backed Shrike	*Lanius tephronotus*			*		

No.	Order name	Family name	Common name	Scientific name	Status				
					D	A	F	O	R
		Nectariniidae	Van Hasselt's Sunbird	*Leptocoma brasiliana*		*			
			Purple Sunbird	*Cinnyris asiaticus*		*			
			Olive-Backed Sunbird	*Cinnyris jugularis*		*			
			Ruby-Cheeked Sunbird	*Chalcoparia singalensis*		*			

Table.10 List of Recorded water birds species Zeka Tin Mine Project Area

No.	Order name	Family name	Common name	Scientific name	Status				
					D	A	F	O	R
1	Anseriformes	Anatidae	Lesser Whistling-Duck	*Dendrocygna javanica*		*			
2	Ciconiiformes	Ciconiidae	Lesser Adjutant	*Leptoptilos javanica*					*
3	Suliformes	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*			*		
4	Pelecaniformes	Ardeidae	Chinese Pond-Heron	*Ardeola bacchus*			*		
			Eastern Cattle Egret	*Bubulcus coromandus*			*		
			Great Egret	*Ardea alba*			*		
			Intermediate Egret	*Mesophoyx intermedia*			*		
			Little Egret	*Egretta garzetta*			*		
5	Charadriiformes	Vanellidae	Red-Wattle Lapwing	*Vanellus indicus*		*			
		Scolopacidae	Common Sandpiper	*Actitis hypoleucos*			*		
			Common Redshank	*Tringa totanus*			*		

Milvus migrans

Haliastur Indus

Spilornis cheela

Acipiter badius

Accipiter soloensis

Accipiter nisus

Columba livia

Streptopelia chinensis

Treron vernans

Psittacula alexandri

Treron bicincta

Clamator coromandus

Surniculus lugubris

Eudynamys scolopaeus

Rhopodytes tristis

Centropus sinensis

Otus sunia

Aerodramus maximus

Halcyon smyrnensis

Halcyon pileata

Alcedo atthis

Coracias benghalensis

Merops leschenaulti

Megalaima lineata

Micropternus brachyurus

Oiolus chinensis

Hypothymis azurea

Dicrurus leucophaeus

Corvus splendens

Aegithina tiphia

Lanius tephronotus

Leptocoma brasiliana

Dicrurus macrocercus

Dicrurus paradiseus

Crypsirina temia

Lanius cristatus

Cinnyris asiaticus

Cinnyris jugularis

Chalcoparia singalensis

Dicaeum trigonstigma

Dicaeum minullum

Dicaeum cruentatum

Passer montanus

Anthus rufulus

Acridotheres fuscus

Aplonis panayensis

Acridotheres tristis

Gracula religiosa

Gracupica contra

Copsychus saularis

Copsychus malabaricus

Ficedula albicilla

Muscicapa dauurica

Muscicapa williamsoni

Pycnonotus finlaysoni

Hirundo rustica

Pycnonotus goiavier

Phylloscopus fuscatus

Orthotomus sutorius

Plate 8(A). Terrestrial bird species recorded from Zekami Tin Mine Project area

Dendrocygna javanica

Leptoptilos javanica

Phalacrocorax niger

Ardeola bacchus

Bubulcus coromandus

Ardea alba

Mesophoyx intermedia

Egretta garzetta

Vanellus indicus

Actitis hypoleucos

Tringatetanus

Plate 8(B). Aquatic Bird species recorded from Zekami Tin Mine Project area

5.4.5. Mammals

A total of (19) mammals species under (12) families ; mouse, rat, mongoose, shrew, fruit bat and squirrel ,etc were recorded as information and they could not identified because of interview survey of local people and strong evidences of hunters during limited study period.

Table 11. List of recroded mammal species from Zegami Tin Mine Project area

Order	No.	Family	No.	Scientific name	Common name	IUCN status
SCANDENTIA	1	Tupaiidae	1	*Tupaia belangeri*	Northern Treeshew	LC
PRIMATES	2	Corcopithecidae	2	*Macaca fascicularis*	Long-tailed Macaque	LC
PHOLIDOTA	**3**	**Manidae**	**3**	***Manis javanica***	**Sunda Pangolin**	**CR**
RODENTIA	**4**	**Sciuridae**	**4**	***Ratufa bicolor***	**Black Giant Squirrel**	**NT**
			5	*Callosciurus erythraeus*	Pallas's Squirrel	LC
			6	*Tamiops swinhoei*	Swinhoe's Striped Squirrel	LC
			7	*Petaurista philippensis*	Indian Giant flying Squirrel	LC
	5	Hystricidae	8	*Hystrix brachyura*	Malayan Porcupine	LC
CARNIVORA	6	Mustelidae	9	*Melogale personata*	Large-toothed Ferret Badger	DD
			10	*Aonyx cinerea*	Oriental Small-clawed Otter	VU
	7	Viverridae	11	*Viverricula indica*	Small Indian Civet	LC
			12	*Paradoxurus hermaphroditus*	Common Palm Civet	LC
	8	Felidae	13	*Prionailurus bengalensis*	Leopard Cat	LC
			14	*Neofelis nebulosa*	Clouded Leopard	VU
ARTIODACTYLA	9	Tragulidae	15	*Tragulus napu*	Greater Oriental Chevrotain	LC
			16	*Tragulus kanchil*	Lesser Oriental Chevrotain	LC
	10	Cervidae	17	*Muntiacus muntjak*	Red Muntjac	LC
CHIROPTERA	11	Pteropodidae	18	*Cynopterus sphinx*	Short-nosed Fruit bat	LC
	12	Rhinolophidae	19	*Rhinolophus pusillus*	Least Horeshoe bat	LC

6. Impacts and Mitigation on Biodiversity of Zegami Tin Mine

Direct and indirect impact areas of the Zegami Tin Mine project will be facing with disturbance that may be more or less for the sustainability of diversity and population status of flora (vegetation) and fauna (animals). Mining affect the environment and associated biota through the removal of vegetation and top soil, the displacement of fauna, the release of pollutants, and the generation of noise.

6.1 Habitat loss

Wildlife species live in communities that depend on each other. Survival of these species can depend on soil conditions, local climate, altitude, and other features of the local habitat. Zakami tin mine may cause direct and indirect damage to wildlife. The impacts may be from disturbing, removing, and redistributing the land surface. Some impacts are short-term and confined to the mine site; others may have far-reaching, long-term effects.The most direct effect on wildlife is destruction or displacement of species in areas of excavation and piling of mine wastes. Mobile wildlife species, like game animals, birds, and predators, leave these areas. More sedentary animals, like invertebrates, many reptiles, burrowing rodents, and small mammals, may be more severely affected. If mine wastes and tailing containing chemicals or marshes are filled or drained, fish, aquatic invertebrates, and amphibians are severely impacted. Food supplies for predators are reduced by the disappearance of these land and water species. Many wildlife species are highly dependent on vegetation growing in natural drainages. This vegetation provides essential food, nesting sites, and cover for escape from predators and also habitat for birds, and many terrestrial species .The habitat requirements of many animal species do not permit them to adjust to changes created by land disturbance. Surface mining can degrade aquatic habitats with impacts felt many miles from a mining site.

6.2 Impacts to aesthetic resources

Mining activities can cause direct and indirect impacts to cultural resources. Direct impacts can result from construction and other mining activities. Indirect impacts can result from soil erosion and increased accessibility to current or proposed mining sites. Potential impacts include:

- Complete destruction of the resource through surface disturbance or excavation;
- Degradation or destruction, due to topographic or hydrological pattern changes or from soil movement (removal, erosion, sedimentation); and
- Visual impacts due to clearing of vegetation, large excavations, dust, and the presence of large-scale equipment, and vehicles.

6.3 Impacts on livelihoods

When mining activities are not adequately managed, the result is degraded soils, water, biodiversity, and forest resources, which are critical to the subsistence of local people. When contamination is not controlled, the course of thecontamination is transferred to agriculture and fishing. Proponents of mining projects must insure that the basic rights of affected individuals and communities. These include rights to control and useland, the right to clean water, and the right to livelihood. Such rights may be enshrined in national law, based on and expressed through arange of international human rights instrumentsand agreements. Bebbington, A., & Williams, M. (2008)

6.4 Impacts on Flora

Mangrove forest along Anyin creek, and sparsely growing primary forest and close forest those were small tree cover direct and indirect impact areas of the project. Since the project area has already cleaned old mine and clearance for vegetation, little impact for insect diversity especially butterflies and moth, those are inhabited in paddy field and plain of grass land. Small mangroves those inhabited at the northern side and south western side of the projects should be conserved for sustainable because those support the organic debris for feeding and breeding of small fishes and certain crustaceans and then those may break the high tide.

No more trees of the indirect impact area may affect negatively the climate condition of this area. Trees absorb atmospheric carbon dioxide causing global warming and used radiant (heat) energy of the sun in their photosynthetic process. Less of trees may reduce carbon consumption and leading to increase the temperature in this project site and its vicinity. Because of extra carbon budget dissolve in near water body the acidity of the river water may also change. Root system of large trees may sustain both water retention and soil erosion. Lacking trees in the direct and

indirect impact area of this project will also erode the top soil layers flowing into Anyin creek and leading to increase sedimentation and deposition into brakish and marine.

6.5 Mitigation of impact on flora

The project would like to propose for conservation and concerning with flora;

- To replant growing tree especially wind break species for sustainable the climate, conserve the top soil layer and habitat of some birds and insect species
- To replant the important species of flora those were cleared from the areas of excavation and piling of mine waste and those may be specific habitat for some species of fauna
- To replant and conserve mangrove and associated species for buffering zone between fresh and salt water and then for feeding and breeding ground of small fishes and some crustaceans
- To conserve urgently ecologically and medicinally important species such as some herbal plants those left in few number of individuals in the project zone

6.6 Impacts on Fauna

Water pollution caused by the anthropogenic effects of inhabitants, noise pollution of trading ship those harbored the jetty and habitat destruction may be concerned and threatened for the species diversity and population abundance of individual species inhabited at the project area and nearby.

There will be only minor impact on some species of insects, butterflies, dragonflies and damsel flies in the project zone because it has been cleaned up. Several impacts will affect negatively the species diversity and population abundance at the proposed area.

- Bushes those are habitats for diversity and abundance of insect species will be cleaned up by the indirect impact zone of the project.
- Noise pollution of the ship harbored to the jetty is main cause to threaten the feeding and breeding habits of recorded fish species of Yangon River. It will also be negative impact for most of other species such as birds those may get stress.

- No more tall trees and changing other habitat types of the project zone may affect relatively the behaviors of birds concerning with mobility, foraging, and courtship and roosting for nesting. This will be seriously for one species, *Leptoptilus javinica* (lesser Adjunt) that is facing with vulnerable (VU) up to IUCN red lists within the project zone.

Human sewage and mine waste discharging from the mine project may flow to Anyin creek and then physio-chemical parameters may be also changed. This situation will improper and unfit for the physiological process of all aquatic organisms including microscopic planktons to all fish species.

6.7 Impacts to fish and aquatic life

If mine waste including acid and poisonous chemical like that heavy metals into Anyin Creek, the impacts to fish, animals and plants can be severe. The types of impacts associated with erosion and sedimentation are numerous, typically producing both short-term and long term impacts on aquatic life. In surface waters, elevated concentrations of particulate matter in the water column can produce both chronic and acute toxic effects in fish "Sediments deposited in layers in flood plains or terrestrial ecosystems can produce many impacts associated with surface waters, ground water, and terrestrial ecosystems. Minerals associated with deposited sediments may depress the pH of surface run off thereby mobilising heavy metals that can infiltrate into the surrounding subsoil or can be carried away to nearby surface waters. The associated impacts could include substantial pH depression or metals loading to surface waters and/or persistent contamination of ground water sources. Contaminated sediments may also lower the pH of soils to the extent that vegetation and suitable habitat are lost and runoff has the potential to increase the rate of erosion and lead to removal of soil from the affected area. Diversity of the fauna mentioned sustainable condition but development of the project zone and anthropogenic factors may alter their natural habitat later.

6.8 Mitigation of Impacts on Fauna

- Noise pollution of project construction and transporting vehicles should be minimized.

- Native species of flora should be replanted for sustainable condition of the climate and habitat for different species of fauna.
- Mangrove forest must be conserved for feeding and breeding ecosystem of some small fishes and crustaceans and buffer zone of tide between salts and freshwater.
- Waste water of inhabitants should be discharged after treatment with settling and / or filtrating.
- Regular monitoring of water quality including heavy metals measurable and physiochemical parameters should be taking care for certain period till after mine closing up.
- Inhabitants and all authorized persons must pay special attention to be conserved for one bird species, *Leptoptilus javanica* (Lesser Adjunt) that was vulnerable (VU) in IUCN red lists.

Discussion and Conclusion for Biodiversity and Biosafety for Zegami Tin Mine

Rain forest and different habitat types of the project site and nearby provide roasting and foraging site of different bird species and coarse woody debris are also resources for ground mammals and reptiles. Some parts of the project and indirect impact area may be a rocky outcropping supplying habitat for ground dwelling fauna and some reptiles.The mangrove between the project area and Anyin creek may also serve as not only corridor of terrestrial and aquatic fauna but also buffering zone for brackish fauna. Although (206) species of flora and (247) species of fauna have been recorded, the direct impact zone of this area is partially fragmented due to clearance of vegetation for construction,excavation and piling mine wastes of the old mine. Total diversity of flora and fauna will be more than this report because the present attempt is on sight and could not find seasonally active species. Conducting with this project, clearance of plantation for construction, driving vehicles for transportation of instruments using in mine, releasing wastes from tailing produced from the project, cutting and using the plantation for fire wood of mine workers, etc may occur in the project area and nearby. Losing habitats and microhabitat will impact negatively to biodiversity of direct and indirect impact areas. The project impact area does not constitute a special living and breeding habitat for the specific species because the land proposed for the project is highly modified and clear up by human activities. Besides negative impacts of tailing containing mine wastes of tin production of project sites, so many factors such as noise pollution, air and water borne pollutants such as acids and heavy metals may also interfere the habitats and the rich of terrestrial and aquatic biodiversity in the indirect impact area closer to mine the project. Seasonal breeding and feeding ground of fish, reproductive behavior and performances of all other animals roosted in the project area and vicinity may be affected by spreading of tailings and producing loud noise that coming from vehicles of field work of tin production.

Habitat fragmentation occurs when large areas of land are broken up into smaller and smaller patches, making dispersal by native species from one patch to another difficult or impossible, and cutting off migratory routes. Isolation may lead to local decline of species, or genetic effects such as inbreeding. Species that require large patches of forest simply disappear.

Existing surface water quality provides detailed information on the location, distribution, quantity, and quality of all water resources that could be affected by this

project and its alternatives. The monitoring of water quality analysis should have a reasonable level of detail, to help understand the conditions of the environmentally significant geographic areas in which some native species those might be influenced by water chemistry. Water chemistry including heavy metals should be measured and standarized regularly for monitoring the aquatic ecosystem that is favorable or not for biological system inhabited all the water bodies of impact areas of the project. Water quality studies should be and compared to water standards and other legal guidelines for each water use.

Mining activities may affect quality of life and the physical, mental, and social well-being of local communities.Indirect effects of mining on public health can include increased incidence of tuberculosis, asthma, chronic bronchitis, and gastrointestinal diseases.

A portion of mine site and closer to the project area have been cultivated for vegetation such as garden and paddy field while some part is currently almost bare ground with scattered re-growth plantation that might be habitat for some insects including butterflies, dragonflies and damselflies so those areaswould not be focused to concentrate for management and re-establishment of natural vegetation of any integrity in Zaykami tin mine.

Sparsely growing of primary rain forestat direct impact zone reveals that the project zone has being already fragile and need to conserve for sustainability. Because of fish species diversity, normal range of their length and weight, small groups of local fishermen, very little or no fishing pressure have been found. Three species of butterfly were uncommon (UC) and other one was rare (R) in the project area and its vicinity (Table 5). Conservation of one aquatic bird, *Leptoptilus javanica* (Lesser Adjunt) should be noticed urgently in this area. Based on interview survey of hunters and local people hunting pressure also affects the conservation status of two mammal species: Sunda pangolin (*Manis javanica*) that is critically endangered (CR) and black giant squirrel (*Ratufa bicolor*) representing nearly threatened (NT) in IUCN red list. Less number of almost all species of plantation has sparsely grown up but the exception of small mangrove forest and paddy field in the proposed area. Reforestation, re-afforestation and conservation of mangrove forest in the mine close plan will be the compensation issue for most of the resident animal fauna, sustainability of the climate and cleaning atmosphere by consuming carbon source.

The stakeholders taking part in Zegami tin mine project should be special care for consideration of mine close plan comprising monitoring of water quality assessment, public health and the animal welfare dealt with the state in which they live with happiness and delight in their real life as wild.

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APPENDIX-F GEOLOGY REPORT

GEOLOGICAL REPORT FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF PROPOSED MAZAM'S ZEGAMI TIN MINE PROJECT LOCATED AT ZEGAMI VILLAGE, KYUNSHU TOWNSHIP, MYEIK DISTRICT, THANINTHARY REGION, THE REPUBLIC OF THE UNION OF MYANMAR

Kyu Kyu Mar, Kyaw Zin Lat

GEOLOGICAL REPORT FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF PROPOSED MAZAM'S ZEGAMI TIN MINE PROJECT LOCATED AT ZEGAMI VILLAGE, KYUNSHU TOWNSHIP, MYEIK DISTRICT, THANINTHARY REGION, THE REPUBLIC OF THE UNION OF MYANMAR

1. INTRODUCTION

1.1 Background

The applicants are in the process of investigation the feasibility of a proposed project by Maszm's Zagami Tin Mine Project located at Zegami Village, Kyunshu Township, Myeik District, Thaninthary Region, The Republic of the Union of Myanmar. The proposed project is defined as tin mine project.

1.2 Terms of reference

OSHE (Occupational Safety, Health and Environmental Services Co., Ltd) has been appointed by the applicant to undertake the Environmental and Social Impact Assessment (ESIA) process for the proposed activity. As part of the Scoping Phase, specialist geological input is required in order to identify potential environmental impacts on the geology within the study area. OSHE has appointed the author to conduct a specialist geological report for the Scoping Phase. The following broad scope of work has been given:

- Carry out a desk study of available information pertaining to the geology and physical aspects of the study area;

- Prepare a brief report which describes the location, physical characteristics and geology of the study area and identifies potential environmental impacts on the geological environment that are likely to be associated with the proposed activity.

1.3 Limitations

Information provided in the specialist report has been based on information provided by the developer, published scientific literature and maps. Besides, the study area was visited to investigate for physical aspects of the study area and for Acid Mine Drainage (AMD) and Contaminant Leaching Potential, Impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities. Some analysis such as XRD, XRF and Heavy Metal Concentration analysis were carried out as a baseline data. There is no detailed geotechnical investigation (trial pits, soil testing) or verification of the existing geological mapping was conducted. This report is discussed the potential environmental impacts on geological environment in study area. The information provided in this report is deemed adequate for the Scoping Phase under Geology Section of the ESIA Report.

2. SITE DESCRIPTION

2.1 Location

The study area is located at Zay Ka Mi Group of Village, Kyun Su Township, Myeik District, Thanintharyi Division and located 1 inch – 1 mile scale, Topographic Map No. 95 L/11 and Map Reference No. 750440. Grid references of the area are as follow. Point A 750440, B 765440, C 765414, D 755414, E 755416, F 750416, G 745420, H 734422, I 750434, J 754430, K 760430, l 760422, L 756422,M 756422, N 758414, O 754415, P 750421, Q 754424.

This area can be travelled from Yagon to Myeik by air, by car and by vessel any time and then around two hour from Myeik to Zay Ka Mi Village by boat or can be reached from Min Than

Village (25 miles) by motorbike to across Thanintharyi river by boat and reach to Maung Law Village and continue to go Zay Ka Mi Village in summer.

2.2 Physiography

Zegami village is situated on the island formed between Thanintharyriver and Anhyinchaung covering about 62 square miles. Generally, all mountain ranges are trending N-S to NW-SE in direction. The highest point in the region is 441 ft (grid ref,754549) and the highest point in our exploration area is 320 ft (grid ref. 754421). Two major ranges are trending parallel forming valley, creek and low flat land. Most of the hills are covered by cashew nut plantation, while low flat land become paddy field. All steams in this area is tidal effected.

2.3 Climate and Vegetation

Thanintharyi region is hot-wet weather and the rainfall can be reach up to 200 inches during raining season from May to October. Temperature is 90 °F in April and the highest temperature is 80°F during cold season. This area is grown natural vegetation such as bamboo and useless trees and around of foreshore, is growing nipa palm.

2.4 Topography

The topographic survey using total station was carried out by survey team from client company. The topographic map is shown in Fig (1).

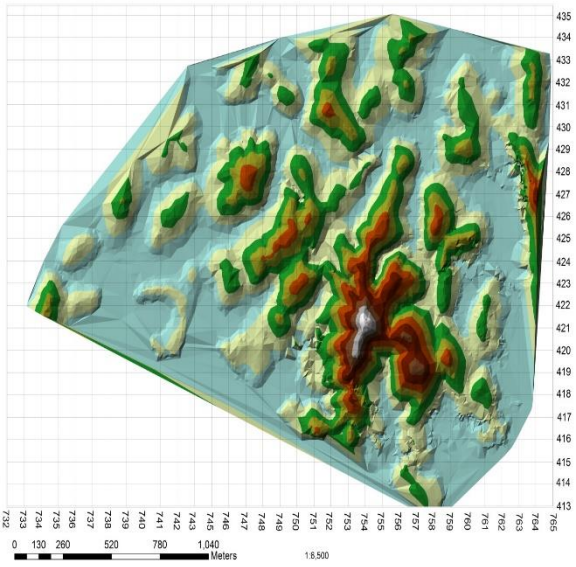

Fig (1) Topographic Map of Proposed Area [1]

2.3 Geology

The regional geology of the proposed area is predominantly covered by Mergui meta-sediments that is argillite, quartzite and schist which are trending N-S, dipping to the east. No intrusion is noted except pegmatite.

The local geology of the proposed area is widely covered by Argillite. Most of the argillite are altered by pegmatite intrusion and change its color into reddish to reddish brown. All these argillite are thinly bedded and quartzite are also highly weathered sometime it may be called quartzotic sandstone. Quartzite is interbeded with micaceous greenschist. From drill hole data thickness of argillite is 50 to 100 ft. For quartzite it is unknown [1].

2.4 Mineralization

Tin is occurred associated with highly weathered, highly decomposed pegmatite. Pegmatite is friable, very soft like sand. Local miners call it sand vein (Thaegyaw) and in some places local people call it white ground vein as the color of decomposed pegmatite is pure white. Most of the

pegmatite occurrences are found under highly weathered or altered argillite and reddish brown color mudstone. In some places, tiny veinlet are noted in weathered argillite zone and tin content is rich in argillite in this situation. Pegmatite contains lepidolite mica at its outer zone and if weathered it turns to red color. This red color is the ore guide for pegmatite exploration. Pitching and swelling of pegmatite ore zone is recognized in both lateral and vertical direction [1].

3. GEOLOGICAL SCOPING ASSESSMENT

The effects of open-pit mining and mineral processing plants on the environment include land degradation, noise, dust, poisonous gases, pollution of water, etc. [2].

The geological environment includes the parent rock and the soil overburden. Important or prominent geological features (geosites) that contribute to the aesthetic scenery of geological interest in the area, such as fossil sites, prominent rock outcrops or features must also be considered in the impact study. Geological features, such as caves, addits, middens, worship rocks, etc. which are important from heritage standpoint are not covered in this report as they are covered in the Heritage Impact Assessment. No prominent geological feature (geosites), such as fossil sites, prominent rock outcrops or features are present according to the previous literatures and there are no other known geo-sites within the study area. Hydrogeological assessments also do not form part of this study.

Mine waste can be defined as part of the materials resulting from the exploration, mining and processing of substances governed by legislation on mines and quarries. They are different types of miner waste materials which vary in their physical and chemical composition, the potential for environmental contamination, and how they are managed at mine site. The environmental impact of mine waster depends on its type and composition, which vary considerably with

commodity being mined, type of ore, and technologies used to process the ore [3]. For instance, where waste rock and tailing contain significant quantities of sulphide minerals and are exposed to air and water, acid mine drainage (AMD) can occur. Much of the mine wastes has high concentration of heavy metals and toxic materials like lead, copper, zinc, aluminum, mercury, marcasite and pyrite (FeS_2), which are harmful for the environment. Specifically, wastes containing pyrite have the potentials of creating dangerous acid mine drainage (AMD). Acid mine drainage and contaminant leaching will be discussed based on the base line data for impacts on water resources. Besides, impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities and mine wastes into surface waters will be discussed.

Besides, mining is widely regarded as having adverse effects on environment of both magnitude and diversity. Some of these effects include erosion, formation of sinkhole, biodiversity loss and contamination of groundwater by chemical from the mining process in general and open-pit mining in particular.

Decreasing water level in the mines due to drainage not only causes undesirable changes in the nearby lakes but it can also threat the aquatics. The main reason of environment pollution of the fresh water is acidic water, draining from mines. Mining operations with degradation of the land largely contribute to the corrosion of soil—a phenomenon that can be seen more in the surface mining activities.

The proposed activity may have certain impacts on the geological environment, and this need to be assessed as an integral part of the broader EIA study.

4. Characterization of Mined Materials

To investigate the mineralogical and chemical properties of mine materials, representative soil samples were mainly collected from the overburden soil (ZGM 1), Ore (ZGM 2), two samples from existing mine tailings of previous mine (ZGM 3 and ZGM 4) and agriculture soil (ZGM 5). The mineralogical and chemical compositions of these samples were investigated by XRD and XRF analyses. XRF analyses were conducted at University of Research Center, University of Mandalay, while XRD analyses were conducted at National Analytical Laboratory, Department of Research and Innovation, Ministry of Education.

4.1 Chemical composition of whole rock analysis

The XRF results showing wt. % of element in the soil samples is presented in Table 1. The results showed that all of the soil samples have high concentration of Si and Al with low concentration of S. However, the As content of ZGM 1 and ZGM 4 samples were 49 mg/kg and 64 mg/kg, respectively, whereas the As was not detected in ZGM 2, ZGM 3 and ZGM 5 samples. According to the results, the As content of ZGM 1 and ZGM 4 samples is higher than the average As concentration of sedimentary rock (around 5-10 mg/kg) [4] [5]. Moreover, high content of Cr was observed in ZGM 1 (167 mg/kg).

The concentrations of toxic elements in ZGM 3 and ZGM 4 were analyzed at Pesticide Analytical Laboratory, Department of Agriculture, Ministry of Agriculture and Irrigation and the results are shown in Table 2. The analytical results of soil samples showed that concentrations of Ni, Cu and Zn in the soil sample (ZGM 3) were lower than the maximum permission level, whereas Pb, As and Cd were not detected. Similarly, the concentrations of Ni, Cu, Pb and Zn were below the maximum permission level in the soil sample of ZGM 4, while the As and Cd were not detected.

4.2 Mineralogy of whole rock analysis

According to XRD results, the samples of overburden soil (ZGM 1), ore rock (ZGM 2) and mine tailing (ZGM 3) and were especially composed of the silicate minerals. The mineralogical compositions of the samples are shown in Appendix (1). The prominent mineral phase observed in ZGM 1 and ZGM 3 were silicate minerals like quartz and kaolinite whereas the iron sulphate mineral, xitieshanite was detected in ZGM 2 in addition to silicate mineral.

Table 1. Weight percent of elements in the samples

Sample	Si (wt.%)	Ti (wt.%)	Al (wt.%)	Fe (wt.%)	Mn (wt.%)	Mg (wt.%)	Ca (wt.%)	Na (wt.%)	K (wt.%)	P (wt.%)	S (wt.%)	As (mg/kg)	Cr (mg/kg)
Overburden soil (ZGM 1)	25.3	0.799	17.8	5.37	-	0.317	0.049	-	2.00	0.054	0.028	49	167
Ore rock (ZGM 2)	27.7	0.035	20.4	0.66	0.016	-	0.015	-	0.723	0.043	0.005	-	-
Tailing (ZGM 3)	34.1	0.185	11.7	1.14	0.015	0.221	-	-	1.45	0.067	0.146	-	-
Tailing (ZGM 4)	30.6	0.504	11.0	5.89	-	0.522	0.062		2.36	0.046	0.111	64	-
Agricultural soil (ZGM 5)	32.4	0.63	11.2	2.35	-	0.385	0.076	0.832	2.28	0.462	0.079	-	-

Table 2. Concentrations of heavy metals in Tailing samples

Elements	ZGM3	ZGM4	Maximum permitted level
	(concentration in ppm)	(concentration in ppm)	(ppm)
Cd	ND	ND	0.8
Ni	0.1	13.5	35
Pb	ND	3.15	85
As	ND	ND	29
Cu	0.65	4	20-300
Zn	14.65	18.5	20-100

5. Geological Impacts

By the very nature of the activity, mining will impact detrimentally on the physical composition of the environment. The removal of mineralized rock for feed to the tin processing plant will change the geological formation at the mining site permanently. The removal of mineralized rock and changing of the geological composition at the site cannot be migrated.

6. Geomorphic Impacts

The geomorphic impacts caused by open- pit mining activities have an associated, often dramatic, visual impact. Open-pit mining is a type of strip mining in which the ore deposit extends in the ground, necessitating the removal of layer upon layer of overburden and ore. In many cases, logging of trees and clear-cutting or burning of vegetation above the ore deposit may precede removal of the overburden. The use of heavy machinery, usually bulldozers and dump trucks, is the most common means of removing overburden. The principal geomorphic impact of open-pit mining is the removal of overburden, which results in the destruction of habitat including relict and active caves and natural sinkholes. The extent of the geomorphic impact is a function of the size of the open-pit mine especially with respect to the overall landscape and the local landforms. The influence of open-pit mine size on environmental impact is obvious: all other things being equal, the larger the mine, the larger the geomorphic impact.

According to geological report from proposed mine project and the geological setting of proposed area, there is no relict, active caves and natural sinkholes. The area is covered with natural vegetation such as bamboo and useless trees and around of foreshore, is growing nipa palm with natural streams flowing from there. Here, the potential geomorphic impact generated by open-pit mine is removal of overburden soil and destruction of land form and landscape.

7. Land Degradation and Overburden Waste

Mining and its subsequent activities have been found to degrade the land to a significant extent. Overburden removal from the mine area results in a very significant loss of rain forest and the rich top soil. Overburden removal is normally done by the process of blasting or using excavators, which results in generation of large volume of waste (soil, debris and other material). This is useless for the industry and is normally just stored in big piles within the mine lease area, and sometimes, on public land. The bigger the scale of the mine, greater is the quantum of waste generated. Opencast mines are therefore more pollution intensive as they generate much higher quantities of waste compared to the underground mines. Open-pit mines produce 8 to 10 times as much waste as underground mines.

7.1 Overburden Waste Quantities

The ratio of overburden excavated to the amount of mineral removed is called the stripping ratio. For example a stripping ratio of 4:1 means that 4 tons of waste rock are removed to extract one tonne of ore. Lower the ratio, the more productive the mine. Stripping ratio varies with the area under mining.

According to the data generated by report on the feasibility of implementing the proposed mine, the ratio is low waste to ore ratio averaging 1:4.3. Pit design for Ore Block 1 at final pit slope of 1 : 1 resulted in a mining pit having a total area of 13.41 hectares. At average waste to ore ratio of 1 : 4.3 total volume of waste to be removed from the pit to expose the ore body is estimated at 425,255 m^3 and total volume of to be treated is estimated at 1,828,598 m^3 . At monthly average volumes of overburden to be removed and ore to be treated by the mineral processing plant of 11,493 m^3 and 49,326 m^3 respectively, the pit is capable to sustain a mine life of about 37 months [6].

7.2 Waste Disposal

According to the report on the feasibility of implementing the proposed mine, overburden and tailings from the mine are expected to dump into mined out area once the mined out area is available.

7.3 Geochemical Nature of Overburden Waste

The geochemical nature of overburden waste collected from ore block tested by XRD analysis indicates that it is composed by silicate minerals such as quartz and kaolinite predominantly. There is no significant sulphide mineral in overburden waste based on XRD analysis. However, there is occurred the trace amount of Arsenic (As) less than 100 ppm.

7.4 Soil Erosion and Sedimentation

The land degradation caused by open-pit mining activity is the removal, alteration or damage to soil and soil-forming processes which can be due to natural processes, such as erosion, or human influence during open-pit mining activities. The preservation of the natural soil is important to maintain environmental status.

Potential impacts relating to soil degradation are anticipated for the proposed activity. Such impacts include soil erosion and sedimentation. For most mining projects, the potential of soil and sediment eroding into and degrading surface water quality is a serious problem. Because of the large area of land disturbed by mining operations and the large quantities of earthen materials exposed at sites, erosion can be a major concern at hard rock mining sites. Erosion may cause significant loading of sediments (and any entrained chemical pollutants) to nearby water bodies, especially during severe storm events and high snow melt periods [7]. The types of impacts associated with erosion and sedimentation are numerous, typically producing both short-term and long-term impacts. Minerals associated with deposited sediments may depress the pH of surface runoff thereby mobilizing heavy metals that can infiltrate into the surrounding subsoil or can be carried away to nearby surface waters. The associated impacts could include substantial pH depression or metals loading to surface waters and/or persistent contamination of ground water sources. Contaminated sediments may also lower the pH of soils to the extent that vegetation and

suitable habitat are lost. There are potential physical impacts associated with the increased runoff velocities and volumes from new land disturbance activities. Increased velocities and volumes can lead to downstream flooding, scouring of stream channels. The major causes of erosion problems at a surface mining operation are the extent of the disturbed areas, poor drainage plans and the lack of a sediment control strategy which is integrated with the mining operations [8].

8. Acid Mine Drainage (AMD) and Contaminant Leaching Potential

Degradation of water systems, including rivers, lakes, and marine coastal waters, and their aquatic ecosystems, is one of the most significant environmental impacts of mining [9]. Sources of water pollution vary from discharge of process effluents containing remnants of process chemicals, to AMD from the mine or from mine waste dumps. The nature of wastewaters from mineral processing varies widely.

Rock containing sulphides oxidizes on contact with the air, producing sulphuric acid. AMD may originate from rainfall dissolving acidic salts from excavated mine surfaces, or as leachate emerging from oxidizing waste rock dumps or tailing disposal facilities. Leachates commonly dissolve metals from materials which they contact. In this way, metal may migrate to the groundwater or to the surrounding surface environment.

The most serious and pervasive environmental problem related to mine water management is arguably AMD and it is commonly associated with gold, copper, and other metal sulphide mining projects. It is also common at coal mines where sulphide minerals may occur on partings in the coal or in interbedded shale. However, there are many mining projects where there is no potential for AMD. These include most laterite mining projects for nickel, iron and alumina, many uranium projects diamond and placer tin mines [9] . Acid generation occurs when mine openings, pit walls, and sulphide-rich materials in waste rock and tailings exposed to, and react with, oxygen and water

to form sulpuric acid as shown in Eq (1). Sulphuric acid, which is generally easily, dissolves metals such as iron, copper, aluminium, and lead. Sometimes dissolved metals in AMD discolour water and cause stains on exposed rocks and streambed. If this happens, AMD is easily detected by eye.

$$FeS_2 + 15/4O_2 + 7/2H_2O \rightarrow Fe(OH)_3 + 2H_2SO_4 \qquad \text{Eq (1)}$$

One of the most serious aspects of AMD is its persistence in the environment. An acid-generating mine waste storage facility has the potential for long-term, severe impacts on surface and groundwater and aquatic life. The process will continue until there are no remaining sulphides. This can take centuries, given the large quantities of exposed rock at some mine sites. Once the process of acid generation has started, it is difficult to stop. The combination of acidity and dissolved metals may harm or even kill aquatic life, rendering streams nearly sterile and making water unfit for human consumption [10].

AMD may occur in or may be derive from many parts of an operation, including:

- Runoff from surface excavations for access roads, drains, and site facilities
- Drainage or seepage from underground excavations form mine access, exploration, development, ventilation, and extraction
- Runoff from open pit mines – exposures in pit walls, berms, and the mine floors
- Seepage of contaminated groundwater into surface or underground mines
- Percolation through and drainage from rock masses fragmented by block caving or subsidence
- Runoff and/or drainage from stockpiles of ore awaiting processing
- Runoff and/or drainage from waste rock storages including coal rejects piles,
- Seepage or overflow spillages or remnants of mineral concentrates around stockpiles, bins, conveyor transfer points, etc.

In the present study, the XRF and XRD results showed that there is a low concentration of S and any sulfide mineral was detected in all samples collected. The result indicated that the potential of AMD may be slightly low. However, monitoring should be done at least per week to assess the potential for AMD. The simplest tests used to delineate areas of AMD in the field, are the paste pH and electrical conductivity tests. For these tests, samples of less than 50 g are crushed to less than 1 mm and mixed with distilled water at a solid to liquid ratio of 1:2 (w/w) to form a paste. After period of equilibration, usually overnight, the pH and conductivity are measured. A pH of less than 4 indicates an acidic sample. An electrical conductivity of more than 2 deci-seimens per meter (ds/m) indicates high level of soluble salts, a result of oxidation with possible neutralization. Similar tests can be conducted on drill cores samples.

9. Impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities

The impacts of wet tailings impoundments, waste rock, heap leach, and dump leach facilities on water quality can be severe. These impacts include contamination of groundwater beneath these facilities and surface waters. Toxic substances can leach from these facilities, percolate through the ground, and contaminate groundwater, especially if the bottom of these facilities is not fitted with an impermeable liner.

A number of environmental concerns are associated with the disposal of waste rock. Waste rock dumps have a large footprint, and they often have a strong visual impact. Waste rock geochemistry affects runoff and leachate, often turning water into wastewater. Finally, erosion by water and wind may occur, and rehabilitation of waste dumps may be difficult to achieve, especially in arid environments.

Tailings (a by-product of metallic ore processing) is a high-volume waste that can contain harmful quantities of toxic substances, including arsenic, lead, cadmium, chromium, nickel, and cyanide (if cyanide leaching is used). Although it is rarely the environmentally-preferable option, most mining companies dispose of tailings by mixing them with water (to form a slurry) and disposing of the slurry behind a tall dam in a large wet tailings impoundment. Because the ore is usually extracted as a slurry, the resulting waste contains large amounts of water, and generally forms ponds at the top of the tailings dams that can be a threat to wildlife. Cyanide tailings in precious metals mines are particularly dangerous. Ultimately, tailing ponds will either dry, in arid climates, or may release contaminated water, in wet climates. In both cases, specific management techniques are required to close these waste repositories and reduce environmental threats. During periods of heavy rain, more water may enter a tailings impoundment than it has the capacity to contain, necessitating the release of tailings impoundment effluent. Since this effluent can contain toxic substances, the release of this effluent can seriously degrade water quality of surrounding rivers and streams, especially if the effluent is not treated prior to discharge. Dozens of dam breaks at wet tailings impoundments have created some of the worst environmental consequences of all industrial accidents. Contaminated runoff and leachate from tailings storage areas pose threats to groundwater and surface water quality. Tailings may be acid generating, creating a long-term environmental liability for the mine operator (9). Because tailings are fine-grained they can be easily eroded by wind when they are dry. Finally, tailings disposal requires significant land areas, thereby creating undesirable visual impacts.

The results showed that the possible impact on leaching of toxic elements from tailing and waste rocks may not be serious. However, the XRF result showed that high content of As and Cr was observed in overburden soil (ZGM1) and tailing (ZGM4). The disposal of waste rocks like

tailings and overburden soil should be done systematically to protect the potential environmental problem. In addition, monitoring of tailing disposal operations and storages should be taken place for several purposes; including

- determining whether the tailings discharged to the storage have the same characteristics as predicted in the feasibility and environmental studies, and if not, whether the differences requires changes in design or operating procedures
- providing early warning of the development of conditions that could lead to unwanted events
- identifying areas or installations requiring maintenance or repairs
- providing feedback to improve management
- measuring the environmental effects of the operations, particularly the quantity and quality of seepage water

10. Assessment of potential impacts

The proposed activity will conduct open-pit mining activities using open-pit dry mining method, overburden and tailing disposal and construction of associated infrastructures. The important issues are the direct impacts of geomorphic impact generated by open pit mining activities, soil degradation generated by mining activities which include soil removal, soil alteration, soil pollution and specifically, soil erosion. Besides, Acid mine drainage and contaminant Leaching and Impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities are also considered as potential impact. **Potential Environmental Impacts** are shown in Table (3).

Table 3: Potential Environmental Impacts

Activity/ process	Potential Environmental Impact	Nature	Extent
Open-pit mining activities	• Geology • Geomorphic impact • Land degradation • Overburden waste	1. The removal of mineralized rock for feed to the tin processing plant will change the geological formation at the mining site permanently. The removal of mineralized rock and changing of the geological composition at the site cannot be migrated. 2. Geomorphic impact including removal of overburden soil and rock, destruction of land form and landscape and disruption of streams and its courses 3. Overburden waste management problem	Local to regional if mitigation measure cannot be done successfully for 2 and 3
Open-pit mining activities	• Erosion of soil and mine wastes into surface water	1. Significant loading of sediments to nearby waterbodies, especially during severe storm events 2. Soil and sediment eroding into and degrading surface water quality	Local to Regional

Open-pit mining activities	• Soil alteration	Alteration of soil texture, density, structure and chemistry due to soil mixing, stockpiling, compaction and removal of overburden soil	Local only
Open-pit mining activities	• Soil Pollution	Pollution of in situ soil due to spillage of hazardous substances such as fuel, oil and tailing	Local to regional
Open-pit mining activities	• Acid mine drainage and contaminant Leaching	Low possibility	Local only
Open-pit mining activities	• Impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities	Low to moderate possibility	Local only

11. Mitigation of impacts

As mentioned above, proposed activities will have certain potential environmental impacts in proposed area. The potential impacts should be mitigated successfully in order to protect serious environmental problems in and around proposed area. The following mitigation measures should be considered for the framework for the **Environmental Management Plan (EMP)** based on several guidelines:

Potential Environmental Impact	Strategies to mitigate potential impact
• Geology • Geomorphic Impact • Overburden Waste	1. Mining activities should be done in restricted areas and activities should be kept to a minimum as far as possible (limit unnecessary earthworks etc.) 2. Excavation process should be monitored to prevent over-excavation 3. Reclamation of mined pits by filling backfilling, recontoured, and revegetation to create a final surface that is consistent with the original topography of the area. 4. Overburden and waste rock are materials that a mining company should consider returning to open pits as backfill, to prevent pit lake formation. 5. Afforestation and green belt development 6. Natural Drainage should not be obstructed 7. The size of open-pit mine site should be limited and should be done in restricted area. 8. Adequate reclamation and closure plan should be established.

	9. The Reclamation and Closure Plan should not allow for the formation of a pit lake. If the plan allows for the formation of a pit lake, the plan should include a detailed discussion of the efficacy and feasibility of all possible options for the prevention of acid mine drainage within the pit lake, the potential characteristics of pit lake effluent, and its impact on groundwater and adjoining surface waters [9]. 10. Overburden waste should not be dumped beside the natural drainages or agricultural field. It should be strictly prohibited. Overburden waste are not allowed into existing natural drainages.
• Erosion of soil and mine wastes into surface water	In developing a sediment control plan the following basic approach should be adopted: a. minimize the area which is disturbed at any one time; b. develop a drainage control system for the mine lease area; c. integrate drainage, erosion and sediment control into each stage of the mining operation; d. develop a mining and rehabilitation plan prior to initiating mining activities; e. construct drainage and erosion controls in advance of mining activities ;

	f. divert storm runoff away from areas with high erosion potential; g. incorporate measures to reduce the flow velocity of storm runoff; h. limit the handling of spoil and topsoil materials; i. rehabilitate areas as soon as possible; j. maintain drainage and erosion control measures. Erosion control must be considered from the beginning of operations through completion of reclamation.
• Soil alteration	1. Avoid soil compaction by restricting the use of trucks and heavy equipment to limited area 2. Ensure those vehicles are restricted to existing roads to avoid soil compaction within and around the project site
• Soil Pollution	1. Correct use of hazardous substances should be controlled in order to prevent soil pollution 2. Tailing storage facility design should be adequate to prevent not only soil pollution but also groundwater pollution and surface water pollution 3. The impoundment should not be located in recharge zone, establishing hydraulic with aquifer.
• Acid mine drainage and contaminant Leaching	1. Surface shaping and capping with low permeability material, to minimize infiltration of rainwater

	2. Total encapsulation to minimize infiltration and also to restrict oxygen supply 3. Preferential placement, with high capacity potentially acid forming (PAF) materials placed in central parts of the dump, and non-acid forming (NAF) materials in outer zones [8] 4. Compaction to reduce overall permeability, to minimize cracks that enable ready access to air and water, and to provide low permeability barrier.
• Impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities	For tailings storage facilities with the potential for AMD, the following two alternative approaches may be used. (1) wet cover, which means maintaining a pond on the surface of the tailing, thereby excluding atmospheric oxygen (2) dry cover, in which a low permeability capping is placed over the surface of the tailings, limiting both the ingress of oxygen and infiltration of rainfall The following alternatives may be adopted for the disposal of tailing in the project area. (1) use of a wet tailings impoundment facility or 'tailings pond' (2) dewatering and disposal of dry tailings as paste backfill or 'dry tailings disposal'

12. CONCLUSIONS

The geological scoping study has discussed related to geological features. Besides, the potential impacts on geologic environment of proposed area has identified that geological impact, geomorphic impact, land degradation and overburden waster, acid mine drainage and impacts of tailing impoundments, waste rock, heap leach, and dump leach facilities are the potential impact associated with geological environment for proposed activity. The possible mitigation of impacts has discussed for Environmental Management Plan (EMP). According to an overview of the discussed geological characteristics of the site, the main potential impacts that have been identified are considered local to regional impacts to geologic environments. The less the EMP is adequate, the more the impact level will be increased. So, the possible mitigation of impacts should be carried out strictly and successfully based on the EMP.

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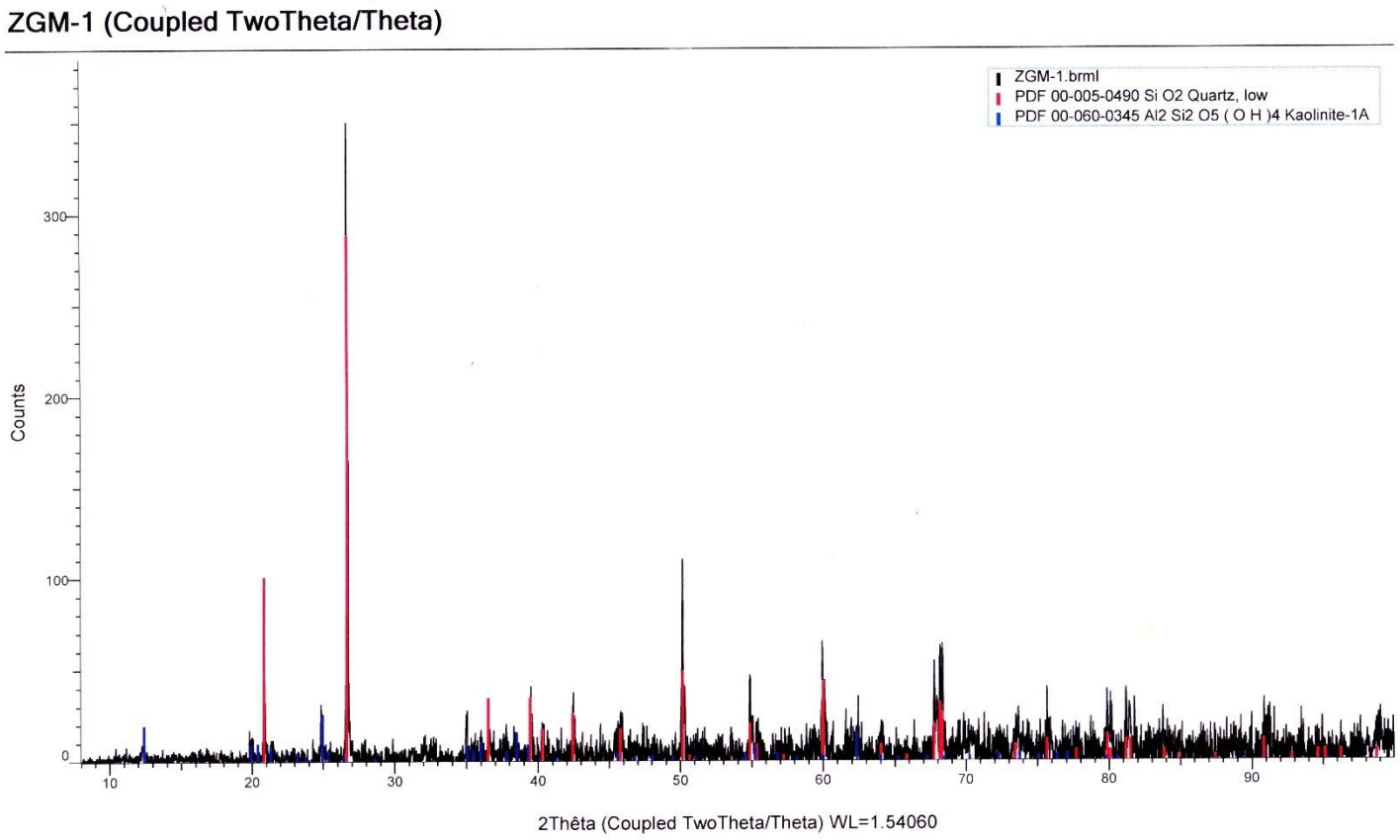
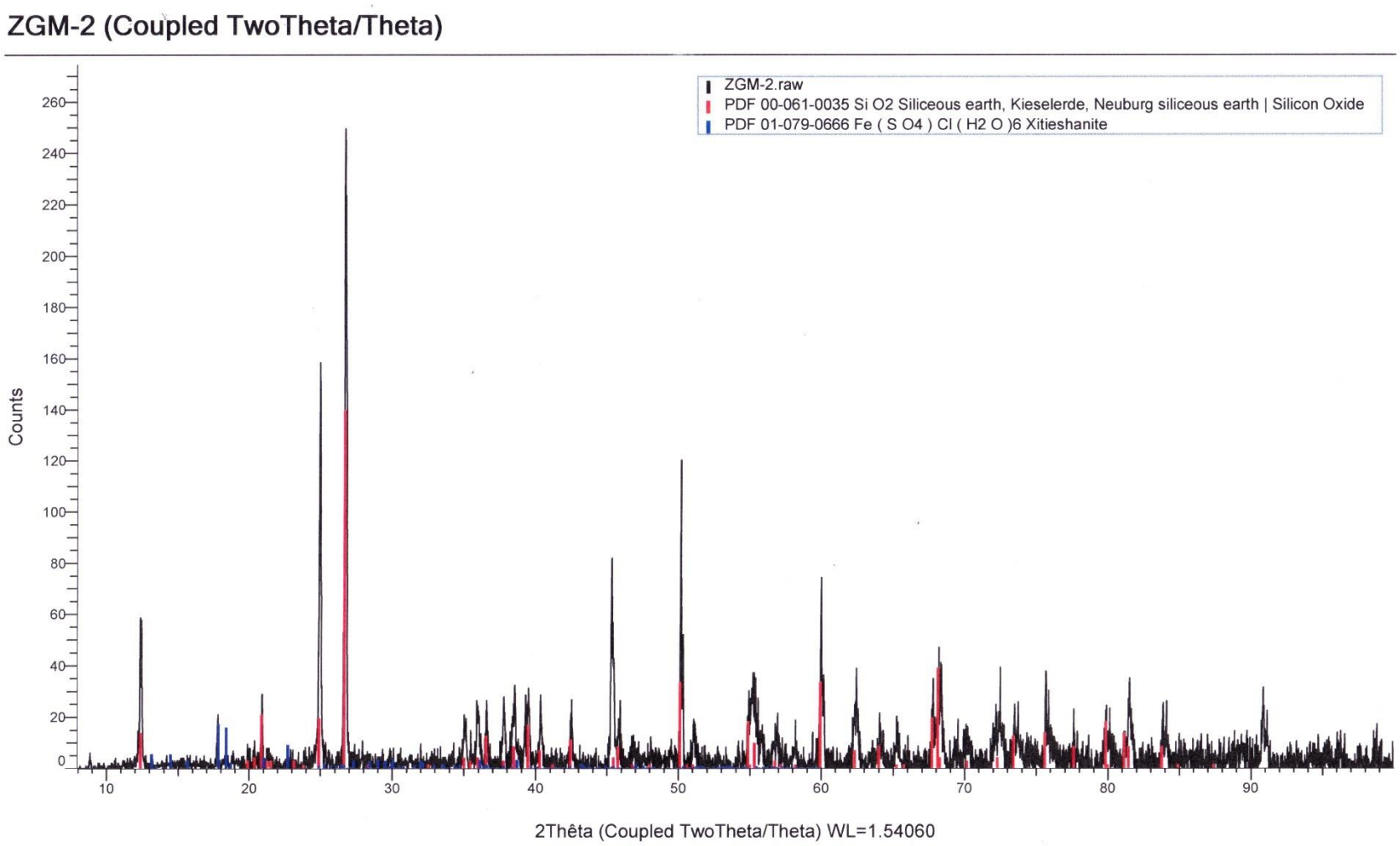
APPENDICES (A)

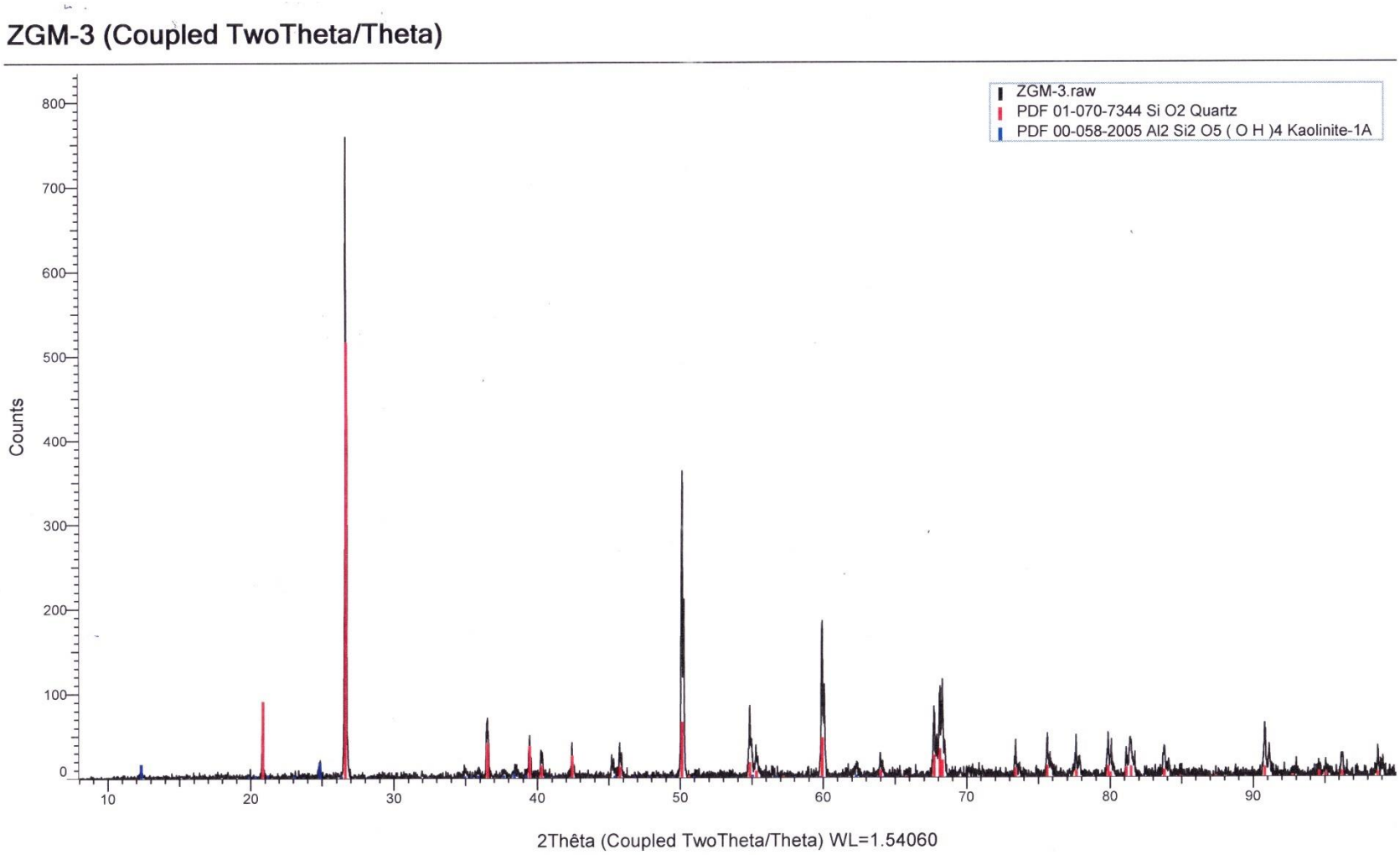
XRD RESULT



A.1 XRD Analysis of ZGM – 1 (Sample collected from overburden soil of existing old open – pit mine)



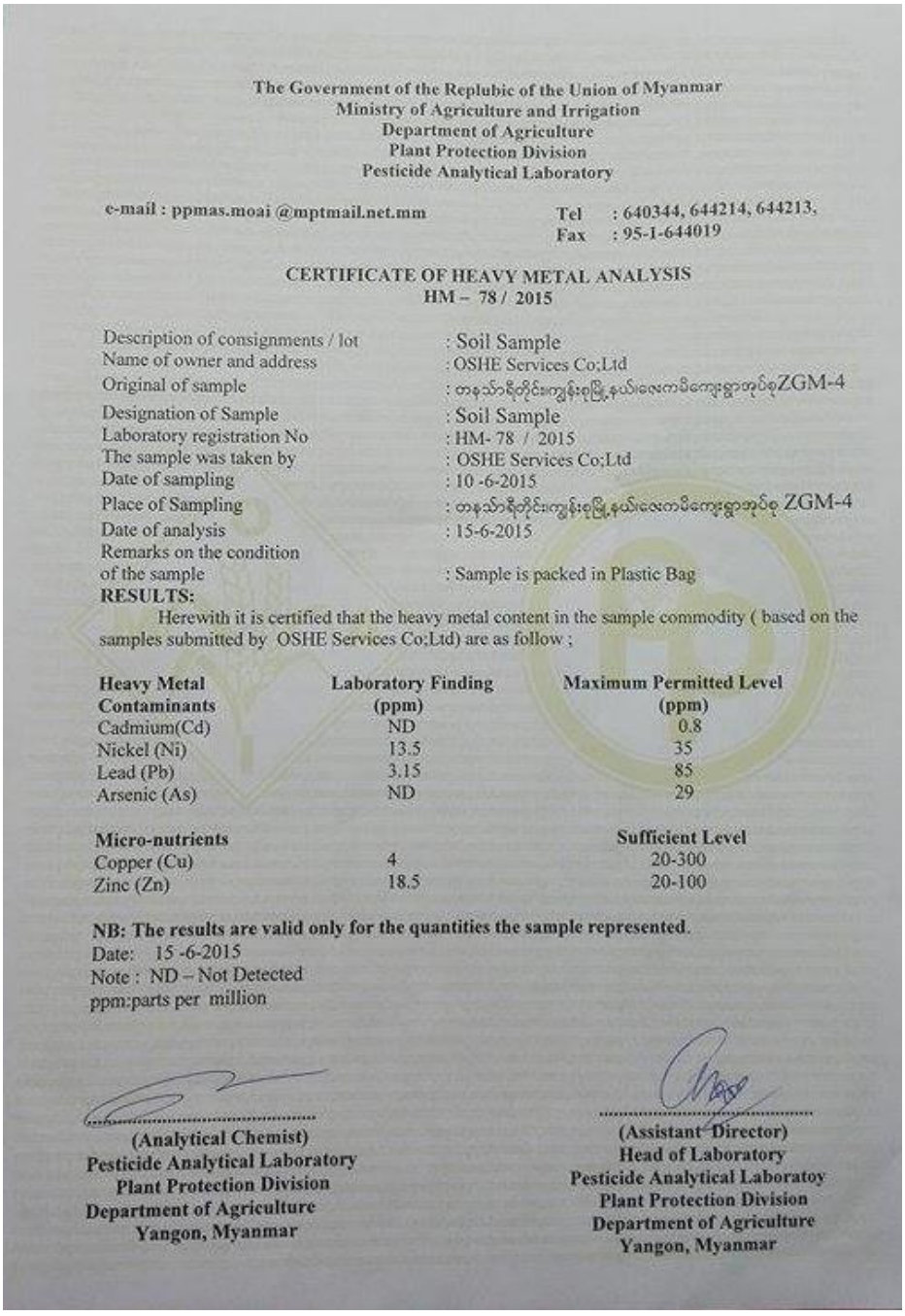
A.2 XRD Analysis of ZGM – 2 (Sample collected from highly weathered, highly decomposed pegmatite associated with Tin



A.3 XRD Analysis Result of ZGM – 3 (Sample collected from Tailing Dump of former open-pits mine)

APPENDICES (B)

Heavy Metal Concentration Result



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CERTIFICATE OF HEAVY METAL ANALYSIS
HM – 78 / 2015

Description of consignments / lot	: Soil Sample
Name of owner and address	: OSHE Services Co;Ltd
Original of sample	: တနင်္သာရီတိုင်းကျွန်းဂျပြို့နယ်ဒေးကဗီကျေးရွာအုပ်စု ZGM-4
Designation of Sample	: Soil Sample
Laboratory registration No	: HM- 78 / 2015
The sample was taken by	: OSHE Services Co;Ltd
Date of sampling	: 10 -6-2015
Place of Sampling	: တနင်္သာရီတိုင်းကျွန်းဂျပြို့နယ်ဒေးကဗီကျေးရွာအုပ်စု ZGM-4
Date of analysis	: 15-6-2015
Remarks on the condition of the sample	: Sample is packed in Plastic Bag

RESULTS:

Herewith it is certified that the heavy metal content in the sample commodity (based on the samples submitted by OSHE Services Co;Ltd) are as follow ;

Heavy Metal Contaminants	Laboratory Finding (ppm)	Maximum Permitted Level (ppm)
Cadmium(Cd)	ND	0.8
Nickel (Ni)	13.5	35
Lead (Pb)	3.15	85
Arsenic (As)	ND	29
Micro-nutrients		**Sufficient Level**
Copper (Cu)	4	20-300
Zinc (Zn)	18.5	20-100

NB: The results are valid only for the quantities the sample represented.
Date: 15 -6-2015
Note : ND – Not Detected
ppm:parts per million

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(Assistant Director)
Head of Laboratory
Pesticide Analytical Laboratoy
Plant Protection Division
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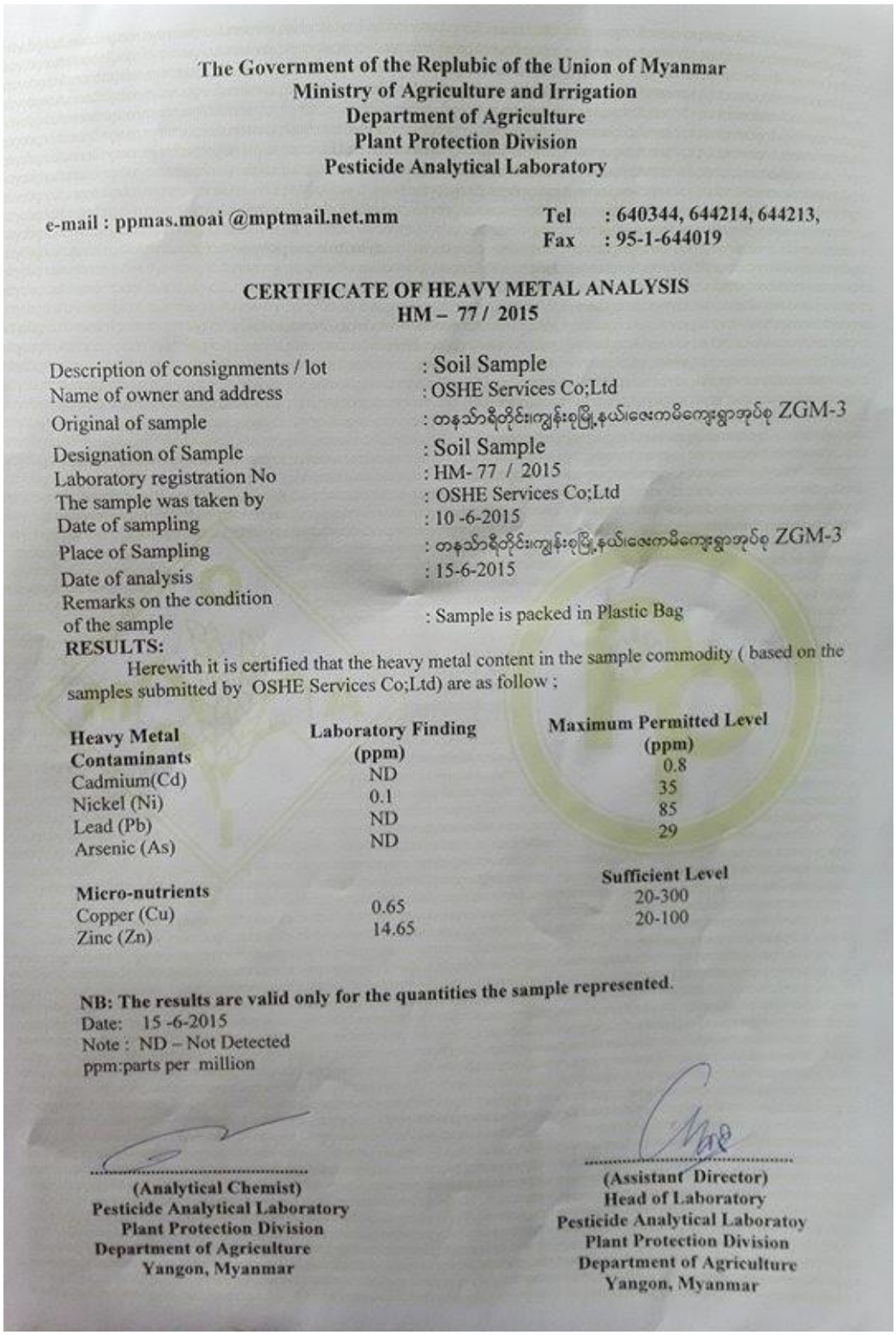
B.1 Heavy Metal Concentration Result of ZGM – 4 (Samples collected from Tailing Dump of pre-existing open-pit mine)



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CERTIFICATE OF HEAVY METAL ANALYSIS
HM – 77 / 2015

Description of consignments / lot	: Soil Sample
Name of owner and address	: OSHE Services Co;Ltd
Original of sample	: တနင်္သာရီတိုင်းကျွန်းစုမြို့နယ်၊လေးကမိကျေးရွာအုပ်စု ZGM-3
Designation of Sample	: Soil Sample
Laboratory registration No	: HM- 77 / 2015
The sample was taken by	: OSHE Services Co;Ltd
Date of sampling	: 10 -6-2015
Place of Sampling	: တနင်္သာရီတိုင်းကျွန်းစုမြို့နယ်၊လေးကမိကျေးရွာအုပ်စု ZGM-3
Date of analysis	: 15-6-2015
Remarks on the condition of the sample	: Sample is packed in Plastic Bag

RESULTS:

Herewith it is certified that the heavy metal content in the sample commodity (based on the samples submitted by OSHE Services Co;Ltd) are as follow ;

Heavy Metal Contaminants	**Laboratory Finding (ppm)**	**Maximum Permitted Level (ppm)**
Cadmium(Cd)	ND	0.8
Nickel (Ni)	0.1	35
Lead (Pb)	ND	85
Arsenic (As)	ND	29
Micro-nutrients		**Sufficient Level**
Copper (Cu)	0.65	20-300
Zinc (Zn)	14.65	20-100

NB: The results are valid only for the quantities the sample represented.
Date: 15 -6-2015
Note : ND – Not Detected
ppm:parts per million

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B.1 Heavy Metal Concentration Result of ZGM – 3 (Samples collected from Tailing Dump of pre-existing open-pit mine)

APPENDIX-G WATER QUALITY ANALYSIS RESULTS

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ISO 9001:2008 Cert. No.688283

WTL-RE-001
Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 1 of 2

W0415 142

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	WW - 5 (ဂူထဲရွာလမ်းဘေးရေတွင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	5.8		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	Nil	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	8	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thit
B.E (Civil) 1980,
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd), Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

ISO 9001:2008 Cert. No.688283

W0415 142

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	WW - 5 (ဂူထဲရွာလမ်းဘေးရေတွင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	Nil	mg/l	
Ammonium (NH_4)	Nil	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	8	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Soe Thit
B.E (Civil) 1980,
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY
Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd), Consultant (Y.C.D.C), LWSE 001,
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

ISO 9001:2008 Cert. No.688283

W0415 141

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	WW - 4 (ရတောင်ဘုန်းကြီးကျောင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	Nil	mg/l	
Ammonium (NH_4)	Nil	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	8	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Soe Thit
B.E (Civil) 1980,
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY
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Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

ISO 9001:2008 Cert. No.688283

W0415 141

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	WW - 4 (ရတောင်ဘုန်းကြီးကျောင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	6.0		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	Nil	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	7	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thit
B.E (Civil) 1980,
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY
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Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 2 of 2

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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	WW - 3 (ဇေကမိရွာတောင်ခြေရေတွင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	0.20	mg/l	
Ammonium (NH_4)	0.21	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	8	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Soe Thit
B.E (Civil) 1980.
Technical Officer
ISO TECH Laboratory

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W0415 140

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	WW - 3 (ဇေကမိရွာတောင်ခြေရေတွင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	4.6		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	Nil	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	12	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

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Signature:
Name: Zaw Hein Oo
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Chemist
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Signature:
Name: Soe Thit
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Issue Date - 01-12-2012
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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	WW - 2 (ရွှေဒူးရွာတောင်ဖျားရေတွင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	1.50	mg/l	
Ammonium (NH_4)	1.59	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	16	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Hein Oo
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Chemist
ISO TECH Laboratory

Approved by

Signature:

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Technical Office
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No.18, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
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ISO 9001:2008 Cert. No.688283

W0415 139

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	WW - 2 (ရွှေဒူးရွာတောင်ဖျားရေတွင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	5.5		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	Nil	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	30	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Law Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thit
B.E (Civil) 1980,
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY
Laboratory Technical Consultant: U Saw Christopher Maung
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Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

ISO 9001:2008 Cert. No.688283

W0415 138

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	WW - 1 (တောင်ပုဘုန်းကြီးကျောင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	5.1		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	Nil	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	26	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thit
B.E (Civil) 1980,
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY
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Issue Date - 01-12-2012
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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	WW - 1 (တောင်ပုဇွန်ကြီးကျောင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	0.10	mg/l	
Ammonium (NH_4)	0.11	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	14	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Soe Thit
B.E (Civil) 1980,
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY
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WTL-RE-001
Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 2 of 2

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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	TW - 3 (မောင်းလှော်နှစ်ရွာကြားဆေးရုံရေစက်)
Location	မြို့ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	Nil	mg/l	
Ammonium (NH_4)	Nil	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	10	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature: Soe Thit

Name: Soe Thit
B.E (Civil) 1980
Technical Officer
ISO TECH Laboratory

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ISO 9001:2008 Cert. No.688283

W0415 133

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	TW - 3 (မောင်းလှော်နှစ်ရွာကြားဆေးရုံရေစက်)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	5.7		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	Nil	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	45	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thit
B.E (Civil) 1980.
Technical Officer
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Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 2 of 2

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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	TW - 2 (ဇေကမိဉ်ကွင်ဒအိမ်အဝိစိတွင်း)
Location	မြတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	Nil	mg/l	
Ammonium (NH_4)	Nil	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	12	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Soe Thit
B.E (Civil) 1980
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY
Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd), Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

ISO 9001:2008 Cert. No.688283

W0415 132

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	TW - 2 (ဇေကမိုက္ကငအိမ်အဝိစိတွင်း)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.3		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	138	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	30	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	1.4	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Hein Oo
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Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thit
B.E (Civil) 1980
Technical Officer
ISO TECH Laboratory

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WTL-RE-001
Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 2 of 2

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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	TW - 1 (ရွှေဒူးမူလတန်းကျောင်း (မောင်ပု))
Location	မြို့ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	Nil	mg/l	
Ammonium (NH_4)	Nil	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	8	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Hein Oo
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Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Soe Thit
B.E (Civil) 1980
Technical Officer
ISO TECH Laboratory

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ISO 9001:2008 Cert. No.688283

W0415 131

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	TW - 1 (ရွှေဒူးမှလတန်းကျောင်း (မောင်ပု))
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	10.2		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	5	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	20	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Hein Oo
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Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thit
B.E (Civil) 1980.
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ISO 9001:2008 Cert. No.688283

W0415 137

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	PW - 4 (တွင်းဟောင်းရေကန်)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
pH	3.8		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	64	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	10	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.2	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Hein Oo
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Approved by
Signature:
Name: Soe Thu
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Technical Officer
~~ISO TECH Laboratory~~

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ISO 9001:2008 Cert. No.688283

W0415 137

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	PW - 4 (တွင်းဟောင်းရေကန်)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	Nil	mg/l	
Ammonium (NH_4)	Nil	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	8	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Hein Oo
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Approved by

Signature:

Name: Soe Thit
B.E (Civil) 1980
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ISO TECH Laboratory

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WTL-RE-001
Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 1 of 2

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WATER QUALITY TEST RESULTS FORM

Client . OSHE Services Co.,Ltd.
Nature of Water PW - 3 (အင်းရေကန်)
Location မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection 19.4.2015
Date and Time of arrival at Laboratory 20.4.2015
Date and Time of commencing examination 22.4.2015
Date and Time of completing 27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	4.9		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	Nil	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	22	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thit
B.E (Civil) 1980.
Technical Officer
ISO TECH Laboratory

(a division of WEG Co.,Ltd.)
No.18, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
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ISO 9001:2008 Cert. No.688283

W0415 136

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	PW - 3 (အင်းရေကန်)
Location	မြို့ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	Nil	mg/l	
Ammonium (NH_4)	Nil	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	14	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature: Soe Thit

Name: Soe Thit
B.E (Civil) 1980
Technical Officer
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ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
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WTL-RE-001
Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 1 of 2

W0415 135

WATER QUALITY TEST RESULTS FORM

Client . OSHE Services Co.,Ltd.
Nature of Water PW - 2 (စက်ရုံဟောင်းရေကန်)
Location မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection 19.4.2015
Date and Time of arrival at Laboratory 20.4.2015
Date and Time of commencing examination 22.4.2015
Date and Time of completing 27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	4.2		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	980	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	20	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	6.6	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Hein Oo
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Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thit
B.E (Civil) 1980
Technical Officer
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ISO 9001:2008 Cert. No.688283

WTL-RE-001
Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 2 of 2

W0415 135

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	PW - 2 (စက်ရုံဟောင်းရေကန်)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	Nil	mg/l	
Ammonium (NH_4)	Nil	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	64	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	20	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Soe Thu
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Technical Officer
ISO TECH Laboratory

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ISO 9001:2008 Cert. No.688283

W0415 134

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	PW - 1 (တွင်းဟောင်းရေကန်)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	0.20	mg/l	
Ammonium (NH_4)	0.21	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	14	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
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Approved by

Signature:

Name: Soe Thu
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ISO 9001:2008 Cert. No.688283

W0415 134

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	PW - 1 (တွင်းဟောင်းရေကန်)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	4.7		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	5	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	58	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
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Chemist
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Approved by
Signature:
Name: Soe Thit
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WTL-RE-001
Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 2 of 2

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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	SW - 4 (ဂူထဲအနီးရေတောင်ချောင်းရေ)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	Nil	mg/l	
Ammonium (NH_4)	Nil	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	96	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	24	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

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Approved by

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ISO 9001:2008 Cert. No.688283

W0415 130

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	SW - 4 (ဂူထဲအနီးရေတောင်ချောင်းရေ)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	6.9		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	5300	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	80	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	23.7	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

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Issue Date - 01-12-2012
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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	SW - 3 (မောင်းလှော် (ပေါ်) ရေကန်)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	0.30	mg/l	
Ammonium (NH_4)	0.32	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	10	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature: Heint

Name: Zaw Hein Oo
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Chemist
ISO TECH Laboratory

Approved by

Signature: Soe Thit

Name: Soe Thit
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Issue No - 1.0/Page 1 of 2

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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	SW - 3 (မောင်းလော် (ပေါ်) ရေကန်)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.9		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	39	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	40	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.3	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

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Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 2 of 2

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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	SW - 2 (အညင်းချောင်းရေ)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	0.40	mg/l	
Ammonium (NH_4)	0.42	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	96	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	30	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

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Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 1 of 2

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WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	SW - 2 (အညင်းချောင်းရေ)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	6.9		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	5200	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	300	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	22.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

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Issue No - 1.0/Page 2 of 2

W0415 127

WATER QUALITY TEST RESULTS FORM

Client	OSHE Services Co.,Ltd.
Nature of Water	SW - 1 (ရတောင်ချောင်းရေ)
Location	မြိတ်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection	19.4.2015
Date and Time of arrival at Laboratory	20.4.2015
Date and Time of commencing examination	22.4.2015
Date and Time of completing	27.4.2015

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)	Nil	mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)	1.0	mg/l	
Ammonium (NH_4)	1.1	mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	128	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	40	mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)	Nil	mg/l	3 mg/l
Copper (Cu)	Nil	mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature: Heiru

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Approved by

Signature: Soe Thit

Name: Soe Thit
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Effective Date - 01-12-2012
Issue No - 1.0/Page 1 of 2

W0415 127

WATER QUALITY TEST RESULTS FORM

Client . OSHE Services Co.,Ltd.
Nature of Water SW - 1 (ရုတ်ခြည်ချောင်းရေ)
Location မြို့တော်ခရိုင်၊ ကျွန်းစုမြို့နယ်။
Date and Time of collection 19.4.2015
Date and Time of arrival at Laboratory 20.4.2015
Date and Time of commencing examination 22.4.2015
Date and Time of completing 27.4.2015

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	6.5		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Tctal Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	1140	mg/l	200 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids	417	mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	17.4	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

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APPENDIX-H AIR QUALITY AND NOISE STUDY REPORT

AIR STUDY REPORT

FOR TIN MINE

Myanmar Asia Zone Activities Mining Co.,Ltd.
Zay Ka Mi group of Villages, Kyun Su Township,
Myeik District,MYANMAR

Prepared By
Dr.Aung Lay Tin
OSHE Service Co.,Ltd

Date: 17-4-2015

1 Physical Environment

1.1 Air Quality

Emission of air pollutants can occur from a wide variety of activities during the construction, operation, and decommissioning phases of the project. These activities can be point sources, fugitive sources, and mobile sources and by process such as combustion, materials storage, or other specific processed. Tin Mine project in near Zegami Group of Villages will prevent or minimize impacts by ensuring that emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standard, and emission do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. Following is the US National Ambient Air Quality Standards (NAAQS) guidelines values for ambient air quality standard applicable as a reference standard for the current project since there is no national ambient air quality standard currently in Myanmar.

Table 1.1 Location of Air Sample (AS) of the Tin Mine Project

Sr. No	Sample Name	Location	Coordinates	
			Latitude(N)	Longitude(E)
1	AS-1	Office area	12°18'33.16"	98° 44'38.15"
2	AS-2	100m from the Office	12°18'34.77"	98° 44'25.32"
3	AS-3	300m North Side of the Office area	12°18'22.64"	98° 44'39.68"
4	AS-4	200m South Side of the Office area	12°18'49.75"	98° 44'22.02"
5	AS-5	300m East Side of the Office area	12°18'51.99"	98° 44'39.30"
6	AS-6	300m West Side of the Office area	12°18'54.30"	98° 44'23.47"
7	AS-7	Near Shwe Duu Village	12°18'57.64"	98° 44'1.55"
8	AS-8	Near Zegami Village	12°19'12.17"	98° 43'55.51"
9	AS-9	Near Taungpu Village	12°19'4.68"	98° 43'54.97"
10	AS-10	Residential Houses area in Taungpu	12°18'44.65"	98° 43'50.70"

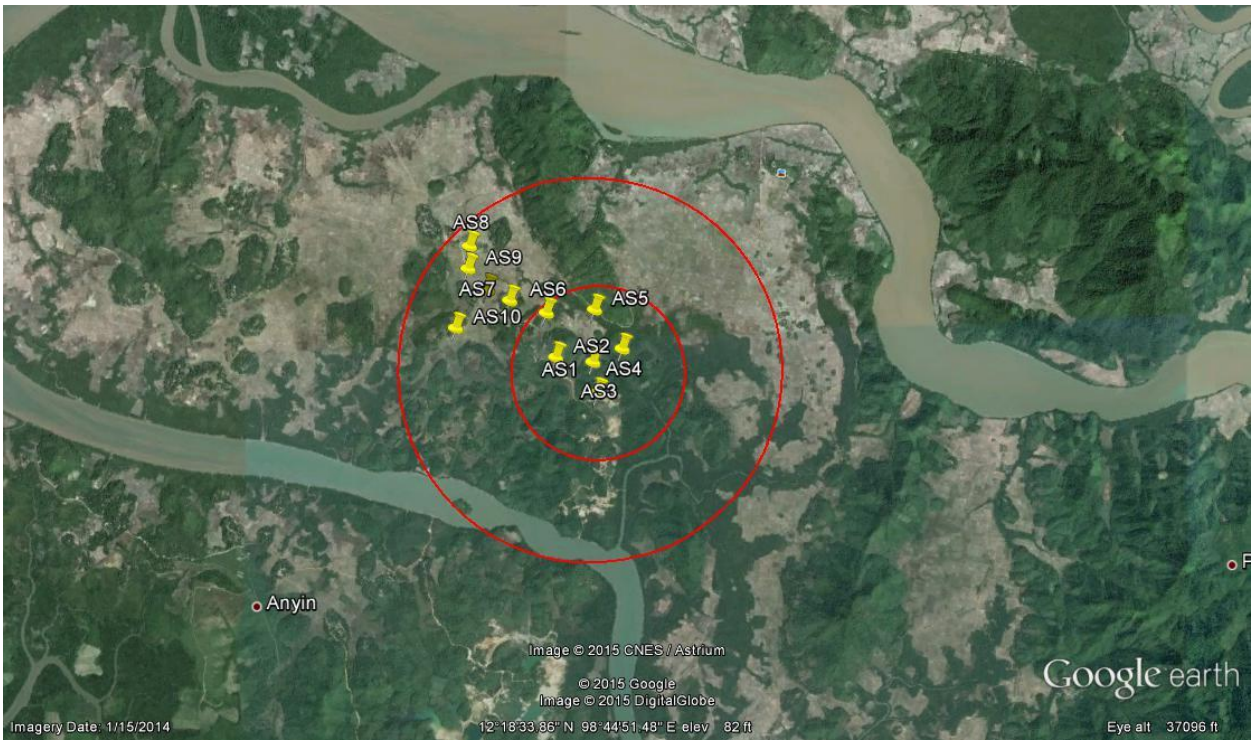


Table 1.2 General Conditions of Ambient Air Quality at the Time of Sampling

Sr.	Locations	Air Temp	WBT	Dew Point	Humidity	Time
1	Office area	27°	26.3°	26°	94%	7:30
2	100m from the Office	30.2°	26.1°	24.6°	73%	8:00
3	300m North Side of the Office area	30.5°	26.6°	24.8°	73%	10:30
4	200m South Side of the Office area	33.3°	27.8°	26°	63.5%	11:30
5	300m East Side of the Office area	34.5°	25.7°	24.4°	58.2%	1:30
6	300m West Side of the Office area	26.6°	25.5°	25.2°	93%	2:30
7	Near Shwe Duu Village	30°	26.6°	25.1°	70%	3:15
8	Near Zegami Village	35.0°	27.7°	25.5°	63.2%	4:00
9	Near Taungpu Village	34.2°	28.5°	25.8°	63.2%	4:30
10	Residential Houses area in Taungpu	34.0°	27.2°	25.2°	63.2%	5:00

Table 1.3 Carbon Dioxide Concentrations

Sr.	Locations	CO2(ppm)			Time
		Min	Max	STEL	
1	Office area	538	575	557	7:45
2	100m from the Office	446	456	448	8:15

3	300m North Side of the Office area	439	445	444	10:45
4	200m South Side of the Office area	446	501	447	11:55
5	300m East Side of the Office area	429	448	437	1:15
6	300m West Side of the Office area	477	488	482	2:50
7	Near Shwe Duu Village	435	447	425	3:15
8	Near Zegami Village	434	444	403	4:15
9	Near Taungpu Village	442	491	456	4:45
10	Residential Houses area in Taungpu	433	443	438	5:15

According to the above table, average ambient air carbon dioxide levels range from 433 ppm to 575 ppm. according the these result, Global carbon dioxide level is 401.3ppm. So, Its could be noted that current ambient carbon dioxide level at the vicinity of the project is a little more than the global carbon dioxide level. But, the project is not a polluting project which emits carbon dioxide into the atmosphere, there could be no impact from the project on the background carbon dioxide level of local community.

Table 1.4 Wind Speed and Air Direction

Sr.	**Locations**	**Wind**		
		Speed(ft/min)	**Direction**	**Time**
1	Office area	493	NS	7:30
2	100m from the Office	220	NS	8:00
3	300m North Side of the Office area	90	NS	10:30
4	200m South Side of the Office area	247	NS	11:30
5	300m East Side of the Office area	40	SN	1:30
6	300m West Side of the Office area	161	SN	2:30
7	Near Shwe Duu Village	124	SN	3:15
8	Near Zegami Village	40	SN	4:00
9	Near Taungpu Village	60	SN	4:30
10	Residential Houses area in Taungpu	43	SN	5:00

Table 4.2 Assessment of Ambient Air Quality in Tin Mine Project

Sr.	**Locations**	**Air Temp**	**WBT**	**Dew Point**	**Humidity**	**CO2 (ppm)**	**WIND SPEED**
1	Office area	Medium	Low	Low	Medium	Medium	Low-Medium
2	100m from the Office	Medium	Low	Low	Medium	Medium	Low-Medium
3	300m North Side of the Office area	Medium	Low	Low	Medium	Medium	Low-Medium

4	200m South Side of the Office area	Medium	Low	Low	Medium	Medium	Low-Medium
5	300m East Side of the Office area	Medium	Low	Low	Medium	Medium	Low-Medium
6	300m West Side of the Office area	Medium	Low	Low	Medium	Medium	Low-Medium
7	Near Shwe Duu Village	Medium	Low	Low	Medium	Medium	Low-Medium
8	Near Zegami Village	Medium	Low	Low	Medium	Medium	Low-Medium
9	Near Taungpu Village	Medium	Low	Low	Medium	Medium	Low-
10	Residential Houses area in Taungpu	Medium	Low	Low	Medium	Medium	Low

Figure 1.1 Measuring the Ambient Air Quality

NOISE STUDY REPORT

FOR TIN MINE

Myanmar Asia Zone Activities Mining Co.,Ltd.
Zay Ka Mi group of Villages, Kyun Su Township,
Myeik District,MYANMAR

Prepared By
Dr.Aung Lay Tin
OSHE Service Co.,Ltd

Date: 17-4-2015

List of Abbreviated Terms

dB	Decibels
Hz	Hertz
kHz	Kilohertz
L_{dn}	Day-Night Level
L_{Aeq}	Equivalent Sound Level
$L_{eq(h)}$	Equivalent Sound Level over one hour
L_{max}	Maximum Sound Level
L_{xx}	Percentile-Exceeded Sound Level
mPa	micro-Pascals
mph	miles per hour
NSRs	Noise sensitive receivers
NSR	noise study report
SPL	sound pressure level

1. Introduction

1.1. Purpose of the Noise Study Report (NCR)

The purpose of this NSR is to evaluate noise impacts and abatement under the requirements of Myanmar Environmental Conservation Law (2012) and Rules (2014). The Protocol outlines the requirements for preparing noise study reports (NSR). Noise impacts associated with this project are evaluated in the project's environmental document.

1.2. Objectives of the Project

The main objective of the distillery is to produce higher quality rectified spirit with specified standard under ISO and CGMP guidelines. ISO 9001-2008 certificate has been awarded to the project. The plant is trying to get CGMP certificate in 2013. It also has a plan to get ISO 14001 certificate and HACCP certificate in a near future. Specific objectives of the project could be pointed out as:

(a) providing food safety for consumers by producing the best quality product

(b) contributing the regional development by setting up a large scale industry

(c) enhancing the job opportunities of people living in the surrounding area

(d) increasing government‟s earning via tax

2. Fundamentals of Noise

2.1. Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as loud, unexpected, or annoying sound.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receiver determine the sound level and characteristics of the noise perceived by the receiver. The field of acoustics deals primarily with the propagation and control of sound.

2.2. Frequency

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second,

or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

2.3. Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascal (mPa). One mPa is approximately one hundred billionth (0.00000000001) of normal atmospheric pressure.

Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 mPa. Because of this huge range of values, sound is rarely expressed in terms of mPa. Instead, a logarithmic scale is used to describe sound pressure level (SPL) in terms of decibels (dB). The threshold of hearing for young people is about 0 dB, which corresponds to 20 mPa.

2.4. Addition of Decibels

Because decibels are logarithmic units, SPL cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB—rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dB louder than one source.

2.5. A-Weighted Decibels

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear.

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz, and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. Then, an "A-weighted" sound level (expressed in units of dBA) can be computed based on this information.

The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B-, C-, and D-scales), but these scales are rarely used in conjunction with traffic noise. Noise levels for traffic noise reports are typically reported in terms of A-weighted decibels or dBA. Table 2-1 describes typical A-weighted noise levels for various noise sources.

Table 2-1. Typical A-Weighted Noise Levels (Source: Caltrans, 1998)

Common Outdoor Activities	**Noise Level (dBA)**	**Common Indoor Activities**
Jet fly-over at 1000 feet	—110 —	Rock band
Gas lawn mower at 3 feet	—100 —	Food blender at 3 feet
Diesel truck at 50 feet at 50 mph	—90 —	Garbage disposal at 3 feet
Noisy urban area, daytime Gas lawn mower, 100 feet	—80 —	Vacuum cleaner at 10 feet
Commercial area Heavy traffic at 300 feet	—70 —	Normal speech at 3 feet
	—60 —	Large business office
Quiet urban daytime	—50 —	Dishwasher next room
Quiet urban nighttime		
Quiet suburban nighttime	—40 —	Theater, large conference room (background)
Quiet rural nighttime	—30 —	Library Bedroom at night, concert
	—20 —	Broadcast/recording studio
Lowest threshold of human hearing	—10 — —0 —	Lowest threshold of human hearing

2.6. Human Response to Changes in Noise Levels

As discussed above, doubling sound energy results in a 3-dB increase in sound. However, given a sound level change measured with precise instrumentation, the subjective human perception of a doubling of loudness will usually be different than what is measured.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern 1-dB changes in sound levels, when exposed to steady, single-frequency ("pure-tone") signals in the mid-frequency (1,000 Hz–8,000 Hz) range. In typical noisy environments, changes in noise of 1 to 2 dB are generally not perceptible. However, it is widely accepted that people are able to begin to detect sound level increases of 3 dB in typical noisy environments. Further, a 5-dB increase is generally perceived as a distinctly noticeable increase, and a 10-dB increase is generally perceived as a doubling of loudness. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a 3-dB increase in sound, would generally be perceived as barely detectable.

2.7. Noise Descriptors

Noise in our daily environment fluctuates over time. Some fluctuations are minor, but some are substantial. Some noise levels occur in regular patterns, but others are random. Some noise levels fluctuate rapidly, but others slowly. Some noise levels vary widely, but others are relatively constant. Various noise descriptors have been developed to describe time-varying noise levels. The following are the noise descriptors most commonly used in noise analysis.

- **Equivalent Sound Level (L_{Aeq})**: Leq represents an average of the sound energy occurring over a specified period. In effect, Leq is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The 1-hour A-weighted equivalent sound level (Leq[h]) is the energy average of A-weighted sound levels occurring during a one-hour period, and is the basis for noise abatement criteria (NAC).

- **Percentile-Exceeded Sound Level (L_{xx})**: Lxx represents the sound level exceeded for a given percentage of a specified period (e.g., L10is the sound level exceeded 10% of the time, and L90is the sound level exceeded 90% of the time).

- **Maximum Sound Level (L_{max})**: L_{max} is the highest instantaneous sound level measured during a specified period.

- **Day-Night Level (L_{dn})**: Ldn is the energy average of A-weighted sound levels occurring over a 24-hour period, with a 10-dB penalty applied to A-weighted sound levels occurring during nighttime hours between 10 p.m. and 7 a.m.

- **Community Noise Equivalent Level (CNEL)**: Similar to Ldn, CNEL is the energy average of the A-weighted sound levels occurring over a 24-hourperiod, with a 10-dB penalty applied to A-weighted sound levels occurring during the nighttime hours between 10 p.m. and 7 a.m., and a 5-dB penalty applied to the A-weighted sound levels occurring during evening hours between 7 p.m. and 10 p.m.

2.8. Sound Propagation

When sound propagates over a distance, it changes in level and frequency content. The manner in which noise reduces with distance depends on the following factors.

2.8.1. Geometric Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 decibels for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path, and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of 3 decibels for each doubling of distance from a line source.

2.8.2. Ground Absorption

The propagation path of noise from a highway to a receiver is usually very close to the ground. Noise attenuation from ground absorption and reflective-wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 feet. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water,), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), an excess ground-attenuation value of 1.5 decibels per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 decibels per doubling of distance.

2.8.3. Atmospheric Effects

Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels.

Sound levels can be increased at large distances (e.g., more than 500 feet) from the highway due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects.

2.8.4. Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver specifically to reduce noise. A barrier that breaks the line of sight between a source and a receiver will typically result in at least 5 dB of noise reduction. Taller barriers provide increased noise reduction. Vegetation between the highway and receiver is rarely effective in reducing noise because it does not create a solid barrier.

3. Relevant Guidelines, Standards and Legislation

3.1. Noise Level Guidelines

As Myanmar is still attempting to regulate the noise level standards for different sectors, World Bank IFC General Environmental, Health and Safety Guidelines are used for reference. They can be used to address impacts of noise beyond property boundary of the facilities. The guidelines show the impacts should not exceed the levels presented in the following table, or result in a maximum increase in background level of 3 dB at the nearest receptor location off-site.

Table 5.2 . Some Acceptable Noise Level Standards

Noise Level Guidelines		
	One Hour L_{Aeq} (dBA)	
Receptor	Daytime 07:00 – 22:00	Nighttime 22:00 – 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Source: (IFC, 2007)

The Noise Levels should be monitored in accordance with any one of the following noise level standards given in table below:

Table 5.3 . Some Acceptable Noise Level Standards

Country/Region	Acceptable Noise Level dB (A)		
	Industrial Areas Day/ Night	Commercial Areas Day/ Night	Residential Areas Day/ Night
EU(UN/WHO)	65	55	55/45
Australia	65/55	55/45	45/35
Japan	60/50	60/50	45/35
USA	70	60	45
Romania	65	65	50/40
India	No Data	65/55	55/45
Vietnam	75/50	70/50	60/45

Source: UNDP guidelines

4. Study Methods

4.1. Measurement time

The noise under investigation is measured for sufficient time to establish that the measured value adequately represents the subject source noise. The source noise is measured over a time interval of at least 15 minutes or, if the noise continues for less than 15 minutes, the duration of the source noise.

Typical monitoring periods should be sufficient for statistical analysis and may last 48 hours with the use of noise monitors that should be capable of logging data continuously over this time period, or hourly, or more frequently, as appropriate (or else cover differing time periods within several days, including weekday and weekend workdays). The type of acoustic indices recorded depends on the type of noise being monitored, as established by a noise expert.

4.2. Measurement location

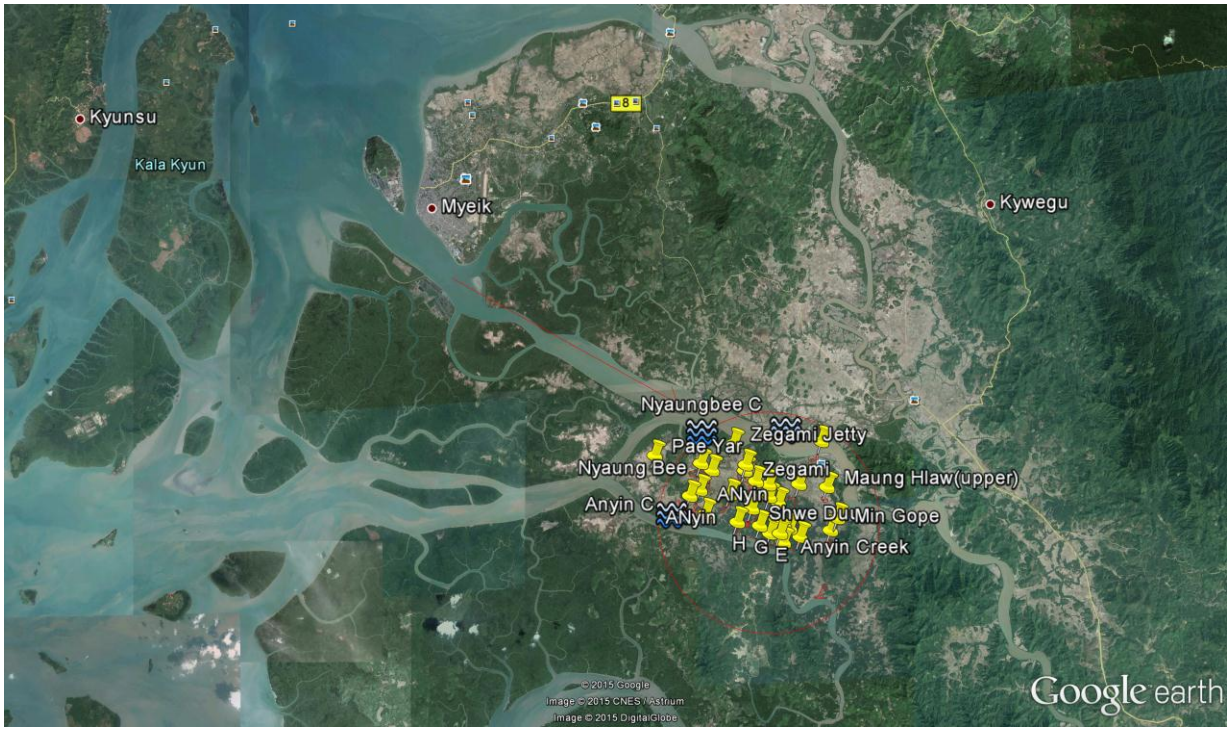
Normally, when undertaking a noise assessment, it is essential to make note of the following on a site map:

- location of noise source
- background noise measurement location
- source noise measurement location
- topography between noise source and sensitive receivers.

The location of noise measurements for the project is shown in Figure 4.1.

Table 4.1. Location of Noise Sensitive Receivers (NSRs)

Sr.No	Sample Name	Location	Coordinates	
			Latitude(N)	Longitude(E)
1	NS-1	Office area	12°18'33.16"	98° 44'38.15"
2	NS-2	100m from the Office	12°18'34.77"	98° 44'25.32"
3	NS-3	300m North Side of the Office area	12°18'22.64"	98° 44'39.68"
4	NS-4	200m South Side of the Office area	12°18'49.75"	98° 44'22.02"
5	NS-5	300m East Side of the Office area	12°18'51.99"	98° 44'39.30"
6	NS-6	300m West Side of the Office area	12°18'54.30"	98° 44'23.47"
7	NS-7	Near Shwe Duu Village	12°18'57.64"	98° 44'1.55"
8	NS-8	Near Zegami Village	12°19'12.17"	98° 43'55.51"
9	NS-9	Near Taungpu Village	12°19'4.68"	98° 43'54.97"
10	NS-10	Residential Houses area in Taungpu	12°18'44.65"	98° 43'50.70"



4.3. Measurement method

Handheld Quick Assessment

The handheld assessment method is used to get noise levels; a tripod is used for a compliance inspection or to take enforcement action. To obtain the most accurate data using this method, the SLM is held out at arm's length and held out to the side with the microphone pointed towards the source of the noise, to minimize sound reflecting off the body.

Affected height of the receptor

A noise reading should always be taken at the height of the receptor. If the receptor is at the ground level, measurement is taken at the ground level (1.2–1.5m off the ground) and no closer than 3 m to any reflecting surface (e.g., wall).

5. Existing Noise Environment

5.1. Existing Land Uses

As in Figure 1, the land uses in the vicinity of the project are found to be commercial, natural mountain slope and farmlands.

5.2. Noise Measurement Results

The project is located in an outlying mountainous area with limited road network, and has no major road traffic related noise sources. The noise environment at the project is dominated by human activities, with most activities during daytime hours.

The noise monitoring results are summarized in Table 5.1 to demonstrate baseline noise levels at the site. There has been no development in the area since this time that would have led to a change in the baseline noise environment.

Existing Noise Levels

Noise level survey at the vicinity of the project was done by the ESIA team. The noise stations, the noise levels and their coordinates are shown in the following table.

Table 5.1. Noise Measurement Results between April 5,2015 and April 9, 2015.

No	Receptor Location	Noise Level In (dB)(A)	
		Day (7:00am to 6:00pm)	Night (7:00pm to 10:00 pm)
1	Office area	45	45<
2	100m from the Office	55	55<
3	300m North Side of the Office area	40	40<
4	200m South Side of the Office area	40	40<
5	300m East Side of the Office area	45	45<
6	300m West Side of the Office area	35	35<
7	Near Shwe Duu Village	58	58<
8	Near Zegami Village	55	55<
9	Near Taungpu Village	60	60<
10	Residential Houses area in Taungpu	60	60<

No	Receptor Location	NOISE LEVEL ASSESSMEENT (Day and Night)			
		Low	Medium	High	Very High
1	Office area	✔			
2	100m from the Office	✔			
3	300m North Side of the Office area	✔			
4	200m South Side of the Office area	✔			
5	300m East Side of the Office area	✔			
6	300m West Side of the Office area	✔			
7	Near Shwe Duu Village	✔			
8	Near Zegami Village	✔			
9	Near Taungpu Village	✔			
10	Residential Houses area in Taungpu	✔			

Figure 4.1 Surveying Noise

6. Future Trend

Based on the planning information, resident people activities, their vehicles, waste collection and treatment works are a potential noise source that may affect NSRs close to the work site during construction. Future increase in the population (upon occupancy of all planned developments) may result in more human activity and potentially a higher noise background.

7. Identification of Potential Construction Noise Impacts

It is anticipated that the use of Powered Mechanical Equipment (PME) during the construction phase will generate potential noise impact upon the existing NSRs in the vicinity of the project site. Based on a practicable equipment inventory provided by the Project Proponent, Table 7.1 presents the likely PME that shall be used to construct the Project according to schedule and the corresponding sound power levels.

Table 7.1. Powered Mechanical Equipment to be Used for Construction

Sr.	Description	Sound Power Level, dB (A)
1	Air compressor	104
2	Bar bender (electric)	90
3	Concrete mixer (electric)	96
4	Crane, mobile (diesel)	112
5	Derrick barge/ Split barge	104
6	Dredger, grab	112
7	Dump truck	117
8	Excavator/ Backhoe	117
9	Generator, Standard	112
10	Poker, vibratory, hand-held	113
11	Roller, vibratory	108

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APPENDIX-I HEALTH

HEALTH IMPACT ASSESSMENT

1.Introduction

1.1 Project Overview

Health Impact Assessment (HIA) process for Myanmar Asia Zone Mining Co.Ltd. was conducted at Zay Ga Mi village , Kyun Su township, Myeik district Thanintharyi division commencing on April 2015.

The proposed project area is of 650 acres and it is situated between Thanintharyi river and Anyin stream.

1.2 HIA Framework

1.2.1 HIA Definition

Health impact assessment is a combination of procedures, methods and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population and the distribution of those effects within the population.

1.2.2 Risk versus well-being model

This definition relate to two different models of health assessment. These will be referred to as "the risk model" and the "well-being model". The risk model is concerned with risks to existing health and tends to emphasize reductions in ill-health and opportunities for improved health associated with health determinants. The "well-being model" is concerned with challenges to peoples' health and well-being associated with health determinants.

Both models are based on the broad socio-environmental definition of health espoused by WHO. The health of communities is always changing as a consequence of many changing factors in the social and physical environment. Many of these are unknown or unplanned.

1.2.3 Aims of HIA

- to systematically assess the potential health impacts, both positive and negative of projects.

- to improve the quality of public policy decisions by making recommendations that are likely to enhance predicted positive health impacts and minimize negative ones

1.2.4 Key Objectives of HIA

- to evaluate the potential impacts on individuals and communes influenced by a proposed project
- to establish the baseline of existing health conditions in a proposed project area
- to provide a formal mechanism for engaging relevant stakeholders in discussions regarding prevention and mitigation of negative effects on health
- to provide a basis for developing formal mitigation action plans

1.2.5 Legal Framework

The HIA team carried out law review processes and some of the relevant laws and their relevancy could be summarized as follow:

Public Health Law(1972) : The law is concerned with protection of people's health, controlling the quality and cleanliness of food, drugs, environmental sanitation, epidemic diseases.

Prevention and Control of communicable diseases Law(1995) (Revised in 2011): The law described the functions and responsibilities of citizens and health personnel in relation to prevention and control of communicable diseases. It also describes measures to be taken in relation to environmental sanitation, reporting and control of outbreaks of epidemics.

National Food Law (1997): The law enacted to enable the public to consume food of genuine quality, free from danger to prevent public from consuming food that may cause danger or are injurious to health, to supervise production of controlled food systematically and to control and regulate the production, import, export, storage, distribution and sale of food systematically.

1.3 HIA process

According to "Good Practice Guidance for Health Impact Assessment" as presented in ICCM [4], internationally recognized good practice disseminated by the WHO[1] and IAIA(International Association for Impact Assessment)[5], this HIA will:

- Identify and maximize the positive community health and wellbeing impacts and opportunities that a proposed project can bring
- Identify, avoid and minimize the unintended negative community health and wellbeing impacts that can arise.
- Provide a way through which the project can work in partnership with local health, social care, and welfare services to jointly alleviate these health problems.
- Form one part of a broader community and local stakeholder involvement and engagement process that can build trust, draw out any community concerns and generate a dialogue about the best ways that the project can benefit local communities.
- Review proposed project specifics
- Identify potentially affected communities
- Analyze the sufficiency of baseline health data and highlight data gaps
- Select key health impacts using a set of defined health effects categories
- Conduct qualitative impact rating and ranking analysis and
- Propose a series of mitigation measures tied to potential impacts

1.4 Types of HIA

An HIA can be classified into three types: (1) a short desktop HIA that takes an expert practitioner less than 2 weeks to prepare (2)a rapid assessment that takes several months (3) a comprehensive report that requires a year or more to complete.

Desktop HIA

The desktop HIA is a qualitative assessment and is most appropriate for projects with few anticipated health impacts. The HIA team often does not pursue extensive stakeholder engagement although some involvement is usually required.

Rapid Appraisal HIA

A rapid appraisal HIA is considered to be a site-specific HIA that uses available health information without conducting new field survey work. Data sources may include peer-reviewed scientific literature, health department database and local private health service data sources. A rapid appraisal HIA may evolve into comprehensive HIA.

Comprehensive HIA

The hallmark of the comprehensive HIA is collection of new data, to address critical data gaps identified during the scoping process. A comprehensive HIA also pursues extensive stakeholder engagement and may be appropriate for projects such as resettlement of existing communities, significant population influx , major disruption of subsistence practices, major impacts to key social determinants of health etc.

The OSHE HIA team utilizes a rapid appraisal strategy together with social survey. This HIA identifies potential project impacts, positive or negative, in a timely fashion for decision makers and stakeholders. The rapid appraisal HIA strategy is fully capable of identifying potentially critical impacts and data gaps. A major goal of this HIA is to accurately inform decision makers and stakeholders regarding potential impacts based on the current set of available data.

1.5 Importance of HIA

Health impact assessment is an important public health method because it ;

- improves the quality of decision making in health and partner organizations by incorporating into planning and policy-making the need to address health issues.
- demonstrates that health is far broader than health-care issues.
- promotes equity, sustainability, and healthy health policy.

- involves a multidisciplinary approach.
- makes values and politics explicit and open issue to public scrutiny.
- emphasizes social and environmental justice.

2. Scope of the study

The HIA study, focusing the project area and it's vicinity, includes nine villages which are Naung Bee, Zaygami, Pan Taung, Taung Pu, Anyin, Wat Toe, Maung Hlaw (upper), Maung Hlaw (lower), Shwe Du.

(a)Scoping: In scoping process , specific information for all the villages such as household numbers, family members, gender and infrastructural information are collected.

(b) Public Participation: Stakeholder identification and consultation with appropriate stakeholders are done in this process. Then first public meeting in which project information is released to general public requesting their comments and suggesting is carried out. In the second public meeting, draft HIA report and its findings are delineated to general public for open discussion.

(c) Household Survey: To obtain the socioeconomic and basic health profile of the study area, a household survey is conducted with a structured questionnaire especially devised for this project by trained questioners. Detailed methodology for household survey is described in later section.

(d) Impact Identification and Assessment; Anticipated impacts of the project relating to its environment are assessed from project information, baseline health and socioeconomic data, and comments and suggestions of local community from public meetings and consultation works.

(e)Mitigation Recommendation: Mitigation recommendations are based on impact ratings and rankings with the aim to enhance predicted positive health impacts and minimize negative ones.

(f) Report Drafting: Health impact assessment report is drafted, reviewed and revised as required by OSHE technical consultants.

(g) Disclosure: Executive summary of the draft HIA report translated into Myanmar is disclosed to the general public before the second public meeting and

discussed in second public meeting. Comments and suggestions on the draft EMP,SIA, HIA report delineated as translated summary are collected.

(h) Final Report: Draft HIA report is reviewed, revised, and modified according to the results from second public meeting.

3. Methodology and Approach

Social Data Survey Methodology

Data survey method is based on the United Nations Guidelines. ST/ESA/STAT/SER.F/98[8] and ST/ESA/STAT/SER.F/31[9]

(a) Questionnaire Preparation: Structured questionnaires developed based on MICS (Multiple Indicator Cluster Survey) 2009-2010[3], WHO (1999) Health Impact Assessment Main Concepts and Suggested Approach[1], Public health ethics and equity, Oxford University Press, Oxford[2].
(b) Informed consent and confidentiality: For all data collection, oral informed consent was obtained from the participants.
(c) Survey team : All member involved in this study received information on research ethics with an emphasis on the importance of informed consent and confidentiality. And also members get training on attitude and manner in questioning, the questionnaire and its meaning, field methods in data survey and practical questioning technique.

Health Impact Assessment Methodology

This HIA followed the standard steps of scoping, developing a baseline health profile, assessing impacts , developing recommendations and report writing. Prioritizing health effect category is used to assess the health impact of the project on its environment. This section indicates how the various health effect categories (HECs) should be prioritized by decision makers and why. Although this section does not provide a quantitative evaluation of health risks, it provides a qualitative ranking system that takes into consideration of four parameters for each HEC: (1) Stakeholder concern (2) data gaps (3) potential impact which considers the potential for both positive and negative health effects as a result of the project (4)

likelihood, the prioritization level for each of the four parameters is defined as low, medium, or high.

Table : 1 Parameter Ranking for Prioritizing HECs

Parameters	Rank		
	Low	Medium	High
Stakeholder concern	HEC not mentioned by stakeholders	HEC mentioned by stakeholders: Somewhat important	HEC highly important to stakeholders
Data Gaps	No data gaps exist for the HEC	Data gaps exist for the HEC but would provide little additional information if filled	Data gaps exist for the HEC and represent critically important information
Potential impact	HEC review reveals no potential impacts or minor positive or negative impacts only, easy adaptation	Modest increase(or decrease) in mild to moderate disease events; effective mitigation strategies exist	Substantial increase (or decrease) in moderate to severe morbidity or mortality events; adaptation with assistance
Likelihood	Unlikely, HEC effects not typically observed in similar settings or have never been observed in similar settings	Possible: At least some of the health effects in this HEC have occurred in similar settings and could occur given proper conditions or design features	Probable: At least some of the health effects in this HEC are known to be common in similar settings and will most likely occur

1. Health Effect Categories (HECs)

The World Health Organization's view of health

Health is the extent to which an individual or group is able:

- to satisfy needs
- to realize aspirations
- to change or cope with their environment

  Health is a resource for everyday life, not the objective for living: it is a positive concept emphasizing social and personal resources as well as physical capabilities.

Figure 1: Determinants of health and well being

The HECs are a standard set of effects categories that have been developed and published by WHO (World Health Organization)

1. Social Determinants of Health (SDH)

   This is a broad category that considers how living conditions and social situations influence the health of individuals and communities. It includes economy, employment and education, depression and anxiety,family stress,

domestic violence, cultural change, isolation, psychosocial issues related to drugs and alcohol etc.

Limitations:

While SDH are real and important, it is extremely difficult to establish direct causality between a change in social determinant and a particular health outcome at a population level. Moreover, this HEC involves aspects of wellbeing that are normally difficult to quantify and objectively measure (eg. negative emotions, stress, anxiety, depression, etc)

2. Water and sanitation

This category includes the changes to access, quantity and quality of water supply. The pathways include: (a) lack of adequate water supply is linked to the high rates of lower respiratory tract infection, gastrointestinal tract infection, and skin infection (b) revenue from the project that supports construction and maintenance of water and sanitation facilities (c) increased demand on water and sanitation infrastructure secondary to influx of non-resident workers.

3. Communicable Disease

This category includes the project's influence on patterns of infectious diseases. The pathways include: (a) influx of non –resident personnel from outside the region(b) crowded or enclosed living and working conditions and the mixing of low and high prevalence populations due to influx can create an increased risk for transmission of sexually transmitted disease such as HIV, syphilis, and Chlamydia (c) changes to groundwater/wetlands can alter habitat for agents that transmit vector-borne diseases.

4. Food , Nutrition, and subsistence Activity

   This category depends on the subsistence analysis and nutritional surveys and considers:

-Effect on diet: This pathway considers how changes in aquatic life, wildlife habitats and food choices will influence the diet of communities.

- Effect on Food security: This effect considers project-specific impacts that may limit or increase the availability of foods needed by local communities.

5. Non-communicable and chronic diseases

   This category considers how the project might change the patterns of chronic diseases. The pathways include: (a) nutritional changes that could eventually produce cardiovascular diseases, diabetes, and obesity. (b) pulmonary exposures that lead to tobacco related chronic lung diseases, asthma (c) local community air quality: clinic visits for respiratory illness (d)cancer rates secondary to diet changes or environmental exposures (e)increased rate of other disorders, specific to the contaminants of concern.

6. Exposure to potentially hazardous materials

   This category includes project emissions and discharges that lead to potential exposure. Exposure pathways include: drinking water, air, food, work etc. Indirect pathways such as changing heating fuels/ energy production fuels in communities.

7. Accidents and Injuries

   This category includes impacts related to both fatal and non-fatal injury patterns for individuals and communities. Change in patterns of accidents and injuries may arise due to: (a) influx of nonresident personnel (increased traffic on roadways) (b) distance of travel required for successful subsistence (c)project related income and revenue used for improved infrastructure (eg. roadways) and improved subsistence equipment/technology.

8. Health services infrastructure and capacity

   This category considers how the project will influence health services infrastructure and capacity. The pathway include: (a) increased demand on infrastructure and services by incoming non-resident employees or residents injured on the job especially during construction phases.

Health effect categories (HECs) have been developed to identify the full spectrum of possible health impacts related to a specific project. The HEC approach includes all of the biomedical and social concerns originally

developed by key international health and development agencies, i.e., the World Health Organization (WHO) and the World Bank Group[6]. Generally, while each of HEC may not be relevant for a given project, it is still important to systematically analyze the potential for project related impacts (positive, negative or neutral) by careful consideration of each HEC.

2. BASELINE CONDITION

Introduction and Background

Baseline health conditions are the fundamental component for the overall health impact assessment (HIA) process. The baseline health summary provides a point of reference for the health status of a community prior to development of proposed project and also describes an overall health profile for an area. Moreover, the health profile can inform decision makers about health vulnerabilities in a region as well as positive health traits present in a population.

In Myanmar, baseline health information resides in public health surveillance systems maintained by the department of health.

Myanmar public health agencies routinely report public health surveillance data at the statewide or regional level. These agencies do not report village or community level data to avoid privacy violations and problems with statistical analysis when case numbers are small. Hospital data described in HIA study is based on the latest official publicity report from the Ministry of Health , Myanmar.

Source of information

Annual Hospital Statistics Report 2013, Department of Health Planning with the collaboration of Department of Health on December 2015, Myanmar,

Township Health Profile, Kyung Su Township, Department of Health, MOH

Annual Public Heath Statistics Report, 2013, Ministry of Health , Myanmar

HIM Health in Myanmar 2014 .

Maung Hlaw Station hospital, 2016.

Naung Bee Health centre, 2016.

Social surveys : Interviews with 64 households from Nyung Bee , 54 households from Zaygami, 43 households from Pan Taung, 42 households from Taung Pu, 40 households from Anyinn, 38 households from Wat Toe, 16 households from Maung Hlaw (upper), 14 households from Maung Hlaw (lower), 9 households from Shwe Du villages.

Baseline health studies were conducted through a survey of 320 households. According to this, the most common chronic disease or conditions were hypertension, diabetes mellitus, respiratory disease, heart disease, gout, rheumatoid arthritis, eye diseases. Concerning the suffering sickness within 2 months, the most common complaints were flu, diarrhea, and gastrointestinal disease. Regarding the question of treatment taken as outpatients at clinics or hospital including accident or injury, the cases noted were flu, hypertension, diabetes mellitus, heart disease, stroke, gastrointestinal diseases, diarrhea, dengue, motor cycle accident, eye disease, and respiratory tract infection. In terms of death of household members within 2 years, the cause of death reported were stroke, cirrhosis of liver, carcinoma of lung. Regarding the hospitalized cases among household members within 1 year, the complaints were diarrhea, pneumonia, hepatitis, heart disease, road traffic accident, hypertension, diabetes mellitus, stroke, snake bite. TB, appendicitis, gastritis, goiter, myoma of uterus, carcinoma of the stomach, DHF, hematemesis, knee pain, back pain, kidney disease, fracture neck of femur .

In case of maternal and child health care, mothers of under 2 years children recalled that they were treated with doctors, HA, nurse or midwife during their pregnancy periods. Most of them answered that their delivery of children were assisted by HA, nurse, auxiliary midwife or traditional birth attendant at home and few of them were assisted by doctors or nurse at hospital. All of the mothers of under 2 years children reported that that their children received complete immunization.

Concerning health services utilization, majority of household members consulted with HA or nurse. The other gave the answer of consulting with health care personnel or among family members. For the water source, almost all of the villagers use common well. Among them, the most commonly used method for drinking purpose was stain it through a cloth and the second commonest was letting the water stand. For the utilization purpose especially for cooking, most of them used water from well and took no treatment. Majority of household used mosquitoes nets at night time and few of them used nets together with anti-mosquitos' coils. Most of the household involved in survey reported that they used sanitary latrine but some household answered they had no latrine for their private use. The types of fuel that the household used for cooking were charcoal and woods.

Table:2 Summary of the health issue of the adjacent community (9 villages)

NB=Nayng Bee, ZGM=Zaygami, PT=Pan Taung, TP=Taung Pu, AN=Anyinn

WT=Wat Toe, MH(U)=Maung Hlaw (upper), MH(L)=Maung Hlaw (Lower)

SD=Shwe Du

Name of village / No. of people who	NB	ZGM	PT	TP	AN	WT	MH (U)	MH (L)	SD
-took treatment as outpatients at health center, clinics or hospitals including accidents or injury within 2 months	16	18	8	11	2	7	1	2	4
-Suffering chronic diseases									

Hypertension	10	1	6	3	3	7	2	2	1
Respiratory disease	1	-	1	1	-	2	-	1	1
Diabetes mellitus	4	1	-	1	1	1	1	-	-
Heart disease	10	1	6	1	1	2	-	-	-
Stroke	2	1	-	-		-	1	-	-
Kidney disease	1	-	-	-	-	-	-	-	-
Gastric ulcer	5	-	2	-	-	-	-	1	-
Rheumatoid Arthritis	1	-	-	1	-	-	-	-	-
Eye disease	-	2	-	1	-	1	-	-	-
Anaemia	2	-	-	-	-	-	-	-	-
Goitre	-	-	1	1	-	-	-	-	-
Liver disease	-	-	-	-	1	-	-	-	-
Musculoskeletal disease	2	-	-	1	-	2	-	-	1
Hospitalization within 1 years	13	10	4	9	6	5	4	4	1
Death within 2 years	-	5	5	-	-	3	1	-	-

Source : Interviews

Table:3 Smoking status of community

	NB	ZGM	PT	TP	AN	WT	MH (U)	MH (L)	SD
Smokers	64	30	41	54	59	57	24	25	14

Table:4 Water and Sanitation in adjacent community (9 villages)

Name of Village / Total number of household using	NB	ZGM	PT	TP	AN	WT	MH (U)	MH (L)	SD
- Drinking Water Sources									
-Common Well	64	52	32	42	40	38	15	9	9
-Purified drinking water	-	2	-				1		
-Water donated by World Bank project			3						
- Flow water from hill			8					5	
-Types of fuel for cooking									
Charcoal	43	44	16	30	27	18	14	9	5
Woods	21	9	27	12	13	18	2	5	4
Gas	-	1	-	-	-	2	-	-	-
-Latrine									
Sanitary latrine use	52	50	40	33	29	22	14	11	7
Pit latrine	3	2	1	-	2	1	1	2	2
No Latrine	9	2	2	9	9	15	1	1	-

Figure: 2

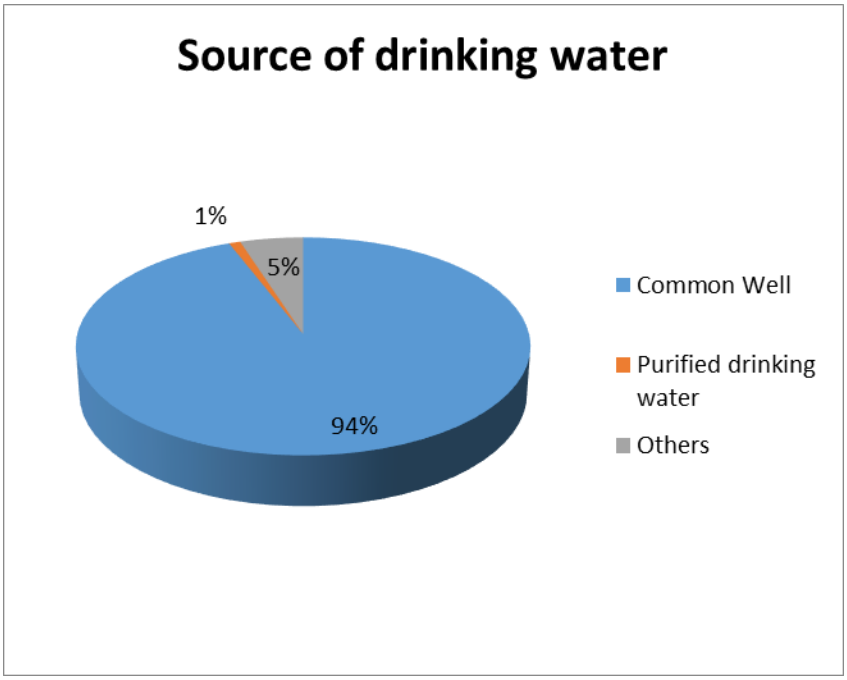
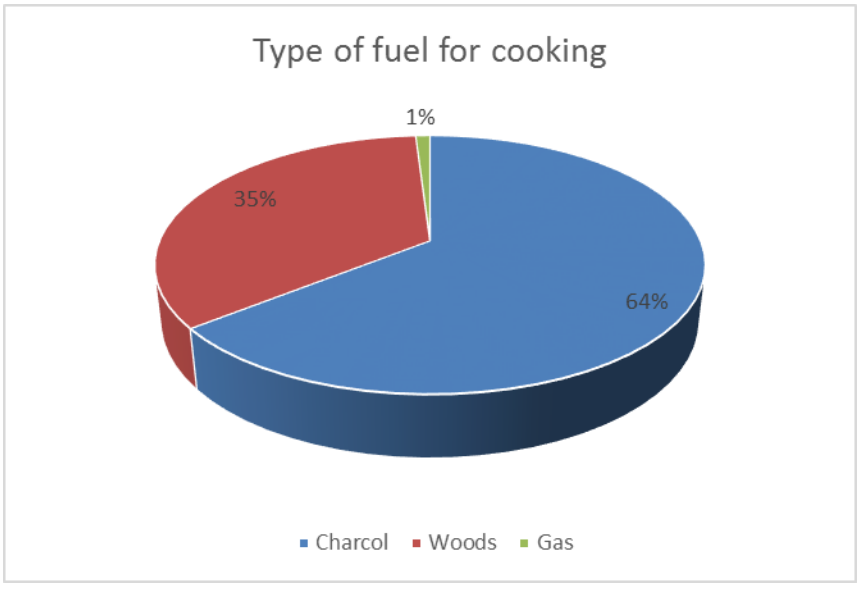


Figure: 3



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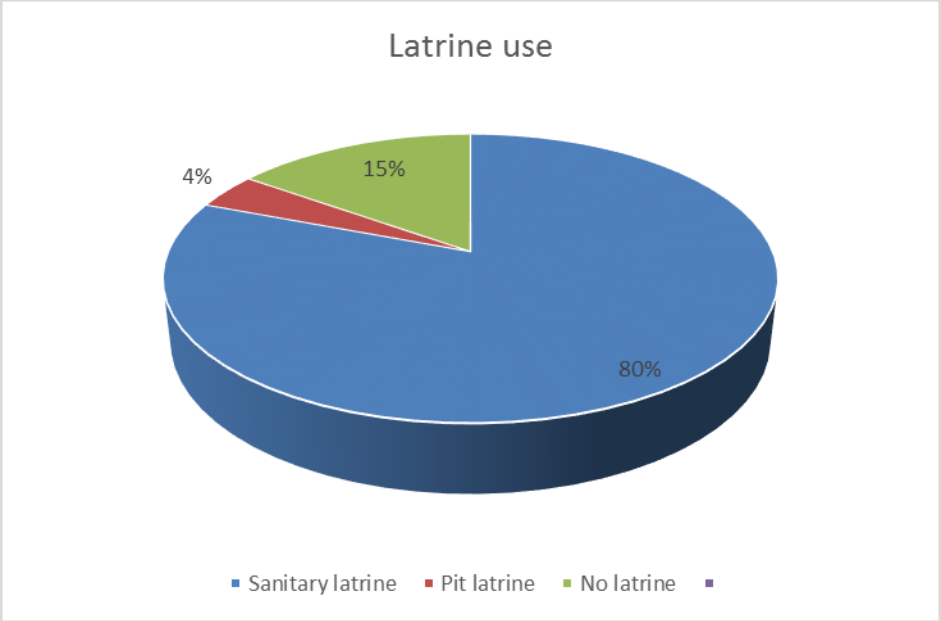
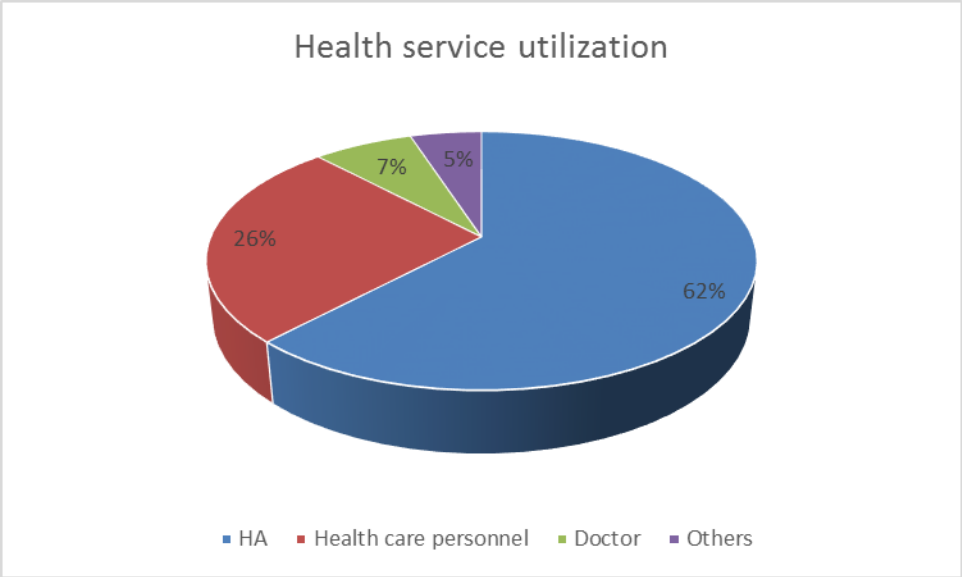


Table:5 Health services utilization

	NB	ZGM	PT	TP	AN	WT	MH (U)	MH (L)	SD
Who was consulted for illness of household members?									
- HA	62	22	24	28	26	23	4	2	7
-Health care Personnel(HCP)	1	28	13	2	11	15	4	8	1
-Doctor	1	4	6	2	1	-	8	2	-
-Family members(others)	-	-	-	10	2	-	-	2	1

Figure :5



5.1 Social Determinants of Health

The HIA team uses both health outcome data and health determinant data to describe the social determinants and establish baseline health information for this health effect category. An outcome is a health event that has actually occurred while a determinant is a setting or context that strongly influences health status. For example, for outcome, it contains report of maternal and child health, suicide rates, substance abuse rates and other serious illness and death rate parameters as general indicators of physical and social well-being. For health determinant, it includes general demographics, family structure, economic status, and educational attainment.

Indicators for mental health

Region	Psychosis	Depress -ion	Anxiety neurosis	Alcohol Dependence	Epilepsy	Mental retardat -ion
Tanintharyi	0.18	0.33	0.04	0.92	0.12	0.08
Union	0.07	0.05	0.05	0.78	0.03	0.05

Maternal and Child Health

Maternal and child health is a dynamic field that aims to improve the health of women, children, youth and entire families and communities. Ministry of health cooperates with Myanmar Maternal and Child Welfare Association, UN agencies and other international and local non -governmental association to provide health care services for the reduction of maternal mortality, infant mortality and under-five mortality.

According to Annual Hospital Administrative Statistics of Kyunsu 25 beded hospital in 2013, total number of livebirths was 98, total number of stillbirths was 1 and abortions was 8. Similarly, station hospital of Sakanthit (Kyunsu) reported the annual hospital statistics as follow, total number of livebirths 31, total number of stillbirths 2 , total number of abortions 4 respectively. Maung Hlaw station hospital was opened in May 2016 and the data from this hospital indicated that the total number of admission case with pregnancy was 69 in 2016.

Indicators for maternal, newborn and child health care activities (2013)

Regions	%of under 5 children with severe dehydration	%of under 5 children with ARI	%of newborn receiving breastfeeding within 1 hour of birth	%of newborn care coverage
Tanintharyi	1.0	14.4	86.8	83.3
Union	2.0	13.5	76.1	74.1

Suicide rate

A sound mind in a sound body has been recognized as a social ideal for many centuries. WHO expert committee on mental health expressed that "Mental health is influenced by both biological and social factors. It is not a static condition but subject to variations and fluctuations of degree; changes in social and physical environment. The social and environmental factors associated with mental ill health comprises worries, anxieties, emotional stress, tension, frustration, poverty, industrialization, urbanization, changing family structure, population mobility, economic insecurity, rejection, neglect and the like. The social environment not only determines the individual's attitudes but also provides the framework within which mental health is formulated. Suicide can function as one indicator of mental health wellness in a population.

Substance abuse

Drug is defined as any substance that, when taken into the living organisms, may modify one or more of its functions(WHO). Drug abuse is defined as self administration of drug for non-medical reasons, in quantities and frequencies which may impair an individual's ability to function effectively, and which may result in social, physical, or emotional harm. Substance abuse influences many health outcomes such as accident and injuries, chronic diseases, mental health problems etc. substance abuse includes illegal drugs (eg., marijuana, opioids, cocaine), alcohol addiction and binge drinking.

Economic Indicators

Economic status may create a powerful context for human health and improved income is generally thought to be associated with improved community health outcomes. There are many indicators such as rate of population increase, per capita GNP, level of unemployment, dependency ratio, literacy rates, family size, housing, per capita calorie availability. Detailed information regarding economic indicators, employment condition, education status, family size etc is mentioned in the SIA report.

5.2 Water and sanitation

Access to improved drinking water is one of the important in environmental sanitation program and the percentage of population with improved drinking water was lowest in Thanintharyi region (51.2%)in 2013 compared to other states and regions.

Indicator for access to improved drinking water

Region	% of population with improved drinking water
Tanintharyi	51.2
Union	78.4

Moreover, sanitary latrine coverage households was 60.2% and population was 66.6%. And also access to improved sanitary latrine in this region was 91.4% in urban area and 76.3 % in rural area.

According to survey, 80% of household used water from common well for drinking purpose, 1% used purified drinking water for drinking and method used to petrify water was stain it through cloth (cloth filtering). In term of sanitary latrine, 80% of household involved in survey used sanitary latrine, 4% of household used pit latrine and 15% of household answer that they had no latrine.

5.3 Communicable diseases

Sexually transmitted diseases

The sexually transmitted diseases are a group of communicable diseases that are transmitted predominantly by sexual contact and caused by wide range of bacterial, viral, protozoa and fungal agents and ectoparasites. Certain demographic factors will undoubtedly contribute to increase in STDs in the developing countries. These include population explosion and marked increased in number of young people, the group at highest risk for STD in the population, rural

to urban migration etc. Percentage of sexually transmitted diseases among outpatients in this region in 2013 was 0.15%.

Other infectious diseases

According to 2013 public health statistic data of this region, Septicemia, Pneumonia, malaria, unspecified cirrhosis of liver, unspecified human immune deficiency virus (HIV) diseases, respiratory tuberculosis were the major contributors in terms of numbers of death associated with infectious diseases.

Indicators for Sexually Transmitted Infection Control Activities

Region	VDRL test positive in primigravida	Genital ulcer detection rate	Genital discharge rate (male)	% of STI among outpatients
Tanintharyi	1.2	6.5	14.8	0.15
Union	0.7	2.2	4.4	0.06

Regarding the genital ulcer detection rate by regions and states in annual public health statistics report 2013, its detection rate per 100,000 population was found to be high in Tanintharyi region. Also, male patients with genital discharge due to STIs were high in Tanintharyi region.

Indicators for Malaria

Region	%of Malaria among out patients	%of hospitalized patient with malaria	%of in-patients deaths among those with malaria (CFR)
Tanintharyi	5.0	2.8	0.5
Union	2.1	1.2	1.2

According to the hospital statistics data of the Maung Hlaw Station Hospital in 2016, total numbers of patient testing malaria infection was 95 and total number of hospitalized with malaria was 3. There was no in-patient death of malaria.

Indicators for morbidity of smear Positive and Negative TB

Region	Morbidity of smear Positive TB per 100,000 population	Morbidity of smear Negative TB per 100,000 population
Taninthartyi	63.8	169.5
Union	57.7	82.5

Tuberculosis is one of the diseases under national surveillance in Myanmar and in 2013, Tanintharyi had the second highest proportion of smear negative TB cases per 100,000 population.

5.4 Food , Nutrition and Subsistence Activity

The word food factor is used for specific dietary constituents such as proteins, vitamins and minerals. Good nutrition means maintaining a nutritional status that enables us to grow well and enjoy good health. Specific nutritional diseases can be identified protein energy malnutrition, endemic goiter, nutritional anemia, nutritional blindness and diarrheal diseases. There are no reported deaths by malnutrition or other nutritional disorders in the proposed project area.

Indicators for growth monitoring

Region	%of newborns with LBW (township) (M)	% of newborn with LBW (township) (F)	Infants with beriberi (per 1000LBs)	% of under5 children with under weight	% of under-nourished children receiving Growth monitoring and promotion per month	% of villages/wards with qualified consumption of iodized salt

Tanintharyi	0.8	0.8	3.1	3.1	5.9	89.3
Union	1.0	1.0	1.6	3.0	7.3	93.4

According to the data, infantile beriberi is a very common cause of death in Myanmar and in attention should be focused in Tanintharyi region where infantile beriberi was high compared to other states and regions

5.5 Chronic Non-communicable Diseases

Non communicable diseases (NCDs) are leading cause of death and disabilities among worldwide. Chronic NCDs are assuming increasing importance among the adult population in both developed and developing countries. NCDs also accounted for 68% of deaths in 2012 (38 million of 56 million). Cardiovascular diseases (CVD) comprise of a group of disease of the heart and the vascular system and includes coronary heart diseases, other diseases of the heart, arteriosclerosis, hypertension and cerebrovascular diseases. In 2013, proportion of hypertension per 1000 above 15 years population was 9.4. The prevalence of current smoker per 1000 above 15 years population was 182.1.

According to interviews, 10.9% of people involving in social survey said that they are suffering hypertension, 6.6% had heart diseases and 2.8% had diabetes mellitus. According to local hospital and clinic statistics, hypertension and related cardiovascular diseases are involved in list of leading cause of morbidity. From the hospital data of the Maung Hlaw hospital in 2016, 49 hypertension cases was recorded as new cases.

Indicators for cardiovascular diseases and risk behaviors

Region	Proportion of hypertension per 1000 above 15 years population	Prevalence of current smoker per 1000 above 15 years population
Tanintharyi	9.4	182.1
Union	6.7	156.4

5.6 Exposure to Potentially Hazardous Materials

Hazard is the intrinsic capacity of an agent, a condition or situation to produce an adverse health or environmental effect. Risk assessment is the process of estimating the potential impact of a chemical, physical, microbiologic, or psychosocial hazard on a specified human population or ecologic system under a specified set of conditions and for a certain timeframe.

Physical exposure:

Air-

The health impacts of air pollution are related to changes in air quality rather than total concentrations. The possible burden of ill-health due to existing level of air pollution is dominated by the impacts of long term exposure to air borne particles. Groups that may have an increased susceptibility to air pollution include people with pre-existing respiratory or cardiac illness, the elderly, babies and those living in deprived communities.

According to the annual statistics of this region in (2013), total number of patients hospitalized for acute upper respiratory tract infection (unspecified) was 776(male 429(2.0%) , female 347(1.3%). According to the data of diseases under national surveillance (2013), morbidity of ARI (pneumonia) in this region was 6947 per 100,000 U5 population.

Water-

It is important to note that there can be no state of positive health and wellbeing without safe water. Water is not only a vital environmental factor to all forms of life, but it has also a great role to play in socio-economic development of human population. A more serious aspect of water pollution is caused by human activity-urbanization and industrialization. The sources of pollution resulting from these are : (a)sewage, which contains decomposable organic matter and pathogenic agents

(b) industrial and trade wastes, which contain toxic agents ranging from metal salts to complex synthetic organic chemicals (c) agricultural pollutants which comprise fertilizers and pesticides, and physical pollutants, heat (thermal pollution) and radioactive substances.

Water-related diseases are caused by the ingestion of contaminated water either directly or through food and by the use of contaminated water for purpose of personal hygiene and recreation.

According to the annual hospital statistics of this area (2013), total number of patients hospitalized for diarrhea and gastroenteritis of presumed infectious origin was 3030 (Male : 1617 (7.5%), Female: 1413(5.4%). Regarding diseases under national surveillance data in 2013 for this area, number of morbidity showed Diarrhea(1163.4), Dysentery (406.1), Food poisoning (51.1), Enteric fever (5.4) per 100,000 Population respectively.

In addition, some diseases are caused by inadequate use of water like trachoma, conjunctivitis, scabies etc. Concerning morbidity rate of new eye diseases in Mandalay region (2103) was about 171.7 per 100,000 Population.

Indicators for Prevention of blindness

Region	Morbidity rate of new eye disease(per 100,000 population)	%of Infectious trachoma (under 10 year population)	%of blindness or loss of eyesight (general population)	Morbidity rate of opthalmia neonatorum in newborn infants(per 1000

				livebirths)
Tanintharyi	508.7	0.0013	0.0099	0.1
Union	132.6	0.0015	0.0048	0.1

Noise-

Noise has become a very important "stress factor" in the environment of man. Noise can be defined as wrong sound, in the wrong place, at the wrong time. The effects of noise exposure are two types, auditory effects and non auditory effects. The potential incremental noise addition from the proposed project is unknown.

5.7 Accident and Injuries

In 2013, there were road traffic accident morbidity rate of 3.6 (per 1000 Population) and mortality rate of 5.5 (per 100,000 Population) in this region. The leading cause of non –transportation related fatalities were farm injuries and assaults about morbidity rate of 1.9 and 0.7 (per 1000 Population) and mortality rate of 1.6 and1.5 (per 100,000 Population) respectively. In case of poisoning, it showed morbidity rate of 0.1 (per 1000 Population) and mortality rate of 0.7 (per 100,000 Population). Concerning data for fall from height and drowning cases, it showed that the morbidity rate of 0.6 and 0.1 (per 1000 Population) and mortality rate of 1.6 and 8.7 (per 100,000 population) respectively. According to the data of Maung Hlaw hospital (2016), there were 15 cases of motor vehicles accident and injury, 3 cases of farm injury, 4 cases of fall from height, 4 cases of burn and scald and 1 case of suicide.

Indicators for prevention of Accidents and Injuries (2013):

Regions	Road Traffic Accident Morbidity rate per 1000 population	Road Traffic Accident Mortality rate per 100,000 population
Tanintharyi	3.6	5.5
Union	2.2	6.6

5.8 Health Services Infrastructure and Capacity

For the project area of nearest villages, the basic health staffs are providing promotive, preventive, curative and rehabilitative services through primary health care approach. Infrastructure for service delivery is based upon rural health centre where lady health visitor and health assistant are assigned to provide primary health care services. There are about 6 private clinics near the project area. Maung Hlaw Station Hospital is the closet medical facility to the proposed project and the facility has 16 beds and it was opened in May, 2016 providing a full range of emergency and surgical services.

Staffing pattern of Maung Hlaw16- bedded hospital

SMO -1

Staff nurse-1

Trained nurse – 1

Compounder- 1

General worker- 1

Staff of the Naung Bee RHC include –HA 1, LHV-16

Hospital Service and Administrative Indicators Maung Hlaw hospital

Items	Total no. of cases in 2016
Malaria OPD	-
Malaria In patient	4
Cerebral malaria	-
<5 year malaria	-
< 5year cerebral malaria	-
Admission with pregnancy	69

Acute GE	108
< 5 year GE	92
Trauma	26
GI cases	50
Koch's lungs	1
Food poisoning	9
ARI	200
Referral	29
Other cases	269
Turn over	-
Duration of stay	65.5
Bed occupancy rate	518.5

According to interviews, most of household consulted with HA for the illness of household members. And, they used motor boat as a mode of transportation for referral cases and used motor cycle for seeking medical care.

Figure 5: Maung Hlaw Station Hospital

Figure 6: Naung Bee health centre

6. STAKEHOLDER AND PUBLIC ENGAGEMENT

Table : 6 Public Issues and Concerns Identified in Public Meetings and Survey Interviews are Summarized by The Health Effect Categories (HECs) According to HIA Toolkit.

Health Effects Category	Health Concern	Contact
Social Determinants of Health (SDH)	Educational infrastructure is needed.	Zaygami, Nyaung Bee,Wat Toe
	No school in this village. School children encounter difficulties in rainy season.	Zaygami
	Afraid of the harmful effect on environment and water.	Zaygami, Pan Taung, Taung Pu, Shwe Du, Maung Hlaw
	Conflicts will surely occur if the	Taung Pu, Pan

	proposed project don't give necessary plantation.	Taung
	All of our family members were living on agriculture. If we lost our lands, there are no replacement land in this area. We cannot do other work for our living and our planation is more than 20 years.	Taung Pu, Pan Taung, Wat Toe,
	Worried for health impacts expected to occur from environmental pollution.	Maung Hlaw, Taung Pu,
	Objected if the project will give harms to villagers.	Maung Hlaw, Shwe Du
	They had experiences of destruction of their land caused by the project of previous company and also there was no compensation.	Taung Pu
	Good hope for job opportunities but difficult to criticize the good or bad.	Zaygami, Pan Taung, Taung Pu, Shwe Du, Maung Hlaw, Naung Bee
	Expected for development and job opportunities.	
Water and sanitation	Want to get help and support for water supply and electricity.	Zaygami, Pan Taung, Taung Pu, Anyinn, Naung Bee, Wat Toe, Maung Hlaw, Shwe Du
	If the streams and natural drainages are destroyed, agricultural sectors	Maung Hlaw

	will be impacted. Worried that the upstream land from the dump site will be flooded if the gutter stream will be blocked by tailing waste. It is needed to fill the hole caused by excavation of land. A tube well for the whole village is essentially needed.	 Maung Hlaw Taung Pu, Taung Pu
Communicable diseases	Would like to get support for health.	Zaygami, Wat Toe,
Food , Nutrition and subsistence activity	Depend on local foods. Do not want to get harmful effect. Depend on local foods and scarcity of some foods because of transportation.	Taung Pu, Pan Taung, LHV
Non communicable diseases	Hypertension is one of the leading cause of morbidity. There is increase the number of diabetes mellitus cases.	HA LHV
Exposure to potentially hazardous materials	Bad smell is dangerous for lung diseases.	Naung Bee
Accidents and Injuries	Increased accidents and injuries on the roadway especially for motorcyclists. CSR program especially for good transportation is needed. Farm accidents and fall from height cases are more frequent because of the working type of local people.	Local Doctor Local doctor HA, LHV
Health Services Infrastructure and capacity	Health care facility is not sufficient.	Zaygami, Pan Taung, Wat Toe

Figure: 7 Social survey: interviewing with local people

Summary

The HIA stakeholder engagement (including public meetings and social surveys) yielded a broad spectrum of comments, concerns and viewpoints. The

following sections are an attempt to summarize the feedback from the stakeholder engagement process according to health effect categories.

6.1 Social Determinants of Health

Concerning the social determinants of health category, a large number of stakeholder comments were received. Many stakeholders expressed their experience of psychological distress (eg. anxiety, fear) regarding the anticipated negative changes to their social, economic, cultural environment. On the other hand, some people expected to get more job opportunities from the proposed project for the betterment of their living conditions.

6.2 Water and Sanitation

The stakeholder focused on supply of water and changes in water quantity and quality from contaminating events. Also they discussed about the blockage of natural streams and drainage and effect on plantation.

6.3 Communicable diseases

Few stakeholders raised concerns related to infectious disease health effect category. They worried about the requirement in health infrastructure.

6.4 Food, nutrition and subsistence activity

Some of the stakeholder pointed out the importance of water sanitation and adequate nutrition to prevent malnutrition and prevention of food borne diseases.

6.5 Non Communicable diseases

In terms of non-communicable and chronic diseases, most of the comments focused on potential decrease in air and water quality, chronic health effects of psychosocial distress,

6.6 Exposure to potentially hazardous materials

Stakeholders raised a wide spectrum of concerns about exposure to waste products and waste water management.

6.7 Accidents and Injuries

Some stakeholders said this area had already experienced traffic related accidents and injuries. Provision for transportation and road is required for local people.

6.8Health Services Infrastructure and Capacity

Some indicated that heath infrastructure is not sufficient and there is in need for support for health of the local people.

7. DATA GAPS

HIA is primarily concerned with predicting and managing changes in the wider determinants of health and in health outcomes attributable to a project. This HIA is conducted together with SIA and draws upon numerous available data sources for information including published reports and researched analyses, expert local opinion, comments from public meetings, interviews with local people etc. It is needed to admit that the HIA process has uncovered additional technical data gaps. But such kind of condition also can be seen even in the international process. A standard step in any HIA (for both regulatory decision makers and stakeholders) is the data gap analysis. Closure of the data gaps would allow for the development of a comprehensive HIA. Because of the limitations of available information, this HIA is a rapid appraisal that can only make broad qualitative priority assessments for potential impacts

8. Literature review

8.1 Introduction

The term environment implies all the external factors living and non-living, material and non-material which surround man. In modern concept, environment includes not only water, air and soil but also the social and economic conditions under which all human beings live. The term "environmental sanitation" has been defined by WHO as "the control of all these factors in man's physical environment which exercise or may exercise a deleterious effect on his physical environment, health and social.

8.2 Stress from community

Concerning with this category, local people are worrying about the proposed project can lead to pollution of water, soil and air around their environment and destruction of their land and plantation. Because of increased in psychological distresses enhance the occurrence of negative impacts on health of local people. If the proposed project can reduce this negative impacts to lower limit, they can not only reduce the stress of local people but also participate in social activities together with local people.

8.3 Health effect from stress

Stress is a potential health impact in communities and there are at least two sources of stress that act at the individual and community levels. Primary stress is caused by real or perceived risks from environmental hazards, while secondary stress is caused by social and community responses to a site or incident. Scientists also distinguish between acute and chronic stress. Acute stress occurs in response to sudden or catastrophic events and it is commonly known as the fight or flight response. Chronic stress occurs when there is long term or repeated activation of normal stress response. Scientific believe that chronic stress occurs from persistent feeling of anxiety and lack of control, or from repeated exposures to stressful situations or environments. Clinical studies have found that chronic stress decreases immune function, increase in risk for cardiovascular disease and endocrine disorders and affects how the brain and body age. Further, it impairs cognitive functions such as memory and concentration , and can trigger or worsen mental illness such as anxiety disorders and depression. In the Caerphilly Study [12]it was found that psychological distress was a predictor of fatal ischemic stroke

in men aged 45-59 years. The Whitehall II Study[13] reported that psychological distress conferred increased risk of coronary heart disease, which was not explained by health behaviors or work characteristics.

8.4 Air quality

The immediate environment of man comprises of air on which depends all forms of life. Apart from supplying the life-giving oxygen, air and atmospheric conditions serve several functions. Poor air quality contributing to an increased incidence of chronic lung disease, heart conditions and, some evidence suggests increased levels of asthma amongst children.

Air pollution

Air pollution is a complex mixture of chemicals, particles, gases and other materials in the atmosphere that can harm human health and damage the environment. The main sources of air pollution are (1) automobiles (2) industries (3)domestic source (4) tobacco smoking (5) miscellaneous comprises burning refuse, pesticide spraying etc.

Air pollutants

More than 100 substances which pollute air have been identified. The important ones are carbon monoxide, carbon dioxide, hydrogen sulfide, sulfur dioxide, sulfur trioxide, nitrogen oxides, fluorine compounds, organic compounds, metallic contaminants, radioactive compounds, photochemical oxidants etc. Direct exposure to the most common air pollutants is associated with short and long term health effects that include respiratory irritation, asthma, cardiovascular disease, cancer, and premature death. Some air pollutants have indirect effect on human health; for example, green house gas emissions accumulate in the atmosphere and contribute to climate change, while persistent pollutants like mercury can deposit on soil and water and accumulate in the food change. The risk from air pollution depend on several factors including (1) the type and toxicity of pollutants (2) synergistic effects between air pollutants (3)routes and levels of exposure (4) whether there are vulnerable or susceptible people in the exposed population.

Health effects of classical air pollutants

Particulate matter

Airborne particulate matter represents a complex mixture of organic and inorganic substances. The fractions of airborne particulate that are believed to be of greatest relevance to health arePM10, the thoracic fraction meaning that which can penetrate to the lungs, and PM2.5, the high risk respirable fraction meaning that which can penetrate to the gas exchange region of the lungs in people with compromised respiratory health. Studies of the effects of PM10 in large urban populations have found associations between PM10and small changes in the daily death rate, the number of hospital admissions for cardiovascular and respiratory illness and increased numbers of GP consultations for respiratory illness(WHO 2000)[14]. Other studies of selected panels of individuals have shown associations between PM10 and increases in respiratory symptoms, particularly in those with pre-existing respiratory illnesses such as asthma (WHO, 2000). In addition, associations have been found between variations in daily concentrations of PM10 or ultrafine particles and various circulatory parameters that help to substantiate the association with heart disease in addition to respiratory illness (eg. Gold *et al*, 2000)[15]. There is also some evidence that long term exposure to PM10 is also associated with the development of bronchitis (Abbey *et al*, 1995)[16] although effects are poorly quantified.

Nitrogen dioxide

Nitrogen dioxide (NO_2) is a well established marker of traffic pollution but is also emitted from other combustion processes. There has been considerable debate as to whether effects attributed to (NO_2) in epidemiological investigations of the health effects associated with urban air pollution are due to (NO_2) itself or whether effects are actually caused by co-exposure to some unmeasured co-pollutant such as fine particles (Seaton & Dennekamp. 2003)[17]. The results of human volunteer experiments show that (NO_2) has effects on lung function, airways responsiveness, respiratory symptoms and on the response of asthmatics to allergens but at concentrations that are slightly higher than those found in ambient air during high pollution episodes (Searl, 2004)[18]. Epidemiological studies of the short term effects of (NO_2) in ambient suggest a small apparent effect on health that is independent of that of PM10 but do not exclude the possibility that the observed effects are partly due to some other unmeasured pollutant (Searl, 2004). The results of studies of the long term effects of exposure to (NO_2) in indoor air or ambient air are not strongly suggestive of an adverse effect.

Sulfur dioxide

The health effects of environmental exposure to sulfur dioxide (SO_2) have been difficult to detect in epidemiological studies because of concurrent exposure to other pollutants. Possible effects of sulfur dioxide on daily mortality rates and respiratory hospital admissions have been reported (WHO, 2000). In studies that have studied the possible effects of long term exposure to (SO_2), it has not been possible to identify a separate effect from that associated with particles
WHO(2000). The results of more recent studies have been mixed. Yang and Chen (2007)[19] and found no association between (SO_2) and hospital admissions for chronic obstructive disease but Ko *et al* (2007)[21] report significantly increased risks of hospital admission for COPD associated with (SO_2), (NO_2),PM10 and PM2.5 particularly during the cold season. Yang *et al* (2007) [20] found an association for asthma admissions and Lin *et al* (2004)[22] reported a consistent positive association between SO_2 exposure and hospitalizations for childhood asthma. Lee *et al* (2006)[23], however, did not find a specific role for SO_2 in the relationship between air quality and hospital admissions for asthma in children. Experimental studies in human volunteers have demonstrated a wide variability in sensitivity with some asthmatics being particularly sensitive effects (WHO, 2000). Effects are immediate but short lived with lung function returning normal within a few hours.

Groups susceptible to air pollution

The elderly

It is generally accepted that air pollution is associated with deaths and hospital admissions arising from cardiovascular or respiratory illness in older people. This is largely because this group is at higher risk of death or admission to hospital than others in the population with an increased prevalence of pre-existing respiratory illness. There is also evidence that the elderly are more susceptible to the effects of air pollution such that the relative risk associated with a given increment of air pollution is greater than for the population as a whole (Filleul *et al* 2004)[24]
Groups with pre-existing illness
Pre-existing respiratory or cardiovascular illness increases the risks associated with exposure to increased levels of air pollution. A high proportion of the extra emergency hospital admissions, for example, will be among those with pre-existing illness. Pre-existing disease may have an important modifying effect on

daily mortality risks arising from air pollution exposure. In a Chinese study, Kan *et al* (2004)[25] established that diabetics are more likely to die on high pollution days than others. There is some experimental evidence that people with asthma are more likely than others to develop respiratory irritation and symptoms on exposure to respiratory irritants such as airborne particles, acid gases such as hydrogen chloride and pollutants such as sulfur dioxide.

Children and babies

It is generally believed that babies and young children are likely to have an increased susceptibility to air pollution. In a small US panel study involving adults and children with asthma, Mar *et al* (2004)[26] found that children appeared to be more susceptible to the effects of air pollution than adults with a relationship between airborne particles and respiratory symptoms being apparent in children but not adults.

Poverty

There is a well established association between deprivation and ill health giving rise to lower life expectancies and greater morbidity in deprived areas. This includes risks of cardiovascular and serious respiratory disease. Higher background rates of ill-health mean that the impacts of any proportionate increment in risk arising from exposure to air pollution in deprived areas is relatively greater than in better off areas. In addition there is increasing evidence that there is a greater proportionate increase in risk associated with a given increment in air pollution in deprived groups than in socially more advantaged groups (e.g. Wheeler & Ben-Shlomo, 2005) [27].Deprived communities often experience higher levels of exposure to air pollution than more affluent communities as a result of greater proximity to heavy industry or major transport routes.

The WHO (2005) " Air Quality Guidelines Global Update " [28]has described approved methods of determining the concentration of common air pollutants and their health hazards. The emphasis in the guideline is placed on exposure , since this is the element that can be controlled to lessen the dose and hence lessen response.

Table:7 WHO Ambient Air Quality Guidelines

Substance	Averaging Period	Guideline value in μg/ m^3
Sulfur dioxide	24-hour	125(Interim target-1) 50 (Interim target-2) 20(guideline)
	10 minute	500(guideline)

Nitrogen dioxide	1-year 1-hour	40(guideline) 200(guideline)
Particulate Matter PM10	1-year 24-hour	70(Interim target-1) 50(Interim target -2) 30(Interim target-3) 150(Interim target-1) 100(Interim target-2) 75(Interim target-3) 50(guideline)
Particulate Matter PM2.5	1-year 24 -hour	35(Interim target-1) 25(Interim target -2) 15(Interim target-3) 10(guideline) 75(Interim target -1) 50(Interim target -2) 37.5(Interim target-3) 25(guideline)
Ozone	8-hour daily maximum	160(Interim target -1) 100(guideline)

8.5 Water Quality

Water is not only a vital environmental factor to all forms of life, but it has also a great role to play in socio-economic development of human population.
Water intended for human consumption should be both safe and wholesome. This has been defined as water that is (a) free from pathogenic agents(b)free from harmful chemical substance (c)free from taste i.e. free from color and odor and (d)usable for domestic purposes .

Water Pollution

A more serious aspect of water pollution is that caused by human activity-urbanization and industrialization. The source of pollution resulting from these are (a)industrial and trade wastes (b) sewage(c)agricultural pollutants (d) physical pollutants and radioactive substances. The indicators of pollution include the amount of total suspended solids, biological oxygen demand (BOD) , chloride concentration , nitrogen and phosphorus and absence of dissolved oxygen.

Water-related diseases

A. Biological (Water-borne diseases)

1.Thosed caused by the presence of an infectious agent (a) Viral : Viral hepatitis A, hepatitis E, poliomyelitis, rota virus diarrhea in Infants (b)Bacterial: typhoid and paratyphoid fever, bacillary dysentery, Esch.coli diarrhea, cholera (c) Protozoa: amoebiasis, giadiasis (d) Helminthic: roundworm, treadworm, hydatid disease (e) Leptospiral : Weil's disease
2.Those due to the presence of an aquatic host (a)Snail: schistosomiasis (b)Cyclops: guineaworm, fish tape worm

B. Chemical

Chemical pollutants of diverse nature derived from industrial and agricultural wastes are increasingly finding their way into public water supplies. These pollutants include detergent solvents, cyanides, heavy metals, minerals and organic acids, nitrogenous substances, bleaching agents, dyes, sulfides, ammonia, toxic and biocidal organic compounds of greater variety.

C. Others

In addition to the above, water is associated with the following, (a) dental health (b) cyanosis in infant(d) cardiovascular diseases (e) diseases that are transmitted because of inadequate use of water such as shigellosis, trachoma, conjunctivitis, ascariasis, scabies (f) disease that are related to disease carrying insects breeding in or near water like: malaria, filarial, arbovirus.

Table:8 Physicochemical parameters of drinking water quality , WHO(2006)

Parameters	Limit

Water Temperature (°C)	27
Total Dissolved Solids (mg/l)	1000
Turbidity (NTU)	5
pH	6.5-9
Dissolved oxygen(mg/l)	5
BOD 5(mg/l)	28-30
Chloride(mg/l)	400
Nitrate (mg/l)	50

Table :9 Inorganic chemicals of health significance in drinking water

Constituents	Recommended maximum limit of concentration (mg /l)
Arsenic	0.005 (P)
Cadmium	0.003
Chromium	0.05(P)
Copper	2(P)
Cyanide	0.07
Fluoride	1.5
Lead	0.01
Manganese	0.5(P)
Mercury(total)	0.001
Selenium	0.01

P- Provisional guideline value

Source: WHO(2006), Guidelines for drinking water quality

Table: 10 Bacteriological quality of drinking water

Organisms	Guideline value
All water intended for drinking	Must not be detectable in any 100 ml

E Coli or thermotolerant coliform bacteria	sample
Treated water entering the distribution system	
E Coli or thermotolerant coliform bacteria	Must not be detectable in any 100 ml sample
Total coliform bacteria	Must not be detectable in any 100ml sample
Treated water entering the distribution system	
E coli or thermotolerant coliform bacteria	Must not be detectable in any 100ml sample
Total coliform bacteria	Must not be detectable in any 100ml sample. In the case of large supplies, where sufficient samples are examined, must not be present in 95% of sample taken throughout any 12 month period.

8.6 Occupational health and safety for mining

Occupational health and safety for mining activity should seek to provide an operation where people are able to work without being injured and where the health of workforce is promoted. Occupational health and safety issues should perform during the all phases of mine cycle and can be classified according to the following categories of; general workplace health and safety, hazardous substances, uses of explosives, electrical safety and isolation, physical hazards, ionizing radiation, fitness for work, travel and remote site health, thermal stress and noise and vibration. Regarding general workplace health and safety, preparation of emergency response plans specifically applicable to exploration and production activities and including the provision and maintenance of necessary emergency response and rescue equipment, need of sufficient number of first aid trained employees to respond to emergencies, training of employees on the recognition and prevention of occupational hazards. Moreover, provision of

workers and visitors with necessary personal protective equipment (PPE) and provide instruction and monitoring in their appropriate maintenance and use. Occupational health assessment should be conducted for employees on regular basis, based on exposure to risk. Medical records should be retained for at least 20 years.

In case of hazardous substances and use of explosives, working areas should be provided with adequate ventilation and dust/fume extraction systems to ensure that inhalation exposure levels for potentially corrosive, oxidizing, reactive or siliceous substances are maintained and managed at safety levels described in the general EHS guidelines. Using, handling and transporting explosives in accordance with local and/or national explosives safety regulations and actively managing blasting activities in terms of loading, priming and firing explosives, drilling near explosive, misfired shots and disposal. Moreover, using of specific warning devices and procedures should be implemented before each blasting activity to alert all workers and third parties in the surrounding area and specific personnel training on explosives handling and safety management should be conducted. Specific audited procedures should be implemented for all activities related to explosives in accordance with relevant national or internationally recognized fire and safety codes as well as qualified security personnel should be used to control transport, storage and use of explosives on site.

Emergency preparedness and response

An emergency is an unplanned event when a project operation loses control or could lose control of a situation that may result in risks to human health, property or environment either within the facility or in the local community. Emergencies do not normally include safe work practices for frequent upsets or events that are covered by occupational health and safety. The project should have an Emergency Preparedness and Response Plan that is commensurate with the risk of the facility and that includes the following basic elements such as administration (policy, purpose, distribution, definition, etc), organization of emergency areas (command centers, medical stations, etc)., roles and responsibilities, communication systems, emergency response procedures, emergency resources, training and updating, checklists (role and action list and equipment checklist), business continuity and contingency. In terms of community notification, if the

local community may be at risk from potential emergency arising at the facility, the company should implement communication measures to alert the community such as audible alarm, fire bells or sirens, fan out telephone call lists, vehicle mounted speakers, communication details of the nature of the emergency, communicating protection options (evacuation, quarantine), providing advise on selecting an appropriate protection option. Emergency management activities can be divided into four phase: mitigation, preparedness, response and recovery.

8.7 Review of studies concerning impact assessment of tin mining

Fare Yahya Alshaebi, Wan Zuhairi Wan Yaccob, Abdul Rahim Samsudin and Esmail Alsabahi from School of Environmental Science and Natural Resources, Faculty of Science and Technology, University of Kenbangsaan Malaysia studied the risk assessment at abandoned tin mine in Sungai Lembing, Pahang, Malaysia [29] . Sungai Lembing is a tin mining town located at 34 km northwest of Kuantan in Panhang. It is an old mining town, which once had the biggest mine on earth. For 80 years of mining activities, it became the largest, longest and deepest underground mine in the world. Until the 1970s, Sungai Lembing was a major producer of underground tin. In 1986, the pit mines were closed due to high operational costs and low yields. The total tunnel length is 322 km with a depth ranging between 610m and 700m. Sungai Lembing mine kept its waste material from treatment plant at a predetermined site near the bank of the river Kenau. In this study, contaminated samples were collected from surface for tailings and at various depth for soil (50,100,150 cm intervals) in eight holes drilled using hand auger. Microwave oven dissolution procedure was used to digest the soil. After cooling to room temperature, the solutions were analyzed for heavy metals using ICP-MS instrument. The mean values for heavy metals are compared according to Dutch list, Kelly Indices and Soil Quality Guidelines (SQG) classification of hazardous waste. The results showed that Pb is the highest contamination heavy metals for soils and tailings in the mining operation area. As; mean value exceeds the value for uncontaminated soil. Mine tailing contaminated with As are leach out into groundwater and enter the river. The whole of the Sungai Lembing abandoned mining area was contaminated by Lead (Pb),Copper (Cu), Nickel (Ni), Arsenic(As), Chromium (Cr). Mine waste or tailings at

abandoned mine exposed to air and water has produced acidic water. Also there was increase level of heavy metals in surface water and soils. This study concluded that amount of pollution varies from one location to another based on the topography and elevation of site for soils. Tin mining activities make living in such area unhealthy. Main problems caused by tin mining are formation of wasteland, damage to natural drainage, pollution and destruction of natural habitats. Aslo suggested that immediate study and care must be carried out in Sungai Lembing ex-mining site.

From the study of Morphology, Geology and Water Quality assessment of former Tin mining catchment by Muhammad Aqueel Ashraf, Mohd. Jamil Maah, and Ismail Yusoff from The Scientific World Journal, Volume 2012, Article ID 369206 [30]stated that Bestari Jaya, former tin mining catchment covers an area of 2656.31 hectares comprised of four hundred and forty two different size lakes and ponds. The present study area comprises of 92 hectares of the catchment that include four large size lakes. Arc GIS used to develop bathymetric map, GPS for hydrographical survey and flow meter was utilized for water discharge analysis (flow routing) of the catchment. The water quality parameters (pH, temperature, electric conductivity, dissolved oxygen DO, total dissolved solids TDS, chlorides, ammonium, nitrates) were analyzed by using Hydrolab. Quality assurance (QA) and quality control (QC) procedures were strictly followed throughout the field work and data analysis. Different procedures were employed to evaluate the analytical data and to check for possible transcription or dilution errors, changes during analysis or unusual or unlikely values. The result obtained are compared with interim national water quality standards for Malaysia indicates that water quality of area is highly degraded. It is concluded that Bestri Jaya ex-mining catchment has high pollution potential due to mining activities and River Ayer Hitam, recipient of catchment water, is a highly polluted river.

Each water body has an individual pattern of physical and chemical characteristics which are determined largely the climatic, geomorphological and geochemical

conditions. The generation of mine water pollution both during and after mining operations has characterized the industry worldwide since ancient time. In the case of acid mine drainage (AMD) waste waters, the problem may persist for many decades to thousands of years. These waters are generally characterized by reduced pH, elevated levels of a range of heavy metal contaminants, most notably iron, and salts such as sulphates and chlorides. While mining activities are associated with the exposure of pyrite and other sulphide containing minerals,, their oxidation has been identified as the main source of acid contamination in AMD generation. AMD generation can occur in underground mine workings, waste rock dumps, mill tailings piles, ore stockpiles, spent ore piles from heap leach operations and in other residue deposits which present a high surface for oxidation.

The importance of mine water pollution is predicated on its potential negative human health impacts and financial and environmental risks and liabilities. Globally, estimates of the impacts and the extent of the problem on various water resources have been reported for a number of regions. For example, estimates by the United States of America's Bureau of Mines indicate that over 19,000 km of rivers and streams and 73,000 hectares of lakes and reservoirs are negatively impacted by mine water from abandoned coal and metal mines.

Materials and methods

Satellite image of Bestari Jaya (SPOT,2009) interpretation and JUPEM (Jabatan Ukur Dan Pemetaan Malaysia) porgraphic data (Scale 1: 500) were used as a base map. GIS mapping (Arc GIS version 9.2) was used to develop final land use and bathymetric map from the base map where known points such as road junctions, bridges, milestones along trunk roads were used as reference point.

Water quality parameters such as pH, temperature, electric conductivity, dissolved oxygen DO, total dissolved solids TDS, chlorides, ammonium and nitrates were analysed by using Hydrolab MS5 USA in situ on a fibre glass engine boat.

Results

Geology and Morphology of the Catchment

Tin mining at the Bestari Jaya catchment was carried out mainly in the alluvium for the rich concentration of cassiterite which was found in the catchment soil or which was trapped within the troughs of the pinnacled limestone bedrock.

Nature of bedrock in mines

The bed rock underlying the alluvium, mine tailing and ex-mining lakes in the Bestari Jaya catchment consists mainly of limestone with interbred of schist, shale, and rarely quartzite.

Mining methods at the catchment

In the past, the most common method of mining was to use the traditional gravel pumps. Another widely used method was to use the capital intensive dredges.

Because of the dredging operation, lakes were left over.

The water discharge of the catchment above the certain location is determined by surface area of all lakes which drains toward the river from above that point. The river's discharge at the location depends on the rainfall on the catchment or drainage area and inflow or outflow of ground water to or from the area as well as evaporation and evapotranspiration from the area's land and plant surfaces.

Average velocities and cross sectional area of the stream are measured for a given stream level. The velocity and the area give the discharge for that level. High water flow is an indicative of high sediment discharge from the catchment into the river as well as impact on the ecosystem.

Water quality characteristics

Water quality analysis of physical and chemical analysis were done. The possibility of using these ponds water for livestock, irrigation, and as raw for washing, bathing etc. The water quality analysis was based on standards set by United states Environmental Agency (2008), world Health Organization (2009) and Malaysian Interim Water Quality standards (2009)

Color (TCU) and Turbidity (NTU) : Water color of the study area has been analysed by TCU (True Color Units), the color unit of 9 TCU which is acceptable for raw water.

Temperature: The temperature values are normal according to the climatic conditions of the area.

pH: The pH of water from study area ranged 3-7.0. The pH of the study area is quite below the minimum allowable limit for use as raw water. The pH of the area tends towards the acidic side. This condition is related to higher concentration of cations in the water.

Dissolved oxygen (DO) : The study area has very low dissolved oxygen 1.5-6.5 mg/L. These DO values are way below the maximum allowable limit for use as raw water.

Electric Conductivity (EC) : The result indicating highly dissolved salts and ions in the water.

Total Dissolved solids (TDSs) : The TDSs values are way below the maximum allowable limit for use as raw water.

Chloride: The concentration of chlorides anions is a way below the maximum allowable limit for use as raw water and portable water.

Ammonium: The study area has ammonium cations ranging from 0.06 to 0.46 mg/L.

Nitrate: Most of the study area had less than nitrate anions recommended allowable limit for raw water.

Acid mine drainage: In the catchment area, the release of acid mine drainage is still an ongoing environmental issue but by far the largest impact was through the release of particulate mine waste (tailings) which were deposited throughout the catchment.

Conclusion

The ponds and lakes derived from the dredging method are generally larger, usually measuring between 300 to 700 m long. Based on the results of water

quality analysis, catchment water did not meet the standards for use as raw water and portable water set by WHO and Ministry of Health, Malaysia.

Similarly, the study of Tin mining and processing in Nigeria [31]revealed that the measured concentration level of uranium and thorium in tailings sample and the measured dose rates were found to be elevated with values up to approximately 100 times above background levels of control soils. Moreover, tailing dump sites of the abandoned mines are generally not identified or perceived as hazardous by members of the local public. So, there was intensive use for various purposes such as building materials for construction or land improvement for farming of soils originating from such sites. For the purpose of protection of workers and the public is advised that these sites should be properly monitored, controlled and potential remediation strategies be considered in order to avoid any radiological impact to the population.

8.7 Conclusion

HIA team reviewed the relevant case studies relating to health impacts of the proposed project. And also pointed out the cases relating to improper control of the waste materials as well as potentially hazardous materials. Project planners and developers should consider and use strategies to anticipate, understand and manage the stress of communities and reduce potential negative impacts. If done well, public participation and community consultation are strategies that can minimize negative and maximize positive impacts (health and others) for local communities, stakeholders and developers.

9.Prioritizing Health Effect Categories and Mitigation/Recommendation

9.1 Social Determinants of Health (HECs)

SDH describes how living conditions and social situations provide a context for the health of individuals and communities. Concerning with this category, local people are worrying about the proposed project can lead to pollution of air, soil and water around their environment. Increased in psychological distresses can enhance the occurrence of negative impacts on health of local people. If the proposed project can reduce these negative impacts to lower limit, they can not only reduce the stress of local people but also participate in social activities together with local people.

Stakeholder concern

Stakeholders expressed high levels of concern for this health effect category. Individuals and public raised issues that belong to this category during every meetings and interviews and in the majority of written comments for the project. Overall, this parameter is ranked as High.

Data Gaps

The HIA team conducted a review of available data sources for the topics relevant to the social determinants of health including early life health indicators, maternal and child health indicators, immunization status, behavioral health indicators, demographics, socioeconomic data, educational data etc.

Moreover, stakeholder engagement meetings and interviews with local people generated reports of psychosocial distress among community members who support and who oppose the proposed project. Detailed public health data for psychosocial distress levels does not exist for the proposed project area. Additionally, this HIA process lacks the typical suite of cultural and traditional knowledge studies. This data gap could be addressed, but information from the study would not likely alter the understanding of the importance of this category.

Data gaps do exist in this category, but they do not represent gaps that prevent decision makers from reaching a responsible conclusion. As a result , the data gaps parameter is ranked as Medium for this health effect category.

Potential Impacts (+/-)

If the proposed project is permitted, this health effect category (HEC) would contain both positive and negative impacts. It is undeniable that this HEC involves some aspect of wellbeing that is by nature difficult to quantify and objectively measures.

Potential positive impacts include, job opportunities for local people in the region with the potential benefits of health insurance, decreased socioeconomic stress, increase in family cohesion, decrease in stress due to shorter commuting time among surrounding community members, and increase in community development and civic opportunities in surrounding communities. Those in favor of the proposed project reported these potential benefits as important.

The potential negative impact involve increased psychosocial distress. This distress is rooted in (1) anxiety regarding negative changes to water , soil, and air quality (2) emotional distress for damage of environment, crops and plantation due to the project (3) fear of increase in disease risk. Based on these anticipated positive and negative health impacts, this parameter is ranked as Medium.

Likelihood

The potential positive and negative impacts described in this health effect category are common in similar settings and will likely to occur. Overall, this parameter is ranked as High.

Actions

The HIA team suggests additional measures to reduce psychosocial distress and improve community participation.

HEC	Stakeholder concern	Potential Impact(+/-)	Data Gaps	Likelihood	Phase
Social determinants of health	High	Medium	Medium	High	Siting and Permission

Mitigation

-Review the best practice of environmental management strategies and guidelines developed by WHO and the International Finance Corporation (IFC) [7] in implementation of procedures and process of waste products management.

-Follow up assessment of monitoring team including local people and relevant authorities.

9.2 Water and Sanitation

Impacts from this health effect category can place pressures on existing sanitation, water supply systems and water resources.

Stakeholder concern

Stakeholders expressed high levels of concern for health impacts that fall within the water and sanitation HEC. Concerns related to surface water and ground water quantity, disposal of waste water were raised at every stakeholder meeting and interviews. Local people repeatedly expressed that they had already experienced the improper management of previous tin mining projects. Also they worried about the damage to the existing water resources because of the waste and waste products of tin mining. Local residents concerns may or may not have hydro geological basis; however, it is needed to provide understandable and detailed information to the public. As a result of high levels of stakeholder concern for potential water and sanitation impacts, this parameter receives a High ranking.

Data gaps

The data sources for this health effect category are the water quality permit, well water monitoring, and studies of hydrogeology. The detailed analysis of hydro geological report was done by EIA team. However, the HIA team has not been able to determine the extent of offsite ground water monitoring particularly for nearby residents. These data gaps hold critical information for decision makers and should be closed in order to provide an adequate guide to decision making. As a result, this parameter receives a Medium ranking.

Potential Impact (+/-)

There will be a substantial increase in moderate to severe morbidity or mortality events such as local river and streams contamination, well contamination, environmental contamination and other major disruptions of local environment and local hydro geology due to waste water and waste materials discharges.

A medium impact scenario would involve potential for changes in water quality that do not exceed regulatory standards that result in increase in acute non-fatal infectious disease events. Potential water quality and quantity effects are dependent on hydro geological features of the area and resident location related to the project area. Environmental sanitation measures, water treatment and water management strategies exist that would mitigate the most severe implications of this HEC. As a result, this parameter receives a High ranking.

Likelihood

Changes in water quality and sanitation systems have been observed with projects of similar size and scale both internationally and domestically. As a result, this parameter receives a High rank.

Actions

Should follow industry accepted methods for addressing impacts from changes to water and sanitation. Significant data gaps should be closed in order to provide a clear understanding of the potential health impacts.

HEC	Stakeholder concern	Potential impact(+/-)	Data Gaps	Likelihood	Phase
Water and Sanitation	High	High	Medium	High	Operation

Mitigation

- Perform the water management and usage and tailing management according to the techniques and guidelines developed by IFC.
- Treat the mine waste or tailings systematically and after doing this, dispose the residual waste products according to the guide lines of respective organization (e.g. WHO).
- Maintain and protect the availability of safe and wholesome water of local people in collaboration with various organizations.
- Monitor water quality and quantity effects of proposed project activities on local water supply.
- Cooperate with local people and various departments in performing environmental sanitation and water control and management procedures.
- Monitoring team involving local people and respective department should frequently check the performing procedures and management.

9.3 Communicable Diseases

Impact in this category would include changes in local environment because of influx of local and non-resident workforce.

Stakeholder concern

Some stakeholder , particularly local medical community , expressed concern for health impacts that fall within the infectious diseases health effect category. So, this parameter receives a Medium ranking.

Data Gaps

Sources of information for this health effect category include publicity available data of infectious disease mortality and morbidity and public health literature for regional disease outbreaks. Detailed clinic visit and hospital discharge data was needed to systematically review the infectious disease condition and to fill the data gaps. However, HIA team believe that filling these data gaps would not materially alter the understanding of this HEC. Hence, the parameter for this HEC receives Medium ranking.

Potential Impact (+/-)

Influx of local and nonresident workforce and several changes to local environment are examples of high level impacts in this health effect category. Because of the workforce is local and small and environmental changes could be monitored and controlled, alteration in infectious disease rate should be minor if they occur. This parameter receives a Low ranking.

Likelihood

Changes in infectious disease are not typically observed in other projects of similar size and scale. This parameter receives a Low ranking.

Actions

Diseases control measures and strategies should be followed.

HEC	Stakeholder concern	Potential impact (+/-)	Data Gaps	Likelihood	Phase
Infectious disease	Medium	Low	Medium	Low	Operation

Mitigation

To protect the local people from transmission of infectious disease

- Do pre-employment medical check-ups for workers.

- Provide monthly and annual medical check -ups and medical cares.

-Perform medical education process

- Set and handle the systemic control of disciplines for workers.

- Cooperate with various departments in disease protection, prevention and curative measures.

-Cooperate with local people and various departments in performing environmental sanitation, water control and management procedures and disease control measures etc.

-Dispose the wastes from camp site systematically and protection and control of cetin agents such as rats, flies, mosquitoes etc.

-Conduct the measures to repair the unused ponds and water retaining areas.

-Closure and post closure plan should be prepared prior to the start of the operations and also future land use and environmental conservation according to EMP should inform and consult with local communities and government representatives.

-Providing project personal and area residents with repellents, clothing, netting and other barriers to prevent mosquito bites.

-Educating the project personnel and local people about the risks, prevention and available treatment relating malaria.

9.4 Food, Nutrition and Subsistence Activity

This category considers health impacts related to food security, adequate nutrition, and availability of subsistence resources.

Stakeholder concern

Stakeholders expressed certain levels of concern for this health effect category. Some concern was related to the fear that subsistence resources may decrease in quality and quantity because of the potential contamination related to the proposed project. This parameter receives a Medium ranking.

Data Gaps

Because of the non-subsistence area designation, it is reasonable to assume that food security is medium. Detailed nutritional data set and subsistence data analysis requirement stand as data gaps. As a result, this parameter receives a Medium ranking.

Potential Impact (+/-)

The impacts of the proposed project would be minimal for nutritional status of the local people. Because of the changes to morbidity would be small, this parameter receives a Low ranking.

Likelihood

Changes to subsistence have occasionally been observed in similar project. As a result, this parameter receives a Medium ranking.

Actions

Local nutritional knowledge surveys could fill the data gaps related to this HEC.

HEC	Stakeholder concern	Potential impacts (+/-)	Data Gaps	Likelihood	Phase
Food, nutritional and subsistence activity	Medium	Low	Medium	Medium	Operation

Mitigation

- The proposed project need to maintain good nutrition and availability of fresh and nutritious foods of local people and avoid formation of negative impacts.
- Cooperate with other departments in examining and controlling of foods and food products.

9.5 Non Communicable Diseases (NCDs)

The non communicable diseases category involve cardiovascular diseases, cerebrovascular diseases, pulmonary diseases, endocrine disease (eg. diabetes mellitus) or changes in behavioral patterns that create risk such as increase in smoking, alcohol abuse etc.

Stakeholder concern

Stakeholders have expressed minor concern for the health impacts concerning non communicable diseases health effect category. As a result, this parameter receives a Medium ranking.

Data Gaps

Data sources for this category include public health reports of mortality patterns for NCDs, hospital discharge information, cancer registry data. Hospital admissions and discharge information would provide insights to changes in non fatal chronic diseases. The HIA team understands that complete and detailed records and reports of hospital as well as clinic concerning non communicable diseases are needed to fill the gaps. However, the HIA team believes that these data gaps would not alter the ranking of this category. As a result, this parameter receives a Medium ranking.

Potential Impact(+/-)

High level impacts in this HEC would involve a significant rise in cardiovascular disease, cerebrovascular diseases, respiratory diseases, endocrine diseases (eg. Diabetes mellitus) that required dedicated public health interventions to assist community adaptation. Medium level impacts would include some small change in NCD rates, but effective treatment measures exist for these conditions and would allow the communities to cope with the impacts. Low level impacts would include low level of changes in NCD rate and mitigation measures can

reduce the negative effects. Changes in employment pattern and behavioral changes of local community such as alcohol drinking, smoking, dietary pattern or air quality could contribute to a rise in non communicable diseases outcomes. One the other hand, providing health care services, control and health education to prevent and control the potential NCD related diseases can result in positive effects for the community. The proposed project is not large enough to create widespread population level effects that would trigger significant changes in morbidity or mortality for the proposed project area. As a result, this parameter receives a Low ranking.

Likelihood

Changes in chronic diseases mortality and morbidity that related to proposed project are not typically observed in other projects of similar size and scale. As a result this parameter receives a Low rank.

Actions

Should follow the preventive and control measures for specific diseases and these approaches can close the data gap in this category.

HEC	Stakeholder concern	Potential impact (+/-)	Data Gaps	Likelihood	Phase
Non Communicable Diseases	Medium	Low	Medium	Low	Operation

Mitigation

-Health education to the local people and employees concerning NCDs such as risk factors, prevention, control etc.
-Protect local people and employees from harmful behaviors such as smoking, alcohol drinking and betel chewing.
-Monitor air quality and utilize advanced techniques in order to reduce occurrence of cardiovascular and respiratory diseases that could be caused by inspiration of polluted air.
- Cooperate with local health departments in performing activities such as disease prevention and control, health education etc, together with local people.

9.6 Exposure to potentially hazardous materials

The proposed project may create exposures to a variety of potentially hazardous materials. These include toxic chemicals, particulate matter, gases, waste water and waste products, dust, etc. Physical exposure include noise. Complete exposure pathways potentially exist via air and water.

Stakeholder Concern

Stakeholders expressed high levels of concern for health impacts that fall within the Exposure to Potentially Hazardous Materials HEC. Concerns related to air and water quality were raised at all meetings and interviews. As a result this parameter receives a High ranking.

Data Gaps

Key data sources for this category include the air modeling for EPA criteria pollutants, the air quality permit, water quality permit, detailed local water and air baseline monitoring data, noise level studies. The lack of detailed air permit application is significant issue. Other data gaps exist for health impacts related to noise level and water quality from wells of residents living close to the project. These data gaps significantly limit the determination of potential health effects for this HEC. As a result, this parameter receives High ranking.

Potential Impacts (+/-)

Potential impact in this category depends on several factors including potential noise level, potential explosive hazards, dust exposure, emission to air, wastewater discharge, waste products removal, potential changes in level of particulate matter, water and soil pollution.

- Noise exposure will not create severe morbidity or mortality events.
- If water quality were profoundly worsened, the potential for severe morbidity outcomes increases, but waste water treatment and water management strategies exist that mitigate the most severe implications of contamination events. Discharge water exposure pathways are dependent on hydro-geological features of the area and resident location relative to the discharge. Generally, the degree of exposure would be depended on the distance from the discharge.
- Inspiring unpleasant odor and polluted air by dust, smoke, toxic gases and chemical vapor can cause sickness and death.
- Incremental changes in PM2.5 are associated with increase in hospitalization for cardiovascular and respiratory illness. If the change in PM 2.5 level was small, there would be decline in morbidity events and diseases exacerbations. If the changes were large enough, severe symptoms could be seen in residents living close proximity to the project area and sensitive individuals further from project area.
- Storage and use of explosive materials and fuels can cause hazards for the residents and local people.

The parameter receives a Medium ranking status.

Likelihood

Effects in this HEC (air, water) are common in similar settings and will most likely occur. The result for this parameter is High.

Actions

Industry standard mitigation strategies should be followed.

HEC	Stakeholder concern	Potential impact (+/-)	Data gaps	Likelihood	Phase
Exposure to potentially hazardous materials	High	Medium	High	High	Operation

Mitigation

- Perform the waste water treatment according to the techniques and guidelines developed by WHO and International Finance Corporation(IFC).
- Collaborate with respective departments in monitoring and examination of chemical compositions of environmental water sources, surface and ground water of the area where the proposed project is located.
- Handle and disposal of waste oil and waste products from proposed project should be managed systematically in order to prevent damage of nearby water sources.
- Perform the advanced techniques and procedures to keep the gas and particulate matters within permissible limits according to WHO and IFC guidelines.
- Conduct dust suppression techniques according to recommended dust management strategies (IFC).
- Loading, transfer and storage of dusty materials should be operated according to guidelines by local departments.
- Exposed soils should be regenerated with shady plants and perform environmental protective measures.
- Implement and apply noise suppression techniques according to the EHS guidelines.
- Monitoring and evaluation team should frequently check the parameters of performing procedures.

- Collaborate with other departments and provide the finding data to the public.
- Cooperate with local health department in performing disease prevention and control programs and health education together with local people.
- Develop a sustainable water management plan to minimize impact to environment and ground water usage during the planning, operation, closure and post closure phase of the project.
- Consult and cooperate with key stakeholders to understand the water usage and demands of local people and conservation requirements of water resources.

9.7 Accidents and injuries

This health effect category considers intentional and unintentional injuries that lead to both fatal and non-fatal outcomes. The scoping process revealed that road traffic accidents are important potential health impact for this HEC .

Stakeholder concern

HIA team reviewed available data for intentional and unintentional injury. Non fatal injury data was also reported from department of health. These data sources represent the standard parameter used to understand fatal and non fatal injury patterns in a population. In case of road traffic accidents, detailed data set for local community does not exist because different in types of injury result in different ways of seeking medical care. As a result, this parameter receives a Medium ranking.

Potential Impact (+/-)

If the proposed project was permitted, changes to traffic patterns on the road could produce both positive and negative health impacts. The positive impacts may reduce the commuting time for villagers employed at the proposed project. Less commuting could lead to decrease in total vehicle travelled and this could produce some small reduction in risk for accidents and traffic fatalities on these roadways. On the other hand, there would be increase in local traffic flow during the construction and operational phases of the proposed project. The

transport pattern of the proposed project would create a change in injury pattern of the area during the life of the project. However, the proposed project represents only a small increase in local traffic for the transport route. Based on the information of estimated vehicles used for proposed project, the potential for positive health impacts and negative morbidity or mortality events is very small and effective strategies exist to mitigate potential impacts in this health effect category. So, this impact parameter receives a Low ranking.

Likelihood

The road traffic accident risks related to projects of similar size and scale do occasionally occur. The rank for this parameter is Medium.

Actions

The HIA team will suggest measures to prevent from potential road traffic accidents. Moreover, the detailed analysis of road and traffic information and injury patterns from the relevant agencies could fill the data gaps.

HEC	Stakeholder concern	Potential impact (+/-)	Data Gaps	Likelihood	Phase
Accidents and injuries	Medium	Low	Medium	Medium	Construction Operation

Mitigation

- Perform the road traffic accidents control measures together with local people and other departments.
- Educating and providing health care and social services (eg. Providing ambulance, clinic etc)

9.8 Health services infrastructure and capacity

This health effect category considers the effectiveness of the health care infrastructure and capacity and access to health care relating to the proposed project.

Stakeholder concern

Stakeholders have expressed concern for the health impacts that related with the health service infrastructure and capacity. Hence, this parameter receives a High ranking.

Data Gaps

Data in this category include review of the local hospital and clinic lists and certain rankings of the adequacy of medical care and services. The HIA team conducted a survey of local health care resources and health services utilization pattern of local residents and found that the area is in need of well serviced. This parameter receives a Medium ranking.

Potential Impact (+/-)

Impacts to this HEC would involve overutilization of local health resources and inadequate health care manpower related to increase in population of local area. At present, the health services infrastructure and capacity of proposed project area can be said not well developed. Maung Hlaw Station Hospital and Naung Bee Health Centre are situated some distance from the proposed project area. If the proposed project can help the development of infrastructure for health as well as transportation for local people, there can be easy accessible for local people to seek health care. As a result, this parameter receives a Medium rank.

Likelihood

Health care infrastructure and capacity changes are not typically observed in project of similar size and scale. In sum, this parameter receives a Medium rank.

Actions

Significant impacts to local health care infrastructure and capacity are not expected.

HEC	Stakeholder concern	Potential impact (+/-)	Data Gaps	Likelihood	Phase
Health service infrastructure and capacity	High	Medium	Medium	Medium	Construction Operation

Recommendation

Providing clinics, medical equipment, drugs, doctors, nurses etc.

-Giving help and support for local people who need emergency treatment (eg, transportation, providing drugs and equipment)

-Cooperate with local people and other departments in disease prevention and curative measures.

Table:11 Summary of Prioritizing Health Effect Categories

HEC	Stakeholder Concern	Potential Impact(+/-)	Data Gaps	Likelihood	Phase
Social Determinants of health	High	Medium	Medium	High	Siting and Permission
Water and sanitation	High	High	Medium	High	Operation
Communicable diseases	Medium	Low	Medium	Low	Operation
Food, nutrition and subsistence activity	Medium	Low	Medium	Medium	Operation
Non communicable diseases	Medium	Low	Medium	Low	Operation
Exposure to potentially hazardous materials	High	Medium	High	High	Operation
Accidents and injuries	Medium	Low	Medium	Medium	Construction Operation
Health service infrastructure and capacity	High	Medium	Medium	Medium	Construction Operation

Table:12 Significance of potential impacts

Health Effect Category	Significance of impact	Distribution
Social determinants of health	Negative/ Medium	Residents, local workers employed and their families, migrant workers
Water and Sanitation	Negative/ High	Local residents
Communicable diseases	Negative/Low	Local people, migrant workers
Food, nutrition and subsistence activity	Negative/Low	Local residents
Non communicable diseases	Negative/ Low	Local residents
Exposure to potentially hazardous materials	Negative/ Medium	Local residents
Accident and injuries	Negative/ Low	Road users, local residents
Health services infrastructure and capacity	Positive/ Medium	Improvement in socio economic program , greater access to health care, emergency management plan

Table:13 Summary of mitigation/recommendation

No.	Health Effect Category	Mitigation/ Recommendation
1.	Social Determinants of health	-Review the best practice of environmental management strategies and guidelines developed by WHO and the IFC(International Finance Corporation in implementation of procedures and process of waste products management. -Follow up assessment of monitoring team including local people and relevant authorities.
2.	Water and Sanitation	-Maintain and protect the availability of safe and wholesome water of local people in collaboration with other organizations -Monitoring team involving local people and respective department should frequently check the performing procedures and management. -Perform the water management and usage and tailing management according to the techniques and guidelines developed by IFC. -Provide the availability of safe and wholesome water for local people.
3.	Communicable diseases	To protect the local people from transmission of infectious disease - Do pre-employment medical check-ups for workers. - Provide monthly and annual medical check ups and medical cares. -Perform medical education process - Set and handle the systemic control of disciplines for workers. - Cooperate with various departments in

		disease protection, prevention and curative measures. Cooperate with local people and various departments in performing environmental sanitation, water control and management procedures and disease control measures etc. -Dispose the wastes from camp site systematically and protection and control of cetin agents such as rats, flies, mosquitoes etc. -Conduct the measures to repair the unused ponds and water retaining areas. -Closure and post closure plan should be prepared prior to the start of the operations and also future land use and environmental conservation according to EMP should inform and consult with local communities and government representatives. -Providing project personal and area residents with repellents, clothing, netting and other barriers to prevent mosquito bites. -Educating the project personnel and local people about the risks, prevention and available treatment relating malaria.
4.	Food, nutrition and subsistence activity	-The proposed project need to maintain good nutrition and availability of fresh and nutritious foods of local people and avoid formation of negative impacts. -Cooperate with other departments in health education, examining and controlling of foods and food products.
5.	Non communicable diseases	-Health education to the local people and employees concerning NCDs such as risk factors, prevention, control etc. -Protect local people and employees from harmful behaviors such as smoking,

		alcohol drinking and betel chewing. -Monitor air quality and utilize advanced techniques in order to reduce occurance of cardiovascular and respiratory diseases that could be caused by inspiration of polluted air.
6.	Exposure to potentially hazardous materials	-Perform the waste water treatment according to the techniques and guidelines developed by WHO and International Finance Corporation(IFC). -Collaborate with respective departments in monitoring and examination of chemical compositions of environmental water sources, surface and ground water of the area where the proposed project is located. -Handle and disposal of waste oil and waste products from proposed project should be managed systematically in order to prevent damage of nearby water sources. -Perform the advanced techniques and procedures to keep the gas and particulate matters within permissible limits according to WHO and IFC guidelines. -Conduct dust suppression techniques according to recommended dust management strategies (IFC). -Loading, transfer and storage of dusty materials should be operated according to guidelines by local departments. -Exposed soils should be regenerated with shady plants and perform environmental protective measures. -Implement and apply noise suppression techniques according to the EHS guidelines. -Monitoring and evaluation team should frequently check the parameters of performing procedures.

		-Collaborate with other departments and provide the finding data to the public. -Cooperate with local health department in performing disease prevention and control programs and health education together with local people. -Develop a sustainable water management plan to minimize impact to environment and ground water usage during the planning, operation, closure and post closure phase of the project. -Consult and cooperate with key stakeholders to understand the water usage and demands of local people and conservation requirements of water resources.
7.	Accidents and injuries	To give continued training on safety procedures to all employees. -Occupational health and safety management system for the proposed project should be developed and implemented. -Perform the road traffic accidents control measures together with local people and other departments. -Educating and providing health care and social services (eg, providing clinics, emergency treatment) -Do pre-employment, monthly and annually medical checkups for workers. -Monitoring and evaluation by the occupational health and safety management team together with local people.
8.	Health services infrastructure and capacity	Providing clinics, medical equipment, drugs, doctors, nurses etc. -Giving help and support for local people

		who need emergency treatment (eg, transportation, providing drugs and equipment) -Cooperate with local people and other departments in disease prevention and curative measures.

10. Concluding Remark

This HIA has assessed the existing health conditions and studied the data from variety of sources to predict the potential impacts of the proposed project based on the eight determinants of health effect categories. Among these HECs, social determinants of health , exposure to potentially hazardous materials and water and sanitation HECs are major stakeholders concerns regarding the proposed project. More specifically, anxiety and worry about waste water and waste products disposal, destruction of plantation are major contributors of the community stress and potential negative impacts of the proposed project. For the potential negative impacts, a number of mitigation measures are delineated in this report. Adoption of policies, guidelines and programs (eg. WHO ,IFC) and plans (especially EMP and SMP) that maximize the positive health effects and minimize the negative health effects, the proposed project is expected to create job opportunities for local residents and to assist the economic development of the region.

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APPENDIX-J SOIL QUALITY ANALYSIS RESULTS

The Government of the Replubic of the Union of Myanmar
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Pesticide Analytical Laboratory

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CERTIFICATE OF HEAVY METAL ANALYSIS
HM – 77 / 2015

Description of consignments / lot	: Soil Sample
Name of owner and address	: OSHE Services Co;Ltd
Original of sample	: တနင်္သာရီတိုင်းကျွန်းစုမြို့နယ်၊ဇေးကမိကျေးရွာအုပ်စု ZGM-3
Designation of Sample	: Soil Sample
Laboratory registration No	: HM- 77 / 2015
The sample was taken by	: OSHE Services Co;Ltd
Date of sampling	: 10 -6-2015
Place of Sampling	: တနင်္သာရီတိုင်းကျွန်းစုမြို့နယ်၊ဇေးကမိကျေးရွာအုပ်စု ZGM-3
Date of analysis	: 15-6-2015
Remarks on the condition of the sample	: Sample is packed in Plastic Bag

RESULTS:

Herewith it is certified that the heavy metal content in the sample commodity (based on the samples submitted by OSHE Services Co;Ltd) are as follow ;

Heavy Metal Contaminants	**Laboratory Finding (ppm)**	**Maximum Permitted Level (ppm)**
Cadmium(Cd)	ND	0.8
Nickel (Ni)	0.1	35
Lead (Pb)	ND	85
Arsenic (As)	ND	29
Micro-nutrients		**Sufficient Level**
Copper (Cu)	0.65	20-300
Zinc (Zn)	14.65	20-100

NB: The results are valid only for the quantities the sample represented.

Date: 15 -6-2015

Note : ND – Not Detected

ppm:parts per million

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(Analytical Chemist)
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Fax : 95-1-644019

CERTIFICATE OF HEAVY METAL ANALYSIS
HM – 78 / 2015

Description of consignments / lot	: Soil Sample
Name of owner and address	: OSHE Services Co;Ltd
Original of sample	: တနင်္သာရီတိုင်းကျွန်းစုမြို့နယ်၊ဇေးကမိကျေးရွာအုပ်စုZGM-4
Designation of Sample	: Soil Sample
Laboratory registration No	: HM- 78 / 2015
The sample was taken by	: OSHE Services Co;Ltd
Date of sampling	: 10 -6-2015
Place of Sampling	: တနင်္သာရီတိုင်းကျွန်းစုမြို့နယ်၊ဇေးကမိကျေးရွာအုပ်စု ZGM-4
Date of analysis	: 15-6-2015
Remarks on the condition of the sample	: Sample is packed in Plastic Bag

RESULTS:

Herewith it is certified that the heavy metal content in the sample commodity (based on the samples submitted by OSHE Services Co;Ltd) are as follow ;

Heavy Metal Contaminants	**Laboratory Finding (ppm)**	**Maximum Permitted Level (ppm)**
Cadmium(Cd)	ND	0.8
Nickel (Ni)	13.5	35
Lead (Pb)	3.15	85
Arsenic (As)	ND	29
Micro-nutrients		**Sufficient Level**
Copper (Cu)	4	20-300
Zinc (Zn)	18.5	20-100

NB: The results are valid only for the quantities the sample represented.

Date: 15 -6-2015

Note : ND – Not Detected

ppm:parts per million

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DEPARTMENT OF AGRICULTURE (LAND USE)
SOIL INTERPREATATION OF RESULTS

Division -

Township - မြိတ်

OSHE SERVICES

Sheet No. 1

Lab No. S 1-4/15-16

Sr No.	Sample	pH Soil:Water 1:2.5	EC Soil:Water 1:5	Organic Carbon	CEC
1	ZGM - 1	Extremely acid	Very low	Medium	Low
2	ZGM - 2	Strongly acid	Medium	Medium	Medium
3	ZGM - 3	Extremely acid	Low	Medium	Low
4	ZGM - 4	Extremely acid	High	Medium	Medium

ဝင်ဝင်းမာ
လက်ထောက်ညွှန်ကြားရေးမှူး
မိတ္ထီလာခန်းတာဝန်ခံ
မြေအသုံးချရေးဌာနခွဲ

DEPARTMENT OF AGRICULTURE(LAND USE)
SOIL ANALYTICAL DATA SHEET

Division -

Township - မြိတ်

OSHE SERVICES

Sheet No. 1

Lab No. S 1-4/15-16

Sr No.	Sample plot	Moisture %	pH Soil:Water 1:2.5	EC ms/cm	Organic Carbon %	Humus %	CEC meq/100gm	Exchangeable Cations meq/100gm					
								Ca^{++}	Mg^{++}	K^{+}	Na^{+}	H^{+}	Al^{+++}
1	ZGM - 1	7.72	4.08	0.06	3.25	5.60	6.27	2.17	2.89	0.08	0.21	0.08	0.85
2	ZGM - 2	3.93	4.87	0.68	3.14	5.41	13.93	6.24	2.08	0.65	4.91	0.03	0.03
3	ZGM - 3	0.42	2.85	0.35	2.15	3.70	6.07	Not detected	4.02	0.05	Not detected	0.10	1.90
4	ZGM - 4	4.81	3.42	1.51	3.03	5.23	14.66	Not detected	4.90	0.25	7.73	0.05	1.73

ခင်ဝင်းမာ
လက်ထောက်သွန်ကြားရေးမှူး
မိတ်ခွဲခန်းတာဝန်ခံ
မြေအသုံးချရေးဌာနခွဲ