2017

ENVIRONMENTAL MANAGEMENT PLANS (EMP) OF GREENFIELD DEVELOPMENT OF BEVERAGE PROCESING PLANT (BEER, CARBONATED SOFT DRINK, AND MINERAL WATER) IN ULMERA, LIQUICA, TIMOR LESTE WITH ANNUAL CAPACITY OF 600,000

This Draft of Environmental Management Plans (EMP) has being prepared by PEC Consulting, Lda. on behalf of GOTA Bebidas e Alimentos, LDA. PEC Consulting is a national environmental and engineering consulting company headquartered in Dili. Comment, suggestion and input for this draft report can be forwarded to pec.dili.consulting@gmail.com

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1.1 Project Overview

GOTA e Alimentos Lda, a local Timorese company, which was established in 2012, would like to construct and operate the multi-purposes beverage development plant with the ultimate capacity of 50,000 Hecto Liter (HL) of beer, 50,000 HL of carbonated soft drink, and 500,000 HL of mineral water, in Suco Ulmera, Posto adminsitrasaun Bazartete in the Municipio of Liquica. The project will occupy 7 Hectares (HA) land that has been secured by the project owner through direct purchasing or acquisition.

The development of the project intends to seize on the growing business opportunity in Timor Leste while at the same time create job opportunity for many youth of Timor Leste. Every year, net import of beverage products such as Tiger, Bintang, ABC, and other brand names in Timor Leste is reasonably high at USS10 million (Statistic Data of MOF, 2014), which indicates a high demand of alcohol beverage in the country. This market demand data are an indication of the opportunity that can be fulfilled. Additionally, with cheap labor cost, ease of doing business in Timor Leste, and widely open market opportunity from adjacent countries such as Indonesia, PNG, Australia, makes this business a viable option. Although Heineken has already started its brewing to fulfill the mentioned demand gap, the propose development will focused on the premium quality of beer that has relatively fewer consumers but the product can be sold with higher unit price. While at the same time, the soft drink will be focused on other brands such as juice that has also a market demand in Timor Leste.Therefore, the project owner is trying to take this opportunity in development the project to produce beverages to fill the market demand and reduce the net import into the country.

Timor Leste on the other hand, is in the process of developing its socio-economic condition to increase overall living standards to its people. Currently, the country is heavily dependent on revenue from the oil and gas sector to run the country which may be a problem in the future, as the oil and gas are not renewable resources that will soon be running out. The country's economy should be diversifying into other non-oil sectors while using the oil money to leverage the process of diversification. Particularly, Timor – Leste needs more capital inflow through the foreign direct investment to invest in various productive sectors of economy. While at the same time, enhance the maximum participation from its citizen, particularly domestic investor to further re-invest their capital within the country to help recirculation economy of Timor – Leste.

The proposed beverage processing plant in Ulmera, Liquica, is a type of investment from local Timorese investor that the government of Timor Leste would expect to create jobs, other related business opportunities and provision of tax payment to the country. Moreover, as the owner or investor is local Timorese, the project will contribute more indirect benefits to the Timor – Leste's economy. However, the development of the above plant and facilities will also cause some negative temporary impacts that may arise during the construction of the facility and regular impacts during the operation of the production process. These impacts must be assessed in the conceptual and design phase of the project so that proper mitigation measures could be proposed to minimize the impacts during each phase of project development. At the end, maximum benefit with minimum impacts will be realized by project owner, government, publics, and nearby community's members.

This EIS has been prepared by PEC – Consulting Lda, on behalf of GOTA Bebidas e Alimentos, Lda, in responding to the requirement of the Decree Law 5/2011 that makes it mandatory for every major development to go through the proper Environmental Impacts Assessment (EIA), where the result of the EIA is put into the EIS, before the permit was granted to commence the construction activity and the operation of the proposed facility. A total investment of US$12 million from GOTA e Alimentos, Lda will be put mainly on the preparation and construction of the plants, where the majority of this investment goes to industrial buildings and equipment such as pressure vessels, reactors, tanks, etc. A wastewater treatment plant to treat wastewater produced from the facility will also be constructed.

The environmental impacts assessment (EIA) was carried out by reviewing all background information related to the nature of the project, necessary field data collection to measure baseline physical parameters of the environment, stakeholder engagement in order to socialize the proposed project to potentially affected community, and analyses of all the potential impacts that will arise during project execution. More importantly, an environmental management plan (EMP) was proposed to be implemented by the project owner in order to avoid, minimize or offset the impacts during each phase of project implementation.

The proposed development project consist of several major components that inter-linkage in a series of operation:

- Groundwater extraction
- Water treatment system
- Beer processing plant
- Carbonated soft drink processing plant
- Wastewater treatment plant
- Support system (utilities)

Each component of the project will cause adverse impacts that need to be assessed and mitigated during the project implementation. The summary of each impacts and mitigation measures are presented in the following section.

1.2 Environmental Impact Assessment and Management Plan

Table 1.1 Summaries of Likely Impacts during each of Project Implementation

Environmental impacts or concern	Source Activities		
	Pre-Construction Activities	Construction Activities	Operation and Maintenance Activities
General Impacts			
Loss of vegetation on the site	v		
Noise and Vibration	v	v	v
Dust and spoil	v	v	
Oil spill	v	v	v
Climate change impacts (Greenhouse Gas Emission from Vehicle)	v	v	v
General health and safety hazard	v	v	v
Energy consumption (Esp. high during O&M)			v
Solid waste	v	v	v
Water Consumption (high during the operation)			v
Impacts from Groundwater Withdrawal			
Over Pumping of groundwater			v
Seawater intrusion			v
Potential land subsidence			v
Impacts from Water Treatment (Desalination) Plant			
Wastewater production			v
Impacts from Beverage Processing Plant			
Sludge production			v
Greenhouse Gas Emission from process			v
Impacts from Waste Water Treatment Plant and Disposal			
Handling of wastewater in the plant			v
Changes in physical parameters of coastal water			v
Changes in chemical parameters of coastal water			v
Eutrophication			v
Bottom contamination			v
Impacts from Solid Waste			
Handling of solid waste			v
Contribute to high BOD, COD, and other qualities of wastewater			v
Health and odor issue			v
Required space and potentially create other hazardous material			v
Valuable by product that could be re-utilize			v

The above impacts will be received by the surrounding environment, people who work within the processing plant, as well as communities living nearby or workers in the facility. The natural environments that will be affected by the project consist of the following:

- Coastal ecosystem, which consist of mangrove, seaweed, seagrass, coral, and other flora and fauna within the ecosystem. This ecosystem is the ultimate receptor of the waste load (both solid and liquid) that potentially discharges from the plant in the absence of employing proper mitigation measures.
- Groundwater aquifer system, where the water will be withdrawn from. As consequence of groundwater pumping for utilization within the plant (for processing and other uses), the aquifer environment will be affected. Potential risk due to over pumping of the water will create impacts that will affect the aquifer and soil on the top of the aquifer.
- Surrounding soil (as well as the aquifer) that can be potentially contaminated by pollutant from the plant. When no prevention is installed, surrounding soil will receive the effluent treated wastewater and over time the waste load will accumulate in soil and at the certain point the assimilative capacity of the soil gets saturated. Consequently, soil will be polluted an the pollutant will be transported downward during the percolation process and eventually contaminate the groundwater aquifer system
- Air/atmosphere that will receive the greenhouse gas emission and eventually contribute to the global climate change.

In order to minimize the above impacts to the existing environment, a proposed mitigation measures in the form of action plan would be necessary. The action plan is the environmental management plans (EMP). The EMP must be implemented by the project owner. The EMP of each impact during each stages of the project implementation is provided in the following tables. The impacts and action plans proposed will be presented in the following tables, are separated based on the phases of the project:

- Pre-Construction Phase
- Construction Phase
- Operation Phase

Table. 1.2 Impacts and Management Plan during Pre-Construction and Construction

Phase	Type of Activity	Potential Impacts /factor of concern	Action Plan
Pre-Construction	Site preparation and grading	soil erosion	➢ Reducing or preventing erosion by: • Scheduling the site preparation such to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical • Contouring and minimizing length and steepness of slopes • Mulching to stabilize exposed areas • Re-vegetating areas promptly • Designing channels and ditches for post-construction flows • Lining steep channel and slopes (e.g. use jute matting)
		Sedimentation	➢ Reducing or preventing off-site sediment transport through use of settlement ponds, silt fences, and water treatment, and modifying or suspending activities during extreme rainfall and high winds to the extent practical ➢ segregating or diverting clean water runoff to prevent it mixing with water containing a high solids content, to minimize the volume of water to be treated prior to release
		Slope Stability	➢ Providing effective short term measures for slope stabilization, sediment control and subsidence control until long term measures for the operational phase can be implemented ➢ Providing adequate drainage systems to minimize and control infiltration
		Loss of vegetation	Replanting in other area
		Air quality	➢ Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements ➢ Avoiding open burning of solid
		Disturbance of water body	➢ Depending on the potential for adverse impacts, installing free-spanning structures (e.g., single span bridges) for road watercourse crossings ➢ Restricting the duration and timing of in-stream activities to lower low periods, and avoiding periods critical to biological cycles of valued flora and fauna (e.g., migration, spawning,etc.) ➢ For in-stream works, using isolation techniques such as berming or diversion during construction to limit the exposure of disturbed sediments to moving water ➢ Consider using trenchless technology for pipeline crossings (e.g., suspended crossings) or installation by directional drilling
Construction	Construction Plants,	Noise and Vibration	➢ Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance ➢ Using noise control devices, such as temporary noise barriers and deflectors for impact and

	Wastewater Treatment Plant, Office Building, Parking and Others		blasting activities, and exhaust muffling devices for combustion engines. ➢ Avoiding or minimizing project transportation through community areas
		Solid waste	Proper collection of solid waste from various sources such as concrete material, excess fill materials from grading and excavation activities, scrap wood and metals, and small concrete spills, can be manage onsite
		Wastewater discharge from workers	Construction and decommissioning activities may include the generation of sanitary wastewater discharges in varying quantities depending on the number of workers involved. Adequate portable or permanent sanitation facilities serving all workers should be provided at all construction sites
		Hazardous Material	➢ Providing adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids, ➢ Using impervious surfaces for refueling areas and other fluid transfer areas ➢ Training workers on the correct transfer and handling of fuels and chemicals and the response to spills ➢ Providing portable spill containment and cleanup equipment on site and training in the equipment deployment
		Land contamination	➢ Managing contaminated media with the objective of protecting the safety and health of occupants of the site, the surrounding community, and the environment post construction or post decommissioning ➢ Understanding the historical use of the land with regard to the potential presence of hazardous materials or oil prior to initiation of construction or decommissioning activities ➢ Preparing plans and procedures to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment consistent with the approach for Contaminated Land
	OHS - Hazard	Over-exertion	➢ Training of workers in lifting and materials handling techniques in construction and decommissioning projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary ➢ Planning work site layout to minimize the need for manual transfer of heavy loads ➢ Selecting tools and designing work stations that reduce force requirements and holding times, and which promote improved postures, including, where applicable, user adjustable work stations ➢ Implementing administrative controls into work processes, such as job rotations and rest or stretch breaks
		Slips and Falls	➢ Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths

			➢ Cleaning up excessive waste debris and liquid spills regularly ➢ Locating electrical cords and ropes in common areas and marked corridors ➢ Use of slip retardant footwear
		Work in Heights	➢ Training and use of temporary fall prevention devices, such as rails or other barriers able to support a weight of 200 pounds, when working at heights equal or greater than two meters or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface ➢ Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards able to support 5000 pounds (also described in this section in Working at Heights above), as well as fall rescue procedures to deal with workers whose fall has been successfully arrested. The tie in point of the fall arresting system should also be able to support 5000 pounds ➢ Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones, as well as securing, marking, and labeling covers for openings in floors, roofs, or walking surfaces
		Struck By Objects	➢ Using a designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes from upper to lower levels ➢ Conducting sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable ➢ Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap ➢ Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged ➢ Evacuating work areas during blasting operations, and using blast mats or other means of deflection to minimize fly rock or ejection of demolition debris if work is conducted in proximity to people or structures ➢ Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes
		Moving Machinery	➢ Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic ➢ Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle ➢ Ensuring moving equipment is outfitted with audible back-up alarms ➢ Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job- site elevations.
		Dust	➢ Dust suppression techniques should be implemented, such as applying water or non-toxic

			chemicals to minimize dust from vehicle movements ➢ PPE, such as dusk masks, should be used where dust levels are excessive
		Confined Spaces and Excavations	➢ Controlling site-specific factors which may contribute to excavation slope instability including, for example, the use of excavation dewatering, side-walls support, and slope gradient adjustments that eliminate or minimize the risk of collapse, entrapment, or drowning ➢ Providing safe means of access and egress from excavations, such as graded slopes, graded access route, or stairs and ladders ➢ Avoiding the operation of combustion equipment for prolonged periods inside excavations areas where other workers are required to enter unless the area is actively ventilated
		Other Site Hazards	➢ Use of specially trained personnel to identify and remove waste materials from tanks, vessels, processing equipment or contaminated land as a first step in decommissioning activities to allow for safe excavation, construction, dismantling or demolition ➢ Use of specially trained personnel to identify and selectively remove potentially hazardous materials in building elements prior to dismantling or demolition including, for example, insulation or structural elements containing asbestos and Polychlorinated Biphenyls(PCBs), electrical components containing mercury ➢ Use of waste-specific PPE based on the results of an occupational health and safety assessment, including respirators, clothing/protective suits, gloves and eye protection
	Community Health and Safety	General Site Hazards	➢ Restricting access to the site, through a combination of institutional and administrative controls, with a focus on high risk structures or areas depending on site-specific situations, including fencing, signage, and communication of risks to the local community ➢ Removing hazardous conditions on construction sites that cannot be controlled affectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked storage of hazardous materials
		Disease Prevention	Similar action as during the operation site on the general OSH
		Traffic Safety	Refer to the traffic safety in the general OSH

Table 1.3 Summaries Occupational Health and Safety Impact Assessment and Environmental Management Plan (EMP) – During the Operation Phase

Type of Hazard	Potential Hazard Source/factor of concern	Action Plan and Mitigation Measures
General Hazard within Working Place	Integrity of work place structure	➢ Surfaces, structures and installations should be easy to clean and maintain, and not allow for accumulation of hazardous compounds. ➢ Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions. ➢ Fire resistant, noise-absorbing materials should, to the extent feasible, be used for cladding on ceilings and walls. ➢ Floors should be level, even, and non-skid. ➢ Heavy oscillating, rotating or alternating equipment should be located in dedicated buildings or structurally isolated sections.
	Severe weather facility shut down	➢ Work place structures should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge, if appropriate. ➢ Standard Operating Procedures (SOPs) should be developed for project or process shut-down, including an evacuation plan. Drills to practice the procedure and plan should also be undertaken annually
	Workspace and exit	➢ The space provided for each worker, and in total, should be adequate for safe execution of all activities, including transport and interim storage of materials and products ➢ Passages to emergency exits should be unobstructed at all times. Exits should be clearly marked to be visible in total darkness. The number and capacity of emergency exits should be sufficient for safe and orderly evacuation of the greatest number of people present at any time, and there should be a minimum two exits from any work area. ➢ Facilities also should be designed and built taking into account the needs of disabled persons.
	Fire precaution lavatory shower	➢ Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present. ➢ Provision of manual firefighting equipment that is accessible and simple to use Fire and emergency alarm systems that are both audible and visible
	Lavatory and showers	➢ Adequate lavatory facilities (toilets and washing areas) should be provided for the number of people expected to work in the facility and allowances made for segregated facilities, or for indicating whether the toilet facility is “In Use” or “Vacant”. Toilet facilities should also be

		provided with adequate supplies of hot and cold running water, hand drying devices. ➢ Where workers may be exposed to substances poisonous by ingestion and skin contamination may occur, facilities for showering and changing into and out of street and work clothes should be provided.
	Potable water supply	➢ Adequate supplies of potable drinking water should be provided from a fountain with an upward jet or with a sanitary means of collecting the water for the purposes of drinking ➢ Water supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing) should meet drinking water quality standards
	Lighting	➢ Workplaces should, to the degree feasible, receive natural light and be supplemented with sufficient artificial illumination to promote workers' safety and health, and enable safe equipment operation. Supplemental 'task lighting' may be required where specific visual acuity requirements should be met. ➢ Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure etc.
	Safe access	➢ Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access ➢ Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted ready access ➢ Hand, knee and foot railings should be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps, etc. ➢ Openings should be sealed by gates or removable chains ➢ Covers should, if feasible, be installed to protect against falling items ➢ Measures to prevent unauthorized access to dangerous areas should be in place
	clean eating area	Where there is potential for exposure to substances poisonous by ingestion, suitable arrangements are to be made for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances
	First aid	➢ The employer should ensure that qualified first-aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work ➢ Eye-wash stations and/or emergency showers should be provided close to all workstations where immediate flushing with water is the recommended first-aid response ➢ Where the scale of work or the type of activity being carried out so requires, dedicated and appropriately equipped first-aid room(s) should be provided. First aid stations and rooms should be equipped with gloves, gowns, and masks for protection against direct contact with blood and other body fluids ➢ Remote sites should have written emergency procedures in place for dealing with cases of

		trauma or serious illness up to the point at which patient care can be transferred to an appropriate medical facility.
	Air supply	➢ Sufficient fresh air should be supplied for indoor and confined work spaces. Factors to be considered in ventilation design include physical activity, substances in use, and process related emissions. Air distribution systems should be designed so as not to expose workers to draughts ➢ Mechanical ventilation systems should be maintained in good working order. Point-source exhaust systems required for maintaining a safe ambient environment should have local indicators of correct functioning. ➢ Re-circulation of contaminated air is not acceptable. Air inlet filters should be kept clean and free of dust and microorganisms
	Working environment temperature	The temperature in work, rest room and other welfare facilities should, during service hours, be maintained at a level appropriate for the purpose of the facility.
Physical Hazard	Rotating and Moving and equipment	➢ Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions ➢ Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts, or in which energy can be stored (e.g. compressed air, electrical components) during servicing or maintenance, in conformance with a standard such as CSA Z460 Lockout or equivalent ISO or ANSI standard ➢ Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms
	Noise and vibration	➢ No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing . protection ➢ The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110dB(A) ➢ Further guideline on the noise and vibration is given in the section 8.1.2.3.
	Electrical	➢ Marking all energized electrical devices and lines with warning signs ➢ Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance
	Eye hazard	➢ Use of machine guards or splash shields and/or face and eye protection devices, such as safety glasses with side shields, goggles, and/or a full face shield. Specific Safe Operating Procedures (SOPs) may be required for use of sanding and grinding tools and/or when working around liquid chemicals. Frequent checks of these types of equipment prior to use to ensure mechanical integrity is also good practice. Machine and equipment guarding should conform to standards published by organizations such as CSA, ANSI and ISO

		➢ Moving areas where the discharge of solid fragments, liquid, or gaseous emissions can reasonably be predicted (e.g. discharge of sparks from a metal cutting station, pressure relief valve discharge) away from places expected to be occupied or transited by workers or visitors. Where machine or work fragments could present a hazard to transient workers or passers-by, extra area guarding or proximity restricting systems should be implemented, or PPE required for transients and visitors. Provisions should be made for persons who have to wear prescription glasses either through the use over glasses or prescription hardened glasses
	Welding or hot work	➢ Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required ➢ Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hotwork on tanks or vessels that have contained flammable materials.
	Illumination	Using proper light illumination: ➢ Emergency light with the light intensity of 10 lux ➢ Outdoor non-working area should use the light intensity of 20 lux ➢ Simple orientation and temporary visit (machine storage, garage, warehouse) should use 50 lux ➢ Workspace with occasional visual task only (Corridors, stairways, lobby, elevator, auditorium, etc.) shall use 100 lux ➢ Medium precision work (simple assembly, rough machine work, welding, packing =) shall use 200 lux ➢ Precision work (reading, moderately difficult assembly, sorting, etc.) use 500 lux ➢ High precision work (difficult assembly, fine sorting, inspection, etc.) shall use 1000-3000 lux
	Vehicle and site traffic	➢ Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits

		➢ Ensuring drivers undergo medical surveillance ➢ Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms ➢ Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures(e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction ➢ Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one-way' circulation, where appropriate
	Working at height	➢ Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area ➢ Proper use of ladders and scaffolds by trained employees ➢ Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines ➢ Appropriate training in use, serviceability, and integrity of the necessary PPE ➢ Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall
Personal Protection Equipment (PPE)	Eye and face Protection	Safety Glasses with side-shields, protective shades, etc.
	Head Protection	Plastic Helmets with top and side impact protection.
	Hearing Protection	Hearing protectors (ear plugs or ear muffs).
	Foot protection	Safety shoes and boots for protection against moving & falling objects, liquids and chemicals.
	Hand Protection	Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc.
	Respiratory protection	➢ Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapors and gases). Single or multi-gas personal monitors, if available. ➢ Portable or supplied air (fixed lines). On-site rescue equipment.
	Body/leg protection	Insulating clothing, body suits, aprons etc. of appropriate materials
Chemical Hazard	Refrigerant leaking	Breweries often have large refrigeration systems, typically using ammonia refrigerant which is toxic and can form explosive mixtures in air. Safety and other guidance offered by professional refrigeration institutions should be adopted in refrigeration system siting, design, maintenance, and operation.
	Asphyxiation	Carbon dioxide is produced during fermentation and maturation processes, carbon dioxide can be recovered, and carbon dioxide and / or nitrogen are stored and used in many brewery processes where inert atmospheres are required. Uncontrolled release of these gases or inadequate ventilation, particularly in confined or enclosed spaces such as fermentation and maturation

		rooms can result in accumulation of sufficient concentration to present asphyxiation risk. Appropriate safety measures should be developed based on a risk assessment, and may include enhanced ventilation, guidance on safe
Biological Hazard	Biological agent should be grouped into four. ➢ ***Group 1:*** Biological agents unlikely to cause human disease, and consequently only require controls similar to those required for hazardous or reactive chemical substances ➢ ***Group 2:*** Biological agents that can cause human disease and are thereby likely to require additional controls, but are unlikely to spread to the community ➢ ***Group 3***: Biological agents that can cause severe human disease, present a serious hazard to workers, and may present a risk of spreading to the community, for which there usually is effective prophylaxis or treatment available and are thereby likely to require extensive additional controls ➢ ***Group 4:*** Biological agents that can cause severe human disease, are a serious hazard to workers, and present a high risk of	➢ If the nature of the activity permits, use of any harmful biological agents should be avoided and replaced with an agent that, under normal conditions of use, is not dangerous or less dangerous to workers. If use of harmful agents cannot be avoided, precautions should be taken to keep the risk of exposure as low as possible and maintained below internationally established and recognized exposure limits. ➢ Work processes, engineering, and administrative controls should be designed, maintained, and operated to avoid or minimize release of biological agents into the working environment. The number of employees exposed or likely to become exposed should be kept at a minimum ➢ The employer should review and assess known and suspected presence of biological agents at the place of work and implement appropriate safety measures, monitoring, training, and training verification programs ➢ Measures to eliminate and control hazards from known and suspected biological agents at the place of work should be designed, implemented and maintained in close co-operation with the local health authorities and according to recognized international standards

	spreading to the community, for which there is usually no effective prophylaxis or treatment available and are thereby likely to require very extensive additional controls	

Table 1.4 Impacts Assessment and Mitigation Measures of Community Health and Safety – during the Operation Phase

Type of Hazard	Potential Hazard Source/factor of concern	Action Plan - EMP
Water availability and quality	Water Availability - over pumping of groundwater pumping will cause water availability problem	Company to provide access water to the community
	Water Quality - wastewater discharge into the groundwater system	➢ Community to drill bore near the project facility ➢ Proper discharge of wastewater
Structural safety of project infrastructure	Reduction of potential hazards is best accomplished during the design phase when the structural design, layout and site modifications can be adapted more easily	➢ Inclusion of buffer strips or other methods of physical separation around project sites to protect the public from major hazards associated with hazardous materials incidents or process failure, as well as nuisance issues related to noise, odors, or other emissions ➢ Incorporation of sitting and safety engineering criteria to prevent failures due to natural risks posed by earthquakes, tsunamis, wind, flooding, landslides and fire ➢ Application of locally regulated or internationally recognized building codes to ensure structures are designed and constructed in accordance with sound architectural and engineering practice, including aspects of fire prevention and response ➢ Engineers and architects responsible for designing and constructing facilities, building, plants and other structures should certify the applicability and appropriateness of the structural criteria employed.
	Follow international best practice in design and construction of the facility and infrastructure	➢ Existing structures ➢ Soils and foundations ➢ Site grading ➢ Structural design ➢ Specific requirements based on intended use and occupancy ➢ Accessibility and means of egress ➢ Types of construction ➢ Roof design and construction ➢ Fire-resistant construction ➢ Flood-resistant construction ➢ Construction materials ➢ Interior environment ➢ Mechanical, plumbing and electrical systems

		➢ Elevators and conveying systems ➢ Fire safety systems ➢ Safeguards during construction ➢ Encroachments into public right-of-way
	Management action to reduce the hazardous material storage	➢ Reducing inventories of hazardous materials through inventory management and process changes to greatly reduce or eliminate the potential off-site consequences of a release Modifying process or storage conditions to reduce the potential consequences of an accidental off Improving shut-down and secondary containment to reduce the amount of material escaping from containment and to reduce the release duration ➢ Reducing the probability that releases will occur through improved site operations and control, and through improvements in maintenance and inspection ➢ Reducing off-site impacts of releases through measures intended to contain explosions and fires, alert the public, provide for evacuation of surrounding areas, establish safety zones around a site, and ensure the provision of emergency medical services to the public codes, local fire department regulations, local legal/insurance requirements, and in accordance with an internationally accepted life and fire safety (L&FS) standard.
	Follow proper compliance with the Life and Fire Safety objectives outlined in these guidelines	➢ Project sponsors' architects and professional consulting engineers should demonstrate that affected buildings meet these life and fire safety objectives. ➢ Life and fire safety systems and equipment should be designed and installed using appropriate prescriptive standards and/or performance based design, and sound engineering practices. ➢ Life and fire safety design criteria for all existing buildings should incorporate all local building codes and fire department regulations.
Life and fire safety	**Fire prevention**: Fire prevention addresses the identification of fire risks and ignition sources, and measures needed to limit fast fire and smoke development.	➢ Fuel load and control of combustibles ➢ Ignition sources ➢ Interior finish flame spread characteristics ➢ Interior finish smoke production characteristics ➢ Human acts, and housekeeping and maintenance
	Means of Egress : Means of egress includes all design measures that facilitate a safe evacuation by residents and/or occupants in	➢ Clear, unimpeded escape routes ➢ Accessibility to the impaired/handicapped ➢ Marking and signing

	case of fire or other emergency,	➢ Emergency lighting
	Detection and Alarm Systems: These systems encompass all measures, including communication and public address systems needed to detect a fire and alert:	➢ Building staff ➢ Emergency response teams ➢ Occupants ➢ Civil defense
	Compartmentation: Compartmentation involves all measures to prevent or slow the spread of fire and smoke, including	➢ Separations ➢ Fire walls ➢ Floors ➢ Doors ➢ Dampers ➢ Smoke control systems
	Fire Suppression and Control: Fire suppression and control includes all automatic and manual fire protection installations, such as:	➢ Automatic sprinkler systems ➢ Manual portable extinguishers ➢ Fire hose reels
	Emergency Response Plan	An Emergency Response Plan is a set of scenario procedures to assist staff and emergency response teams during real life emergency and training exercises. This chapter of the and Life Safety Master Plan should include an assessment of local fire prevention and suppression capabilities.
	L&FS Master Plan Review and Approval	➢ A suitably qualified professional prepares and submits a Life and Fire Safety (L&FS) Master Plan, including preliminary drawings and specifications, and certifies that the design meets the requirements of these L&FS guidelines. The findings and recommendations of the review are then used to establish the conditions of a Corrective Action Plan and a time frame for implementing the changes. ➢ The suitably qualified professional conducts a review as part of the project completion test at the time of life and fire safety systems testing and commissioning, and certifies that construction of these systems has been carried out in accordance with the accepted design. The findings and recommendations of the review are used as the basis for establishing project completion or to establish the conditions of a Pre-Completion Corrective Action Plan and a time frame for implementing the changes. ➢
	Specific Requirements for Existing building	➢ All life and fire safety guideline requirements for new buildings apply to existing buildings programmed for Renovation. A suitably qualified

		professional conducts a complete life and fire safety review of existing buildings slated for renovation. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes ➢ If it becomes apparent that life and fire safety conditions are deficient in an existing building that is not part of the project or that has not been programmed for renovation, a life and fire safety review of the building may be conducted by a suitably qualified professional. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes.
Traffic safety	Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public	➢ Emphasizing safety aspects among drivers ➢ Improving driving skills and requiring licensing of drivers ➢ Adopting limits for trip duration and arranging driver rosters to avoid overtiredness ➢ Avoiding dangerous routes and times of day to reduce the risk of accidents ➢ Use of speed control devices (governors) on trucks, and remote monitoring of driver actions
	Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.	
	Managing future traffic increase in the project area	➢ Minimizing pedestrian interaction with construction vehicles ➢ Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present. Collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns) ➢ Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents ➢ Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimizing external traffic ➢ Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions

Emergency Preparedness and Response	Communication System : Worker notification and communication Alarm bells, visual alarms, or other forms of communication should be used to reliably alert workers to an emergency	➢ Testing warning systems at least annually (fire alarms monthly), and more frequently if required by local regulations, equipment, or other considerations ➢ Installing a back-up system for communications on-site with off-site resources, such as fire departments, in the event that normal communication methods may be inoperable during an emergency
	Communication notification	➢ Audible alarms, such as fire bells or sirens ➢ Fan out telephone call lists ➢ Vehicle mounted speakers ➢ Communicating details of the nature of the emergency ➢ Communicating protection options (evacuation, quarantine) Providing advise on selecting an appropriate protection option
	Media and Agency Relation	➢ A trained, local spokesperson able to interact with relevant stakeholders, and offer guidance to the company for speaking to the media, government, and other agencies ➢ Written press releases with accurate information, appropriate level of detail for the emergency, and for which accuracy can be guaranteed
	Fire Service	The company should consider the level of local firefighting capacity and whether equipment is available for use at the facility in the event of a major emergency or natural disaster. If insufficient capacity is available, firefighting capacity should be acquired that may include pumps, water supplies, trucks, and training for personnel.
	Medical Service	The company should provide first aid attendants for the facility as well as medical equipment suitable for the personnel, type of operation, and the degree of treatment likely to be required prior to transportation to hospital
	Availability of Resource	➢ Maintaining a list of external equipment, personnel, facilities, funding, expert knowledge, and materials that may be required to respond to emergencies. The list should include personnel with specialized expertise for spill clean-up, flood control, engineering, water treatment, environmental science, etc., or any of the functions required to adequately respond to the identified emergency ➢ Providing personnel who can readily call up resources, as required ➢ Tracking and managing the costs associated with emergency resources ➢ Considering the quantity, response time, capability, limitations, and cost of these resources, for both site-specific emergencies, and community or

		regional emergencies ➢ Considering if external resources are unable to provide sufficient capacity during a regional emergency and whether additional resources may need to be maintained on-site
	Mutual Aid	Mutual aid agreements decrease administrative confusion and provide a clear basis for response by mutual aid providers. Where appropriate, mutual aid agreements should be maintained with other organizations to allow for sharing of personnel and specialized equipment.
	Contact List	The company should develop a list of contact information for all internal and external resources and personnel. The list should include the name, description, location, and contact details (telephone, email) for each of the resources, and be maintained annually.
	Training and Updating	
Disease and prevention	Communicable Disease	➢ Providing surveillance and active screening and treatment of workers ➢ Preventing illness among workers in local communities by: • Undertaking health awareness and education initiatives, for example, by implementing an information strategy to reinforce person-to-person counseling addressing systemic factors that can influence individual behavior as well as promoting individual protection, and protecting others from infection, by encouraging condom use • Training health workers in disease treatment • Conducting immunization programs for workers in local communities to improve health and guard against infection • Providing health services ➢ Providing treatment through standard case management in on-site or community health care facilities ➢ Promoting collaboration with local authorities to enhance access of workers families and the community to public health services and promote immunization
	Vector Borne diseases	➢ Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements ➢ Elimination of unusable impounded water ➢ Increase in water velocity in natural and artificial channels ➢ Considering the application of residual insecticide to dormitory walls ➢ Implementation of integrated vector control programs ➢ Promoting use of repellents, clothing, netting, and other barriers to prevent

		insect bites ➢ Use of chemoprophylaxis drugs by non-immune workers and collaborating with public health officials to help eradicate disease reservoirs ➢ Monitoring and treatment of circulating and migrating populations to prevent disease reservoir spread • Collaboration and exchange of in-kind services with other control programs in the project area to maximize beneficial effects ➢ Educating project personnel and area residents on risks, prevention, and available treatment ➢ Monitoring communities during high-risk seasons to detect and treat cases ➢ Distributing appropriate education materials ➢ Following safety guidelines for the storage, transport, and distribution of pesticides to minimize the potential for misuse, spills, and accidental human exposure

Table 1.5 Summaries of Environmental Impacts and Mitigation Measured during Operation Phase of Plant

Source of Issues /problem	Potential Impacts	Action Plan
Water Consumption		
Groundwater Extraction	Increase water stress in the area	➢ Propose water resource protection at upland catchment system ➢ Ensure the responsible discharge of effluent ➢ Water recycling to recharge the aquifer ➢ Reduce the amount of water use in the production (technology choice and conservation)
	Affect groundwater sustainability	➢ Pumping rate to be less than sustainable yield of groundwater ➢ Monitor and controlled pumping rate to be less than sustainable yield ➢ Reduce water consumption in the entire facility ➢ Water resource protection ➢ Water recycling and recharge the groundwater aquifer ➢ Enhance recharge program from the rain water at the upland catchment, such as micro DAM or rain harvesting to collect the store temporarily to allow the rain water to infiltrate into the groundwater
	Affect salt water intrusion	
	Susceptibility of groundwater contamination	
	Land subsidence	
	High energy cost of water pumping - contribute to greenhouse gases emission	➢ Water conservation to reduce rate of water consumption ➢ Work together with the government to find other water sources in the mountain area that will be used for brewing and community ➢ Apply energy alternative to complement the energy need (solar and wind energies)
Water treatment system	High cost of treatment	➢ Water conservation to reduce rate of water consumption

		➢ Apply energy alternative to complement the energy need (solar and wind energies)
	Wastewater - Brine disposal	➢ Applies proper dilution with sea water prior to discharging into the sea ➢ Reduce the brine discharge by reducing water consumption rate with water conservation program
Energy Consumption		
➢ Beverage processing plant ➢ wastewater Treatment Plant ➢ Water Treatment plant ➢ Pumping of groundwater ➢ Utility uses ➢ Beverage proc	High operating cost /expensive	➢ Monitor and measures the energy consumption within the facility (possible for each section) ➢ Using the data to perform the energy auditing system ➢ Reduce the usage per unit production of beverage by applying the energy conservation within the facility ➢ Switch to more renewable energy source
	Contribute to greenhouse gas emission	
		Energy conservation and Management: ➢ Energy management (optimizing the energy utilization) ➢ Energy efficiency in both cooling and heating system ➢ Energy conservation system
Solid waste Management		
Spent Grain	➢ Contributing to the high BOD/COD if discharge into wastewater stream ➢ Large quantity which required space to store ➢ Odor and create other problems ➢ Potentially becomes bio-hazard	➢ Reduce the quantity by increasing the efficiency of raw material conversion to product ➢ Reused by sending to farmer as cattle food ➢ Recycle via composting ➢ Convert to fuel (Bio-process) but it will required higher capital investment
Spent yeast	➢ Unpleasant odor ➢ Contribute to high BOD and COD if discharge into drain/wastewater stream ➢ Potential becomes bio-hazard	➢ Reduce the quantity by increasing the efficiency of raw material conversion to product ➢ Save and reused yeast ➢ Reused in in bakeries to make bread or cookies ➢ Recycle via composting ➢ Convert to bio-energy (required high cost on the capital

		investment)
General solid waste	➢ Need space to store (Space limitation) ➢ Create unpleasant environment ➢ Create unhealthy environment and may be generate illness	➢ Proper Collection of the general waste in every section of the unit processing ➢ Separate bio-degradable and non-biodegradable materials - identify the recyclable material ➢ Send the recyclable material to the recycle process ➢ Non-recyclable material to be sent to sanitary land fill in Tibar
Diatomaceous Earth (DE)	➢ Significant quantity which required space to store ➢ Dust problem	➢ Reduce the quantity by optimizing the efficiency of using the DE (for instance, optimizing the particle size) ➢ Work together with Brewing team to reduce the use of DE without compromising the quality of beer ➢ Explore the membrane process to filter the beer ➢ Recycle the material for other use such as additive to the construction material (concrete cement, brick, etc.) ➢ Always keep in wet condition to ovoid the danger associate with the airborne dust
Corrugated - Cardboard	➢ Space limitation ➢ Becomes hazmat ➢ End up in the sea and polluted the sea, city, and environment	➢ Reused – can be used for packaging ➢ Reprocess into compost ➢ Dispose into the proper sanitary land filling
Wood pellets	➢ Space limitation ➢ Becomes hazmat ➢ Unhealthy environment	➢ Reused - within the facility for other uses ➢ Recycle into table ➢ Composting
Shrink wrap , Bag, sack	➢ Space limitation ➢ Becomes hazmat ➢ Non-biodegradable material, took a long time to break the molecule ➢ Unhealthy environment	➢ Reuse ➢ Incinerate in the proper location
Aluminum cans	➢ Space limitation ➢ Unhealthy environment	Recycle the cans

Plastic bottles	➢ Space limitation ➢ Unhealthy environment ➢ It takes a long time to decompose the non-biodegradable material such as plastic	➢ Reuse the bottle for other purpose ➢ Collect the bottles and recycle if possible ➢ Incinerate in the proper location
Glass bottles	➢ Space limited ➢ Becomes hazmat ➢ Unhealthy environment	➢ Reused the bottle ➢ Recycle the broken one
Leftover food	➢ Odor ➢ High BOD/COD ➢ Bio-hazard ➢ Unhealthy environment and cause sickness and poisonous	➢ Send them for animal food ➢ Dry the food to avoid the process of decomposition that cause hazard ➢ Composting the food by mixing the leftover food within organic composting material
Corrugated - Cardboard	➢ Space limitation ➢ Becomes hazmat ➢ End up in the sea and polluted the sea, city, and environment	➢ Reused – can be used for packaging ➢ Reprocess into compost ➢ Dispose into the proper sanitary land filling
Wood pellets	➢ Space limitation ➢ Becomes hazmat ➢ Unhealthy environment	➢ Reused - within the facility for other uses ➢ Recycle into table ➢ Composting
Shrink wrap , Bag, sack	➢ Space limitation ➢ Becomes hazmat ➢ Non-biodegradable material, took a long time to break the molecule ➢ Unhealthy environment	➢ Reuse ➢ Incinerate in the proper location
Aluminum cans	➢ Space limitation ➢ Unhealthy environment	Recycle the cans
Plastic bottles	➢ Space limitation ➢ Unhealthy environment ➢ It takes a long time to decompose the non-biodegradable material such as plastic	➢ Reuse the bottle for other purpose ➢ Collect the bottles and recycle if possible ➢ Incinerate in the proper location

Wastewater Management System		
High solid material	➢ Contribute to high BOD/COD ➢ Blockage the instrument and drainage system if dump into drainage system	➢ Apply physical treatment process (screening to separate solid material) ➢ Improve efficiency of production by increasing high conversion factor ➢ Apply the fine raw material to reduce solid contain in the waste ➢ Control and monitoring the process
High COD	➢ Oxygen depletion ➢ Odor emission ➢ Greenhouse gases emission	➢ Apply proper biological treatment process to reduce the COD to the level where acceptable to environment ➢ Treatment in the closed system ➢ Final disposal at the percolation of downward ➢ Control and monitor the level of treatment
High BOD	➢ Oxygen depletion ➢ Odor emission ➢ Greenhouse gas emission	➢ Apply proper biological treatment process to reduce the BOD to the level where acceptable to environment ➢ Treatment in the closed system ➢ Final disposal at the percolation of downward ➢ Control and monitor the level of treatment
High Nutrient (Nitrogen based compound)	Eutrophication	➢ Biological treatment ➢ Advance chemical treatment process ➢ Control the level of treatment system
High Phosphors	Eutrophication	➢ Biological treatment ➢ Advance chemical treatment process ➢ Control the level of treatment system
PH issues	Affect all the living organism and ecosystem	PH equalization and neutralization to adjust the PH that is acceptable to the environment
High turbidity (TSS)	Cause high turbidity and block the sun penetration and hence disturb the photosynthesis with the marine ecosystem	Treatment process
Emission of gases Management		
By product of CO2 from brewing	Greenhouse gases emission - Carbon Footprint and contribute to the global climate change	➢ Using high efficiency of CO_2 process for carbonation

Methane from anaerobic wastewater treatment Steam loss from boiler Other emission of gas within the facility		process ➢ Recover CO_2 from the beer processing plant ➢ Reduce the steam loss within the boiler ➢ Burn the methane gas
High Energy consumption	Power/ fuel consumption	➢ Applying various methods of Energy Conservation ➢ Control and monitored the energy utilization ➢ Audit the energy consumption ➢ Using the latest technology that operate at high efficiency and less fuel consumption
Impact of Climate Change		
Sea Level rise	➢ Coastal flooding ➢ Damage of infrastructure/structure in the coastal area ➢ Change in ecosystem pattern	➢ Elevated the structure (particularly floor level) within the coastal area by considering the increasing sea level rise ➢ Construction of retaining fall to protect the structure/infrastructure from the coastal flooding ➢ The Proponent to elevate all the structures within their facility above the existing/natural ground by at least 1 meter.
Change of Rainfall Pattern	➢ More frequent flooding ➢ Potential prolong drought or drought hazard ➢ Production of food in Agriculture will reduce ➢ Increase the risk of groundwater vulnerability (both quality and quantity) ➢ Sea water intrusion to the groundwater	➢ Drainage system within the project facility should already considered the rainfall change due to climate change in the design prior to the construction, so that once it is constructed, the drainage will be able to convey the storm water runoff due rainfall regardless of condition ➢ Apply water conservation to consume less water ➢ Potential treatment of sea water into the fresh water (backup plan, in case the groundwater is no longer viable to be used due to various issues ➢ Monitoring the groundwater level and sustainability estimation
Change in Temperature (becomes higher)	➢ High evaporation rate and cause water loss ➢ Increase energy consumption (refrigeration, heating, cooling, etc.)	The project owner to adjust the design parameters of the system by considering the temperature increase so that the current design and construction will accommodate the future increase of temperature
OHS – Related to the Specific Beverage Processing Plant		

Exposure to Risk	Organic dust arising from grain storage, milling, and transport operations presents an explosion risk in the areas of the Brewery where these operations occur. In addition to the guidance in the General EHS Guidelines (IFC standard, 2007)	➢ Frequent sweeping to control dust accumulation, and use of dust extraction and recycling systems to remove dust from work areas; ➢ Provision of electrical grounding, spark detection and prevention, and, if necessary, quenching systems; ➢ Use of explosion proof electrical motors, lights, switches, and connections in high risk areas; ➢ Integration of explosion relief vents in facility design and construction; ➢ Elimination of external ignition sources; ➢ Implementation of hot-work permits; ➢ Control of all smoking materials; ➢ Prohibition of cell phone use.
Exposure to Chemical	Refrigerant leaking	Breweries often have large refrigeration systems, typically using ammonia refrigerant which is toxic and can form explosive mixtures in air. Safety and other guidance offered by professional refrigeration institutions should be adopted in refrigeration system siting, design, maintenance, and operation.
	CO_2	Carbon dioxide is produced during fermentation and maturation processes, carbon dioxide can be recovered, and carbon dioxide and / or nitrogen are stored and used in many brewery processes where inert atmospheres are required. Uncontrolled release of these gases or inadequate ventilation, particularly in confined or enclosed spaces such as fermentation and maturation rooms can result in accumulation of sufficient concentration to present asphyxiation risk. Appropriate safety measures should be developed based on a risk assessment, and may include enhanced ventilation, guidance on safe
Physical Hazard	➢ Level (falling) ➢ Slippery ➢ Use of machine and tools ➢ Collision (transport equipment such as forklift, truck, and containers, etc) ➢ Dust	See the general guideline on the OSH

	➢ Pressurize gas/water system ➢ Heat and Cold system/area	
Noise and Vibration	A variety of operations in food and beverage processing units generate substantial noise levels, for example the canning plant, bottling machines, conveyors and blanching applications	➢ Using PPE ➢ Latest technology that generate less noise and vibration ➢ Applying the general OHS

Table : 1.6 Summary of Impacts and Mitigation Measures during the Deactivation (Decommissioning) of Project

Impacts	Source of Impact	Mitigation /EMP
Noise and Vibration	From all the activity to decommission of the facility and equipment	Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are
Solid waste removal	From the office building, equipment, etc.	Proper collection and disposal
Contaminant or hazardous material	From special material such as PCB and the like	Proper handling of the hazardous waste
OHS	All the activity of decommission	Applies all the relevant standard
Loss Income and opportunity	All the activity of decommission	The local company to find other opportunity from the experience that they gain during the practice
Employment problem	All the activity of decommission	Company to compensate for certain period of time for the transition in finding the new job
Loss economic opportunity for the country	All the activity of decommission	Government may engaged other similar opportunity from other foreign type of investment

1.3 Environmental Monitoring and Performance Indicators

The monitoring program should focus on major issues that can cause major impacts related to processing activity especially effluent, gas emission, and resource (water and energy) utilization. Moreover, occupational health and safety standards should always be enforced by adhering with the best available standards in the industry that has a target to achieve zero rate accident and fatality.

1.3.1 Effluent Guidelines

Wastewater effluent standards for various parameters can be seen from the following table. These standards should be used as guidelines to determine the level of wastewater treatment prior to discharging into the marine environment. Measurement and monitoring program for effluent wastewater quality parameters should be conducted in the field and report should be produced by project owner and performance should be evaluated against the following benchmark values.

Table 1.7 Wastewater Effluent Standards (IFC, 2007)

Pollutants	Units	Guideline Value
pH	pH	6 – 9
BOD_5	mg/l	25
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Temperature increase	°C	<3[b]
Total coliform bacteria	MPN[a] / 100 ml	400
Active Ingredients / Antibiotics	To be determined on a case specific basis	

Notes:
[a] MPN = Most Probable Number
[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity

The following table shows applicable standards for solid waste and liquid waste produced from beer processing plant.

Table 1.8 Byproduct and Waste Generation (IFC, 2007)

Outputs per Unit of Product	Unit	Benchmark
By-products [a]		
Spent Grains	kg/hl beer	16-19
Yeast & Lees		1.7 - 2.9
Kieselguhr		0.4 – 0.7
Liquid Wastes		
Liquid Effluents	hl/hl beer	3 – 6
Beer Loss	%	1 - 5
Notes: [a] Input and Output Figures for Large German Breweries (capacity over 1 million hl beer) EC (2006		

1.3.2 Resource Utilization Guidelines

The sustainability of the proposed plant will depend on how well the resources are utilized efficiently. The more efficient in managing the resources, the better off the company in making profit on one hand and the better off the environment on the other as waste will be reduced.

Two important resources are in use extensively at the facility are energy and water. To efficiently manage the use of these resources, mitigation measures should be implemented with clear indicators (following table).

Table 1.9 Proposed Guideline of Resources Utilization (IFC, 2007)

Outputs per Unit of Product	Unit	Benchmark
Energy [a]		
Heat	MJ/hl	85–120
Electricity	kWh/hl	7.5–11.5
Total Energy	MJ/hl	100-160
Water [a]		
Water consumption	hl/hl beer	4 - 7
Notes: [a] Input and Output Figures for Large German Breweries (capacity over 1 million hl beer) EC (2006)		

1.3.3 OHS Guideline and Standard

The implementation of Occupational Health and Safety (OHS) measures should be monitored and evaluated based on international standards. The standards may refer to the US, European best practice standards or applicable ISO standards (ISO 18001).

Table 1.10 Reference Standard of the OSH Implementation

Implementation	Guidelines
Proposed OHS - EMP ISO	➢ Occupational Safety and Health Administration of the United States (OSHA) ➢ Indicative Occupational Exposure Limit Values published by European Union member states, ➢ ISO 18001 ➢ IFC performance standard

Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by accredited professionals, as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents, diseases, and dangerous occurrences and accidents. Further detail on the action plan has been presented in the general OHS. The following table shows the safety parameters and indicators for GOTA's facility

Table 1.11 GOTA Proposed Safety Parameters Indicator

Parameters	1. Fatal accidents	Fatalities of workers in the facility
	2. Accidents resulting in permanent disability	Permanent disabilities of workers
	3. Accidents resulting in absence from work	Accidents involving workers
	4. Lost days	Absence due to an accident
Performance Indicators	1. Accident frequency	Workers, numbers of accidents resulting in absence of work per 100 Full Time Equivalent (FTE)
	2. Accident severity	Workers, lost days per 100 FTE

1.4 Public and Community Consultation

The EIS process has been conducted by following each step as required in the Decree Law 5/2011. The community and public were engaged and consulted regarding the project in general and scope of environmental impacts to be carried out, where the summary of finding has presented earlier. The finding of this EIS study was consulted and verified with the relevant government agencies and NGOs who have direct interest and work correlation to the proposed project and area of interest. All the comment and suggestion have been elaborated in this report and can be found in the public and community consultation chapter.

In principal, the government agencies and NGOs provide positive view related to the project development, as the project will provide a lot of positive impacts to the economy and society but the government agencies and NGOs also hoped that the EMP will be implemented by the project owner. These agencies and NGOs will also involve actively in the monitoring program to ensure the result.

Moreover, the local community, nearby project location who are affected directly by the project was also engaged and consulted their opinion on the project. In general the community welcomes the development but raised some concern related to the land compensation to the project owner and hope that some of their men and women will be employed by GOTA in this facility.

The following table provides summaries of community and public consultations during the preparation of the EIS document.

Table 1.12 : Summary of Public and Community Consultation During the EIS process

Date	Type of Consultation	Result and Issue
2014 - 2015	Meeting relevant line ministries and local authority in the project location	Government response positive to the investment and local also welcome their business to the site to create job and opportunities
14 June 2017	TOR - Scoping consultation with the public and relevant stakeholder in Hotel Dcity	The scoping study proposed in the environmental impacts assessment should cover the groundwater, solid waste, and marine water quality measurement. Issue to be considered: 1. Water pumping from the groundwater system that includes the sustainability, public access to the clean water, and mechanism of monitor groundwater utilization. 2. Effect of stream flow (flooding) to the nature of the project, given the location of the project within the proximity of the small creek 3. System transportation of raw material and product from /to the facility 4. The scale and size of the project and categorization 5. Wastewater and mechanism of the wastewater handling 6. Land title and the impact of the project to the community and monitoring of the quality (product and wastewater) should be informed other relevant government agency such as SAS and Ministry of Health 7. The impact of above groundwater activity to the underground system such as groundwater 8. The distance of the project location to the nearest community 9. Recommendation of the treatment of the wastewater The above issues have been addressed and clarified by project owner and consultant during the meeting and in this document of the EIS

26 August 2017	Consultation and socialization of the project and impacts of environment to community in the Suco Ulmera	The community nearby project location raised several issue related to the following: 1. Road access that has not improved 2. Water issue (community asked the company if they can provide water for community) 3. Solid waste handling 4. Impacts of dust and how to handle them 5. Groundwater utilization 6. Job employment to consult with the local authority in Ulmera and give priority to local people
20 October 2017	Consultation and presentation of result of the EIS to the relevant stakeholder and NOGs	Various issues and concerns were discussed related to the draft of Environmental Impacts Statement (EIS) that was presented. The following are the summary of concerns and issues raised: - Emergency management system - Design of drainage system that convey the treated wastewater - Groundwater pumping test data and groundwater sustainable yield estimation - The quantity of solid waste and management of solid waste system - How this proposed brewing system will compete the Heineken brewing plant in Hera All the above issue and question have been addressed by the representative from GOTA, PEC during the meeting and in the document of EIS

1.5 Positive Social and Economic Impacts of the Project

With the implementation of the project (operation) and decommissioning phases, there several key positive and negative impacts, which can be summarized in the following table.

Table 1.7 Summary of Positive and Negative Impacts of the project

Positive	Negative
Pre and Construction Phase	
1. Temporary job for Timorese in construction activity, feasibility study, EIA, and other related works 2. Positive effect to the investment grow in Timor – Leste	1. OHS impacts 2. Negative impact due to dust, noise and vibration, loss of vegetation 3. More impervious land surface will cause more surface runoff
Operation Phase	
1. Reduce or eliminate the net import of beverage in Timor Leste 2. Create employment to youth of Timorese 3. Provision of tax payment to the government of Timor Leste 4. Social corporate responsibility that project owner is doing to the community 5. Good and viable business scale in Timor Leste 6. Potential technical skills transfer from the project owner to the local Timor – Leste, through the continuous training and involvement in the project implementation	1. Some potential environmental risk (air quality, groundwater contamination, wastewater, hazardous waste, etc.) that already presented in this document, the negative impacts could all be mitigated with the technical, as well as non-technical approaches 2. If disaster occurs such as fire and explosion, potential loss could be high
Decommissioning Phase	
1. Potential land availability 2. Potential new provider or business opportunity for other company, potentially, the local Timorese	- Provide negative contribution to the Timor – Leste's economy - Loss of income from the project owner - Loss job for Timorese, which create some social issue - Government loss the revenue from the income/service tax that the company will pay if the project close

Considering more positive impacts during the project operation and more negative impacts will be created if the project closed, then it is recommended to continue the project or any consideration to decommission the project should be assessed in detail in order to minimized the impacts and maximized the positive impacts

2 DETAILS OF THE PROJECT PROPONENT

The project is proposed by GOTA Bebidas e Alimentos LDA. Company's representative and his contact details are provided as follows:

Mr. Nilton T. Gusmao do Santos (Director)
Rua San Jose, Bairo Pite, Dom Aleixo
Dili, Timor Leste

Telephone: +670 3322336
Mobile: +670 77243585
Email: info@eto.tl

GOTA Bebidas e Alimentos Lda is a Timorese Company has already operating since 2013 that specializes in water production and distributing in Dili and other place in Timor Leste territory.

3. DETAILS OF THE EIA CONSULTANTS

The Environmental Impacts Statement (EIS) and Environmental Management Plan (EMP) have been prepared by PEC Consulting, Lda., a Timorese-own planning and engineering consulting company headquartered in Dili. PEC Consulting is headed by Sr. Krispin Fernandes, PhD., who has qualifications in Chemical Engineering, Hydrology and Environmental Planning and Engineering. PEC Consulting has experience in Timor Leste in the area of environmental and planning for developmental projects including - irrigation infrastructure, water infrastructure, drainage infrastructure, and environmental impact assessment for environmental licensing according to Timor Leste regulatory framework.

Staffs involved in the environmental assessment and preparation of the EIS are listed in the following Table.

Table 3.1 Summary of Consultant Staff who prepared the EIS document

No	Staff	Expertise
	CONSULTANT STAFF	
1	Sr. Krispin Fernandes, PhD	He has more than 15-years of experience in environmental engineering, process engineering, and wastewater treatment and disposal into the deep ocean through a marine outfall. Sr. Krispin has undergraduate degree in Chemical Engineering, hence is qualified to understand the manufacturing processes involved in beer production
2	Sr. Mario Marques Cabral, S.Si, M.Sc	Mr. Mario has more than 15-years of professional experience in marine biology and fishery assessment including assessment of socio-economic characteristics of coastal community. He is a marine ecological specialist for PEC Consulting and has involved in most of the projects under PEC management.
3	Sr. Juvencio dos Santos	Trained Economist and social impacts assessment specialist. He has two year of experience in data collection and analysis of social and economic profile
4	Sra. Rosalyn Fernandes, S.T. MURP	Rosalyn has substantial professional experience in delivering small to large scale environmental impacts assessment documents, including for fuel storage development, University Campus development, Sanitation Improvement Schemes, etc. She has recently finalized a task as senior environmental specialist who writes the environmental assessment reports for ADB loan funded road project.
5	Sr. Lourenco Pedro	Trained in Geology and Geo-science. Sr. Lourenco has experience working as geologist and hydro-geologist with Institute of Petroleum and Geology – Timor Leste
6	Sr. Venancio Rego Fernandes, S.T.	Trained in Industrial Engineering, Venancio has experience working as plant engineer in major manufacturing establishment in Indonesia, environmental officer and recently as a project engineer for stream flow and meteorology study in Timor Leste
7	Crisanto dos Santos	Graduated with a diploma in computer engineering, Crisanto serves as a logistic officer in the project.
	OTHER SPECIALIST	
8	Dr. Mont Kania Dewi, S.T., M.T.	Head of Air Quality Laboratory,Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung (ITB). Mrs. Kania, is responsible in providing observation data on air quality baseline.

The detailed descriptions of PEC profile, including various projects that have completed in the past can are presented as followed.

3.1 PEC –Consulting Summary

Since its establishment four years ago, PEC has involved in various development projects and has successfully delivered 15 projects (small – medium size of the projects). The company has a vision to support sustainable infrastructure development in Timor Leste through proper planning and engineering design that also adhere to the social and environmental safeguarding principals.

The areas of specialties of PEC consulting include:

(1). Hydrologic and Hydraulic Analysis for various infrastructure development
(2). Environmental Impacts Assessment (EIA) and Licensing for various infrastructure projects
(3). Survey - Topographic and Bathymetric data collection
(4). River flow estimation and Catchment Analysis
(5). Hydro-Meteorological Data Collection

Our client of the consultancy works include private sectors and international agencies such as JICA, World Bank, and Asian Development Bank (ADB).

3.2 List of Completed EIA Project by PEC Consulting

The following lists are the EIA projects that PEC consultant team already completed and the environmental licenses have already granted. These granted licensed projects are currently under the implementation or under financial consideration for the future implementation.

Table 3.2 List of Completed EIA Project by PEC Consulting Team

Project Type	Project Title	Client	Service Provided
Environmental Impact Assessment	Fuel Storage and Jetty Development in Kaitehu, Liquica, Timor Leste	Clobal Fuel	Category **A** of Environmental Impacts Statement and Environmental Management Plans
	Fuel Storage and Jetty Development in Hera, Dili, Timor Leste	ETO, LDA	Category **A** of Environmental Impacts Statement and Environmental Management Plans
	Cement Packing Plant in Kaitehu	Cement Trading, SA	Category **B** of Simplified Environmental Impacts Statement (SEIS)and Environmental Management Plans
	Quarry and Stone Crushing Plant	Suai Indah, LDA	Category **B** of Simplified Environmental Impacts Statement (SEIS)and Environmental Management Plans

Field Survey and Data Collection	Meteorological and Hydrological Observation in Timor Leste	JICA - Irrigation Master Plan	Hydrological and Meteorological data collection for Timor Leste Territory to support the master plan in Irrigation improvement in Timor Leste
	Social and Economic Survey	JICA - Irrigation Master Plan	Data collection of social and economic profile of selected irrigation beneficial area (Maliana and Vemase)
	Hydrological Observation and data collection	JICA preparatory work on Buluto Irrigation Improvement	Hydrological data collection and analysis of Laleia River

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3	Sr. Juvencio dos Santos	Trained Economist and social impacts assessment specialist. He has two year of experience in data collection and analysis of social and economic profile
4	Sra. Rosalyn Fernandes, S.T. MURP	Rosalyn has substantial professional experience in delivering small to large scale environmental impacts assessment documents, including for fuel storage development, University Campus development, Sanitation Improvement Schemes, etc. She has recently finalized a task as senior environmental specialist who writes the environmental assessment reports for ADB loan funded road project.
5	Sr. Venancio Rego Fernandes, S.T.	Trained in Industrial Engineering, Venancio has experience working as plant engineer in major manufacturing establishment in Indonesia, environmental officer and recently as a project engineer for stream flow and meteorology study in Timor Leste
6	Crisanto dos Santos	Graduated with a diploma in computer engineering, Crisanto serves as a logistic officer in the project.
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7	Dr. Mont Kania Dewi, S.T., M.T.	Head of Air Quality Laboratory,Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung (ITB). Mrs. Kania, is responsible in providing observation data on air quality baseline.

The detailed descriptions of PEC profile, including various projects that have completed in the past can are presented as followed.

3.3 PEC – Consulting Summary

Since its establishment four years ago, PEC has involved in various development projects and has successfully delivered 15 projects (small – medium size of the projects). The company has a vision to support sustainable infrastructure development in Timor Leste through proper planning and engineering design that also adhere to the social and environmental safeguarding principals.

The areas of specialties of PEC consulting include:

(1). Hydrologic and Hydraulic Analysis for various infrastructure development
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(4). River flow estimation and Catchment Analysis
(5). Hydro-Meteorological Data Collection

Our client of the consultancy works includes private sectors and international agencies such as JICA, World Bank, and Asian Development Bank (ADB).

3.4 Resume of Specialist Involved in this Project

3.4.1 Krispin Fernandes, PhD

He has more than 15-years of experience in environmental engineering, process engineering, and wastewater treatment and disposal into the deep ocean through a marine outfall. Sr. Krispin has undergraduate degree in Chemical Engineering, hence is qualified to understand the manufacturing processes involved in beer production

A. Experiences:

1. ***2012- Present, Principle Environmental Engineer, at PEC – Consulting, that has completed all the environmental impacts Assessment (EIA) from Beverage processing plant, fuel storage development, quarry, and cement industry, and irrigation infrastructure development.***
2. *April 2013 – July 2013,* **Consultant for Aurecon, Pty., Ltd. On Water and Wastewater Treatment Design in F-FDTL Training Center, Metinaro, Timor Leste**
3. *November 2012 – July 2013,* **Consultant for Japan International Cooperation Agency (JICA) on Irrigation Rehabilitation and Improvement Project, Laleia, Manatuto, with primary duty on the hydrological survey and environmental baseline data collection**
4. *October 2011 –July 2012, Consultant for* **SKM Consulting, Australia, working on the Dili urban drainage and sanitation master plan, including training of GIS and Hydrological Modeling for GoTL staff**

5. *February 2011 – October 2011, consultant for* **Melbourne Water Corporation** , working on the Dili Hydrological Modeling and data collection for master plan development of Sanitation and Drainage system of Dii

6. *June- December 2010,* **Water Resource Research University of Hawaii at Manoa, Post-Doctoral Research Scholar working on the project of** : Survey and modeling analysis of Municipal Separate Storm Sewer System (MS4) at highway storm runoff network on Oahu, Hawaii, USA.

7. *July 2006 – August 2010, University of Hawaii at Manoa,* **Research Assistant at Water Resource Research Center, University of Hawaii at Manoa,**

8. *Summer 2002 and Summer 2003,* **Climate and Information System Project Intern, National Oceanographic and Atmospheric Administration (NOAA), Office of GlobaI Program (OGP), Silver Spring, Maryland, USA**

9. *November 1999 – January 2000* **, Staff at Oxfam International Australia in Timor Leste, working on the** Water supply and sanitation improvement project in Dili, Liquica, and Bobonaro

B. University Education

No	*University*	*Main Course of Study*	*Place*
1.	University of Hawaii at Manoa	Civil and Environmental Engineering (Completed Doctor of Philosophy)	Honolulu, Hawaii, USA
2.	University of Hawaii at Manoa	Civil and Environmental Engineering (Completed Master Degree)	Honolulu, Hawaii, USA
3.	Gadjah Mada University	Chemical Engineering (Completed Bachelor Degree)	Jogjakarta, Indonesia

C*. Computer Skill*

1. ArcGIS 9.3.1 : Mapping, data conversion, spatial analyst, 3D analyst, and other general GIS operation
2. ArcView 3.x: Mapping, spatial analyst
3. EPA-BASINS/MapWindow: GIS-based modeling, database management
4. HEC-HMS: Catchment hydrological modeling
5. HEC-RAS: River Hydraulic modeling
6. GEO-HEC-RAS: Flood plain modeling
7. EPA-SWMM: Hydraulic modeling for urban drainage system
8. EPANET: Drinking water distribution modeling
9. MS. Office: Excel, words, power point, front page

D. Publications

1. **Fernandes K**, Liu C.C.K.,Moravcik, P. 2010. GIS-Based Linear Systems Modeling of Watershed Sediment Transport Process. (*presented at 2010 AWRA Annual Conference in Philadelphia, USA*)
2. Liu C.C.K, **Fernandes K**. 2009. Linear Systems Modeling of Watershed Hydrology and Sediment Transport. *The 3rd IWA-ASPIRE Conference, International Water Association (IWA), October 188211;22, 2009, Taipei, Taiwan*
3. **Fernandes K**, Liu C.C.K. 2005. Flood Hydrograph Analysis for Manoa Watershed, Oahu, Hawaii. *Proceedings of AWRA 2005 Summer Specialty Conference.* Honolulu, Hawaii, American Water Resources Association, Published in CD-ROM
4. Liu C.C.K., **Fernandes K**. 2006. Natural-Energy-Driven Brackish Water desalination: Field testing and mathematical modeling. *Technical Report, water resources research center, University of Hawaii at Manoa*, Honolulu, HI, USA

3.4.2 Rosalyn Fernandes, S.T., MURP

Rosalyn has substantial professional experience in delivering small to large scale environmental impacts assessment documents, including for fuel storage development, University Campus development, Sanitation Improvement Schemes, etc. She has recently finalized a task as senior environmental specialist who writes the environmental assessment reports for ADB loan funded road project.

A. Experience

1. *January 2014 – Present, PEC – Consulting,* **Environmental Specialist,**
   Working on Simplified Environmental Impact Statement (SEIS) and full scale EIS under contract from PEC Consulting. Responsibility including desk review of relevant document, field investigation, document write ups, presentation and coordination of other specialist.
2. *October 2012– October 2013***Consultant for Timor Leste Greenhouse Gas (GHG) Inventory,** Contracted service at UNDP Timor Leste for the national GHG Inventory and Mitigation Options Analysis. Duties include conducting research, analysis, workshop and training for stakeholders from different agencies. Stakeholders include ALGIS, SOL, DNMA, DNAAI, Forestry, Fisheries, DNSSB, EDTL, and others.
3. *June – July 2012,* **Environmental Specialist,** Part of the team that put together the Environmental Impact Assessment document for development of UNTL Hera facility on 365 ha land. Responsible for baseline write up on socio-economic condition and waste management. Responsibilities include report writing, analysis, map making, community consultation, client liaison. Contracted service by Oasis, Sustainable Projects.
4. *January – May 2012,* **Community Engagement Specialist**,Contracted by SKM International, coordinated and implemented Sanitation Willingness to Pay Survey (600 samples), coordinated and implemented Flooding Damage Survey (50 samples), and coordinated and implemented community consultation (qualitative survey) covering topics: environmental cleanliness, sanitation, hygiene, solid waste, flooding, and kangkung management.

5. *February – June 2012,* **Consultant for State Secretary for the Environment,**
   Consultant for Timor Leste State Secretary for the Environment (SEMA) working on compilation and analysis of SEMA's activities between 2007 – 2012 to articulate achievements and recommend ways to improve weaknesses. Purpose of project was preparation of three documents – SEMA activities 2011, SEMA activities 2007-2012 for the government, SEMA activities 2007 – 2012 for the general public. The documents concluded on SEMA achievements as well as opportunities for future improvements towards environmental sustainability in Timor Leste. Works included interviewing with SEMA employees, desk review of documents, and report writing.
6. *July - December 201,* **National Environmental and Safeguard Specialist**,
   Contracted by ADB Timor Leste, working as the national environmental and safeguard specialist for the district capital water supply specialist. The project includes three components – rehabilitation of the Debo Lehumo Lake weirs, rehabilitation of the water supply system in Pante Makassar, Oecusse and rehabilitation of the water supply system in Manatuto. Engaged by Aurecon, Inc., the main contractor for the PPTA. Responsible for:

7. *2008 -2010,* **Environmental Specialist/Planner,** Staff planner at Townscape, Inc. in Hawaii, USA, **for Preparation of Koolau Poko Watershed Management Plan,**

8. *2008-2010,* **GIS Specialist for Ala Wai Drainage Project,**The Ala Wai Drainage Project was an urban drainage upgrade with two main thrusts: flood control and improvements to the natural conditions of Honolulu urban streams.
9. **Graduate Assistant for Community Consultation for the Transit Oriented Development Project,** *2006-2008*

B. University Education

No	*University*	*Main Course of Study*	*Place*
1.	University of Hawaii	Urban and Regional Planning (Completed Master Degree)	Honolulu, Hawaii
2.	University of Gadjah Mada	Chemical Engineering (Completed undergraduate level)	Jogjakarta, Indonesia

C. International Seminar

- Participant at the East West Center International Graduate Student Conference, 2007.
- Participant at the UH Manoa International Graduate Student Conference, 2008
- Participant at the Xian Urban Planning Practicum at Xian, China, 2006. The Practicum involved a collaboration between students from NorthWestern University in Xian, China; students from the National Taiwan University in Taiwan and students from the Urban Planning Department, University of Hawaii. All students travel to Hawaii, Taipei and Xian for research, discussion and presentation.

D. Certificate of Competencies:

- Basic and advance security in the field of the United Nations system

E. Organization:

- American Planning Association (APA), Hawaii Chapter

3.4.3 Mario Marques Cabral, S.Si, M.Sc

Mr. Mario has more than 15-years of professional experience in marine biology and fishery assessment including assessment of socio-economic characteristics of coastal community. He is a marine ecological specialist for PEC Consulting and has involved in most of the projects under PEC management.

A. Experiences

1. **Agriculture Specialist/Consultant,***November – December 2012:*
   Contract service with JICA Study Team for the Project for Rehabilitation and Improvement of Buluto Irrigation Scheme (Laleia and Vemase) in Baucau and Manatuto Districts. Agriculture survey, interview to government and farmers, interpretation, reporting.
2. **Marine Biology Specialist/Consultant,** *July – August 2012:*
   Contracted service at Ministry of Marine Affairs and Fisheries, Directorate General of Marine, Coastal and Small Islands (Indonesia). Review and Profiling the Potential of Ecological and Social Economical for Marine Protected Area in Gunungkidul and Bantul Districts of Yogyakarta Province.
3. **Natural Resources Management Specialist/Consultant,** *October – December 2011:*
   Contracted service at Forestry Ministry, Directorate General of Watershed Management Building and Social Forestry, Watershed Management Center of Benain Noelmina, Strengthening Community-Based Forest and Watershed Management (SCBFWM) Project Region of East Nusa Tenggara. Cooperation among Ministry of Forestry (Indonesia), UNDP and GEF.

4. **Extra ordinary lecturer,** *September 2011 – August 2012:* Employed as extra odinary lecturer at Faculty of Fisheries and Marine Science of Artha Wacana Christian University Kupang (East Nusa Tenggara Province-Indonesia).

5. **Coastal and marine resources management specialist**, *August - December 2011:*
   Act as volunteer service at fish hatchery unit of Marine Affairs and Fisheries Services of East Nusa Tenggara Province (Indonesia).

6. **Manager Program,** *August 2011– until now:*
   Founder and member of Talitawan (a local NGO with core development mission in agriculture, forestry, marine affairs and fisheries), coverage areas of East Nusa Tenggara Province (Indonesia).
7. **Natural resources management specialist, volunteer**, *July - December 2011:*
8. **Natural resources management specialist, volunteer,** *February –July 2011:*
9. **National Project Manager,** *January – December 2010,* Personnel service agreement at Regional Fisheries Livelihoods Programme (RFLP) for South and South East Asia (GCP/RAS/237SPA), FAO Indonesia. Project location: Kupang Municipality, Kupang District, Alor District and Rote Ndao District of East Nusa Tenggara Province. Cooperation between FAO and AECID.

10. Coastal and marine resources management specialist, *April - October 2009:*

Contracted service at PT.Nusa Karimun Divers, Semarang-Central Java Province (Indonesia).

11. Coastal and marine resources management specialist, *March-April 2008*:

Acted as Freelance Consultant service at CV. Rekayasa Jati Mandiri, Semarang-Central Java Province to provide technical assistance for coastal habitat degradation study in Pulau Panjang (Jepara District) as conservation and ecotourism basis development.

12. Natural resources management specialist, *May- July 2007:*

Contracted service at PT. Puri Aji Buana, Semarang-Central Java Province to provide a technical assistance for Detail Engineering Design (DED) of picnic park Kalianyar river basin-Solo project..

13. Fisheries Consultant, volunteer, *January- March 2007:*

Volunteer service at National Directorate for Fisheries and Aquaculture Timor Leste to provide a technical assistance for National Consultant under the project of Strengthening the Capacity in Fisheries Information Gathering for Management. The main assignment was to design a pilot project cycle for Community Based-Marine Sanctuary (CB-MS) in the coastal areas of Batugade and AtauroAnd as Resource Person to advise the Director of the Fisheries Directorate and staff and provide assistance to develop an enhance the capability and achieve respective objectives.

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14. Resource Person/Fisheries Consultant/Fisheries Information Management Specialist, *April 2005 – December 2006,* Contracted service at Ministry of Agriculture, Forestry and Fisheries, National Directorate of Fisheries and Aquaculture Timor Leste cooperate with FAO (GCP/RAS/199/SWE)"Strengthening the Capacity in Fisheries Information Gathering for Management Project." Project location: 11 coastal districts of Timor Leste.

15. Part time lecturer, *March 2005 – November 2006:*

Contracted service at University of National Timor Lorosa'e, Faculty of Civil Engineering, Dili-Timor Leste.

16. Fisheries expert staff, *September – December 2004:*

Contracted service at *(PT. Swakon, Semarang-Central Java Province)* cooperate with Coastal Community Development and Fisheries Resource Management Project. Posted at Tegal Municipality, Central Java Province (Indonesia).

17. Research and development staff, *July up to August 2003:*

Contracted service at *(LPPSP, Semarang-Central Java Province)* a Local NGO of Research, Improvement and Development Resources Institute cooperate with Central Java Development Planning Agency including Strategic Planning of Central Java Province.

B. University:

No	*University*	*Attended from/to*	*Main Course of Study*	*Place*
1.	University of Gadjah Mada	2000 – 2003	Environmental Science (Post graduated – S2)	Yogyakarta (Indonesia)
2.	University of Diponegoro	1992 – 1999	Marine Science (Bachelor graduated – S1)	Semarang (Indonesia)

C. International Seminar Experiences:

- Participant on APFIC the third Regional Consultative Forum Meeting on balancing the needs of people and ecosystems in fisheries and aquaculture in the Asia Pacific, in Jeju – Republic of Korea, 1 – 4 September 2010;
- Speaker on international workshop at field study of fisheries which sponsored by Regional Asia and the Pacific of FAO with title *Second Regional Transfer Workshop on Gathering Information for Fisheries Management* in Halong Bay – Viet Nam, 24 – 27 October 2006;
- Participant on the Third Biannual International Conference and Exhibition on Energy 2002 "Energy for Sustainable Development." Yogyakarta – Indonesia, 29 – 31 July 2002;
- Participant on Indonesian in Transition. Yogyakarta, 22 – 23 November 2001;
- Participant on International Seminar and Exhibition on Information Technology for Sustainable Management of Natural Resources. Bogor – Indonesia, 2 October 2001; and
- Participant on Linggarjati Environmental Meeting "Towards Decentralized Environmental Management" Kuningan, West Java – Indonesia, 9 – 13 November 2000.

D. Trainer Experiences:

- Coastal community-based and fisheries resources management;
- Performance, Improvement and Planning (PIP);
- Logical Framework Approach (LFA);
- Participatory Approach-Ranking, Scoring and Map/Diagram Design;
- Social Impact Assessment (SIA);
- Socio-economic monitoring;
- Learning to lead: An approach of managerial and leadership test score;
- Fishery extension planning: Bottom-up development planning;
- Basic fishery statistics of data collection and analysis;
- Participatory problems ranking and SWOT analysis; and

- Problem solving and decision making.

E. Certificate of Competencies:

- Basic of procurement of FAO;
- Basic and advance security in the field of UNDSS; and
- Environmental management specialist.

F. Publication:

- The study of unconfined groundwater quality distribution based on the types of non-irrigated rice field and fish pond land uses in Karimunjawa Island. Journal of People and Environment. Vol. 12, No. 2, July 2005. Center for Environmental Studies of Gadjah Mada University.

G. Organization:

- Founder of local NGO "Talitawan" (Community Care for Agriculture, Forestry, Marine Affairs and Fisheries) located at Kupang-East Nusa Tenggara Province;
- Association of sustainable forestry for people of Indonesia, East Nusa Tenggara Province;
- Indonesian Fishers Union of Kupang District, East Nusa Tenggara Province;
- Founder of Sumawis Entreprise, an event organizer for environmental education, located at Semarang-Central Java Province;
- Member of student regiment, Diponegoro Universitity, Semarang-Central Java Province.

3.4.4 Venancio Fernandes, S.T.

Trained in Industrial Engineering, Venancio has experience working as plant engineer in major manufacturing establishment in Indonesia, environmental officer and recently as a project engineer for stream flow and meteorology study in Timor Leste

A. Experience

1. **Project Engineer, Timor Leste,** *February 2014 – Present,* Contracted by PEC Consulting to provide services as follows:

- Planning, design and installation of automatic meteorological data collection equipment
- Through PEC Consulting, contracted by Seeds of Life (SOL) to repair and maintain SOL's automatic meteorological data collection equipment already in the field
- Manage a team of 4 personnel for field installation, equipment checking and data collection monitoring
- Coordinate for recruitment of field assistants at each thirteen locations of weather station installation. Recruitment was conducted through consultation and close collaboration with *chefi de suco* and/or *chefi de aldeia*.

- Responsible for payment of services to district field assistants.

2. **Agricultural Census Coordinator, Indonesia,** *March 2011 –December 2011*

   Contracted service at P.T. Tanjung Buyu Perkasa Timur in East Kalimantan, Indonesia to coordinate for palm tree census at Tanjung Buyu's plantation. Responsible for:
   - Coordination of field assistance
   - Random sampling of palm fruit trees about to be harvested. Sampling was conducted for each block of the palm fruit trees.

3. **Foreman, Indonesia,** *January 2010 – December 2012*

   Contracted service at P.T. Tanjung Buyu Perkasa Timur. Responsible for checking employees' presence and work quality.

4. **Administrative Staff at Ticketing Agency in Timor Leste,** 2009

   Staff at a local ticketing agency (LGX Tour and Travel) in Timor Leste. Responsible for keeping of reservation document and delivering deposit money to the bank.

5. **Distribution Staff at P.T. Diamond Ice Cream, Jogjakarta,** 2006 – 2007

   Staff at P.T. Diamond Ice Cream in Jogjakarta, Indonesia. P.T. Diamond Ice Cream is a supplier of ice cream to McDonalds Indonesia as well as a large processed food producer in the country with products ranging from frozen meat to frozen vegetables. Previously recruited as intern in the company branch in Jogjakarta and later on recruited as permanent staff. Responsible for delivering frozen food to hotels and restaurants including to McDonald's in Jogjakarta.

6. **Assistant Trainer at Computer Laboratory at Akprind College in Jogajakarta,** 2006
   Professionally paid as lab assistant at the Computer Laboratory at Akprind College in Jogjakarta, Indonesia. Responsible for preparation of computers, student organization and filling in for the lecturer when he is absent.

12 . Education

No	***University***	***Main Course of Study***	***Place***
1.	Institute of Science and Technology Akprind	Industrial Engineering (Completed Bachelor Degree)	Jogjakarta, Indonesia
2.	Escola Vocational de Dom Bosco Fatumaka, Baucau	Majoring in Mechanical Engineering	Baucau, Timor Leste
3.	SMP Negri 1, Lospalos		Lospalos, Timor Leste

4.	SD Negri 19, Cacavei		Lospalos, Timor Leste

E. Trainings

No	*Training Course of Subject*	*Organized by*	*Year/Month*	*Place*
1.	Water Treatment for Industrial Application Training	Institute of Science and Technology Akprind and P.T. Ipal	2004	Jogjakarta, Indonesia
2.	Environmental Impact Assessment Training	Institute of Science and Technology Akprind	2005	Jogjakarta, Indonesia
3.	Verification and Data Analysis for Statistical Purposes	Institute of Science and Technology Akprind	2005	Jogjakarta, Indonesia
4.	Sugar Production Processing and Fabrication	Institute of Science and Technology Akprind in collaboration with P.T. Madu Baru	2005	Jogjakarta, Indonesia

F. Computer and Other Skills

- Corel Draw for Engineering Application
- SPSS
- QSB
- Microsoft Office 2003 and 2007

3.4.5 Crisanto dos Santos

Graduated with a diploma in computer engineering, Crisanto serves as a logistic officer in the project.

A. Experience

1. **Logistic Support,***February 2013 – December 2013*

   For the JICA funded Buluto Irrigation System data collection. Contracted through PEC Consulting. Responsible for river flow data collection, equipment purchase and assisting of the Japanese team members.

2. **Logistic Support for Dili Drainage System Survey,** *January – April 2012*

   Field assistant to the Australian and Timor Leste team. Equipment purchase at stores in Dili for use in project.

3. **Enumerator for Sanitation Willingness to Pay Survey,** *May 2012*

   Survey to several neighborhoods around Dili to ask about their existing sanitation system in their house and how much fee money they are willing to pay for new sanitation system. Followed training to survey people and businesses, do survey by questionnaire to people and enter data to Excel.

4. **Intern at Ministry of Economic Development,** January – June 2011

   Internship part of school Instituto Professional de Canossa. Enter data to computer, type letter, checking absent, photo copy, etc.

5. **Assistant Trainer at Computer Laboratory,** 2009

B. University Education

No	*University*	*Main Course of Study*	*Place*

C. Trainings

No	*Training Course of Subject*	*Organized by*	*Year/Month*	*Place*
1.	Microsoft Windows Operation System 98 SE, 2000 Professional, XP	Instituto Professional de Canossa (IPdC)	2010	Dili, Timor Leste

3.4.6 Juvencio dos Santos

Trained Economist and social impacts assessment specialist. He has two year of experience in data collection and analysis of social and economic profile

A. Experience

2013 – Present, PEC – Consulting, LDA, as project assistant and economist of the EIA

B. Education

B.A degree from the National University of Timor Leste (UNTL), 2013

C. Training

Attend the business development training with the Government of Timor Leste

4. DESCRIPTION OF THE PROJECT

4.1 Project Identification and Categorization

The project owner identified the proposed project in 2014 by mobilizing a team to conduct market potential assessment in Timor Leste. It was concluded that the market size was reasonable for the development of beverage processing plant to produce alcoholic and non-alcohol beverages. The idea was consulted with the government on Timor Leste and Government responded positively as the project is the foreign type of investment that will contribute to the Timor Leste's economic diversification in the future.

Based on project document submitted to and approved by DNPCEI, the project is categorized as category "**A**" project that potentially has adverse impact to the environment. Various components of the project, as will be elaborated further in detail in the following sections, potentially generating major impacts to the existing environment that will require proper assessment and implementation of mitigation measures to eventually control and minimize them during the operational phase of the facility.

4.2 Project Location and Boundary

The proposed construction is located along the national road connecting Dili to Liquica. Administratively, the project is located within Suco Ulmera, Postu Administrasaun Bazartete, Liquica Municipal. Project location can be reached by about thirty minutes (30 min) driving from Dili town center. The following figure is the location of the development in reference to Dili. GPS coordinates of the project location are 125.452112° longitude / -8.587683° latitude (longitude/latitude).

Figure 4.1 Locations of New site of Beverage Processing Plant Relative to Dili

Figure. 4.2 Project Location

Activities during the study including site visit for terrestrial environment, ecological assessment for marine environment as well as interview with local community for socio-economic study and compiling of the information into a report. The duration of the study take about 5 months period.

Study area includes all areas within and surrounding project location that are potentially affected by pollution or other alterations from the development. Potentially affected areas are soil, surface and ground water, marine ecosystem, safety of the nearby communities and their properties and the socio-economic characteristics of Suco Ulmera. The following figure contains illustration of the potentially affected area due to project location.

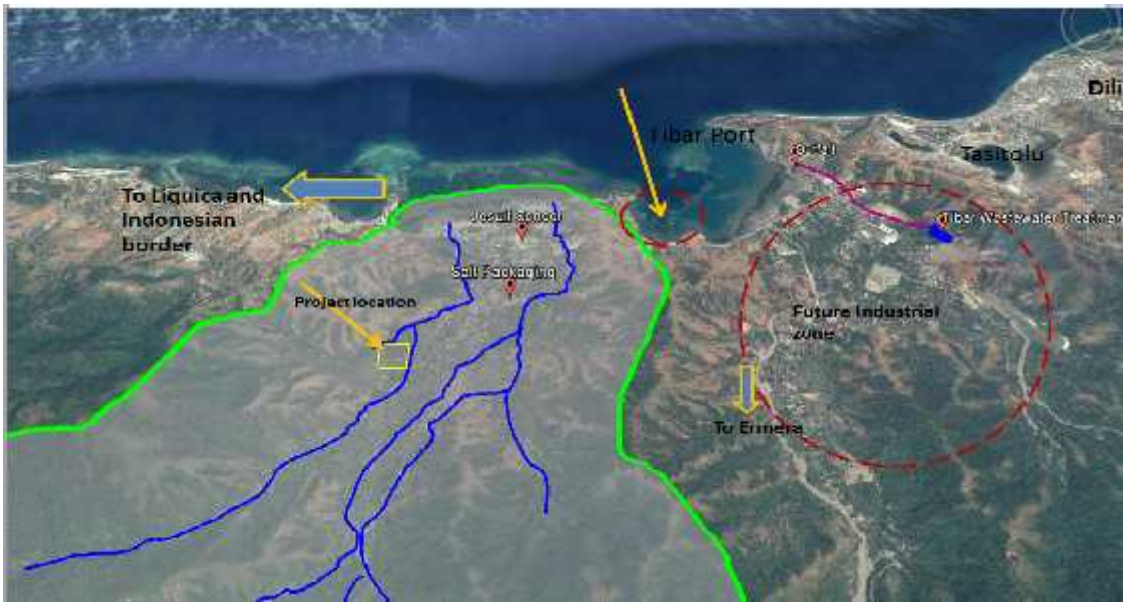

Figure 4.3 Potentially Affected Terrestrial Area and Marine Environment

4.3 Area Potentially Affected by Development

Areas potentially affected by the proposed development consist of:

- Marine/coastal water near Ulmera as final receiving environment
- Sensitive environmental receptors nearby includes coral beds immediate by the project site, marine water quality and other marine flora and fauna such as bottom fauna, fish, phytoplankton and zooplankton.
- Groundwater aquifer
- Local communities in Suco Ulmera
- National government properties (school, soon to be constructed Tibar Port, road, etc.)
- Existing and future expansion of infrastructure

4.4 Description of Project Component and Scale

The project development consists of several major components that will be placed in sequences (series) and will take total investment of $12.68 million to finance the following components from the feasibility assessment, process design and equipment installation, utility design and installation, and up to trial of the system production.

(1).Ground water extraction
(2). Water treatment (Reverse Osmosis process to further purify the groundwater)
(3). Beer processing plant
(4). Soft drink processing plant
(5). Wastewater treatment plant and disposal

This processing plant will utilize a substantial amount of water that will be extracted from groundwater in the site. As the quality of groundwater may not meet the requirement for the proposed process, water treatment and purification will be required. Reverse Osmosis (RO) Plant will be proposed to remove contaminant in the raw water into pure water for industry. Treated water from the RO plant will be used as feed to the process, which are the beer plant and carbonated soft drink. Large portion of this treated water will be packed directly as final product of bottled and gallon water to enter the market. The general process flow diagram of the proposed manufacturing plant can be seen in the following figure.

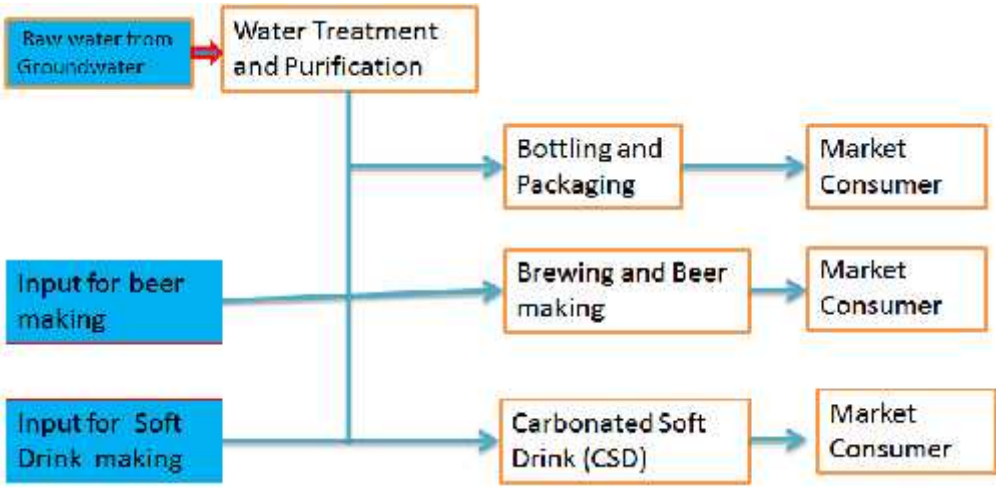

Figure 4.4. Flow Diagram Process of Proposed Project

Total investment is around 12.68 million to finance the project that will be arranged through equity (35. 5%) an debt capital (64.5%). The overall cost figure of each of the above components can be roughly estimated in the following table.

Table 4.1: Indicative Figure of the Investment cost of project Component

No	Component	Initial Investment Cost ($M)	
1	Preparation (study, EIA, pre-drill water, etc.)	$	1.73
2	Construction and Land preparation	$	1.95
3	Equipment	$	8.54
4	Office equipment and other	$	0.45
5	Operating cost (1 year)		TD
	Total Capital (Capex + 1 yr Opex)	$	12.68

Processing plant building will also be constructed in the facility the design of which is shown in the figure below.

Figure 4.5 Design of the Proposed Processing Plant

The scale of each component of the project is presented in the following table.

Table 4.2 Summary of Project Component and Scale of Each Component

No	Project Component	Scale and Concerns
1	Groundwater Extraction	Extraction capacity: 200 L/minutes This rate is considered moderate amount but required further detailed study on the pumping test to provide an information on the water availability and sustainability of the aquifer.
2	Water Treatment via RO plant	The analyze of water quality via laboratory has indicated that the quality of extracted groundwater is pure but some parameters may not meet the specification for drinking and further use as water processing
3	Brewing Processing Plant	The Scale of this component is 50,000 HL. Issue that will become a major concern during the operation of the plant are: water consumption, energy consumption, wastewater, solid waste, and by product that will required comprehensive management system
4	Soft Drink Processing Plant	The Scale of this component is 50,000 HL. Issue that will become a major concern during the operation of the plant are; water consumption, energy consumption, wastewater, solid waste, and by product that will required comprehensive management system
5	Wastewater Treatment Plant	Wastewater will be designed and operated at maximum capacity of 100 L/minutes. Wastewater will become a major environmental concern due to the effluent quality that contain high BOD, COD, low/high pH, TSS, and other characteristics that are harmful to the receiving environment. The comprehensive assessment on the choice of process, level of treatment, and disposal mechanism would be important to minimize the impacts of wastewater to the environment.
6	Wastewater Disposal System	About 100 L/minutes will be disposed. There are two disposal mechanisms: (1) Treated with the Best Available Technology and use the treated water as irrigation water; (2) Treatment and discharge the treated water into marine water. The calculation of economic cost will determine the most optimum option.

Detailed information of each of project components is presented in the following sub-section of this section.

4.4.1 Groundwater Extraction

Water is main component of the beverage product (roughly 95%). Water is also being used in cleaning, packaging, washing and sanitation needs in the facility. The following figures show the average distribution of water consumption within the beer processing plants and ratio of water usage in the beer processing plants in various beverage processing plants.

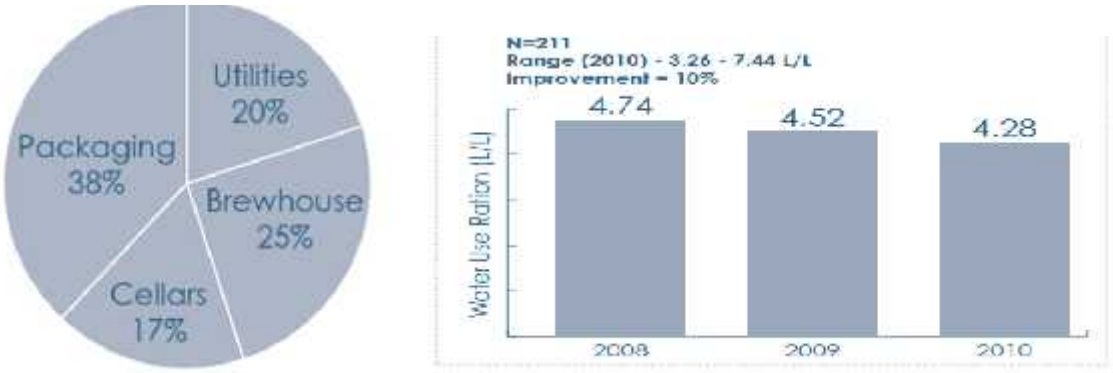

Figure 4.6 Distribution and Consumption Rate of Water within Beverage Processing Plants (Source: Brewing Association, 2013)

According to available data of water consumption from various beverage plants, the rate of water consumption to produce 1 liter of beer and 1 liter of beverages are in the range of 3- 10 L water/1 L beer and 2- 5 L water/1 L soft drink. By taking these average values, the rate of water consumption can estimated based on the capacity of production of beer, carbonated soft drink, and packed mineral water.

The above ratio of water demand in producing the unit volume of the product could be used in this study to approximate the water needed within the factory. The assumptions made were:

1. As the plant will be new, the ratio of water used to produce 1 liter of beer is assumed equal to 6 liter of water
2. To produce 1 liter of soft drink, will require 2.5 liter of water
3. To produce 1 liter of packed water will require 1.1 liter of raw water

Total water consumption for the proposed beverage processing plant in Hera can be estimated with a simple formula:

W = Water consumption for beer production + Water Consumption for CSD + Packed mineral water

Using the above number and assumption, the total annual capacity of water consumption in GOTA facility in Timor Leste would equal to 1 million HL. This rate would be equivalent to 210 L/min of raw feed entering the production system. This volume rate water consumption is reasonably medium size and required a comprehensive assessment on the availability of the water (source), quality, and mechanisms to ensure sustainability of water production from the aquifer or any water source that shall be utilized.

Situational investigation in the project site suggested that only groundwater is the feasible option to provide the water in the proposed proposal and as the groundwater investigation and exploration has suggested that quantity and quality of groundwater in project area meets with the requirement of the beverage processing plant. Total pumping rate from the production well is estimated based on the proposed capacity of the beverage products by using the ratio of product and water requirement in many practices around the world. The initial capacity of the plant would around 50,000 HL of beverage but the ultimate capacity would be equal to 600,000 HL of beverage product. Using this capacity, the water demand can be calculated. The following table is used as guide in this estimation.

Table4.3 Estimation of Pumping Capacity with ultimate Capacity of the Plant

Type of Product	Capacity , HL	Ratio Water /Products (HL/HL)	Selected Ratio	Water Requirement,HL
Beer	50000	4 - 8	6	300000
Soft Drink	50000	2-4	3	150000
Water	500000	1.25	1.1	550000
Total	600000			1000000

Total water requirement for the production of the beverage with the capacity of 650,000 HL per year would be equal to 1,000,000 HL per year. This capacity is the highest capacity of the plant that was proposed by the company. This volume of water needs is equal to pumping rate of 210 L/min or equal to 3.3 L/s. Another scenario would be using the initial capacity, which 300,000 HL of total beverage product volumes. Using this initial capacity, the total volume of water requirement would be equal to 500,000 HL or equivalent to 1.75 L/s.

Table 4.4 Estimation of Pumping Capacity with initial Capacity of the Plant

Type of Product	Capacity , HL	Ratio Water /Products (HL/HL)	Selected Ratio	Water Requirement,HL
Beer	25000	4 - 8	6	150000
Soft Drink	25000	2-4	3	75000
Water	250000	1.25	1.1	275000
Total	300000			500,000.00

The pumping of groundwater with the initial proposed capacity of consider small and may not create any concern related to the groundwater sustainability. However, with the pumping capacity at the rate of ultimate capacity, the analysis of groundwater pumping test and sustainability of groundwater in responding to the pumping would be needed to be conducted as part of the EIA study. The following figure shows the increasing pumping rate, which is proportional to the capacity of the beverage processing plant.

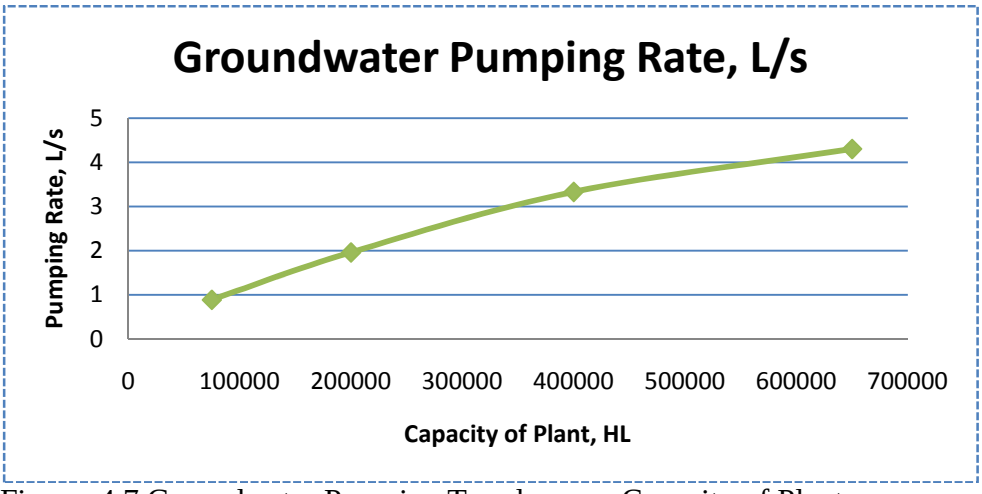

Figure. 4.7 Groundwater Pumping Trend versus Capacity of Plant

Should it is later proved that groundwater will not be sustainable, then project owner can select to desalinate sea water source or operate by downscaling the capacity of the production plant to be within the range of sustainability. The analyze of section will further discussed more on the groundwater pumping test data and how that test suggest the sustainability of groundwater in responding to the capacity of the plant.

4.4.2 Water Treatment and Purification

Despite the good quality of groundwater as discussed in the previous section, the treatment of the raw water from groundwater is necessary to meet industrial specification. In general the process can be represented in the following diagram.

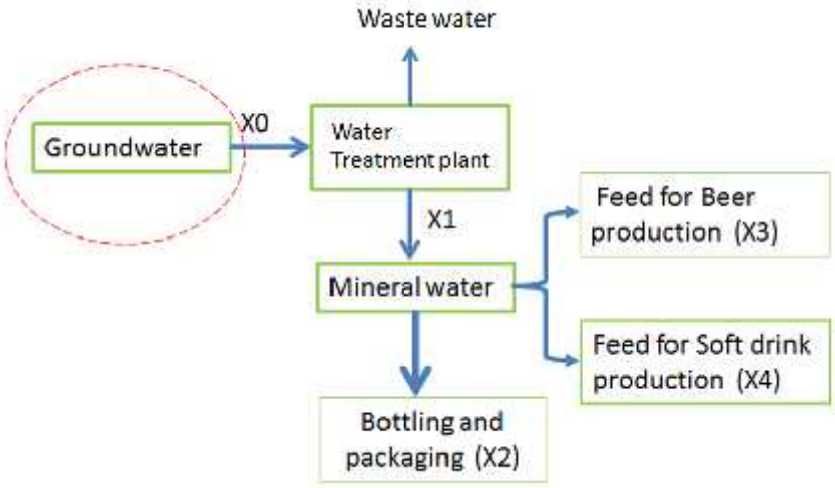

Figure 4.8 Schematic of Water Resources Utilization in the GOTA Processing Plant

The proposed method of treatment unit will be the Reverse Osmosis (RO) system.

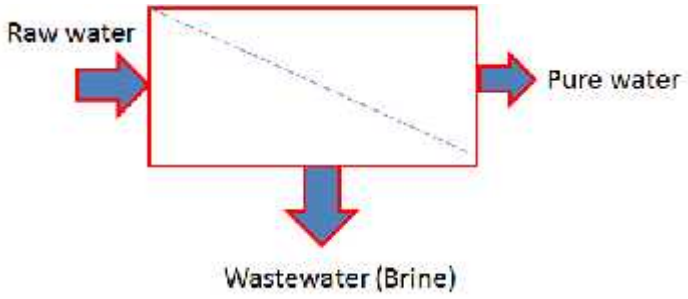

Figure 4.9 Simplified Process of RO Unit

The RO module usually has a very high refection rate (up to 99%) of contaminant with 95% of the feed will converted into product water with the rest discharged as effluent (wastewater). The product water or pure water has very low salt content (less than 50 mg/L) while wastewater would have very high salt concentration (up to 100,000 mg/L). Disposal of wastewater can be done by dumping into the sea through the marine outfall with the provision of perfect dilution such that impact of high concentration of brine in the sea water will be very small. The water product will then go through further treatment to remove odor or taste prior to entering the beer and soft drink plants

There a unit processing within the water treatment system, such as pre-treatment, RO, and post treatment which involve disinfection processes such as ozone process prior to the packaging or entering to the further process such as beer and soft drink production. The main environmental concern to be considered would the energy consumption that will contribute indirectly to the carbon footprint.

4.4.3 Brewing Processing Plant

The beer process plant is a complex process but the simplification can be represented with a box diagram as follows, where large volume of water is processed with the raw material to produce beer and wastewater.

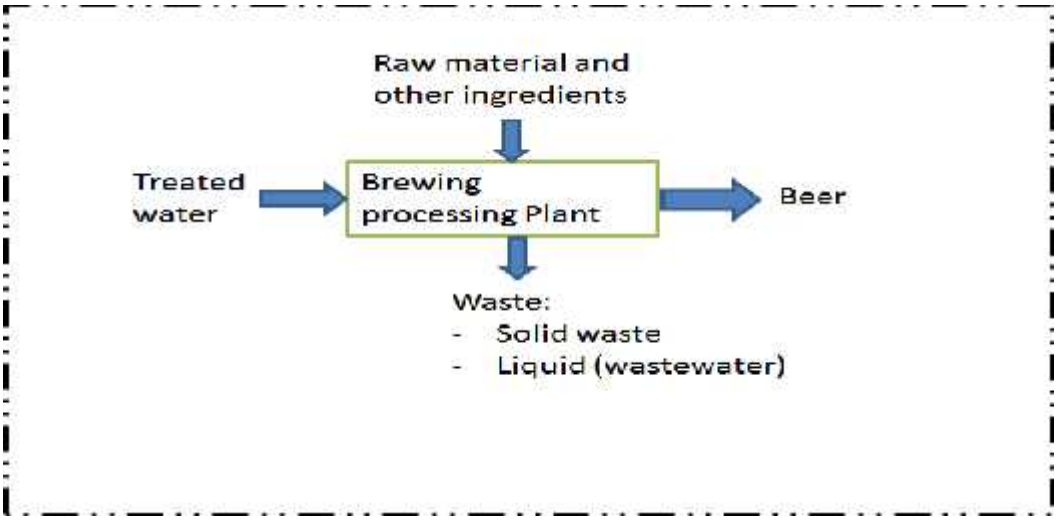

Figure 4.10. Simplification of Beer Processing Plant

The annual production rate of beer is estimated to be 50,000 HL (Hecto litter) and subsequently, the annual wastewater rate is equal to 1,200,000 HL. The wastewater from a beer manufacturing plant has high BOD, COD, and other physical and chemical parameters, therefore require proper treatment before discharge into the drainage system or disposed into the ocean.

In general, the process production of beer involves five main steps, where each has its own sub-process:

(1). Raw material handling
(2). Wort Production
(3). Fermentation and Maturation
(4). Purification
(5). Packaging and Pasteurization

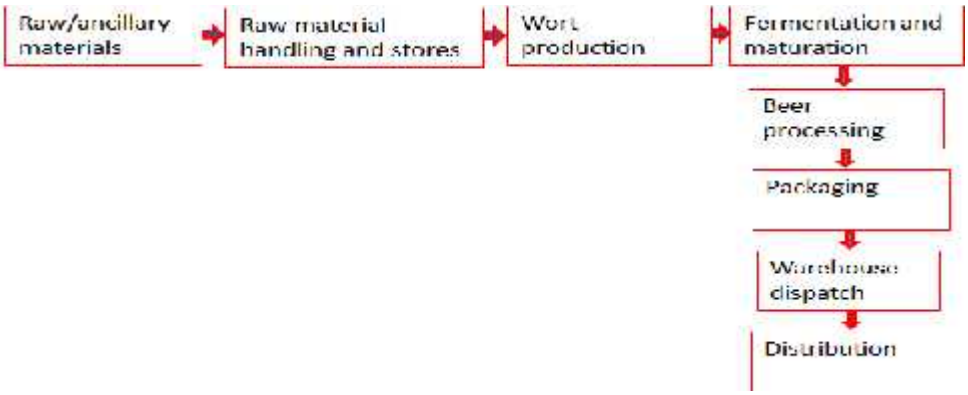

Figure 4.11 Main Processes Component of Beer Processing

4.4.3.1 Raw Material Handling

Four natural ingredients are used as main raw material to produce beer, which are (i) water, (ii) barley, (iii) hops and (iv) yeast. Water, as discussed earlier, is the major component of beer, which takes up to 90% volume in the final product of beer. Pure water from the water treatment is stored in huge water tank before entering the processing unit.

Figure 4.12 Storage of Purified Water and Malt

Figure 4.13 Main Raw Material for Beer Making

The barley is imported from neighboring countries and will arrive in Timor Leste as raw grain. The raw grain is then processed via malting process to convert it into starch and then the barley into fermentable sugar. Malted barley is ready to enter the beer processing unit which is normally stored in the malt storage. Other raw material that provides natural bitterness and aroma to the beer is hops. It is also a natural preservative to the beer and normally only use the female flower. By cooking the hops, the bitterness and preservative substance is extracted and used in the mix of beer processing. The fermentable sugar in the malt and water can be converted into alcohol (beer) with specific operating condition, only in the presence of enzyme or yeast through the fermentation process.

4.4.3.2 Wort Production

Malt that is stored is weighed and milled to produce a mixture of flour and husks, known as grist. Grist is ready to be mixed with hot water to form mash. The purpose of mashing process is to obtain a high yield of fermentable malt grist, which will be the extracted into brewing water. The mixture of mash is then filtered to separate the solid part, which is known as wort and spent grain from the liquid mash.

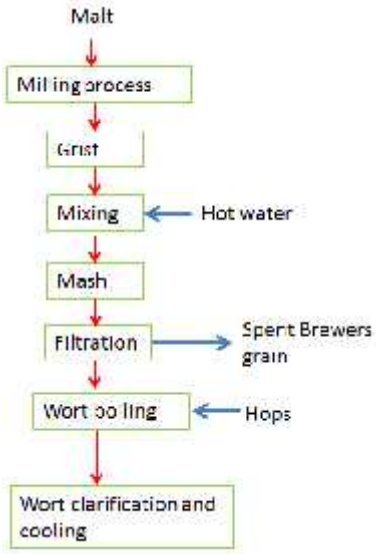

Figure 4.14 General Steps of Wort Production

The spent grain (by product) is then sent to farmer as animal food. Liquid mash is going through further process - boiled in the kettle and added to the hops. The mixture of wort boiling is then going through the process of cooling and separation of solid that are part of the hops. After the cooling process, oxygen is injected into the wort and it is ready to enter fermentation vessel.

Figure 4.15 Spent Grain after Wort Filtration (Animal Feed)

4.4.3.3 Fermentation and Maturation

Wort already mixed with oxygen is pumped to the Fermentation Vessel (FV) and adds the yeast to start the fermentation process. Bio-chemical reaction involved in the process is the enzyme from yeast that convert sugar and oxygen into alcohol and carbon dioxide as follows:

$$sugar + O_2 \xrightarrow{yeast} Alcohol + CO_2$$

As the enzyme is only effective at certain temperature, it is highly controlled to reach igh conversion factor for the above chemical reaction. The carbon dioxide produced in this process is collected for internal use such as carbonation within the brewing process and also at the carbonated soft drink process. The duration of fermentation is between 1 to 2 weeks, depending on the product type or product recipe. Fermentation is stopped through a rapid cooling, in which yeast is harvested and immature beer is pumped into the storage tank. As the yeast that was originally added has grown, which resulted in more yeast than the quantity required for the process, some part of the yeast will be disposed or sent out as animal food. The maturation of the young beer will take several weeks by storing the young beer in the storage tank under control temperature.

4.4.3.4 Purification and Filtration

After the maturation process for several weeks, matured beer is then filtered to remove solid material and remaining yeast to obtain lighter colored beer. The filtration takes place in a “kieselguhr” (diatomaceous earth) filter using frame, candle, or mesh filters. Spent kieselguhr can be used in farming, reprocessed, or

used as building material. Following filtration beer is stored in “bright beer tanks” and is ready for packaging in the bottling hall.

Figure 4.16 Micro-Filtration unit that Filter the Mature Beer

The bright beer from the filtration process is stored in the storage tank for further process, which is packaging and pasteurization.

4.4.3.5 Packaging and Pasteurization

Bright beer from the storage tank is carbonated by injecting CO_2 and a small quantity of nitrogen to enhance foam performance prior to entering the packaging process. In the case of beer processing plant in Timor Leste, only can is used. So packaging means to fill the can with the bright carbonated beer from the storage tank.

Figure 4.17 Process of Filing the Cans and Packaging Process

A detailed technical drawing of the main process of beer making is provided in the Annex_1 Technical drawing of beer processing flow diagram

4.4.4 Carbonated Soft Drink Processing Plant

The carbonized soft drink plant will utilize large volume of water and sugar to produce soft drink and wastewater.

Figure 4.18 Flow diagram Process of CSD

It is assumed that the ration of feed water to product CSD is 2 while the average of this value was used to calculate the rate of feed and rate of wastewater. Total water required for producing the above figure is 150,000 HL and subsequently, 75,000 HL waste water will be produced

Processing steps can be summarized briefly as follows:

1. Sugar is dissolved in hot water
2. Cooling down of sugar solution
3. Mix with the natural flavor and malt extract
4. Dilute the concentration of mixture with water (based on the product specification)
5. Carbonization by adding the CO_2
6. Process filtration
7. Filling the cans
8. Process of pasteurization and packaging

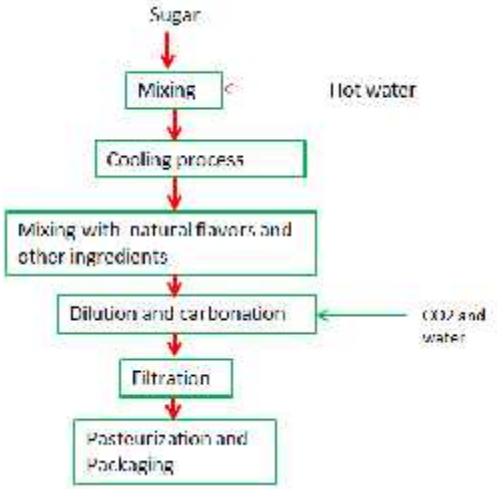

Figure 4.19 Conceptual Drawing of Carbonated Soft Drink

4.4.5 Wastewater Treatment and Disposal

The annual production of wastewater in the overall processing plant is 100,000 – 300,000 HL or equal to 0.4 L/s and 1 L/s with high BOD, COD, high nutrient (Nitrogen), low pH, high temperature and other pollutant content that requires proper treatment before being discharged into the marine water body. To address this problem, international best practice generally utilize two types of approaches – (i) technological approach that address emission and (ii) ambient water quality approach that focus on changes in ambient quality of receiving water.

Project proponent proposed to implement technological approach using optimum technology in the market to treat the wastewater into the level that is acceptable by environment and local or international standard of effluent discharge. The selection method will depend on the technical and economic feasibility. Comprehensive assessment of these two options will lead to cost-saving to the project owner.

If the disposal is to the nearest drainage system, then the wastewater will need to be treated to remove BOD into 50 mg/L, total nitrogen into less than 5 mg/L, TSS into 100 mg/L. In order to reach this desire water quality condition, the level of wastewater treatment will be comprehensive, which means that the cost of wastewater treatment will be reasonably high. On the other hand, if the disposal is into the marine ocean outfall, the level of treatment in the wastewater unit shall not be comprehensive. However, the investment in the piping system and construction of marine outfall will significant. The comprehensive assessment would be required in order to select one of these methods, concerning the limited water availability in the project site, length of the piping system, cost of technology, and water reuse system, etc. Comprehensive analysis on the cost and benefit of the option taken would be required in order to provide information on the best option to be selected.

Figure 4.20 potential route of wastewater pipe:

Two options for wastewater solution will be proposed:

1. Discharge treated wastewater into the existing creek
2. Pipe the treated wastewater into the ocean marine outfall

Analysis of the impacts of these two options will be conducted to know the risk of this each option in term of cost and benefit. International best practices for treatment of wastewater can be used which generally based on the following three approaches:

- Technological approach
- Ambient water quality approach
- Usability of the receiving environment approach

The technological approach by means of using the best available technology (BAT) in the market to treat the wastewater into the level that is acceptable to the environment. Ambient water quality approach on the other hand, means, that disposal of the wastewater into the environment must look into the overall ambient water quality after discharge. If the pollutant contribution from the plant is within the assimilative capacity of environment, then the discharge is acceptable. If not, then the treatment will be required up to the level that is acceptable. The last but not least, is the usability of the receiving environment, which would be important to be considered in determining the waste loading to the receiving environment. In many practical applications, the above three approaches were combined in order to comply with standard regulations of effluent discharge on one hand and without losing the usability of the receiving environment on the other hand.

For the proposed plant in Ulmera, project owner has proposed to treat the wastewater prior to discharging effluent into receiving water environment. Project owner also planned to "test" quality of effluent by constructing a manmade pond with fish in it that will receive the effluent. Changes in the chemical and physical characteristics of the pond will be monitored including the health of the fish in the pond. Overflow of the pond will be discharge into the nearest drainage system that will eventually be discharged through marine outflow. Conceptually, the proposed wastewater treatment system can be represented by the following flow diagram.

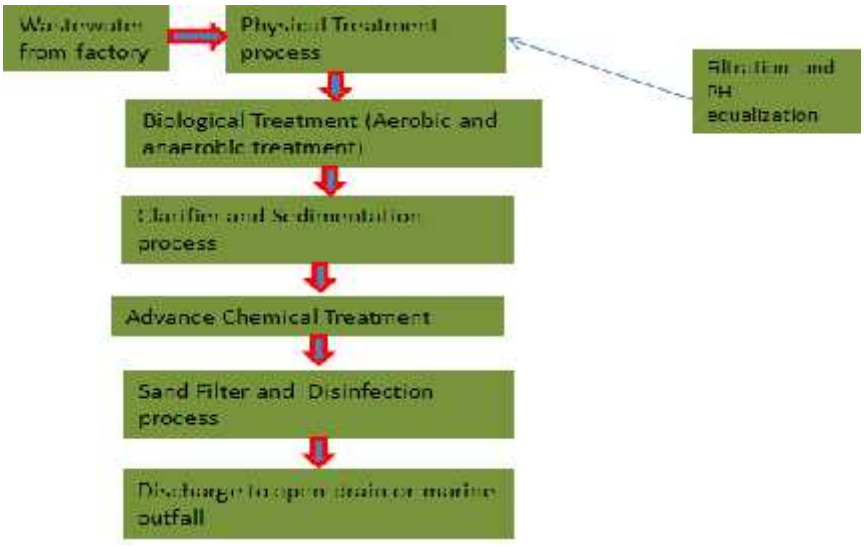

Figure 4.21 Conceptual Proposal of Wastewater Treatment Plant

The drainage system such as road drainage and ditch and curvet are mainly dry most of the time, except during heavy rainy days, where the system receive storm runoff from surrounding location. Especially, the discharge point at the project location has no drainage and only river that mainly dry most of the time, except only during the heavy rain, has river flow. In this sense, receiving environment, accept the

discharge from the end of the treatment system within the plant without any further dilution process. In this case, effluent discharge from the plant shall be at a level that will not be influence the ambient quality of receiving environment.

Wastewater from the drainage system will eventually discharge to the open space, which is permeable and has very high permeability rate in transporting the water into the percolation downward. Thus, for the long-term impact, the treated effluent will contribute re-charge of water into the aquifer.

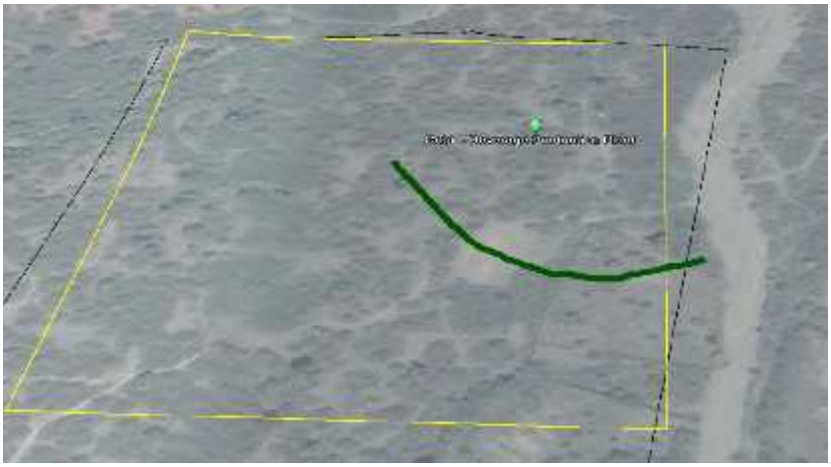

Figure 4.22 Full scale wastewater Treatment Plant and disposal to drainage ditch

Receiving environment, consist of mangrove, marine aquaculture, where the loading of the waste from fish pond to the environment will not contribute the long-term effect to the mangrove and marine aquaculture, as treated wastewater will eventually move downward as percolation loss. Except however, during the heavy rainy seasons, where high runoff would further dilute the wastewater prior to entering the marine ecosystem.

4.4.5.1 Wastewater Characteristics

The choice of wastewater treatment technology depends on the wastewater characteristics produced by the plants. The following table shows effluent characteristics of wastewater from the beverage process plant.

Table 4.5 Characteristics of Untreated Effluent from Beer Processing Plant
(Source: American Brewing Association, 2014)

Parameter	**Typical Range**
Water to beer ratio	4-10 liter/liter
Wastewater to beer ratio	1.3 – 2 liter/liter lower than water to beer ratio
BOD	600 – 5,000 ppm
COD	1,800 – 5,500 ppm
Nitrogen	30 – 100 ppm
Phosphorus	30 – 100 ppm
pH	3 – 12
Total Suspended Solids	200 – 1,500 ppm

Components produced and source of the equipment/process are given below.

Table 4.6 Source of Wastewater within a Brewing Process Plant

Source	Operation	Characteristics
Mash Tun	Rinsing	Cellulose, sugars, amino acids, ~3,000 ppm BoD
Lauter Tun	Rinsing	Cellulose, sugars, spent grain, SS ~3,000 ppm, BoD ~10,000 ppm
Spent Grain	Last running and washing	Cellulose, nitrogenous material, very high SS (~30,000 ppm), up to 100,000 ppm BoD
Boil Kettle	Dewatering	Nitrogenous residue, BoD ~2,000 ppm
Whirlpool	Rinsing spent hops and hot trub	Proteins, sludge and wart, high in SS (~35,000 ppm), BoD ~85,000 ppm
Fermenters	Rinsing	Yeast SS ~6,000 ppm, BoD up to 100,000 ppm
Storage Tanks	Rinsing	Beer, yeast, protein, high SS (~4,000 ppm), BoD ~80,000 ppm
Filtration	Cleaning, start up, end of filtration, leaks during filtr.	Excessive SS (up to 60,000 ppm), beer, yeast, proteins, BoD up to 135,000 ppm
Beer spills	Waste, flushing, etc	1,000 ppm BoD
Bottle washer	Discharges from bottle washer operation	High pH due to chemical used, also high SS and BoD especially through load of paper pulp.
Keg washer	Discharges from keg washing oprtn.	Low in SS (~400 ppm), higher BoD
Miscellaneous	Discharged cleaning and sanitation materials, floor washing, flushing water, boiler blow down, etc.	Relatively low on SS and BoD. Problem is pH due to chemicals being used

With the above effluent characteristics, widely applied wastewater treatment processes include, pH equalization, physical, biological, and chemical treatments, including disinfection before disposal to the drain or receiving waterbody.

Figure 4.23 Typical Aerobic Treatment of Wastewater Effluent in the Brewing Process

As for carbonated soft drink treatment plant, typical characteristics of effluent can be seen in the following table.

Table 4.7 Typical Wastewater Characteristics from Soft Drink Effluent

Parameter	**Value**
Total CoD (mg/L)	33,000
Soluble CoD (mg/L)	27,000
TKN (mg/L)	54
Total P (mg./L)	2.5
TSS mg/L	250
pH	5.4

These two wastewater streams (from brewery and CSD production) are combined, prior to entering the treatment unit. Combined characteristic can be determined from the ratio of the volume rate.

4.5 Justification and Need of Project

The proposed development has an objective to seize business opportunity in Timor Leste in the provision beverage product processing plant that has high market demand in Timor Leste. Every year, Timor Leste imports a significant amount of the aforementioned beverage products valued at US$10 million (MOF – External Trade Statistics, 2014). Investment in the proposed project will take over import of a significant portion of the above types of products therefore Timor Leste can realize many economic benefits from domestic manufacturing such as employment creation, tax contribution and capacity building. Moreover, this investment is coming from a local Timorese-owned company as the project owner, which will ensure the sustainability and continuity of this proposed manufacturing process plant even further.

Moreover, Timor Leste is in the process of developing its economic and social conditions to increase living standards of its people. Currently, the country is heavily dependent on revenue from the oil and gas sectors which may present a problem in the future, as the oil and gas resources are non-renewable resources. Moreover, above 90% of the real expenditure in Timor Leste has come from the Government general budget, as the private sectors investment is in early development stage. The country has to continue to push for private sector participation in the economy taking advantage of basic infrastructure that has been built so far. The proposed beverage processing plant is the type of productive investment from private sector, particularly the local Timorese company that the government of Timor Leste should support.

4.6 Other Development Related to Construction and Operation of Project

The following map shows that, there are other development in the proposed project location that affects the project during the construction and operation of the project.

Figure 4.24 Other Development Projects in the Area

The existing project in the area that identified are:

- National road of Dili – Liquica
- Soon to be constructed Tibar Port
- Projected Industrial zoning area
- Tibar Dumpsite development
- Road developed of Tibar – Gleno
- Tibar septage/wastewater treatment plant

The proposed project development and listed projects will contribute some effect that need to be managed in an integrated manner from each project owner with close coordination.

4.7 Proponent Endorsement of the EIS

There have been discussions with the proponent regarding the contents of the EIS and hereby, the proponent endorses the EIS and EMP.

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4.8 Structure of the EMP

The structure of the updated EMP document, as presented in the table of content, follows standard guidelines released by DNCPIA, as provided in the Expert 101 package according to decree Law 5/2011:

1. Executive Summary
2. Detail of Project Proponent
3. Detail of Consultant that prepared EMP
4. Description of the Project Component
5. Legal Framework of TL Environmental Protection
6. Contractual and corporate obligation
7. Summary of Impacts
8. Summary of Proposed Mitigation Measured
9. Governing Parameters
10. Monitoring Program
11. Report requirement
12. Responsibility of Mitigation and Monitoring
13. Emergency Plan
14. Decommissioning plan
15. Capacity Development and Training
16. Public Consultation and Information closured
17. Complaints and grievances mechanisms
18. Work plan and implementation schedule
19. Cost estimates
20. Review of EMP
21. Non-technical Summary

5. LEGAL REQUIREMENTS

5.1 Relevant Policy and Legislation

The objective to support the environmental protection and preserve natural resources as stipulated in the constitution of Timor Leste (article 6 – f), has provided a general guideline to direct the national development toward one that is environmentally sustainable.

Decree law 5/2011- Environmental Licensing provides a technical guideline on how to exercise the constitution mandate in securing environmental permit to start development activities. According to this decree law, every major development should go through proper environmental impacts assessment (EIA) in order to get the environmental licensing prior to the commencement of the development to ensure that the impacts of the proposed development is identified and mitigation measures are proposed in order to minimize the environmental and social impacts. The guidelines for the formulation of required documents to prepare for environmental license have been developed through the Expert101 system that contains checklist and other necessary documents for the preparation of Project Document, Environmental Impact Statement (EIS) for category A projects and Simplified EIS for category B projects.

Other relevant environmental laws and their objectives are listed in Table 5.1.

Table 5.1. Relevant Laws and Regulations

Agency	Relevant Laws
State Secretary of the Environment	Decree Law No.5/2011
	Decree Law No. 26/2012 on Environmental Base Law
	(Draft) Law on Biodiversity (March 2012)
	(Draft) Law on Protected Area (May 2013)
	UNTAET Law No. 19/2000 on Protected Area
State Secretary of Forestry and Protection of the Nature	(Draft) Law on Protected Area (May 2013)
	UNTAET Law No. 19/2000 on Protected Area
State Secretary of Fisheries and Aquaculture	Law No. 12/2004 on Crimes Related to Fisheries
	Law No.6/2004 on Legal Basis for Management and Regulation of Fisheries and Aquaculture
National Petroleum Authority	(Draft) Regulation on Installation and Operation of Fuel Depot
International	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Protocol)

Other important government decree law to be complied during the project implementation is the decree law 28/2011 that regulates the food industry and market regulation. This government decree law, mandate the private entity who provide food and beverage service to comply with the health and safety standard. Other government law that may be relevant to the proposed industry is listed as followed.

- Decree law 5/2009 related to drinking water quality and distribution
- Decree law 23/2009 related to food safety and business administration offences
- Decree law 24/2011 related to licensing of commercial activity

The above law should be complied by project proponent and by doing so the project owner will be entitled to various benefits such as protection of business property in Timor Leste, the project owner would also be able to conduct export and import of products with relative ease, just to name a few.

5.2 Relevant National and International Environmental Quality Standard

Standards and best practices for environmental quality in Timor Leste are still limited. However, in the absence of local regulation, the government of Timor Leste always refers to the best international practices. The following are standard best practices that Timor Leste has derived from various international best practices are provided in Table 5.2. No standards have been provided for sedimentation as the project will actually reduce sedimentation from the compacting and sealing of the surface.

Table5.2. Applicable International Standards in Absence of Timor Leste's Standards

Environmental Standard	TL National Standard	International Standard
Drinking Water Quality Standards	Adopted WHO standards	WHOs
Waste water effluent	None	WHO/USEPA
Ambient Air Quality Standards	None	IFC/WHO
Heavy Metal Standards	None	WHO
Noise	Leq55dB(A) per UNTAET Regulation	World Bank
Vibration	None	USEPA
Soil	None	IFC/World Bank
Ambient receiving water quality standard		IFC/WHO
OHS	None	IFC/ISO -81001

5.3 Guidelines in Measurement and Monitoring

Several guidelines are applicable for measurement and monitoring of the environmental and social parameters. These guidelines included those guidelines published by NDPCEI such as the Expert101 Guidelines as well as applicable international guidelines such as the Head of BAPEDAL Diploma No. 113/2000 on General and Technical Guidelines for Environmental Laboratory tests (Indonesian guidelines).

Other measurement and guideline of the monitoring program would refer to best practice that will be adopted internationally in the absence of local standard in Timor Leste. There are varieties of international best practice such as from ISO, IFC, and WHO, which should be adopted and used as guideline in complement to the existing standard and guideline in Timor Leste.

5.4 Relevant Institutional Aspects

There are several institutional aspects related to the implementation of Decree Law 5/2011 on Environmental Licensing that are relevant to the proposed development. The first one is institutions responsible for general environmental protection (marine, coastal and terrestrial). The second one is institution responsible to regulate and monitor downstream petroleum industry including large scale fuel storage. The third one is institutions responsible for the protection of public health and safety. These institutions are identified in the following table.

Table 5.3 Government Responsibility and Relevant Institutions

No	Responsibility	Relevant Institutes
1	Environment and Nature Protection (Terrestrial)	State Secretary of the Environment
		State Secretary of Forestry and Natural Protection
2	Marine and Coastal Environment	State Secretary for Fisheries and Aquaculture
3	Water and Sanitation System , Power and energy consumption	Ministry of Public Works - Water and Sanitation
4	Public Health and Safety	Ministry of Health
		National Directorate for Civil Protection
5	Worker Health and Safety	State Secretary for Professional Training (SEPFOPE – Portuguese Acronym)

5.5 Institutional Constraint and Barriers

To materialize the objectives of Decree Law No.5/2011, the implementation of environmental licensing system also requires monitoring of the implementation of proposed measures as well as monitoring of environmental impacts resulted from the development. Monitoring is the responsibility of project proponent with compliance inspected by the above mentioned institutions.

It should be noted though that several institutional weaknesses hinder a more effective implementation of the law:

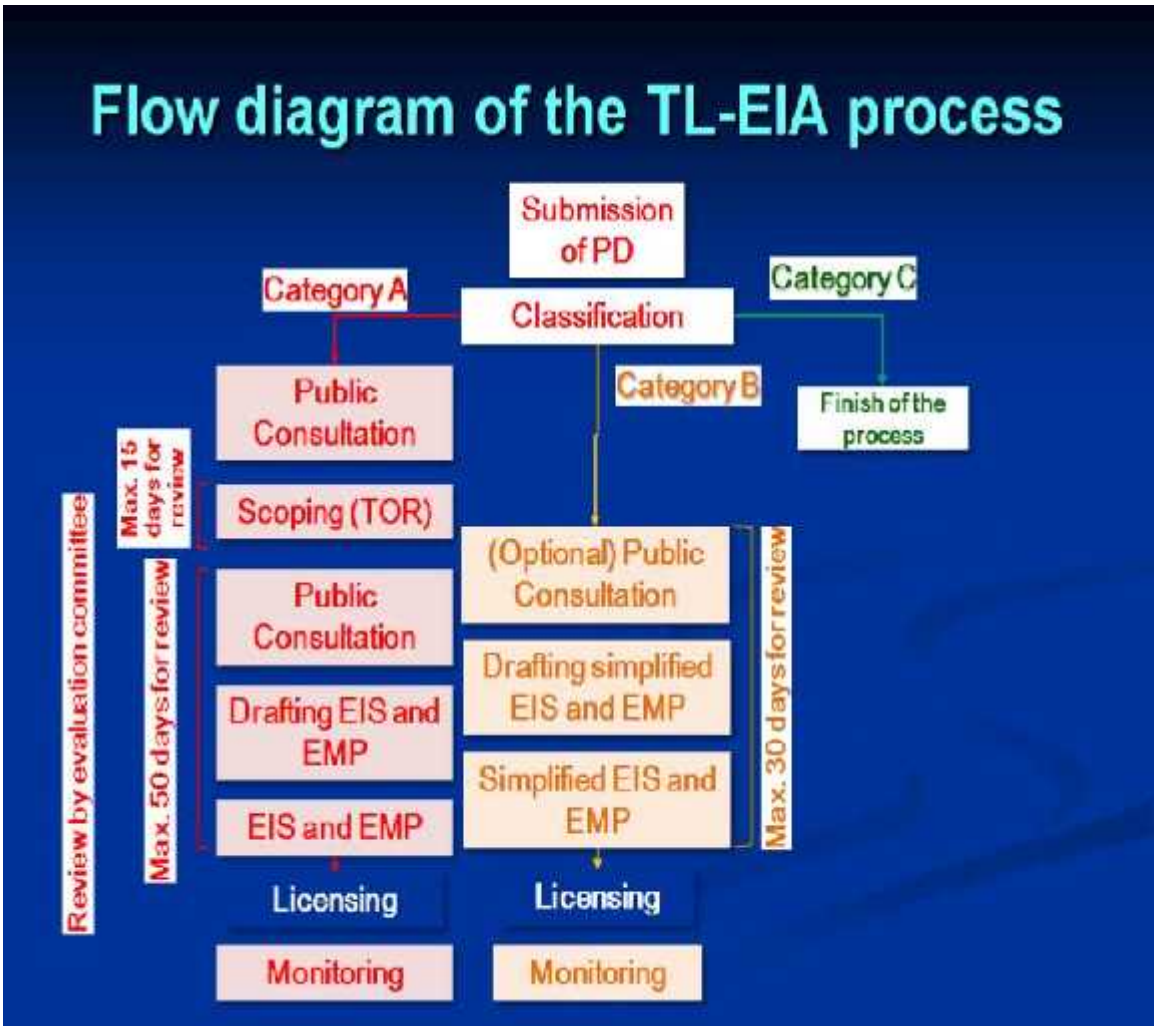
1. Lack of national standards for a lot of environmental health parameters
2. Lack of regulations related to zonation for the purpose of development of infrastructure, residential, industrial and educational facilities as well as zonation for the purpose of environmental protection
3. Lack of capacity to implement monitoring of the private sectors' and government's projects for compliance
4. There is a need to broaden knowledge and strengthen the capacity of local private sectors related to the issue of environmental protection and health and safety of workers.
5. Coordination for integrated planning is needed related to disaster prevention especially for industrial facilities

5.6 Procedure of Environmental License

The decree law 5/2011 provide a specific guideline on how to issue environmental license and urge to follow several in order to ensure a duly implemented classification, review and monitoring of the environmental impacts. These steps include screening, scoping, preparation of an EIS/Simplified EIS and monitoring of the implementation of Environmental Management Plans (EMPs) contained in the EIS/SEIS.

The process for issuance of environmental permit according to Decree-Law No 5/2011 is shown in the figure below.

Figure 5.1. Processes for Issuance of Environmental Permit



The environmental licensing process starts with screening of the project based on project document (PD) and application form submitted by the project proponent. The result from screening is a classification of projects into either Category A, B or C (No EIA required). For Category A projects, screening is followed by scoping, where project coverage is defined. Opinion on the environmental scope of the project is issued by NDPCEI within 15 days of the receipt of the project documentation such as application form, project document, and any feasibility assessment document. For Category B projects, no scoping is required and project proponents can proceed to preparing the SEIS.

EIS for category A or SEIS for category B as well as the application document is then prepared by project proponent and submitted to NDPCEI for review. Upon duly submission of all required documentation, technical review process commenced. As shown in Figure 2.1, Category A projects are required to go through lengthier review process through the formation of an

evaluation committee and conduct of public consultation. The evaluation committee usually consists of representatives from several relevant entities.

The evaluation committee has a duty to carry out technical evaluation of the document, review public input and recommend the approval or denial of application for environmental permit. Public consultation has to be conducted starting 10 days after the formation of the evaluation committee. The public is given 24 days to submit comments, recommendations or proposals on the EIS and EMP.

To complete technical evaluation and decide on the recommendation for approval or denial of the project, the Evaluation Committee has 50 days, counted from 5 days after the formation of the Evaluation Committee. During the review period, the Evaluation Committee may request additional information from project proponent, local communities where the project is going to take place or government agencies that have interest on the project. The 50 days allowance to come to decision is suspended until all required information is received. The Environmental License Law also allows 10 days for review of additional information submitted by proponent.

After the technical review, the Evaluation Committee will write a report that contains recommendation for approval or denial of the application. The report is then submitted to the Superior Environmental Authority that will issue final approval. Environmental permit should be released within 15 days from the time the Evaluation Committee report is received. When an application is not approved, the proponent will be notified of the decision.

Decree Law No. 5/2011 makes provision for an Impact Benefit Agreement between project proponent and local communities affected by the development. Negotiation for Impact Benefit Agreement can start at the time the approval for environmental permit is published.

For Category B projects, after an SEIS which contains and EMP and the application are submitted, the Environmental Authority has 30 days to complete technical evaluation of the application. Similar to the EIS process, the Environmental Authority may ask for additional information from project proponent, affected communities or government agencies with interest on the project. The 30 days period will be suspended until all required information is submitted. The Environmental Authority has 10 days to review additional information and may require a public consultation be conducted on the project.

Once the evaluation is completed, the Environmental Authority then submit to the Superior Environmental Authority the approval or denial recommendation. The Superior Environmental Authority, within 10 days of receipt of the evaluation, shall then issue an order for issuance of environmental permit.

For projects that do not require preparation of an EIS/SEIS (Category C projects), the Environmental Authority would recommend that the projects implement certain measures to protect the environment and maintain an environmental management plan.
The Decree Law No.5/2011 categorizes projects according to the potential impacts to the environment. There are three categories of projects:

1. Category A – to include projects that potentially cause significant environmental impacts. These projects are subject to Environmental Impact Statement (EIS) developed based on

Impact Analysis and Environmental Management Plan (EMP) in accordance with the Decree Law No. 5/2011.

2. Category B – to include projects that potentially cause environmental impacts and are subject to the procedure of Simplified Environmental Impact Statement (SEIS) developed based on the EMP in accordance with the Decree Law No. 5/2011.
3. Category C – to include projects where environmental impacts are negligible or nonexistent and not subject to any procedure for Environmental Assessment in accordance with Decree Law No.5/2011.

Annexes I & II of Decree Law No.5/2011 spelled out in more detail the type and scale of projects within mining, oil, energy, general industry, transport, civil, water, sanitation, agriculture, tourism and defense sectors that belong to Category A and B projects. It also makes stipulations that those developments that happen within environmentally, socially and geographically sensitive areas should fall under Category A projects.
With support from the Asian Development Bank (ADB), the Decree Law No.5/2011 has recently been going through review for the purpose of clarification and ascertain the meaning and intent of relevant provisions that require inclusion, and those provisions that require clarification/amendment, to arrive at a common understanding of all issues that must be addressed in these laws and in the implementing regulations.

The following Table contains recommendations produced from the ADB experts.

Table 5.4 Recommendation to Existing Guidelines for the Implementation of Decree Law No. 5/2011

	Recommendation
Draft-3 Ministerial Diploma (Ministry of Commerce, Industry and Environment/MCIE) and Guidelines on Regulation on the Detailed Requirements for Screening, Scoping and the Terms of Reference, EIS, and EMP for Environmental Assessment	Clarification on general provisions, screening of projects, objectives and contents of: (1) EIS; (2) Simplified EIS; and (3) Environmental Management Plan (EMP)
Draft-3 Ministerial Diploma (MCIE) and Guidelines on Procedures and Requirements during the Environmental Assessment Process	Clearer definition on project affected people and vulnerable groups, notice of classification of proposed projects, public consultation on the proposed ToR, during the study phase and public consultation on the submitted EIS and EMP, record keeping and public access to documents.
Draft-3 Ministerial Diploma (MCIE) and Guidelines on Regulations on Impacts and Benefit Agreements (IBA)	Scope of the IBA, traditional land use, customs, and Tarabandu's role in IBA, negotiation process, conditions in any IBA and complaints and grievance mechanisms.

Draft-3 Ministerial Diploma (MCIE) and Guidelines on Regulations on the Status and Rules of Procedures for the Evaluation Committee for Managing the EIA Procedure for Category A Projects	Composition of the Evaluation Committee, working principles (including quorum, decision making, technical analysis, etc.), and expertise from entities outside the environmental authority.

In addition to recommendations to existing guidelines, the ADB team also makes recommendation on the use of several terms in the Decree Law No.5/2011 for the purpose of clarification and to reflect international best practice on aspects covered in EIS laws (following table).

Table 4.5 Proposed Amendments to the Use of Several Terms in the EIS Laws

	Proposed Amendments
Article 1 (k)	Definition of "environmental impacts"
Article 1 (w)	Addition of "women" and "affected people" to the definition of "public"
Article 1 (y)	Use of term "Environmental Assessment"
Article 4 (1)	Use of term "Environmental Impact Assessment" and "Simplified Environmental Impact Statement"
Article 4 (3)	Replacement of the article to reflect international best practice on aspects covered in EIS definition
Articles 18, 21, 22, 25,	The use of the term "proponent", "Simplified EIS", etc.
Article 19	The deadline for the technical analysis of the Simplified EIS and EMP and others
Article 33 (1)	Addition of the obligation to keep record on monitoring
Article 38 (1)	Clarification on record and information access to show that the register should also include EIA, EIS and EMP for any project
New Chapter XII	Insertion of a new chapter to cover procedures applicable for proposed projects that may have significant cross border environmental impacts
Article 42	Addition of a "catch all" phrase to account for the emergence of other issues that may require regulations

5.7 Institutional Arrangements and Responsibilities

The roles and responsibilities of various agencies involve in the implementation and monitoring program is very important to be defined in the legal documentation such as EIS and EMP. This will allow effective coordination during the implementation which is needed, particularly the define role in day to day operation during the project implementation

5.7.1 Overall Monitoring Responsibilities and Activities

GOTA shall nominate Project Management (PM) who will be responsible for monitoring of the project construction activities; assisted by the environmental specialists on a day to day basis. During the operation of the facility, the monitoring of the implementation of EMP will be responsible by the HSE unit within the company. The Project manager and HSE unit will carry out regular daily and weekly inspections of construction activities and monitoring of mitigation measures. GOTA will carry out spot checks to ensure that the implementation is in line with the proposed EMP.

5.7.2 Organization Roles and Responsibilities

The overall organizational structure for environmental management for the project is divided into two that cover the stage of project implementation (during the pre- and construction and during the operation of the processing plant)

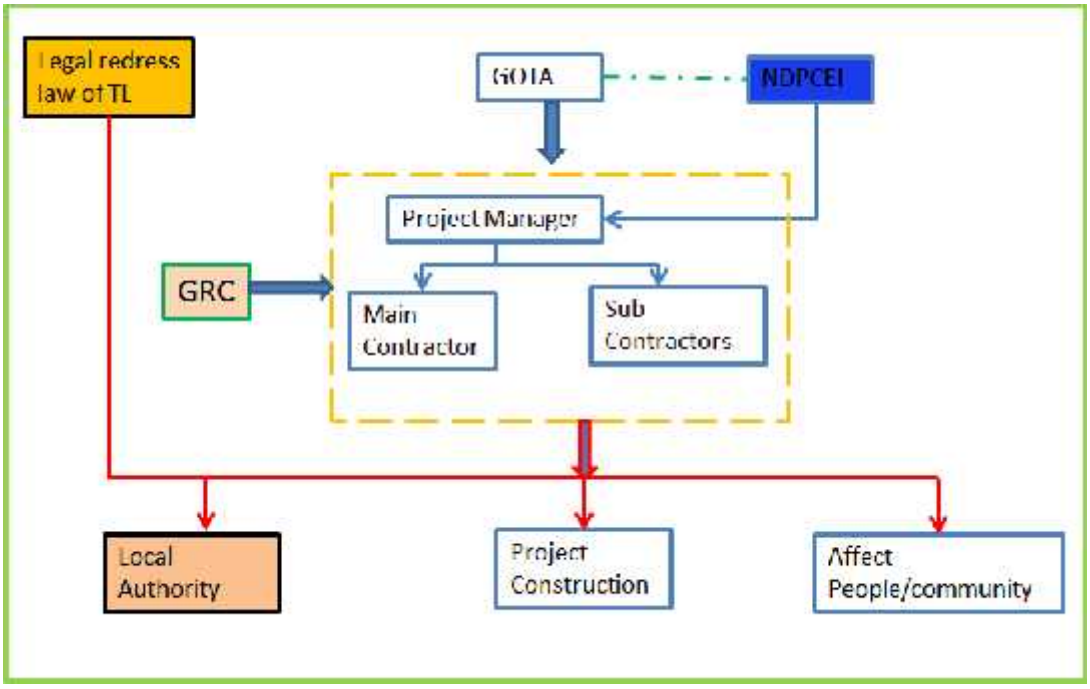


Figure. 5.2 Organization and Intuitional Arrangement during pre- and Construction Phase

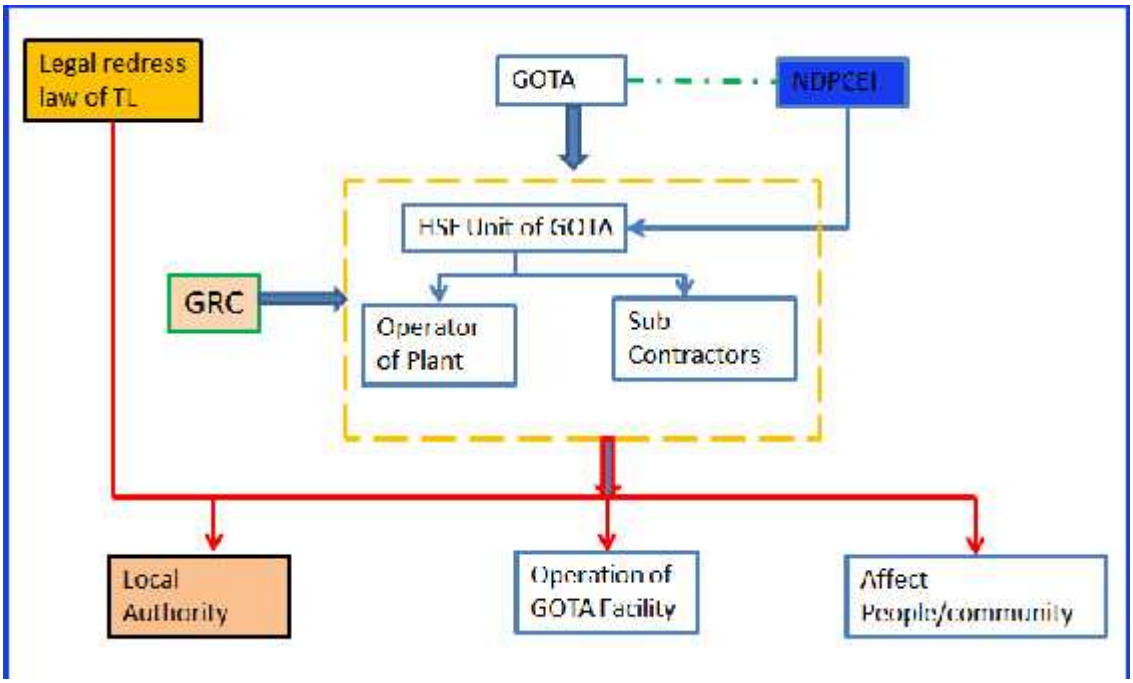


Figure 5.3. Organization and Intuitional Arrangement during the Operation of Facility

5.7.2.1 Role of GOTA

As the project owner, GOTA has overall responsibility for preparation, implementation and financing of environmental management and monitoring tasks as they pertain to the project and inter-agency coordination. GOTA will exercise its functions through the representative project manager and GOTA main office which will be responsible for general project execution, and which will be tasked with day-to-day project management activities, as well as monitoring. During the operation of the processing plant facility, HSE (Heath Safety and Environment) section at GOT under GOTA will take fully reasonability in overall monitoring and implementation of the EMP. A consulting firm has been hired to provide services for detailed engineering design, construction supervision, and other assignments, as needed.

Project Manager of GOTA, has is already established company in Timor Leste since October 2012 to implement the project and manage detailed design and supervision of construction. The branch is headed by a full-time general manager and supported by a team consisting of staff and experience project manager who has been involved in the establishment of various GOTA brewing plant in other country. The GOTA Timor Leste will be responsible for the following: (i) assisting the implementing the Project; (ii) carrying out procurement and engaging design and supervision consultants (PISC) and contractors; ((iii) managing the contractors, and liaising with other stakeholders, on the day to day implementation of Project activities.

5.7.2.2 Role of NDPCEI

The NDPCEI, the agency responsible for environmental management, was consulted at the onset of the EIS process and will be consulted on the confirmation of the categorization of the project. Under the provisions of the ELL, the EIS will be submitted to NDE for review and issuance of environmental clearance. Ongoing consultations with NDPCEI will be required during the construction of the project and NDPCEI will be asked to assist in the monitoring of implementation of the EMP and ensure that environmental management and mitigation of the project is undertaken to an acceptable standard. Periodic inspections will take place with NDPCEI, GOTA HSE, PISC and Contractors.

5.7.2.3 Role of the Contractor

The civil works contractor will be responsible for responding fully to all contract conditions including those covering environmental mitigation, social mobilisation and awareness and monitoring. The contractor will then be responsible for implementing all environmental, health and safety actions included in the EMP and relevant clauses in the bidding documents and contract during the pre-construction and construction period.

The contractor will prepare the contractors EMP (CEMP) based on the site-specific construction methodologies they propose to use and the EMP in this EIS. The EMP will further develop the EMP contained in this EIS and will detail measures for all impacts covered in the EMP. The GOTA Timor Leste will review and approve the EMP before the commencement of construction.

The contractor will appoint an Environmental and Safety Officer (ESO) who will be responsible for site inspections on a daily and weekly basis to check compliance with the approved EMP and ensuring implementation of all health and safety requirements, these will be documented and subject to monitoring by GOTA Project Manager and NDPCEI. The responsibilities of the Contractor include:

- Participate in induction on EMP and mitigation measures to be delivered by PMU prior to preparation of the EMP;
- Appointing an ESO and Deputy ESO, sending letter to GOTA confirming that these positions have been filled and by whom before construction commences (the bidding documents and contract specify the roles and tasks of the ESO);
- Seeking training and support from GOTA on any aspects of environmental management, as required;
- Coordinating with GOTA Timor Leste for preparing and submitting the EMP following detailed design, the ESO will be responsible for ensuring that the Contractor complies with the clauses in the contract and bidding documents in respect of environment, health and safety;
- As required, preparing, and submitting for approval, appropriate plans (tree cutting, aggregate extraction, traffic management etc.);
- Engaging an approved service provider to undertake HIV/AIDS briefings and awareness raising amongst the contractor's employees and communities, and reporting on the same;
- Coordinating with GOTA in respect of community consultation i.e. establishing GRM etc; and

Undertaking daily and weekly site inspections (by the ESO) recording the findings in a site diary, and participating in monitoring and coordinating with GOTA central office to ensure that environmental management activities are reported in Monthly Progress Reports as required.

5.7.2.4 Assessment of Institutional Capacity

GOTA, as an established company in mineral water processing will try to compliancy with the requirement of environmental for their facility, including the activities of other beverage making. This is a very important experience for the project owner to implement the propose EIS and EMP to ensure that the all the procedures and standards have been followed. However, the well trained local operator of the facility will be important to enhance the effective implementation of the EMP. GOTA is currently has trained operators working for water production and will send numbers of staff to be trained on other places such as possibly in Indonesia, on the beverage making process such as brewing and soft drink processing, prior to the commencement of the production system.

Other institutions that should have proper capacity in ensuring the effective implementation would be the NDPCEI and other government agencies to monitor and control the mentioned parameters during the implementation of the project so that the activity will follow all the standard and procedures.

6. CONTRACTUAL AND CORPORATE OBLIGATIONS

The proposed development is 100% private sector-funded; therefore, there is a limited contractual and corporate obligation in relation to the natural environment and social impacts related to the development. However, as an established company that already established its reputation and commitment to the health, safety, and environment, the company has made it its policy to implement internationally recognized standard in its operation (ISO standards), which consist of:

- Environmental Management System (ISO 14000)
- Occupational Health and Safety Standard (ISO 18001)
- Energy Conservation (ISO 5001)

Moreover, Decree Law No.5/2011 in Articles 15 and 16 established the Impacts and Benefit Agreement procedure to allow for project proponent and affected communities around Category A projects to enter into a legal agreement for the community's benefit (Table 5.1). While there have been no clear guidelines on how to enter into these types of agreement, it is prudent to say that most project proponents are willing to enter into this type of agreement as far as the agreements are reasonable and within the scale of the potential impacts identified in the EIS.

For this particular project, during the final stakeholder consultation and the presentation of the draft EIS, it was clear that local community residing near the project potentially be affected by the development. Potential impacts to local community range from negative as well as positive impacts. Potential negative impacts can be direct and indirect impacts that will be felt during the pre-construction, construction and operation and maintenance phases of the project. During the pre-construction and construction phases, direct impacts can be in the form of social disruption from workers present in the construction site while during operation and maintenance phase, impacts can come in the form of pollution and others. Potential positive impacts are related to job provision in every phase of the project, be it pre-construction, construction and operation and maintenance impacts.

As part of the development process, project proponent has entered into agreements with several members of the community that are being resettled out of project site. These contractual agreements are related to compensation payment to the community member to move out of their houses to a new location. Eleven members of the community signed the agreement and have since moved out of their houses. The contracts for compensation payment are provided in appendix 3

Table 6.1. Impacts and Benefits Agreement in Decree Law No. 5/2011

Chapter	Article	Article Title	Main Point
V	15	Impacts and Benefits Agreement (IBA)	Establishment of the IBA as the legal instrument for communities around or near the proposed Category A projects to enter into an agreement that defines rights and obligations between the community and project proponent in relation to traditional land use, customs and community rights to the scale of potential impacts identified in the EIS.
	16	Negotiation of the IBA	Timing of the IBA negotiation, process, facilitation, conflict resolution and status of the IBA as a "statute."

7. SUMMARY OF IMPACTS

As presented in the EIS that the potential impacts that may arise during the project implementation consist of environmental impacts, socio-economic impacts, and related occupational health and safety impacts throughout the project implementation stages. The following summary presented the impacts during the phases of project implementation, where during pre-construction and construction stages, impacts generated will be temporary and relatively preventable. During the operational phase on the other hand, several potential significant impacts with serious consequences to the natural environmental will occur and have to be identified and managed.

7.1 Summary Impacts during Pre-construction and Construction Phase

The impacts during the pre-construction and during the construction phase are only temporary that can be mitigated onsite. The following table shows the impacts arise during the pre-construction and during the construction.

Table 7.1 Impacts and Source of Impacts during the pre-construction and during the Construction

Type of activity	Potential Impacts /factor of concern
Site preparation and grading	soil erosion
	Sedimentation
	Slope Stability
	Loss of vegetation
	Air quality
	Disturbance of water body
Construction	Noise and Vibration
	Solid waste
	Wastewater discharge from workers
	Hazardous Material
	Land contamination
OHS - Hazard	Over-exertion
	Slips and Falls
	Work in Heights
	Struck By Objects
	Moving Machinery
	Dust

	Confined Spaces and Excavations
	Other Site Hazards
Community Health and Safety	General Site Hazards
	Disease Prevention
	Traffic Safety

Table 7.2 Social and Economic Impacts

Component	Potential Impacts /factor of concern
Social	Loss of livelihood
	Physiological effect from relocation
Economic	Loss monetary value of vegetation loss
	Loss of 7 HA land that will be occupied by the project
	Economic opportunity to state and community
	Create employment/temporary
	Opportunity of other service

7.2 Summary of Impacts during Operation and Maintenance Phase

The impacts during the operation phase of the project have the potential to be adverse therefore, require a comprehensive solution to avoid, minimize or offset the impacts. The major impacts related to beverage processing plant is related to directly to the resource utilization (water, energy, and raw material) in the production as well as the waste (solid and liquid) that will be resulted as byproduct or residue that will be required a proper handling.

7.2.1 Groundwater withdrawal rate

Total volume rate of water extraction is equal to 200 L/min, which will be pumped out from the groundwater. This volume rate of extracted groundwater will be used in beverage making, equipment process and associated activities. The rate of extraction at 3.3 L/s is considered moderate and analysis of the water availability in the aquifer should be conducted to ensure the safety. When withdrawal is higher than what can be sustainably provided by the aquifer, continuous withdrawal at this rate will result in the following impacts:

- Potential land subsidence from rapid diminishing volume of water
- Potential seawater intrusion into the groundwater
- Structural damage and risk on the structure above the ground
- High cost of pumping and treatment

The following figure presents the summary of impacts and mitigation measures to be taken in order to office, minimize, and or offset the impact.

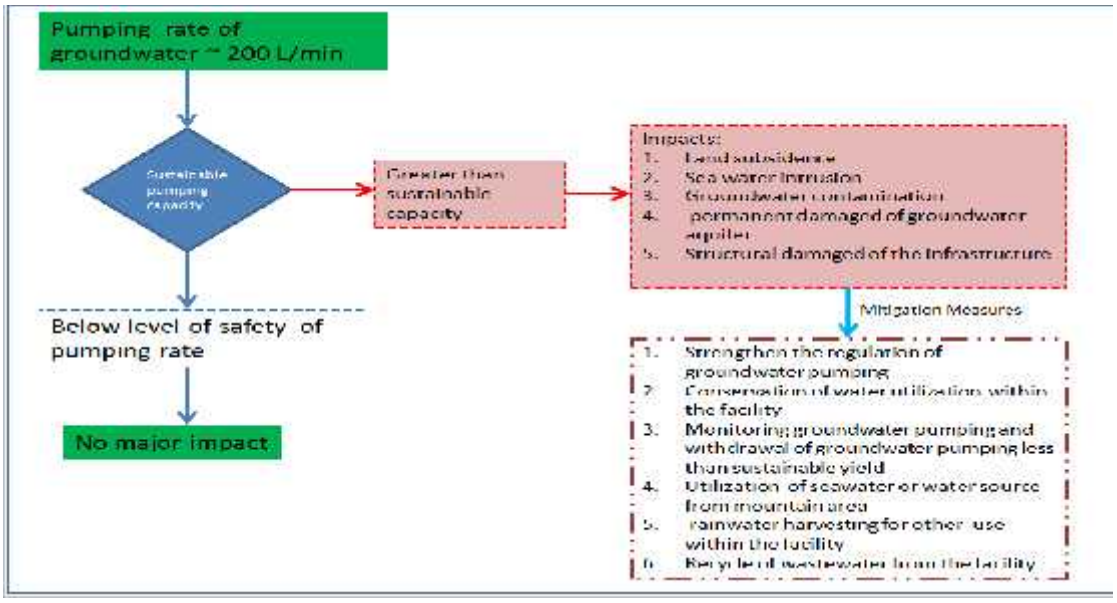


Figure 7.1. Impacts Assessments of Groundwater Utilization and Mitigation Measures

In order to understand the magnitude of the impacts and proposed mitigation measures, the analysis of groundwater pumping and relation to the aquifer level dropdown may be necessary by understanding the nature of aquifer and rate of groundwater pumping. As can be understood in many groundwater books that aquifer is underground storage, where water is stored. Therefore, in theory the storage or volume of groundwater within the aquifer can be estimated. The pumping rate on the other hand, is a given parameters, as volume to be taken out to fulfill the demand of water by design is known.The properties of aquifer (storage and transmitivity) can be estimated indirectly from the pumping test data of the production and monitoring wells. The project owner has conducted the pumping test to collect the data on the pumping rate and level of aquifer drawdown. Summary of potential impacts assessment and proposed mitigation measured are provided in the following table.

Table. 7.3 Summary of Impacts and Mitigation Measures of Groundwater Extraction

Capacity Extraction, L/Min	Sustainable Capacity, L/Min	Potential Impacts	Mitigation Measures
		Land Subsidence	➢ Pumping rate should below the sustainable yield ➢ Monitor the pumping rate ➢ Reduce the water utilization or water conservation ➢ Reduce the pumping rate from the bore by using the water source from upland catchment system
		Sea water intrusion	
		Structural Damage	
		Groundwater Contamination	
		Water stress in the community	Provide water to the community
		High Pumping cost	Water meter and control the water pumping
210	2857	OHS	See OSH section

The pumping testing was conducted by the project owner to collect the data on the storage sustainability of the groundwater. The result of the testing can be seen in the following table.

Table: 7.4 Result of the Groundwater Pumping Test

Pumping Rate, L/S	Duration Test, Hr	Drawdown, m	Time of Recovery, min
2.5	24	0.45	10
3	24	0.5	10
3.5	24	0.65	15

The above table indicated that the groundwater pumping rate test was conducted for the rate of 2.5 L/s to 3.5 L/s, only produced the maximum drawdown of 65 cm of water table in a duration of relatively small (15 minute). The result shows the good quantity of groundwater volume in the aquifer for the given pumping rate.

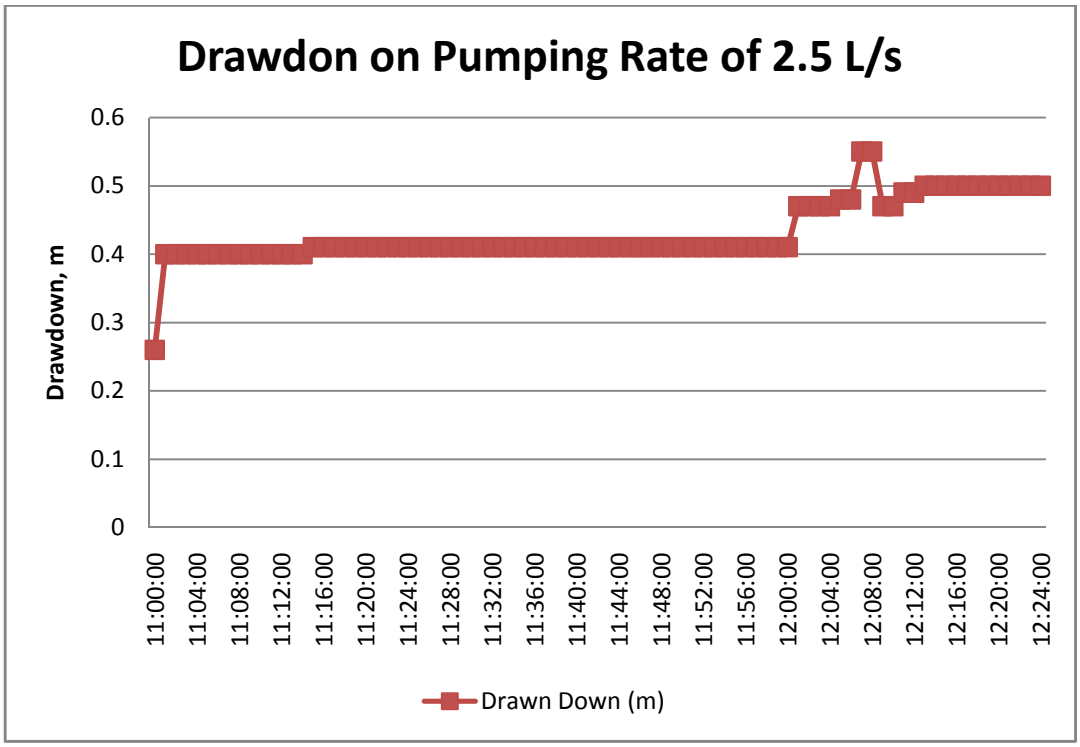


Figure. 7.2. Drawdown Profile of Pumping test at Rate 2.5 L/s

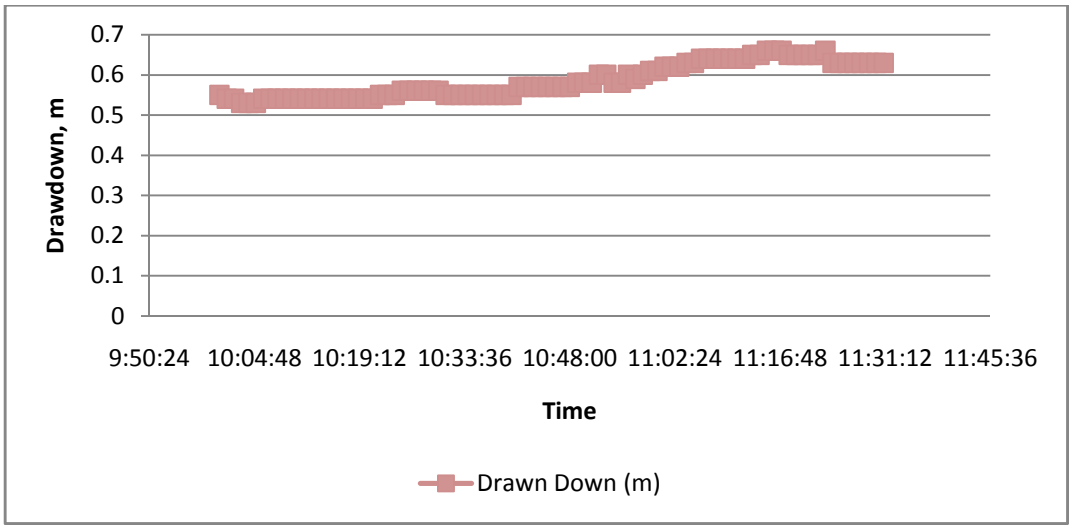
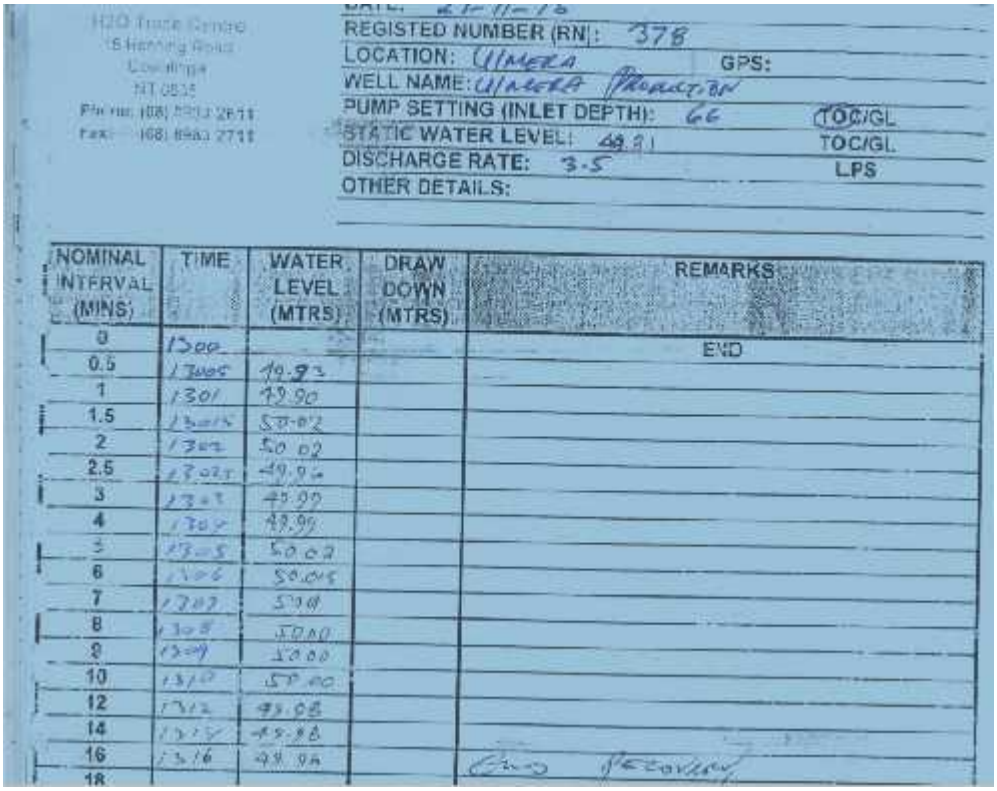


Figure 7.3 Drawdown Profile of Pumping Test at Rate 3 L/s

Table.7.5 Recovery Test data on the Borehole - Ulmera



REGISTED NUMBER (RN): 378
LOCATION: ULMERA GPS:
WELL NAME: ULMERA PRODUCTION
PUMP SETTING (INLET DEPTH): 66 TOC/GL
STATIC WATER LEVEL: 49.91 TOC/GL
DISCHARGE RATE: 3.5 LPS
OTHER DETAILS:

NOMINAL INTERVAL (MINS)	TIME	WATER LEVEL (MTRS)	DRAW DOWN (MTRS)	REMARKS
0	1300			
0.5	1300	49.93		END
1	1301	49.90		
1.5	1301	50.02		
2	1302	50.02		
2.5	1302	49.96		
3	1303	49.99		
4	1304	49.99		
5	1305	50.02		
6	1306	50.05		
7	1307	50.08		
8	1308	50.00		
9	1309	50.00		
10	1310	50.00		
12	1312	49.98		
14	1314	49.98		
16	1316	49.98		End Recovery
18				

Future groundwater modeling shall be developed by collecting more comprehensive data to understand the property of aquifers and potential storage yield of groundwater within the area. Particularly to understand the relationship between the pumping rate and recharge rate to judge sustainable yield as the maximum threshold of pumping. Very preliminary estimation of

recharge rate from average rainfall volume, which is around 1,100 mm within the catchment area of 40 km^2 of potential recharge area

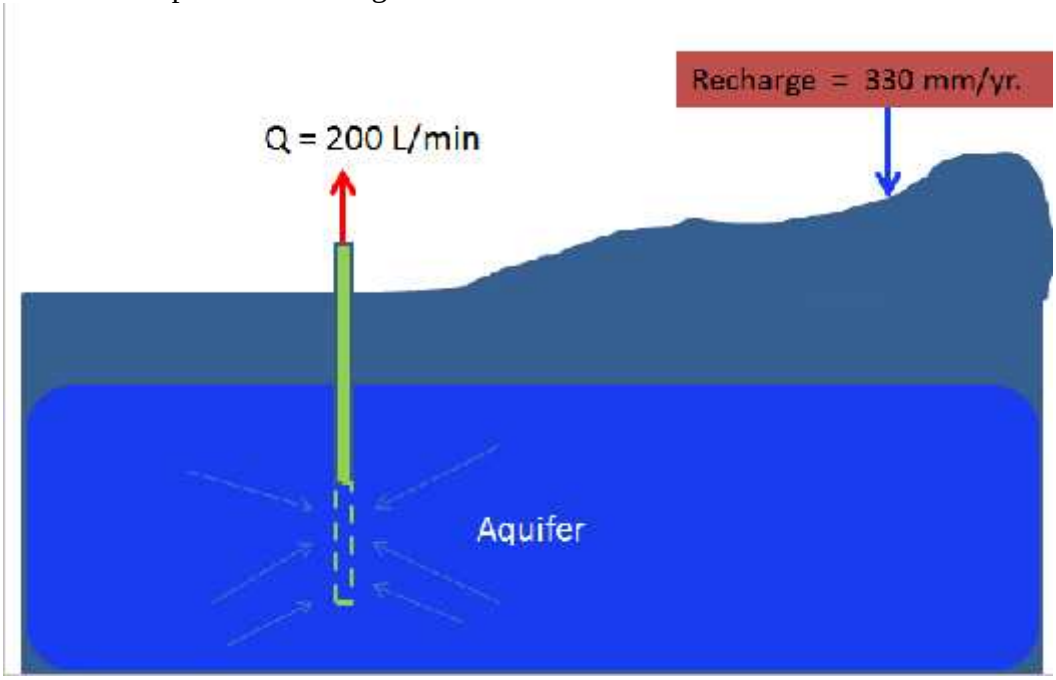


Figure. 7.4 Conceptual Representation of Groundwater Pumping and Recharge System

The recharge rate mainly coming from the rainfall, which occurs during the rainy season and assuming that the average annual rainfall within the project location is around 1,100 mm and by assuming that average 30% of annual rate will contribute to infiltration process and eventually recharge to the groundwater. This means that the average annual recharge rate of groundwater around project location is roughly 330 mm per year. The total pumping rate for this proposed development project in the aquifer area of 4.2 Km^2, with the annual rate of 100 million litters.

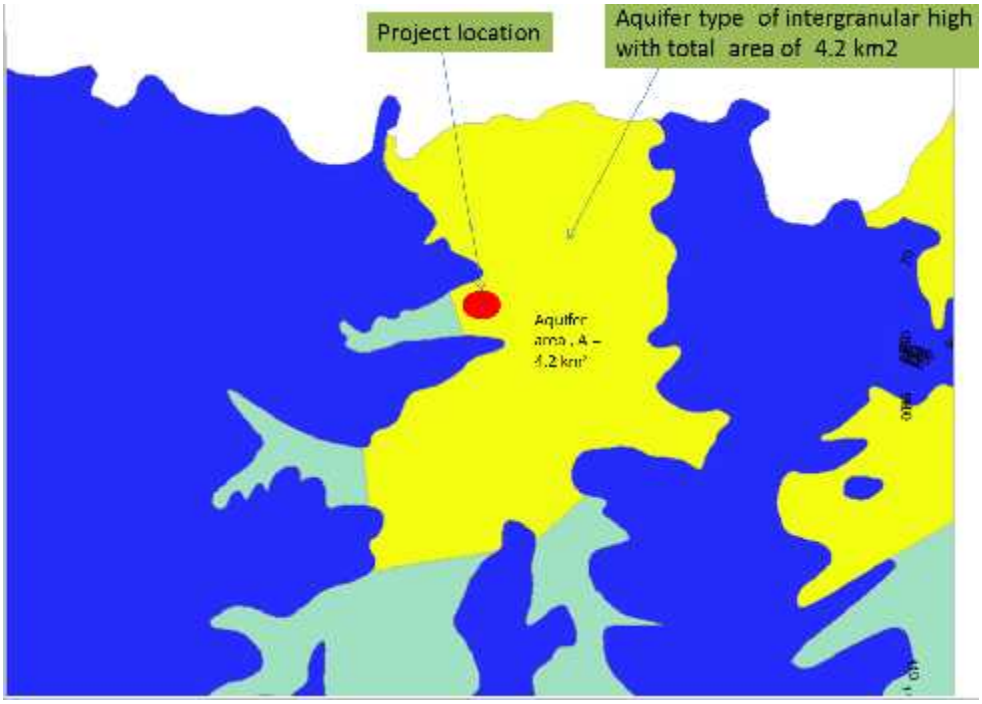


Figure. 7.5 Estimation of Aquifer Area

The annual pumping rate is equal to 100 million litters or equal to 24 mm, which is only around 7% of total annual recharge rate. Event, the demands grow at the project area for 200% in the future, will only utilize less than 20% of the groundwater volume. Therefore, the extraction of the groundwater for the development project shall not create any significant issue in the future.

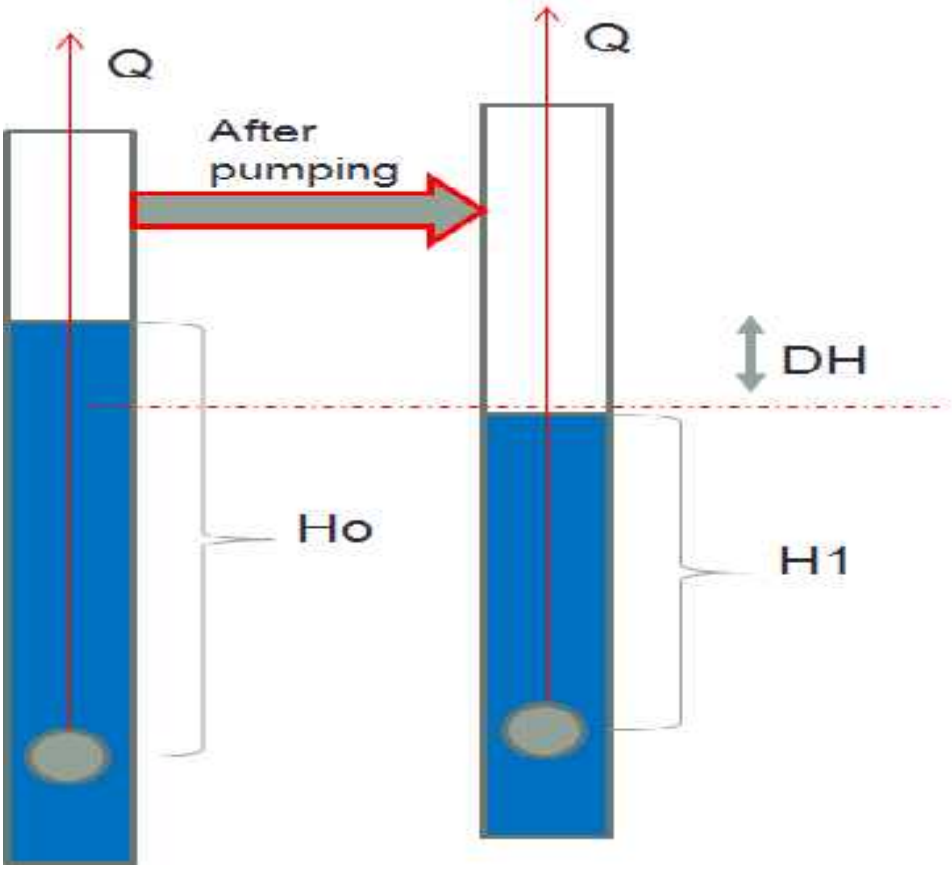


Figure 7.6. Profile of Pumping Test

7.2.2 Wastewater discharge into marine water body

The untreated wastewater produced from the facility will likely have characteristics as shown in the following table.

Table 7.3 . Ranges of Brewery Untreated Wastewater Effluent

Typical Ranges Of Brewery Unfiltered "End-Of-Pipe" Wastewater Effluent

PARAMETER	TYPICAL RANGE
Water to beer ratio	4 - 10 liter/liter
Wastewater to beer ratio	1, 3 - 2 liter/liter lower than water to beer ratio
Biochemical Oxygen Demand (BOD)	600 - 5,000 ppm
Chemical Oxygen Demand (COD)	1,800 – 6,500 ppm
Nitrogen	30 - 100 ppm
Phosphorus	30 - 100 ppm
pH	3 - 12
Total Suspended Solids (TSS)	200 – 1,500 ppm

Untreated, wastewater effluent will have high Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), nutrient (nitrogen and phosphorous compounds), extreme pH and Total Suspended Solids (TSS). At about 1.7 L/s wastewater with this kind of characteristics would impact the coastal environment severely especially when it is dumped close to the coast line. The potential significant impacts are eutrophication, excess turbidity of coastal water, localized loss of healthy marine ecosystem due to extreme pH, and others. Combined, these impacts will affect the otherwise healthy and productive marine ecosystem.

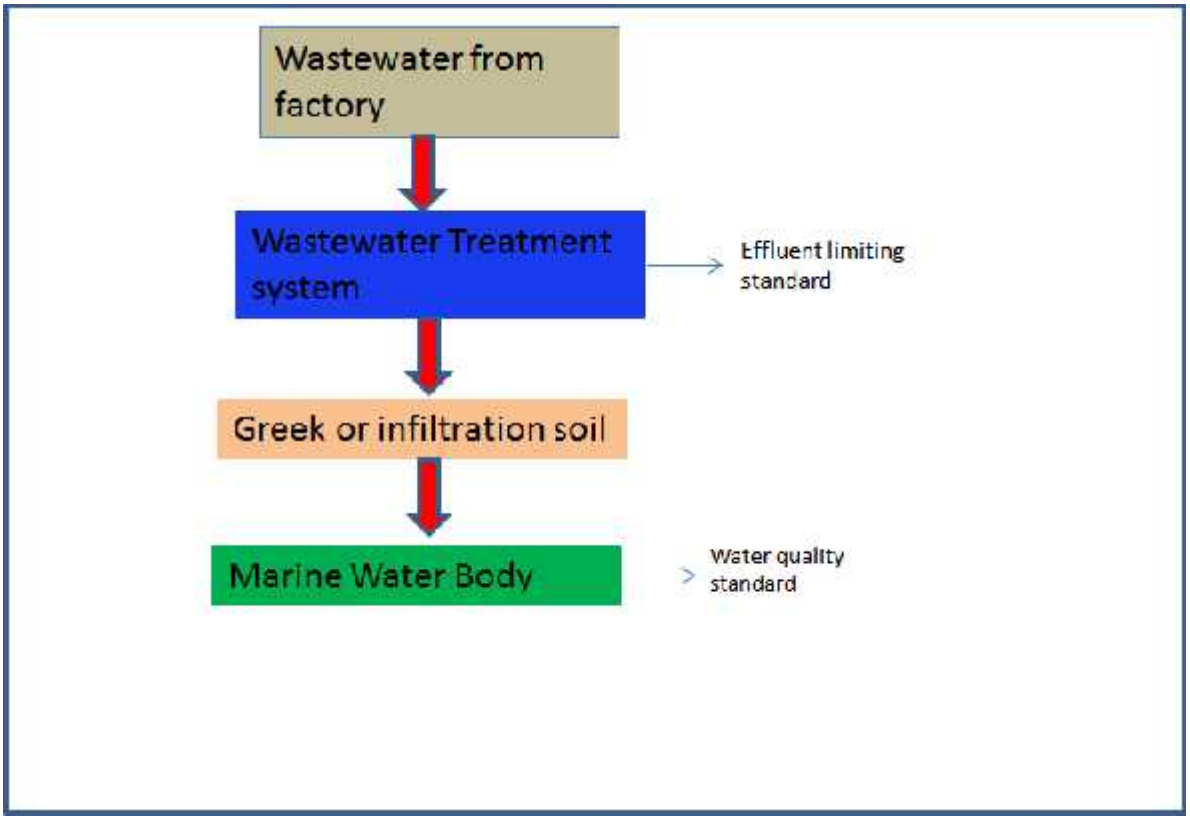


Figure. 7.7 Impacts and Procedure of Wastewater Treatment and Disposal

The above quality of untreated wastewater will be a problem to the environment and therefore require treatment with the technological approach, as well as receiving water quality management approach.

7.2.3 Energy Consumption and Greenhouse Gas Emission

The impacts of high energy consumption are high cost of energy, indirectly high emission of greenhouse gases because energy generation in Timor Leste is very dependent on fossil fuel. High cost will be bore by project owner while higher emission of GHG is a global problem that

will eventually impact human kind globally through the need to adapt to sea level rise, changing rainfall pattern and higher temperature in general. In addition to indirect release of GHG from EDTL facility, GOTA facility will directly produce CO_2, NO_x, SO_x, H2O (water vapor) from steam losses and CH_4. Albeit its small contribution when compared to the total amount of GHG produced by Timor Leste, GOTA in general should be as concern in Timor Leste as in its operation in other nations with larger capacity and more developed environmental regulations.

7.2.4 Solid-waste generated during the production process

The amount of solid waste generated by the plant is reasonably high at 5000 ton/year. In the absence of good treatment, solid waste will end up into the coastal environment, affected the currently pristine condition, deteriorate in the area and result in further impacts to the surrounding environment.

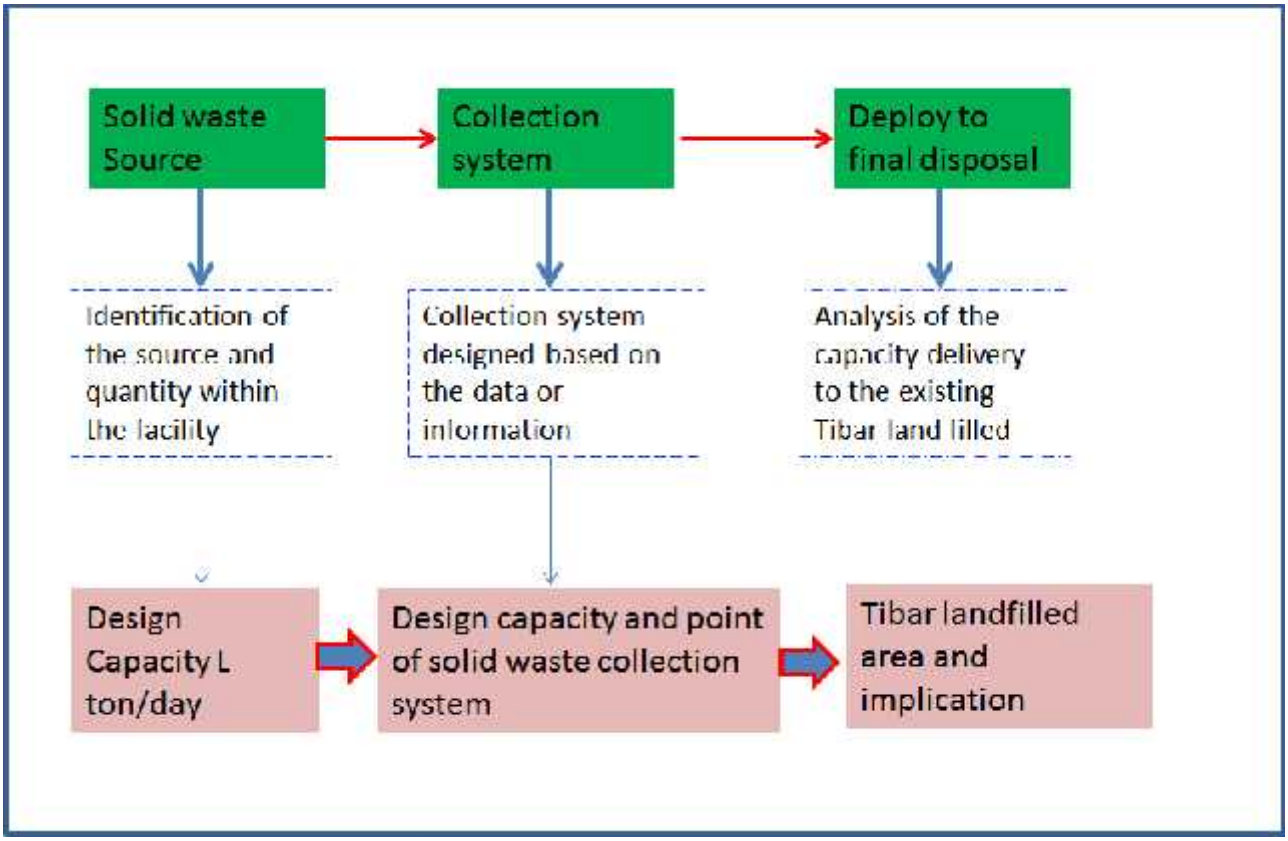


Figure. 7.8 Solid Waste Identification and Procedure of the Solution

The following table contains a summary of potential impacts during operation and maintenance phase including potentially less significant impacts.

Table 7.4. Summary Impacts and Source during the Operation of the Plant

Source of Issues /problem	Potential Impacts
Water Consumption	
Groundwater Extraction	Increase water stress in the area
	Affect groundwater sustainability
	Affect salt water intrusion
	Susceptibility of groundwater contamination
	Land subsidence
	High energy cost of water pumping - contribute to greenhouse gases emission
Water treatment system	High cost of treatment
	Wastewater - Brine disposal
Energy Consumption	
➢ Beverage processing plant ➢ wastewater Treatment Plant ➢ Water Treatment plant ➢ Pumping of groundwater ➢ Utility uses ➢ Beverage proc	High operating cost /expensive
	Contribute to greenhouse gas emission
Solid waste Management	
Spent Grain	➢ Contributing to the high BOD/COD if discharge into wastewater stream ➢ Large quantity which required space to store ➢ Odor and create other problems
Spent yeast	➢ Unpleasant odor ➢ Contribute to high BOD and COD if discharge into drain/wastewater stream
General solid waste	➢ Need space to store (Space limitation) ➢ Create unpleasant environment ➢ Create unhealthy environment and may be generate illness
Diatomaceous Earth (DE)	➢ Significant quantity which required space to store ➢ Dust problem
Corrugated - Cardboard	➢ Space limitation ➢ Becomes hazmat ➢ End up in the sea and polluted the sea, city, and environment
Wood pellets	➢ Space limitation ➢ Becomes hazmat ➢ Unhealthy environment

Shrink wrap , Bag, sack	➢ Space limitation ➢ Becomes hazmat ➢ Non-biodegradable material, took a long time to break the molecule ➢ Unhealthy environment
Aluminum cans	➢ Space limitation ➢ Unhealthy environment
Plastic bottles	➢ Space limitation ➢ Unhealthy environment ➢ It takes a long time to decompose the non-biodegradable material such as plastic
Glass bottles	➢ Space limited ➢ Becomes hazmat ➢ Unhealthy environment
Leftover food	➢ Odor ➢ High BOD/COD ➢ Bio-hazard ➢ Unhealthy environment and cause sickness and poisonous
Corrugated - Cardboard	➢ Space limitation ➢ Becomes hazmat ➢ End up in the sea and polluted the sea, city, and environment
Wood pellets	➢ Space limitation ➢ Becomes hazmat ➢ Unhealthy environment
Shrink wrap , Bag, sack	➢ Space limitation ➢ Becomes hazmat ➢ Non-biodegradable material, took a long time to break the molecule ➢ Unhealthy environment
Aluminum cans	➢ Space limitation ➢ Unhealthy environment
Plastic bottles	➢ Space limitation ➢ Unhealthy environment ➢ It takes a long time to decompose the non-biodegradable material such as plastic
Wastewater Management System	
High solid material	➢ Contribute to high BOD/COD ➢ Blockage the instrument and drainage system if dump into drainage system
High COD	➢ Oxygen depletion

	➢ Odor emission ➢ Greenhouse gases emission
High BOD	➢ Oxygen depletion ➢ Odor emission ➢ Greenhouse gas emission
High Nutrient (Nitrogen based compound)	Eutrophication
High Phosphors	Eutrophication
PH issues	Affect all the living organism and ecosystem
High turbidity (TSS)	Cause high turbidity and block the sun penetration and hence disturb the photosynthesis with the marine ecosystem
Emission of gases Management	
By product of CO2 from brewing	Greenhouse gases emission - Carbon Footprint and contribute to the global climate change
Methane from anaerobic wastewater treatment	
Steam loss from boiler	
Other emission of gas within the facility	
High Energy consumption	Power/ fuel consumption
Impact of Climate Change	
Sea Level rise	➢ Coastal flooding ➢ Damage of infrastructure/structure in the coastal area ➢ Change in ecosystem pattern
Change of Rainfall Pattern	➢ More frequent flooding ➢ Potential prolong drought or drought hazard ➢ Production of food in Agriculture will reduce ➢ Increase the risk of groundwater vulnerability (both quality and quantity) ➢ Sea water intrusion to the groundwater
Change in Temperature (becomes higher)	➢ High evaporation rate and cause water loss ➢ Increase energy consumption (refrigeration, heating, cooling, etc.)
OHS – Related to the Specific Beverage Processing Plant	
Exposure to Risk	Organic dust arising from grain storage, milling, and transport operations presents an explosion risk in the areas of the Brewery where these operations occur. In addition to the guidance in the General EHS Guidelines (IFC standard, 2007)
Exposure to Chemical	Refrigerant leaking
	Asphyxiation
Physical Hazard	➢ Level (falling) ➢ Slippery ➢ Use of machine and tools ➢ Collision (transport equipment such as forklift, truck, and

	containers, etc) ➢ Dust ➢ Pressurize gas/water system ➢ Heat and Cold system/area
Noise and Vibration	A variety of operations in food and beverage processing units generate substantial noise levels, for example the canning plant, bottling machines, conveyors and blanching applications

7.2.5 Social Impacts

Social impacts that may occur during the construction and operation of the proposed facility including – (i) potential disruption to social cohesion due to unruly workers' behavior and (ii) spread of disease due to the concentration of new workers in the area, this is especially the case during construction period and (iii) local community's protest over perceived unfair allocation of social benefits brought by the facility. The following table shows potential social impacts that may occur during project implementation and its phases in the development.

Table 7.4 Summary of Likely Social Impacts from the Proposed Development

Social impacts or concern	Source Activities		
	Pre-Construction Phase	Construction Phase	O & M Phase
Potential disruption to social cohesion due to unruly workers' behavior	V		
Public health and safety impacts		v	v
Local community's protest over perceived unfair allocation of social benefits		v	v

An analysis of potential social stress and shocks from the proposed development to affected population and vulnerable groups in the community concluded on the limited and mitigatable nature of the social impacts (Table 7.5).

Table 7.5. Potential Social Impact of the proposed Development Project

No	Social Impact	Analysis
1	Impacts on Land Ownership	No impacts on land ownership, land for the project has been purchased by project proponent from a private owner.
2	Impacts on Immovable Property	No impacts on immovable property as no households were residing in the project site.
3	Impacts on Movable Property	No specific impacts on movable property as well.
4	Impacts on Crops and Productive Trees	No impacts on crops and productive trees as the proposed location are not a productive agricultural area.
5	Impacts on Community Used	No surface water body near project location including creek

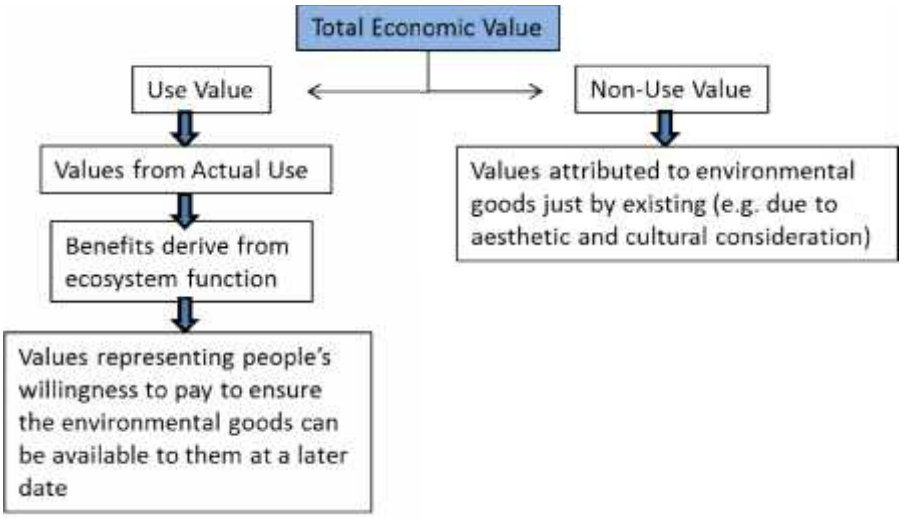
	Surface and Ground Water	or spring. No impact to the ground water use (at least in the medium term). Nearby communities also do not appear to have wells as domestic water is supplied through a gravity system from the springs at an upstream location.
6	Impacts on Access to Natural Resources	No direct impacts are foreseen in terms of access to natural resources as the project is not taking away or block access any natural resource (e.g. coastal and marine resources).

7.2.6 Economic Impacts

Timor Leste Environmental Impact Assessment Checklist provides guidelines on the preparation of the components in the Environmental Impact Statement (EIS). For the preparation of the economic impact chapter, the focus should be on the assessment of economic loss due to environmental impacts.

In the environmental economy literature[1], economic loss due to environmental impacts can be assessed using several tools, the most widely used of them is the Total Economic Value (TEV) methodology. Components that make up the TEV analysis are explained in simple terms as shown in the following chart.

Figure 7.9 Total Economic Value Methodology



For the proposed development, potentially the most significant environmental impact is aquifer damage which can result from over withdrawal of the groundwater. Groundwater is without a doubt a valuable resource due to the following reasons:

[1]Ledoux and Turner, 2002.

- It provides a source of clean and fresh water that can be used for drinking water and other domestic water supply with minimal treatment and minimum infrastructure.
- It provides source of water for river and stream flow during periods of dry season, which in turn maintains aquatic life and recreational use.
- It supports wetland areas and the ecological resources at the wetlands
- It provides stable ground surface, over drafting of groundwater beyond could result in surface subsidence.

The European Union Water Framework Directives provide definitions for "groundwater", "aquifer" and "groundwater body" as shown in the following table.

Table7.6. Key Definitions

Term	**Definition**
Groundwater	All water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil
Aquifer	A subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater.
Groundwater body	A distinct volume of groundwater within an aquifer or aquifers.

Use values

- **Direct Use Value**: including consumptive use such as groundwater use for domestic, public, commercial, agricultural and industrial supply. This is the component of groundwater benefits that is, to some extent, directly traded and the part of TEV that may be quantifiable using data from the market.
- **Indirect Use Value**: this is derived from the ecological services provided by the resource. An example of indirect use value is removal of nutrients/provision of clean water to those withdrawing groundwater from the downstream location, flooding prevention, etc.

Non-use values

- **Existence value**: derived simply from the satisfaction of knowing that the resource continues to exist, whether or not this might also benefit others. Groundwater as a resource on its own and through its function as a recharge of surface water is likely to be assigned existence values.
- **Bequest value**: this is associated with the knowledge that the resource will be passed on to the next generations. Groundwater is likely to attract bequest value as a resource and through its contribution to surface water bodies and the ecological services it provides.

To assign appropriate values to the Use and Non-Use Values described above, users and non-users of the resources should be identified. Users (direct or indirect) may possess both use and non-use values while none users will only hold non-use values.

As clearly shown from Figure 7.10, the water body where groundwater is extracted from is located within the boundary of Suco Ulmera. This particular water body is part of the larger intergranular aquifer. The aquifer supports a range of uses within the area, include:

1. Domestic water supply (from spring water),

2. Domestic wells (shallow wells owned by the population especially in the coastal location near the mangrove and a deep well owned by Colegio St. Inacio de Loyola)

Figure. 7.10 Borehole and Spring Water Resources System

It is believed that no other **direct use** from the groundwater body is present in the area as there is no agriculture or other industrial complex utilizing groundwater from the groundwater body is currently present in the area.

To simplify the analysis, **indirect users** can be assigned to the population of the Ulmera Suco. It is assumed that the suco populations are those that benefits from the removal of nutrients/ provision of clean water and prevention of flooding in the downstream locations.

Non-Use Values include the existence and bequest values which are most likely also held by the residents of Ulmera Suco.

The most direct methods to estimate the value of water is the market price proxy methodology, meaning assigning market price of the commodity and the services it provides to the users. Clean water are sold at different prices per liter. The municipal system's water supply tariff is USD 0.24/cbm while private vendors supply 5,000 liter of water for USD 50 or USD 10/cbm. The price of the bottled water, on the other hand is USD 1 per 19 liter or USD 0.05/l.

It is conservatively estimated that the sustainable yield of the groundwater body in Ulmera to be approximately 2,857 l/min or 1.357 million cbm per year (assuming 330 days of continuous

production - see Chapter 10). Using the price range of water between USD 0.24/cbm to USD 10/cbm, the direct use value of water can be estimated to range between USD 326,000 to USD 13,577 million per year. It is more likely that the value of direct use of water be close to the upper range since the government water supply tariff is a subsidized tariff.

Other values of the groundwater body are the ecosystem service it provides in the form of the removal of nutrients/provision of clean water and the prevention of flooding in the downstream location. It is hard to assign value for these services as it will require a deeper analysis of cost of water treatment and costs related to flooding. It is sufficient to say, however, that damage to the groundwater body will result in a loss of significant economic resources benefiting especially the population in the respective suco.

7.2.6.1 Costs, Benefits and Cost-Effectiveness of Mitigation Measures

Estimation of costs of the mitigation measures to protect the environment is discussed in detailed in Chapter X on Environmental Management and Monitoring Plan. This part will discuss the cost and benefits of several important mitigation measures including information on cost effectiveness of the measures.

The total cost required by project proponent to implement the proposed EMP is about USD of 4.8 Million during the pre-construction and construction phases. During the O&M phase, the total cost for mitigation measures is predicted to be about USD 320,000 per year. A detailed breakdown of the costs is provided in the following table.

7.2.6.2 Positive Economic Impacts

The proposed development will also generate positive economic impacts in the form of employment, income for the workers and tax contribution to the government. In terms of employment, it is estimated that the facility will generate 53 permanent employments during Operation phase with more than 100 estimated to work temporarily during construction.

The number of permanent employees during O&M phase is estimated to consists of 2 expatriates and 51 national employees. The breakdown of the total employees at the facility is provided in the following table.

Table 7.7. Employment Generated at the Facility during O&M Phase

Category	**Number of Jobs**
Expatriates	
1. General Manager	1
2. Chief Engineer	1
TOTAL	2
Nationals	

1. Administration	2
2. Finance	2
3. Marketing	2
4. Production	33
5. Cleaning/security	12
TOTAL	51

Total salary to be paid is estimated to be in excess of USD 200,000 for the national and expatriate officers.

A total private investment of USD 4.8 million is projected for the first phase of the development which most likely only consists of bottled water facility. First year revenue is projected at USD 5.855 million at 60% of production capacity. Productivity is projected to continue to increase to 100% capacity by three years.

7.3 Impacts of Occupational Health and Safety

The project implementation will involve facility worker and others happened to be within the premise of the facility. This will expose people to various risks during the pre-construction, construction, and operation. The following table shows the type of activities that will especially produce occupational health and safety related risk.

Table 7.8. Occupational Health and Safety Risks

Type of Hazard	Potential Hazard Source/factor of concern
General Hazard within Working Place	Integrity of work place structure
	Severe weather facility shut down
	Workspace and exit
	Fire precaution lavatory shower
	Lavatory and showers
	Potable water supply
	Lighting
	Safe access
	clean eating area
	First aid
	Air supply
	Working environment temperature
Physical Hazard	Rotating and Moving and equipment
	Noise and vibration

	Electrical
	Eye hazard
	Welding or hot work
	illumination
	Vehicle and site traffic
	Working at height
Personal Protection Equipment (PPE)	Eye and face Protection
	Head Protection
	Hearing Protection
	Foot protection
	Hand Protection
	Respiratory protection
	Body/leg protection
Chemical Hazard	Refrigerant leaking
	Asphyxiation
Biological Hazard	Biological agent should be grouped into four. ➢ ***Group 1:*** Biological agents unlikely to cause human disease, and consequently only require controls similar to those required for hazardous or reactive chemical substances ➢ ***Group 2:*** Biological agents that can cause human disease and are thereby likely to require additional controls, but are unlikely to spread to the community ➢ ***Group 3***: Biological agents that can cause severe human disease, present a serious hazard to workers, and may present a risk of spreading to the community, for which there usually is effective prophylaxis or treatment available and are thereby likely to require extensive additional controls ➢ ***Group 4:*** Biological agents that can cause severe human disease, are a serious hazard to workers, and present a high risk of spreading to the community, for which there is usually no effective prophylaxis or treatment available and are thereby likely to require very extensive additional controls

7.4 Impacts of Community Health and Safety

The following table summarized the potential community health and safety impacts during each phases of the project implementation.

Table 7.9. Summary of Potential Impacts to Community Health and Safety

Type of Hazard	Potential Hazard Source/factor of concern
Water availability and quality	Water Availability - over pumping of groundwater pumping will cause water availability problem
	Water Quality - wastewater discharge into the groundwater system
Structural safety of project infrastructure	Reduction of potential hazards is best accomplished during the design phase when the structural design, layout and site modifications can be adapted more easily
	Follow international best practice in design and construction of the facility and infrastructure
	Management action to reduce the hazardous material storage
	Follow proper compliance with the Life and Fire Safety objectives outlined in these guidelines
Life and fire safety	**Fire prevention**: Fire prevention addresses the identification of fire risks and ignition sources, and measures needed to limit fast fire and smoke development.
	Means of Egress : Means of egress includes all design measures that facilitate a safe evacuation by residents and/or occupants in case of fire or other emergency,
	Detection and Alarm Systems: These systems encompass all measures, including communication and public address systems needed to detect a fire and alert:
	Compartmentation: Compartmentation involves all measures to prevent or slow the spread of fire and smoke, including
	Fire Suppression and Control: Fire suppression and control includes all automatic and manual fire protection installations, such as:
	Emergency Response Plan
	L&FS Master Plan Review and Approval
	Specific Requirements for Existing building
Traffic safety	Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public
	Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.
	Managing future traffic increase in the project area

Emergency Preparedness and Response	Communication System : Worker notification and communication Alarm bells, visual alarms, or other forms of communication should be used to reliably alert workers to an emergency
	Communication notification
	Media and Agency Relation
	Fire Service
	Medical Service
	Availability of Resource
	Mutual Aid
	Contact List
	Training and Updating
Disease and prevention	Communicable Disease
	Vector Borne diseases

7.5 Summary Impacts during the Deactivation Stage

During the deactivation, once the project has decommissioned, there would be remaining impacts that need to be identified and mitigated accordingly though the company has no plan to experience in this type of circumstance. The impacts during this stage of project are summarized in the following table.

Table 7.10 Impacts Assessment during Deactivation of Project

Impacts	Source of Impact
Noise and Vibration	From all the activity to decommission of the facility and equipment
Solid waste removal	From the office building, equipment, etc.
Contaminant or hazardous material	From special material such as PCB and the like
OHS	All the activity of decommission
Loss of job and opportunity	From other related activity and project
Loss of income from the company and government	No production causes no income and no tax payment
Land pollution	From wastewater and solid waste

7.6 Summary of Positive Impacts Assessment of Project

Beside the above temporary negative impacts, there are several positive impacts that will be generated during the pre-construction and construction phase that both government and community surrounding will gain that include job creation and positive sense of sign of stability and condition for foreign investment to Timor Leste. The following table provides the summary of positive impacts of the project during the pre-construction and during the construction phases.

Table 7.11. Summary of Positive Impacts during the Pre- and Construction Phases

Activity	Potential Positive Impacts
Feasibility and Environmental Impacts Assessment	➢ Create opportunity for local ➢ Increase level of understanding of the nature of environment by thorough investigation ➢ Share knowledge sharing to the community, government, and GOTA ➢ Positive sign and hope for strategic investment from the foreign company ➢ Local people and company were employed in various sub-project such as drilling, water exploration, security, delivery

	good and services, and other related works that impacted positively to the economy
Transportation of good and service	➢ Employment creation ➢ Contribute to national tax (custom duty, etc.,) ➢ Create opportunity for local ➢
Construction of facility	➢ Employment for the young people ➢ Training of the staff who are Timorese ➢ Provide opportunity for local content and local company to develop in order to have future opportunity with GOTA such as intermediate in their service delivery

The positive impacts and benefit will be realized during the operation of the proposed facility, as during this time, company will generate positive cash flow and achieve sustainable in operation of the facility. By having positive net cash flow, other real positive impacts such as tax payment, job security for employees, and other social corporate reasonability can be realized. The following table provide the list of positive impacts during the operation of the proposed facility.

Table 7.12 Summary of Positive Impacts during the Operation of Plant

Activity /	Potential Positive Impacts
Operation	➢ Job creation for Timorese (GOTA is training 50 local operators in Indonesia to assume the roles and reasonability as operator), marketing staff, and other blue color jobs that will be generated during the operation of the facility ➢ Tax payment to the government ➢ Social corporate responsibility by the company to local community ➢ Create opportunity for other business (supply chain). For instance, enhance agriculture sectors to grow, and other business such as service delivery of product
Spent grain	➢ Enhance cattle raising such as pig, cow, and other with the presence of spent grain as food source ➢ Increase the production of meat and other protein sources

8. DESCRIPTION OF PROPOSED MITIGATION MEASURES

The proposed mitigation measures, as presented in the EIS involve physical or non-physical measures to be implemented to avoid, reduce/mitigate or compensate the impacts of the proposed plant to environment, workers and local community. The first steps of the mitigation hierarchy are to take any action to avoid generating negative impacts. For instance, if groundwater source is not abundant to respond to the needs, then desalination of seawater can be done in this proposed plant such that adverse impacts due to groundwater extraction can be avoided.

This, however, is currently not the first option as sourcing from the sea water means that the facility has to deal with removing more salt content from the water which require more energy as well as the need to guarantee safety to the withdrawal point which is located far in the middle of the sea. Therefore, for this facility, most of the mitigation measures proposed will fall under the "mitigate" or "offset" hierarchy.

8.1 Proposed Mitigation Measures during the Pre-Construction and Construction Phases

The mitigation measures during the pre-construction and construction phases are temporary measures to be applied during the two phases. This is especially due to the temporary and in-significant nature of the potential impacts that can be mitigated with relative ease.

Table 8.1 Mitigation Measures Proposed during Pre-Construction and Construction Phases

Impacts	Proposed Measures	Proposed Monitoring Measures	Parameter to be Monitored	Frequency and Means of Verification	Monitoring Responsibility
Specific to Pre-Construction Phase					
Loss of vegetation	▪ Vegetation to be cleared out has limited conservation values; nevertheless there is a loss of biomass ▪ Re-plant the facility with suitable local species ▪ Offset for loss of trees in the upper areas.	- To be conducted after facility in operational phase - Monitor during the first three years until trees have grown healthy	- Number of trees replanted - Species suitability	- Annual verification - Means: visual	GOTA/Contractor
Resettlement	▪ Proper resettlement and compensation according to regulation or best practices in place ▪ Land lease with the government	- Monitoring during survey to estimate for compensation payment - Monitoring for payment to Affected Household (AH)	- Number of AH - Payment has been received in full by entitled AH	- During survey and payment - Means: interview and direct observation	Chefi de Aldeia, Chefi de Suco, GOTA
Construction Phase and Common Impacts to Both Phases					
Noise and Vibration	▪ Schedule operation of the noise production equipment on the day time only ▪ Use ear protective equipment for workers and those on the compound ▪ Utilize the latest heavy duty equipment that produce less noise and vibration	- Routine monitoring - Community control - Employee control	- Workers wearing safety equipment - Adherence to schedule; - Complaints logged	- Every month or after complaint - Means: consultation (ensure schedule being adhered to) and GRM register	GOTA/Contractor
Gas emission and dustgenerated	▪ Heavy machinery should be maintained to a good standard ▪ Prohibition on the use of machinery producing black smoke ▪ Regular spraying of broken soil to reduce susceptibility of dispersion by air ▪ Ensuring that all vehicles transporting potentially dust-producing material are not	- Employee control Routine monitoring - Community control - Employee control	- Air quality, emissions, dust, particulate matter; - Frequency of spraying - Workers wearing PPE	- Every month or after complaint - Means: visual inspection	GOTA/Contractor

	overloaded ▪ Use of PPE for workers				
Soil erosion and Sedimentation	▪ Soil compaction and grading as soon as possible ▪ Sediment controls such as silt fences or other sediment reducing devices (rock dams or silt barriers), to prevent both siltation and silt migration ; ▪ Diversion ditches will be dug around material stockpiles to catch runoff;	- Monitor for occurrence of spoil in drainage area	- Evidence of spoil in drainage lines - Elevated turbidity in nearby coastal water with direct correlation to the drainage line from the facility	- After rain event - Means: visual inspection	GOTA/Contractor
Oil pollution to soil and water from leakage and spill	▪ Lubricants should be stored in containers / dedicated enclosures with a sealed floor >50m from water bodies; ▪ Fuel tanksshould be located in dedicated areas with a sealed floor >50m from water bodies; ▪ Change of lubricant should be conducted in dedicated areas with sealed floor ▪ Discharge of used oil properly at Tibar used oil storage facility	- Routine monitoring of usage and storage - Routine control and monitoring for sign of leakage or spill	- Oil layers on the ground or oil film on nearby water - Proper discharge of used oil	- Daily monitoring - Means: visual inspection	GOTA/Contractor
Occupational Health and Safety (OHS)	▪ Contractor should conduct training for all workers on safety and environmental hygiene ▪ The contractor should instruct workers in health and safety matters ▪ Workers shall be provided with appropriate PPE including safety boots, helmets, reflector vest, gloves, protective clothes, dust mask, goggles as appropriate per industry standards ▪ Fencing and signage should be installed on all areas of excavation greater than 1m deep and on sides	- Routine monitoring of PPE usage - Monitoring on implementation of fencing - First aid/health post at the camp.	- PPE usage - Areas fenced - Training conducted - Signage installed	- Daily monitoring - Means: visual inspection	GOTA/Contractor

	of temporary works; ▪ Establishment of a first aid/health post at the camp				
Presence of construction workers generating social impacts and disease/STI spread	▪ The general public/local residents shall not be allowed in high-risk areas, e.g., excavation sites and areas where heavy equipment is in operation and these sites will have a watchman at the entrance to keep public out; ▪ The contractor should make prior provision to ensure the construction workforce attends STI and HIV/AIDS prevention session.	- Routine monitoring for non-worker's movement in the construction area - Monitoring for order and safety related to interaction of workers with local community	- Number of trespasses by local community - Implementation of STI prevention workshop	- Daily monitoring - Means: record keeping of trespassing and order disruption	GOTA/Contractor

8.2 Mitigation Measures during the Operation of Facility

Major impacts during operation of the facility are related to resource utilization and generation of waste that have the potential to createsevere and long term impacts to the environment, infrastructure and local community utilizing the resources. Mitigation measures of major impacts are presented in the following sections.

8.2.1 Mitigation Measures for Water Consumption

As presented earlier that substantial amount of water is extracted from the groundwater and treated before using in the processing plant and other utility usage. The objective of the water conservation or environmental management plan (EMP) is to reduce the rate of water consumption on one hand but production rate will be met. By reducing the water consumption is not only good for the environment but also save money and energy so the company must have a lot of interest and motivation to apply various strategic management program to achieve the goal of water reduction. As is the case in many other places, at the beginning of the operation (when the plant start-up) , the rate of water consumption, as determined in the previous sections is reasonably high, where 1 liter beer required 7 liter water and 1 liter soft drink, required 3 L water. This ratio should reduce overtime, as the plant already reached the steady state operation, where the environmental management plan (EMP) has already implemented and the company already has several years of experiences. The following table shows the trend of the reduction of water consumption within the beverage processing plant.

Table 8.2 Proposed Reductions of Water Consumption Trends of GOTA in Timor Leste

Year	Ratio	Water extraction, HL	Pumping rate, L/min	% reduction
2018	7	500000	105	0
2019	6	570000	120	57%
2020	5	630000	133	52%
2021	4	670000	141	49%
2022	3.9	720000	152	45%
2023	3.9	879500	185	33%
2024	3.9	905000	190	31%
2025	3.9	905000	190	31%

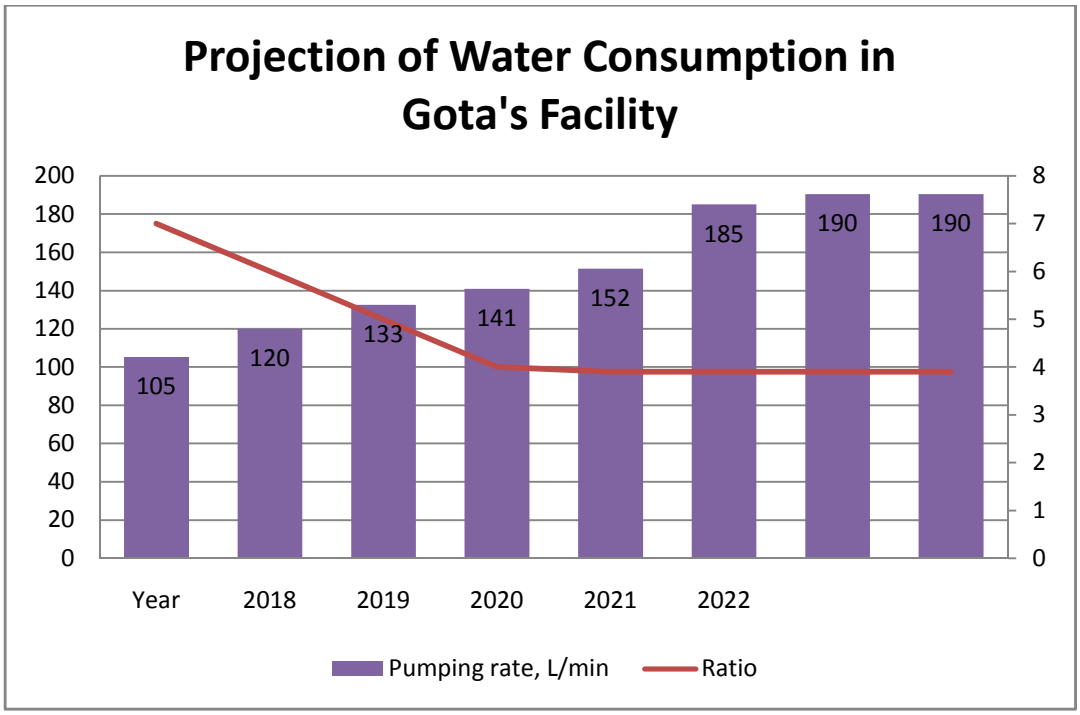


Figure 8.1. Relationships of pumping Rate and Ratio of water Consumption

The latest best practice in industry suggested that the ratio of water consumption only reach 3.9 or 3.9 liter of water required to produce 1 L of beer. The reduction of ratio further lower than 3.9, would depend on the choice of technology. The above figure suggested that after 2-years of operating, the facility should be able to reduce the rate of water consumption up to 4 Liter/1 L of beverage. This target can only be achieved by applying various strategic management programs, which is summarized in the following table.

The reduction of water consumption rate will provide a lot of benefits for the project owner and the environment as the reducing the water consumption will also means,

- Reduction of water withdrawal from the aquifer or lower rate of pumping rate
- Lower pumping rate means lower energy cost and prolongs the lifetime of pump
- Reduce the risk of land subsidence and salt water intrusion to the groundwater aquifer
- Lower cost of water treatment at the RO unit and also lower rate of brine to be disposed
- Lower rate of wastewater from the plant and that means also lower treatments cost and prolong the lifetime of the industrial equipment. The lower rate of wastewater effluent means also that the receiving environment such as marine water body and surrounding soil will be able to accept as the incoming loading rate is lower than the assimilative capacity of the environment.

All the above benefit of water consumption reduction is essentially a cost-saving measures to the company. The above projection trend is in line with the target that the various major brewing companies have set to achieve by 2020.

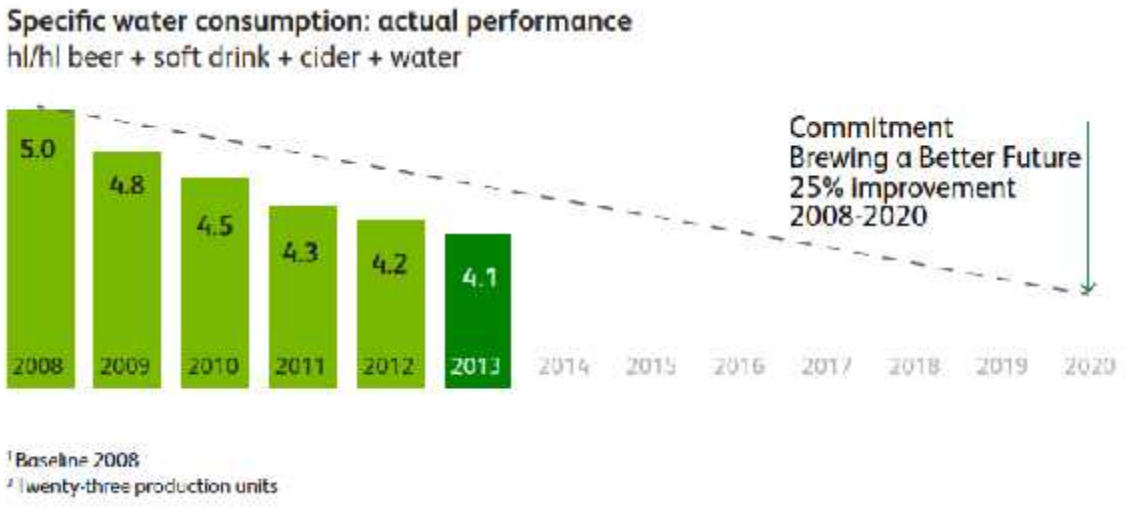


Figure 8.2 Target goals of Reduction of Water Consumption per Unit Production Rate

Groundwater Extraction

As the impact of groundwater extraction could be severe, depending on the rate of utilization of water and the availability of water within the groundwater aquifer. The total rate of groundwater pumping was projected to be 3.3 L/second or 200 L/minutes, to fulfill water demand for the planned capacity. The pumping test of three production wells indicated that at a pumping rate of 3.5 L/second, production wells did not create a significant drawdown that may be a concern during the operation. The estimation of groundwater recharge rate in the chapter X of EIS document indicated that the extraction of groundwater in this area would be only at the rate of 7% from the total volume of recharge. Therefore, the consumption rate by this project is relatively small and has negligible impacts to the sustainability of groundwater aquifer.

However, it is very important to monitor the level of drawdown in each production well, when operating simultaneously provide a more comprehensive data for later analysis of aquifer capacity compare to the rate of utilization. Especially, to response to any future expansion of groundwater utilization, in this proposed development project, as well as the utilization of groundwater surrounds the project location. The mitigation measures to response the potential impacts have already presented in the table 8.2

Water Treatment (Desalination)

Although the raw water is relatively clean, a treatment still required to meet the quality required specifically by the industry. The reverse osmosis (RO), technology will be used in this treatment to purify the raw water in the processing plant.

Table 8.3 Mitigation Measures for Water Consumption and Production of Brine

Sub-Impacts	Proposed Mitigation Measures	Proposed Monitoring Measures	Parameter to be Monitored	Frequency and Means of Verification	Monitoring Responsibility
Impact from Ground Water Extraction					
Increase water stress in the surrounding area	➢ Propose water resource protection at upland catchment, tree planting ➢ Reduce the amount of water use in production (technology choice and conservation) ➢ Provide water to nearby community that are impacted by excessive water discharge	➢ Monitoring for water stress felt by surrounding community	➢ Record of complaint from surrounding community	➢ As logged ➢ Means: GRM record	GOTA/ contractor
Aquifer sustainability, land subsidence, high cost of pumping	➢ Determination of sustainable yield (SY) through close monitoring of pumping test ➢ Pump below SY, allow comfortable margin ➢ Water recycling to recharge the aquifer ➢ Reduce the amount of water use in production (technology choice and conservation)	➢ Monitoring draw down and impact to the other wells during simultaneous production	➢ Draw down ➢ Pumping rate ➢ Recovery time	➢ Hourly data collection ➢ Means: in situ sensor	GOTA/ contractor
Salt water intrusion	➢ Same measures as above	➢ Monitoring of salinity	➢ Salinity	➢ Hourly data collection	GOTA/ contractor
Groundwater contamination through salt water intrusion	➢ Same measures as above	➢ Monitoring of soluble heavy metal	➢ At least the same as baseline parameters collected	➢ Every year	GOTA/ contractor

Impact from Water Treatment system					
Water treatment system produces wastewater	➢ Reduction in water consumption lead to reduction of wastewater production because less water will be needed to be treated ➢ Treated properly wastewater prior to discharging into receiving environment ➢	➢ All monitoring measures for reduction in water consumption applies ➢ Monitor for salinity in the coastal area at least at the locations where baseline data collection have been conducted ➢ Monitor health of mangrove communities nearby and other	➢ Salinity of nearby coastal location ➢ Ecological health	➢ At least every 6 months	GOTA/ contractor/ Government agency responsible for coastal health monitoring

8.2.2 Mitigation Measures for Wastewater Production

Reducing water consumption previous section is not only an important step in achieving sustainable water resource management but also lead to generation of less wastewater associated with the facility. About 50% of total water that enters the system will eventually become wastewater high BOD, COD, extreme pH, high TSS and high in other contaminants. If waste that enter the environment is greater than the assimilative capacity, then the nature will not be able to clean the waste that enter the environment. Therefore, managing wastewater has an objective to limit or control the amount of waste that enters the environment to be less than the natural ability to perform self-cleaning. Controlling waste-loading into the environment can be achieved by reducing quantity (volume of wastewater) that enter the system and/or improve the quality of wastewater prior to discharging to receiving environment.

$$W = C \times Q$$

Where WL = waste loading, unit mass/time
C = Concentration, mass/volume
Q = volume rate of wastewater, volume/time

From this equation, it is clear that waste load reduction can be achieved by using three approaches, which are – (i) to reduce the volume rate, (ii) reduce the concentration of waste and (iii) proper location of disposal outlet to maximize ability to assimilate waste. Proposed mitigation measures will focus on measures falling under these two approaches. The receiving environment, on the other hand, is a stable and relatively healthy marine environment which provides a myriad of ecosystem services.

The following table contains overall management measures that should be implemented at the plant.

Table 8.4 Environmental Management Plan for Waste Loading Reduction

Method of waste load reduction	Actions Plan - How to do	Monitoring Plan
Reducing the volume rate	➢ Reduce water consumption that will lead to less volume of wastewater ➢ Improve water conservation system to conserve water ➢ Apply CIP (Cleaning In Place) to save water for cleaning that will lead to less water consumption ➢ Urge/encourage employees to help conserve water	Monitor and measure the volume rate of wastewater and compare with the water consumption rate
Improved quality	By using best available technology to treat and reduce the concentration of the wastewater (BOD, COD, NOx, etc.)	➢ Control and monitoring program within the treatment plant ➢ Place the sensor within end-pipe discharge to the ambient environment to detect the quality and quantity of wastewater

Further proposed measures for important parameters in the wastewater can be seen in the following table.

Table 8.5 Mitigation Measures of Wastewater

Sub-Impacts	Proposed Mitigation Measures	Proposed Monitoring Measures	Parameter to be Monitored	Frequency and Means of Verification	Monitoring Responsibility
Impact from Ground Wastewater Load into the Environment					
High TSS potentially led to higher turbidity and blocking of sunlight penetration in the near coast water.	➢ Apply physical treatment process (screening to separate solid material) ➢ Improve efficiency of production by increasing conversion factor through applying finer raw material	➢ Monitor for load of solid waste at the effluent	➢ TSS	➢ Every day ➢ Means: sampling and in-situ testing using calibrated equipment	GOTA
High COD potentially lead to oxygen depletion and odor production around the area	➢ Apply proper biological treatment process to reduce COD (aerobic and anaerobic) to a level that is acceptable to the environment ➢ Final disposal at deep marine location	➢ Monitor at the effluent	➢ COD	➢ Every hourMeans: sampling and laboratory testing ➢	GOTA
High BOD lead to oxygen depletion and odor production around the area	➢ Apply proper biological treatment process to reduce COD (aerobic and anaerobic) to a level that is acceptable to the environment ➢ Final disposal at deep marine location	➢ Monitor at the effluent	➢ BOD	➢ Every hour ➢ Means: sampling and laboratory testing	GOTA
High Nutrient (Nitrogen and phosphorous based compound) lead to eutrophication around outfall point	➢ Biological treatment ➢ Consider options to use advanced chemical treatment to bring down concentration of nutrient	➢ Monitor at the effluent	➢ Nitrogen and Phosphorous based compound	➢ Every hour ➢ Means: sampling and laboratory testing	GOTA

Extreme pH affect all living organism and the ecosystem	➢ pH equalization and neutralization by applying cost effective but environmentally friendly method	➢ Monitor pH before and after treatment in the equalization tank	➢ pH	➢ Every hour ➢ Means: sampling and laboratory testing	GOTA

8.2.3 Mitigation Measures of Solid waste

As previously discussed, solid waste could be produced at the rate of 1,000 tons per year. This rate will potentially create a lot of problems especially if wastewater load reach the coastal area.

- Raw Material is solid and Conversion of raw material to the end product is normally not 100%.
- Domestic waste is commonly a solid waste
- Packaging system applies the solid material that will eventually become waste
- By product that may have economic value if manage properly (if not it become a problem)

The estimation of the rate of the solid waste within the processing plant facility as presented earlier will required management plan to reduce the risk and impacts. Without proper management of the solid waste, the environmental problem, health and hazard will occur and which will be costly to be handled later on. The following table shows, the EMP proposed to reduce the overall solid water impacts to the environment, which was prepared based on the concept of reducing, reuse, recycling, and disposing.

Table 8.6 Proposed EMP on Solid waste management Related to Processing Plant

Sub-Impacts	Proposed Mitigation Measures	Proposed Monitoring Measures	Parameter to be Monitored	Frequency and Means of Verification	Monitoring Responsibility
Impact from Solid Waste Generation					
Spent grain when spilled into the environment and ends up in drainage line potentially contribute to high BOD and COD in coastal location also create odor problems. Generation of spent grain, however, can lead to the creation of downstream industry including cattle industry	➢ Reduce the quantity by increasing the efficiency of raw material conversion to product ➢ Reuse by sending to farmer as cattle feed (contract local vendor) ➢ Recycle via composting ➢ Temporary storing in lined and closed area to minimize spill to the surrounding environment and potential for odor production ➢ Remove from the plant as soon as possible to avoid further problem ➢ Consider conversion to fuel (Bio-process) but it will require higher capital investment	➢ Monitor for potential spill of spent grain to the environment ➢ Monitor for proper removal from the facility by third party	➢ Evidence of spent grain spill into the environment especially in drainage line and coastal location ➢ Odor production	➢ Monthly ➢ Means: visual inspection	GOTA
Spent yeast contribute to unpleasant odor, also high BOD and COD if discharged into drain/wastewater stream	➢ Reduce the quantity by increasing the efficiency of raw material conversion to product ➢ Reuse yeast in the facility ➢ Reuse in in bakeries to make bread or cookies ➢ Recycle via composting ➢ Consider conversion to bio-energy ➢ Proper packaging of the spent	➢ Monitor for potential spill of spent yeast to the environment ➢ Monitor for proper removal from the facility by third party	➢ Evidence of spent yeast spill into the environment especially in drainage line and coastal location ➢ Odor production	➢ Monthly ➢ Means: visual inspection	GOTA

	yeast to reduce odor				
Generation of Diatomaceous Earth (DE) in significant quantity which require space to store and could be flying dust	➢ Reduce the quantity by optimizing the efficiency of DE usage (for instance, optimizing particle size) ➢ Work together with Brewing team to reduce the use of DE without compromising the quality of beer (R&D) ➢ Explore membrane process for use in filtering the beer (substitute to DE) ➢ Recycle material for other use e.g.additive to construction material (concrete cement, brick, etc.) ➢ Always keep in wet condition to avoid becoming airborne ➢ Remaining DE should be disposed to Tibar Landfill properly	➢ Monitor for potential spill of DE to the surrounding environment ➢ Monitor for proper removal to landfill	➢ Evidence of DE spill into the environment especially in drainage line and coastal location	➢ Monthly ➢ Means: visual inspection	GOTA
Corrugated cardboard, wood pellets	➢ Proper Collection of the general waste in every section of the unit processing ➢ Bio-degradable materials - send for composting or other use by third party ➢ Proper temporary storage to avoid becoming airborne ➢ Proper disposal at Tibar land	➢ Monitoring for waste leak into surrounding environment including those that became airborne	➢ Evidence of solid waste spill	➢ Monthly ➢ Means: visual inspection	GOTA

	fill				
Plastic containers/bottles/ other plastic waste	➢ Recycle PET bottles through third party ➢ Dispose unrecyclable plastic waste properly	➢ Monitoring for waste leak into surrounding environment	➢ Evidence of solid waste spill into surrounding environment	➢ Monthly ➢ Means: visual inspection	GOTA
Aluminum cans and glass bottles	➢ Recycle aluminum cans through third party ➢ Reusing glass bottles ➢ Recycle broken glass bottles	➢ Monitor for waste leak into surrounding environment	➢ Evidence of solid waste spill	➢ Monthly ➢ Means: visual inspection	GOTA
Miscellaneous organic waste	➢ Composting through third party ➢ Proper disposal to Tibar Landfill	➢ Monitor for waste leak into surrounding environment	➢ Evidence of spill into surrounding environment	➢ Monthly ➢ Means: visual inspection	GOTA

8.2.4 Mitigation Measures for Gas Emission

Most of emitted gasses are also greenhouse gasses. Reducing greenhouse gas emission into the air is very important as it is proven scientifically that the greenhouse gas emission is the main cause of global climate change. As described earlier there are two components of greenhouse gas emission contribution from the proposed beverage plant, namely directly from the plant (gas emission discharge directly from the plant) and indirect contribution which is mainly due to energy consumption (electricity) purchased from EDTL.

Mitigation measures for gas emission are provided in the following table.

Table 8.7. EMP – Greenhouses gas emission

Impacts	Sources	Mitigation Measures	Monitoring program
Greenhouse gases emission - Carbon Footprint	➢ CO_2 from the brewing processing plant as by product ➢ H_2O from the steam generation and use ➢ Methane	➢ Using high efficiency of CO_2 process for carbonation process ➢ Recover CO_2 from the beer processing plant ➢ Reduce the steam loss within the boiler ➢ Burn the methane gas	Control and monitor rate of Recovery of CO2
	Power/ fuel consumption	➢ Applying various methods of Energy Conservation ➢ Control and monitored the energy utilization ➢ Audit the energy consumption ➢ Using the latest technology that operate at high efficiency and less fuel consumption	Control and monitor the energy consumption

8.3 Mitigation Measures of OHS

The worker and management within the proposed facility will also be contacts to the risk of safety and health that required action plan to avoid and minimize the risk. The following table shows the mitigation plan for the general occupational health and safety and occupational health safety.

Table 8.8 Summary of Mitigation Measures of General Occupational Health and Safety

Type of Hazard	Potential Hazard Source/factor of concern	Action Plan and Mitigation Measures
General Hazard within Working Place	Integrity of work place structure	➢ Surfaces, structures and installations should be easy to clean and maintain, and not allow for accumulation of hazardous compounds. ➢ Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions. ➢ Fire resistant, noise-absorbing materials should, to the extent feasible, be used for cladding on ceilings and walls. ➢ Floors should be level, even, and non-skid. ➢ Heavy oscillating, rotating or alternating equipment should be located in dedicated buildings or structurally isolated sections.
	Severe weather facility shut down	➢ Work place structures should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge, if appropriate. ➢ Standard Operating Procedures (SOPs) should be developed for project or process shut-down, including an evacuation plan. Drills to practice the procedure and plan should also be undertaken annually
	Workspace and exit	➢ The space provided for each worker, and in total, should be adequate for safe execution of all activities, including transport and interim storage of materials and products ➢ Passages to emergency exits should be unobstructed at all times. Exits should be clearly marked to be visible in total darkness. The number and capacity of emergency exits should be sufficient for safe and orderly evacuation of the greatest number of people present at any time, and there should be a minimum two exits from any work area. ➢ Facilities also should be designed and built taking into account the needs of disabled persons.
	Fire precaution lavatory shower	➢ Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present. ➢ Provision of manual firefighting equipment that is accessible and simple to use Fire and emergency alarm systems that are both audible and visible
	Lavatory and showers	➢ Adequate lavatory facilities (toilets and washing areas) should be provided for the number of people expected to work in the facility and allowances made for segregated facilities, or for indicating whether the toilet facility is “In Use” or “Vacant”. Toilet facilities should also be provided with adequate supplies of hot and cold running water, hand drying devices. ➢ Where workers may be exposed to substances poisonous by ingestion and skin contamination may occur, facilities for showering and changing into and out of street and work clothes should be provided.
	Potable water supply	➢ Adequate supplies of potable drinking water should be provided from a fountain with an upward jet or

		with a sanitary means of collecting the water for the purposes of drinking ➢ Water supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing) should meet drinking water quality standards
	Lighting	➢ Workplaces should, to the degree feasible, receive natural light and be supplemented with sufficient artificial illumination to promote workers' safety and health, and enable safe equipment operation. Supplemental 'task lighting' may be required where specific visual acuity requirements should be met. ➢ Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure etc.
	Safe access	➢ Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access ➢ Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted ready access ➢ Hand, knee and foot railings should be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps, etc. ➢ Openings should be sealed by gates or removable chains ➢ Covers should, if feasible, be installed to protect against falling items ➢ Measures to prevent unauthorized access to dangerous areas should be in place
	clean eating area	Where there is potential for exposure to substances poisonous by ingestion, suitable arrangements are to be made for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances
	First aid	➢ The employer should ensure that qualified first-aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work ➢ Eye-wash stations and/or emergency showers should be provided close to all workstations where immediate flushing with water is the recommended first-aid response ➢ Where the scale of work or the type of activity being carried out so requires, dedicated and appropriately equipped first-aid room(s) should be provided. First aid stations and rooms should be equipped with gloves, gowns, and masks for protection against direct contact with blood and other body fluids ➢ Remote sites should have written emergency procedures in place for dealing with cases of trauma or serious illness up to the point at which patient care can be transferred to an appropriate medical facility.
	Air supply	➢ Sufficient fresh air should be supplied for indoor and confined work spaces. Factors to be considered in ventilation design include physical activity, substances in use, and process related emissions. Air distribution systems should be designed so as not to expose workers to draughts ➢ Mechanical ventilation systems should be maintained in good working order. Point-source exhaust systems required for maintaining a safe ambient environment should have local indicators of correct functioning. ➢ Re-circulation of contaminated air is not acceptable. Air inlet filters should be kept clean and free of dust and microorganisms
	Working environment temperature	The temperature in work, rest room and other welfare facilities should, during service hours, be

		maintained at a level appropriate for the purpose of the facility.
Physical Hazard	Rotating and Moving and equipment	➢ Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions ➢ Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts, or in which energy can be stored (e.g. compressed air, electrical components) during servicing or maintenance, in conformance with a standard such as CSA Z460 Lockout or equivalent ISO or ANSI standard ➢ Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms
	Noise and vibration	➢ No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing . protection ➢ The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110dB(A) ➢ Further guideline on the noise and vibration is given in the section 8.1.2.3.
	Electrical	➢ Marking all energized electrical devices and lines with warning signs ➢ Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance
	Eye hazard	➢ Use of machine guards or splash shields and/or face and eye protection devices, such as safety glasses with side shields, goggles, and/or a full face shield. Specific Safe Operating Procedures (SOPs) may be required for use of sanding and grinding tools and/or when working around liquid chemicals. Frequent checks of these types of equipment prior to use to ensure mechanical integrity is also good practice. Machine and equipment guarding should conform to standards published by organizations such as CSA, ANSI and ISO ➢ Moving areas where the discharge of solid fragments, liquid, or gaseous emissions can reasonably be predicted (e.g. discharge of sparks from a metal cutting station, pressure relief valve discharge) away from places expected to be occupied or transited by workers or visitors. Where machine or work fragments could present a hazard to transient workers or passers-by, extra area guarding or proximity restricting systems should be implemented, or PPE required for transients and visitors. Provisions should be made for persons who have to wear prescription glasses either through the use over glasses or prescription hardened glasses
	Welding or hot work	➢ Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required ➢ Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations,

		including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hotwork on tanks or vessels that have contained flammable materials.
	illumination	Using proper light illumination: ➢ Emergency light with the light intensity of 10 lux ➢ Outdoor non-working area should use the light intensity of 20 lux ➢ Simple orientation and temporary visit (machine storage, garage, warehouse) should use 50 lux ➢ Workspace with occasional visual task only (Corridors, stairways, lobby, elevator, auditorium, etc.) shall use 100 lux ➢ Medium precision work (simple assembly, rough machine work, welding, packing =) shall use 200 lux ➢ Precision work (reading, moderately difficult assembly, sorting, etc.) use 500 lux ➢ High precision work (difficult assembly, fine sorting, inspection, etc.) shall use 1000-3000 lux
	Vehicle and site traffic	➢ Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits ➢ Ensuring drivers undergo medical surveillance ➢ Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms ➢ Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures(e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction ➢ Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one-way' circulation, where appropriate
	Working at height	➢ Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area ➢ Proper use of ladders and scaffolds by trained employees ➢ Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines ➢ Appropriate training in use, serviceability, and integrity of the necessary PPE ➢ Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall
Personal Protection Equipment (PPE)	Eye and face Protection	Safety Glasses with side-shields, protective shades, etc.
	Head Protection	Plastic Helmets with top and side impact protection.
	Hearing Protection	Hearing protectors (ear plugs or ear muffs).
	Foot protection	Safety shoes and boots for protection against moving & falling objects, liquids and chemicals.
	Hand Protection	Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc.
	Respiratory protection	➢ Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapors and gases). Single or multi-gas personal monitors, if available.

		➢ Portable or supplied air (fixed lines). On-site rescue equipment.
	Body/leg protection	Insulating clothing, body suits, aprons etc. of appropriate materials
Chemical Hazard	Refrigerant leaking	Beverage plants often have large refrigeration systems, typically using ammonia refrigerant which is toxic and can form explosive mixtures in air. Safety and other guidance offered by professional refrigeration institutions should be adopted in refrigeration system siting, design, maintenance, and operation.
	Asphyxiation	Carbon dioxide is produced during fermentation and maturation processes, carbon dioxide can be recovered, and carbon dioxide and / or nitrogen are stored and used in many brewery processes where inert atmospheres are required. Uncontrolled release of these gases or inadequate ventilation, particularly in confined or enclosed spaces such as fermentation and maturation rooms can result in accumulation of sufficient concentration to present asphyxiation risk. Appropriate safety measures should be developed based on a risk assessment, and may include enhanced ventilation, guidance on safe
Biological Hazard	Biological agent should be grouped into four. ➢ ***Group 1:*** Biological agents unlikely to cause human disease, and consequently only require controls similar to those required for hazardous or reactive chemical substances ➢ ***Group 2:*** Biological agents that can cause human disease and are thereby likely to require additional controls, but are unlikely to spread to the community ➢ ***Group 3***: Biological agents that can cause severe human disease, present a serious hazard to workers, and may present a risk of spreading to the community, for which there usually is effective prophylaxis or treatment available and are thereby likely to require extensive additional controls	➢ If the nature of the activity permits, use of any harmful biological agents should be avoided and replaced with an agent that, under normal conditions of use, is not dangerous or less dangerous to workers. If use of harmful agents cannot be avoided, precautions should be taken to keep the risk of exposure as low as possible and maintained below internationally established and recognized exposure limits. ➢ Work processes, engineering, and administrative controls should be designed, maintained, and operated to avoid or minimize release of biological agents into the working environment. The number of employees exposed or likely to become exposed should be kept at a minimum ➢ The employer should review and assess known and suspected presence of biological agents at the place of work and implement appropriate safety measures, monitoring, training, and training verification programs ➢ Measures to eliminate and control hazards from known and suspected biological agents at the place of work should be designed, implemented and maintained in close co-operation with the local health authorities and according to recognized international standards

	➢ ***Group 4:*** Biological agents that can cause severe human disease, are a serious hazard to workers, and present a high risk of spreading to the community, for which there is usually no effective prophylaxis or treatment available and are thereby likely to require very extensive additional controls	

8.4 Mitigation Measures of Community Health and Safety

The community members and public may have an access to facility and therefore the health and safety should be a concern. The following table presents the mitigation measure to prevent/reduce the risk of community health and safety to the proposed project development.

Table 8.9 Mitigation Measures of Community Health and Safety

Type of Hazard	Potential Hazard Source/factor of concern	Action Plan - EMP
Water availability and quality	Water Availability - over pumping of groundwater pumping will cause water availability problem	Company to provide access water to the community
	Water Quality - wastewater discharge into the groundwater system	➢ Community to drill bore near the project facility ➢ Proper discharge of wastewater
Structural safety of project infrastructure	Reduction of potential hazards is best accomplished during the design phase when the structural design, layout and site modifications can be adapted more easily	➢ Inclusion of buffer strips or other methods of physical separation around project sites to protect the public from major hazards associated with hazardous materials incidents or process failure, as well as nuisance issues related to noise, odors, or other emissions ➢ Incorporation of siting and safety engineering criteria to prevent failures due to natural risks posed by earthquakes, tsunamis, wind, flooding, landslides and fire ➢ Application of locally regulated or internationally recognized building codes to ensure structures are designed and constructed in accordance with sound architectural and engineering practice, including aspects of fire prevention and response ➢ Engineers and architects responsible for designing and constructing facilities, building, plants and other structures should certify the applicability and appropriateness of the structural criteria employed.
	Follow international best practice in design and construction of the facility and infrastructure	➢ Existing structures ➢ Soils and foundations ➢ Site grading ➢ Structural design ➢ Specific requirements based on intended use and occupancy ➢ Accessibility and means of egress ➢ Types of construction ➢ Roof design and construction ➢ Fire-resistant construction ➢ Flood-resistant construction ➢ Construction materials

		➢ Interior environment ➢ Mechanical, plumbing and electrical systems ➢ Elevators and conveying systems ➢ Fire safety systems ➢ Safeguards during construction ➢ Encroachments into public right-of-way
	Management action to reduce the hazardous material storage	➢ Reducing inventories of hazardous materials through inventory management and process changes to greatly reduce or eliminate the potential off-site consequences of a release Modifying process or storage conditions to reduce the potential consequences of an accidental off Improving shut-down and secondary containment to reduce the amount of material escaping from containment and to reduce the release duration ➢ Reducing the probability that releases will occur through improved site operations and control, and through improvements in maintenance and inspection ➢ Reducing off-site impacts of releases through measures intended to contain explosions and fires, alert the public, provide for evacuation of surrounding areas, establish safety zones around a site, and ensure the provision of emergency medical services to the public codes, local fire department regulations, local legal/insurance requirements, and in accordance with an internationally accepted life and fire safety (L&FS) standard.
	Follow proper compliance with the Life and Fire Safety objectives outlined in these guidelines	➢ Project sponsors' architects and professional consulting engineers should demonstrate that affected buildings meet these life and fire safety objectives. ➢ Life and fire safety systems and equipment should be designed and installed using appropriate prescriptive standards and/or performance based design, and sound engineering practices. ➢ Life and fire safety design criteria for all existing buildings should incorporate all local building codes and fire department regulations.

Life and fire safety	**Fire prevention**: Fire prevention addresses the identification of fire risks and ignition sources, and measures needed to limit fast fire and smoke development.	➢ Fuel load and control of combustibles ➢ Ignition sources ➢ Interior finish flame spread characteristics ➢ Interior finish smoke production characteristics ➢ Human acts, and housekeeping and maintenance
	Means of Egress : Means of egress includes all design measures that facilitate a safe evacuation by residents and/or occupants in case of fire or other emergency,	➢ Clear, unimpeded escape routes ➢ Accessibility to the impaired/handicapped ➢ Marking and signing ➢ Emergency lighting
	Detection and Alarm Systems: These systems encompass all measures, including communication and public address systems needed to detect a fire and alert:	➢ Building staff ➢ Emergency response teams ➢ Occupants ➢ Civil defense
	Compartmentation: Compartmentation involves all measures to prevent or slow the spread of fire and smoke, including	➢ Separations ➢ Fire walls ➢ Floors ➢ Doors ➢ Dampers ➢ Smoke control systems
	Fire Suppression and Control: Fire suppression and control includes all automatic and manual fire protection installations, such as:	➢ Automatic sprinkler systems ➢ Manual portable extinguishers ➢ Fire hose reels
	Emergency Response Plan	An Emergency Response Plan is a set of scenario procedures to assist staff and emergency response teams during real life emergency and training exercises. This chapter of the and Life Safety Master Plan should include an assessment of local fire prevention and suppression capabilities.
	L&FS Master Plan Review and Approval	➢ A suitably qualified professional prepares and submits a Life and Fire Safety (L&FS) Master Plan, including preliminary drawings and specifications, and certifies that the design meets the requirements of these L&FS guidelines. The findings and recommendations of the review are then used to establish the conditions of a Corrective Action

		Plan and a time frame for implementing the changes. ➢ The suitably qualified professional conducts a review as part of the project completion test at the time of life and fire safety systems testing and commissioning, and certifies that construction of these systems has been carried out in accordance with the accepted design. The findings and recommendations of the review are used as the basis for establishing project completion or to establish the conditions of a Pre-Completion Corrective Action Plan and a time frame for implementing the changes. ➢
	Specific Requirements for Existing building	➢ All life and fire safety guideline requirements for new buildings apply to existing buildings programmed for Renovation. A suitably qualified professional conducts a complete life and fire safety review of existing buildings slated for renovation. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes ➢ If it becomes apparent that life and fire safety conditions are deficient in an existing building that is not part of the project or that has not been programmed for renovation, a life and fire safety review of the building may be conducted by a suitably qualified professional. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes.
Traffic safety	Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public	➢ Emphasizing safety aspects among drivers ➢ Improving driving skills and requiring licensing of drivers ➢ Adopting limits for trip duration and arranging driver rosters to avoid overtiredness ➢ Avoiding dangerous routes and times of day to reduce the risk of accidents ➢ Use of speed control devices (governors) on trucks, and remote monitoring of driver actions
	Regular maintenance of vehicles and use	

	of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.	
	Managing future traffic increase in the project area	➢ Minimizing pedestrian interaction with construction vehicles ➢ Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present. Collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns) ➢ Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents ➢ Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimizing external traffic ➢ Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions
Emergency Preparedness and Response	Communication System : Worker notification and communication Alarm bells, visual alarms, or other forms of communication should be used to reliably alert workers to an emergency	➢ Testing warning systems at least annually (fire alarms monthly), and more frequently if required by local regulations, equipment, or other considerations ➢ Installing a back-up system for communications on-site with off-site resources, such as fire departments, in the event that normal communication methods may be inoperable during an emergency
	Communication notification	➢ Audible alarms, such as fire bells or sirens ➢ Fan out telephone call lists ➢ Vehicle mounted speakers ➢ Communicating details of the nature of the emergency ➢ Communicating protection options (evacuation, quarantine) Providing advise on selecting an appropriate protection option
	Media and Agency Relation	➢ A trained, local spokesperson able to interact with relevant stakeholders, and offer guidance to the company for speaking to the

		media, government, and other agencies ➢ Written press releases with accurate information, appropriate level of detail for the emergency, and for which accuracy can be guaranteed
	Fire Service	The company should consider the level of local firefighting capacity and whether equipment is available for use at the facility in the event of a major emergency or natural disaster. If insufficient capacity is available, firefighting capacity should be acquired that may include pumps, water supplies, trucks, and training for personnel.
	Medical Service	The company should provide first aid attendants for the facility as well as medical equipment suitable for the personnel, type of operation, and the degree of treatment likely to be required prior to transportation to hospital
	Availability of Resource	➢ Maintaining a list of external equipment, personnel, facilities, funding, expert knowledge, and materials that may be required to respond to emergencies. The list should include personnel with specialized expertise for spill clean-up, flood control, engineering, water treatment, environmental science, etc., or any of the functions required to adequately respond to the identified emergency ➢ Providing personnel who can readily call up resources, as required ➢ Tracking and managing the costs associated with emergency resources ➢ Considering the quantity, response time, capability, limitations, and cost of these resources, for both site-specific emergencies, and community or regional emergencies ➢ Considering if external resources are unable to provide sufficient capacity during a regional emergency and whether additional resources may need to be maintained on-site
	Mutual Aid	Mutual aid agreements decrease administrative confusion and provide a clear basis for response by mutual aid providers. Where appropriate, mutual aid agreements should be maintained with other organizations to allow for sharing of personnel and specialized equipment.
	Contact List	The company should develop a list of contact information for all internal and external resources and personnel. The list should include the name, description, location, and contact details (telephone, email) for each of the resources, and be maintained annually.

	Training and Updating	
Disease and prevention	Communicable Disease	➢ Providing surveillance and active screening and treatment of workers ➢ Preventing illness among workers in local communities by: • Undertaking health awareness and education initiatives, for example, by implementing an information strategy to reinforce person-to-person counseling addressing systemic factors that can influence individual behavior as well as promoting individual protection, and protecting others from infection, by encouraging condom use • Training health workers in disease treatment • Conducting immunization programs for workers in local communities to improve health and guard against infection • Providing health services ➢ Providing treatment through standard case management in on-site or community health care facilities ➢ Promoting collaboration with local authorities to enhance access of workers families and the community to public health services and promote immunization
	Vector Borne diseases	➢ Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements ➢ Elimination of unusable impounded water ➢ Increase in water velocity in natural and artificial channels ➢ Considering the application of residual insecticide to dormitory walls ➢ Implementation of integrated vector control programs ➢ Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites ➢ Use of chemoprophylaxis drugs by non-immune workers and collaborating with public health officials to help eradicate disease reservoirs ➢ Monitoring and treatment of circulating and migrating populations to prevent disease reservoir spread • Collaboration and exchange of in-kind services with other control programs in the project area to

		maximize beneficial effects ➢ Educating project personnel and area residents on risks, prevention, and available treatment ➢ Monitoring communities during high-risk seasons to detect and treat cases ➢ Distributing appropriate education materials ➢ Following safety guidelines for the storage, transport, and distribution of pesticides to minimize the potential for misuse, spills, and accidental human exposure

8.5 Mitigation Measures during Deactivation Phase

The average lifetime of the plant is 20-years and perhaps after the proposed plant reaches its life time, the facility should be decommissioned or in other cases some major rehabilitation in order to replace the aging industrial equipment. During the decommission and deactivation of the plant, the greatest impacts and mitigation measures would to deal with economic and social loss, as the income to originally received by beneficiaries (company owner, worker, government, society) will stop and this create social impacts that needed to be resolved. Other impacts related decommission activity would be the occupational health and safety hazard, where the EMP is summarized in the following table:

Table 8.10 Impacts and EMP during the decommission plans and Deactivation

Impacts	Source of Impact	Mitigation /EMP
Noise and Vibration	From all the activity to decommission of the facility and equipment	Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are
Solid waste removal	From the office building, equipment, etc.	Proper collection and disposal
Contaminant or hazardous material	From special material such as PCB and the like	Proper handling of the hazardous waste
OHS	All the activity of decommission	Applies all the relevant standard
Loss of job and opportunity	From other related activity and project	➢ Worker to find a new job ➢ Project owner to provide proper compensation based on agreement ➢ Some of the good workers can be transferred to other similar GOTA facility in other countries ➢ Government may find/engage other company to construct similar type of plant ➢ Government may engage other foreign direct investment type of activity
Loss of income from the company and government	No production causes no income and no tax payment	➢ Reform taxation by government ➢ Government top engage other company to build a new plant ➢ Government to engaged other foreign direct investment
Land pollution	From wastewater and solid waste	- Proper land treatment and remediation by GOTA during the decommission of the plant - If not waste that will be discharged into environment , the over time the nature will get recovery -

9. GOVERNING PARAMETERS

As described in the EIS that the major environmental problem during the operation of the proposed beverage processing plant is related directly to the resource utilization, which is water and energy in making production. The utilization of these resources within the production facility will generate wastewater, solid waste (from byproduct and general solid waste), and emission to air, which need to be managed effectively. Other impacts during the pre-construction, during the construction are considered temporary and shall be managed properly onsite effectively by the project owner.

The implementation of occupational health and safety is a required standard based on the international best practice as recommended in the ISO 18001 or IFC standard in 2007 in order to reduce the impacts and achieve the zero incident rate and fatality during each phase of project implementation. The community health and safety is also a concern and standard applicable method as applied in other places were identified and recommended for the adoption.

Nevertheless, governing parameters are used to quantify measurable environmental quality such that changes in environmental conditions can be compared to the baseline and ambient quality threshold. The important environmental baseline parameters that were measured are;

- Groundwater availability and quality
- Marine water quality (multi- parameters including the eutrophication indicator from nutrient content)
- Air quality emission
- Marine ecological indicator

The following standards could be used as threshold value for environmental evaluation.

9.1 Emission

Emission or discharge from the proposed facility to the ambient environment (waterbody, soil, and air) consists of the following:

- Wastewater
- Greenhouse gas emission
- Solid waste
- Noise and vibration
- Air quality parameters

In discussing emission standards, it should be noted that there are no national standards for emission currently in effect in Timor Leste. Therefore, international emission standards from other countries have to be adopted. Several types of emission standards are recommended for the facility as listed in the following table.

Table 9.1. Emission Standards Recommended

No	Element	Source	Recommended Standards
1	Air	➢ Vehicular emission ➢ Emission from dust and particulate matter ➢ Emission from machine that operate within the processing plant	➢ Indonesian Government's Regulation No. 35/MENLH/10/1993 on Upper Limit for Vehicle Emission ➢ IFC standards (2007)
2	Water/wastewater	➢ Water treatment plant (brine) ➢ Wastewater treatment plant ➢ The whole facility	➢ IFC/WHO standards (2007)
3	Noise	Pre-construction, construction and operation	➢ Indonesian Environmental Ministerial Diploma No. 48/MENLH/11/1996 on Noise Level Standards ➢ IFC standard (2007)
4	Vibration	Pre-construction, construction and operation	➢ Indonesian Environmental Ministerial Diploma No. 49/MENLH/11/1996 on Vibration Level Standards ➢ IFC standard (2007)
6	Groundwater drawdown	Groundwater aquifer	No standard but the pumping rate should be less than the sustainable rate

9.2 Ambient Environmental quality

The ambient environmental quality suggested the natural or existing environmental quality prior to receiving the emission from the proposed facility. As the proposed facility will release the emission that will enter the existing ambient environment, the degradation of ambient environmental quality will occur or parameters of the ambient quality will be elevated. The ambient environmental quality standards are normally set to ensure that by receiving loading from the facility will not cause significant change that will make the quality of ambient becomes worse (above the standard) that affect usability of the specific environment. Ambient environmental quality consists of standards relevant to maintain good quality of air, water and soil.

- Marine Ecological quality Standard
- Marine water quality standard
- Natural Environment
- Soil/land

In relation to ambient air quality, project owner and regulatory agencies should measure the ambient air quality at least once a year and compare the results to the baseline survey in absence of the project. Recommended standards for ambient air quality are the Indonesian Government Regulation No. 41/1999. Water body found in the area is coastal water body and the recommended standards for the water quality is Indonesian Ministry of Environment Ministerial Decision (KepMen LH) Kep.51/MENLH/2004.

9.3 Occupational Health and Safety Standard

Recommended Occupational Health and Safety Standards for every project activity during the construction and during the operation should be followed. This includes:

- General construction health and safety standard applicable to general construction and civil work
- Occupational health and safety for industry specific of brewery and beverage processing plant
- Community Health and safety

The standard practice for the above mentioned health and safety standard, as recommended for specific industry:

Table 9.2 Summary of Recommended Standard on OHS

No	Element OHS	Recommended Standards
1	General Occupational Health and Safety Concern	➢ ISO 18001 – Health safety ➢ US Department of Labor – Occupational Safety and Health Administration ➢ GOTA Standard (if any but applies only when it is more stringent than the other international standard) ➢ IFC standard (2007)
2	OHS for Industry Specific for beverage industry	➢ ISO 18001 – Health safety ➢ US Department of Labor – Occupational Safety and Health Administration ➢ GOTA Standard (if any but applies only when it is more stringent than the other international standard) ➢ IFC standard (2007)
3	Community Health and Safety	➢ Indonesian Environmental Ministerial Diploma No. 48/MENLH/11/1996 on Noise Level Standards ➢ IFC standard (2007)

10. MONITORING PROGRAM

Monitoring program is very important to ensure that proper mitigation measures that recommended based on the impacts have implemented throughout the project implementation. The monitoring plan however, needs to define the type of monitoring parameters and indicators use to perform the monitoring system.

10.1 Monitoring parameters and Indicator

As presented in the EIS that potential environmental quality degradation due to the presence of this project is proportional to the resources utilization that will lead to the amount and quality of waste and emission that will be released by the facility. The following list is the important parameters to be monitoring related to the current proposed beverage processing plant in each stage of development.

- Rate of water utilization
- Groundwater pumping rate
- Energy utilization
- Wastewater discharge
- Solid waste
- Air quality
- Water quality
- Incident rate
- Complaint rate (grievance)
- Climate parameters
- OHS standard

The indicator of the above mentioned parameters to be monitored would be important, as benchmark to evaluate what was put into the EMP and what is actually being implemented. Ultimately, this monitoring result is the true value of the release that received by the environment and one can re-evaluate the actual ambient environmental quality. The following table presents the monitoring program of the mentioned parameters during the stages of project implementation.

Table10.1: Frequency of Monitoring Program during the project Implementation

Parameters (Impacts)	Frequency of Monitoring Program			
	Pre-construction	Construction	Operation	Decommissioning/deactivation
Rate of water utilization	Not a main concern, as limited or no utilization	- Installed instrument online to perform the monitoring system - Piping system installation, water treatment system and sensor	- Real time monitoring system in each key points of water consumption - Report to be provided every six months	Minor water utilization
Groundwater pumping rate	- Study and exploration of groundwater availability	- Construction of bore and installation of equipment (pumping, etc.) - Visual monitoring on the daily basis by project owner - Report to be produced during the well/bore construction - Installed sensor to measure groundwater level	- Monitoring of real time (every hour) to measure the rate of pumping and groundwater level dropdown - Report produce every 6 months	- Monitoring the activity of decommission of bore - Handover the bore/well to government if government wish - Report produced after decommission and deactivated
Energy utilization	Feasibility study assessment – no major activity to monitor	- Installation of power system as part of building and facility construction - Monitoring will be conducted on daily basis on the impacts and mitigation measures - Report provides every six months	- Monitoring monthly utilization of energy - Report to be provided to the GOTA management and EDTL	Report to the relevant authority once decommission is finalized.

Wastewater discharge	Design and study so no major impact to be monitored	Minor wastewater discharge from the workers during the construction and onsite treatment will be monitored in daily basis and report to be provided every 6 months	- Automatic sensor is used to monitored various water quality parameters (PH, BOD, COD, etc.) - Monitored hourly - Report every month	Monitored/measured the residual pollutant during the decommission and one six months after decommissioning to know that pollutant level is dropdown and not increasing
Solid waste	Visual monitoring in daily basis – from clearance and grading material.	Every day	Every day and report every 6 months	Every day
Air quality	Visual monitoring in a daily basis and report every once finished pre-construction activity	- Visual monitoring every day and provide report every 6 month - Sample collection every 6 months (from regulatory agency)	- Monitoring real time (hourly) of air quality parameter (CO_2, Methane, SO2, NOx, and PM10) - Sample will be taken by GOTA or regulatory agency within the facility to be measured by independent laboratory once a year	- Continue monitoring every hour during the decommissioning and deactivation process until all the processes have completed - Provide the final decommissioning report on the air quality to GOTA and regulatory/government agencies
Ambient Water quality	- No monitoring required	- Sample collection of the ambient water quality measurement - one time during the construction period	Sample collection and laboratory measurement of various water quality parameters (PH, BOD, COD, NOx, etc.) At least once in 6 months to detect the ambient water quality. The sampling location as	The measurement of ambient water quality will be conducted after the completion of decommissioning of the plant in the original sampling location

			indicated in the EMP is located within the sea/costal area	
Incident rate	- Every day and report if there is any indecent related to the work - Report to the relevant agency and GOTA on the general incident rate during the period of pre-construction	- Every day and report if there is any indecent related to the work - Report to the relevant agency and GOTA on the general incident rate during the period of construction	- Every day and report if there is any indecent related to the work - Report to the relevant agency and GOTA on the general incident rate every six months	- Every day and report if there is any indecent related to the work - Report to the relevant agency and GOTA on the general incident rate after the completion of the decommissioning phase
Complaint rate (grievance)	Monitor and record the number of complaint – every day or month	Monitor and record the number of complaint – every day or month	Monitor and record the number of complaint – every day or month	Monitor and record the number of complaint – every day or month
Climate parameters	Secondary data collection and no monitoring is required	- Monitoring climate parameters (Temperature, rainfall, humidity) every day - Report every six months	- Monitoring climate parameters (Temperature, rainfall, humidity) every day - Report every six months	
OHS standard – Implementation	- Monitored every day - Report to management and relevant agency every year	- Monitored every day - Report to management and relevant agency every year	- Monitored every day - Report to management and relevant agency every year	- Monitored every day - Report to management and relevant agency every year
Community health and Safety	- Monitored every day - Report to management and relevant agency every year	- Monitored every day - Report to management and relevant agency every year	- Monitored every day - Report to management and relevant agency every year	- Monitored every day - Report to management and relevant agency every year

10.1.1 Water Utilization

Water utilization should be monitored in order to provide the data of the rate of water utilization so that improvement can be made in order to reduce the rate of consumption. The overall benchmark of water utilization within the beverage processing plan, as presented in the following figure should be used as guide in the implementation of the various EMP in order to reduce the rate of water consumption within the facility.

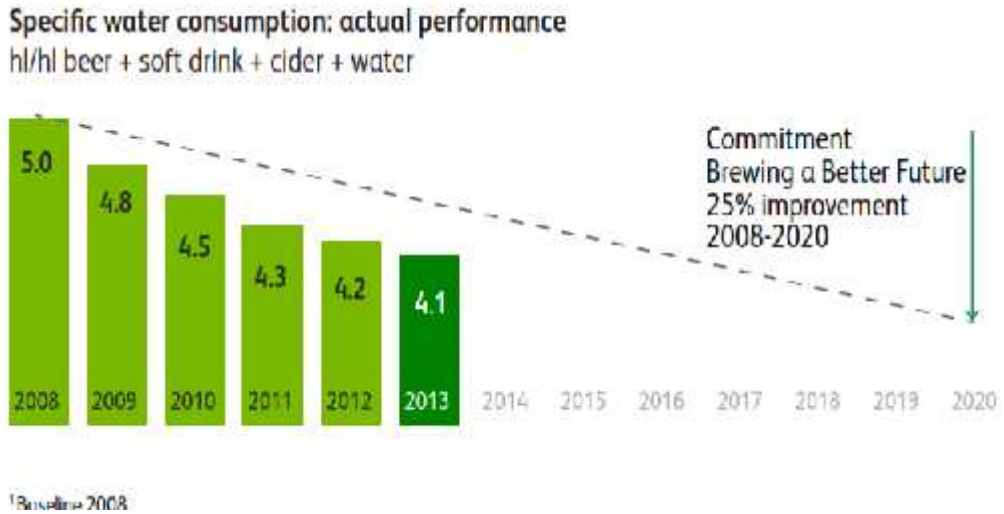


Figure . 10.1 Trend of the water consumption and Target that major Brewing Company would like to achieve

The Benchmark of water consumption within the beverage processing plant is range from 7- 3 liter per liter of beverage. The lesser the consumption rate, the better off the company in term of cost saving and less environmental impacts.

10.1.2 Energy Utilization

The benchmark of energy utilization, as presented in the following table can be used as guideline in monitoring the implementation of the EMP of energy conservation.

Table 10. 2: Benchmark of Energy Utilization within the Processing Plant

Outputs per Unit of Product	Unit	Benchmark
Energy ▫		
Heat	MJ/hl	85–120
Electricity	kWh/hl	7.5–11.5
Total Energy	MJ/hl	100-160
Water ▫		
Water consumption	hl/hl beer	4 - 7
Notes: ▫ Input and Output Figures for Large German Breweries (capacity over 1 million hl beer) EC (2006)		

The energy conservation action plan, as provide in the EMP, should be implemented and internal energy audit should be performed in order to provide overall data on the energy consumption within the facility. The data collection is then compared within the benchmark value so see where is the existing condition and how much improvement should be done in order to achieve the target.

10.1.3 Waste Generation

The waste generated is one of the environmental problem that cannot be avoided and can only be minimized and or offset. The benchmark in the following table should be used as guideline in the monitoring of the overall waste rate that generated in the processing of production. This benchmark has not include the domestic waste and other waste from packaging or unpacked of the raw material that associate with the process.
Table 10.3 Benchmark of Waste generated

Outputs per Unit of Product	Unit	Benchmark
By-products [a]		
Spent Grains	kg/hl beer	16-19
Yeast & Lees		1.7 - 2.9
Kieselguhr		0.4 – 0.7
Liquid Wastes		
Liquid Effluents	hl/hl beer	3 – 6
Beer Loss	%	1 - 5
Notes: [a] Input and Output Figures for Large German Breweries (capacity over 1 million hl beer) EC (2006		

The inventory and monitoring of waste production should be compared with this indicator and evaluation should be made in order to come up with the proposed improvement in the implementation of EMP if the overall waste production is way beyond the above benchmark.

10.1.4 Wastewater

The wastewater associate with beverage processing plant is roughly 50% of the total freshwater that used in the facility. If the monitoring of wastewater effluent rate is around 50% of the monitored freshwater rate, then it is considered acceptable. The quality of effluent on the other should be judged against the following table. That means that a wastewater stream within the facility that does not meet the following benchmark value must go to the treatment process prior to discharging to the natural environment.

Table 10.4 Wastewater Effluent Standard Guidelines

Pollutants	Units	Guideline Value
pH	pH	6 – 9
BOD_5	mg/l	25
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Temperature increase	°C	<3[b]
Total coliform bacteria	MPN[a] / 100 ml	400
Active Ingredients / Antibiotics	To be determined on a case specific basis	

Notes:
[a] MPN = Most Probable Number
[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity

10.1.5 Groundwater Pumping and drawdown

The groundwater level monitoring and rate of pumping is not regulated. However, the benchmark should be based on the aquifer sustainability and freshwater utilization. The freshwater rate of utilization according the proposed plant is equivalent to 200 L/minutes. It remains unclear if the pumping rate of this capacity will cause aquifer sustainability problem. The monitoring of pumping test suggested that the pumping rate of 240 L/minute caused the drawdown in the aquifer of roughly 60 cm. To be conservative, the benchmark should be established based on this testing value. However given the estimation that the consumption rate would only take less than 7% of the total annual recharge rate from rainfall, at this point the rate of utilization is in relatively safe side.

Table 10.5 . Pumping test result on drawdown and future expected capacity

Pumping Rate, L/Min	Average drawdown, m
210	0.2 – 0.6

Real time monitoring of the groundwater utilization would be needed in order to provide an information of the trend of utilization and water availability in the groundwater aquifer.

10.1.6 OHS Indicator

The health and safety indicators should also be cleared in order to provide a guidance during the implementation. The following table was adopted from GOTA target and best practice has always the put the safety as the main concern above everything else in their daily operation of the plant.

Table 10.6 Key Parameters Indicator of OSH

Safety parameters and indicators

Parameters	1. Fatal accidents	Fatalities, own staff and contractor personnel
	2. Accidents resulting in permanent disability	Permanent disabilities, own staff
	3. Accidents resulting in absence from work	Accidents, own staff and contractor personnel
	4. Lost days	Absence due to an accident, own staff in calendar days
	5. Workforce	Expressed in Full-Time Equivalents (FTE)
Performance indicators	1. Accident frequency	Own staff, number of accidents resulting in absence from work per 100 FTE
	2. Accident severity	Own staff, lost days from work per 100 FTE

The level success of the implementation will always be judged against the performance indicator and this will provide guidance on the improvement required.

10.2 Monitoring Frequency

Certain environmental parameters are sensitive and perhaps required a real time monitoring program as any event in very short time may cause catastrophic consequence. For instance, PH monitoring program, if for whatever reason, a problem in the PH equalization process, the release of wastewater with very low PH to the marine water body in only 1 hour, could affect locally the marine ecosystem significantly.The following table shows, the monitoring program, and proposed frequency for various environmental parameters and OSH.

Table 10.7 . Environmental Monitoring parameters and Frequency

No	Parameters	Frequency
1	Pumping rate	real time
2	Water consumption within facility	real time
3	PH	real time
4	BOD/COD/TSS	real time
5	Groundwater drawdown	real time
6	solid waset collection	daily

Table 9.7. OHS Monitoring parameters and Frequency

No	Parameters	Frequency
1	OHS	Daily
2	Comunitty healrth and safety	monthly

10.3 Monitoring Location

Monitoring location in general should be inside the facility, especially related to the process within the streamline. The following table shows the overall proposed monitoring locations and parameters.

Table10.8 . Monitoring Location of the Environmental Parameter and OHS

Parameters	Location
OHS	Within the affected area
wastewater	wastewater treatment plant (pipe), treatment plant, and discharge point of entry to ambient
Water uses	Online (pipe)
Energy	Throughout the process, electricity
Solid waste	solid waste collection and measurement
CO_2	Fermentation tank and CO_2 tank
Methane	an aerobic process
Climate change	Sea level monitoring
Air quality	Within the project location
water quality	Feed to water treatment plant and entry point into processing (beer and beverage)

10.4 Response of Monitoring Data

The monitoring data is very important that provide useful information in order to improve the efficiency that will lead to cost saving and minimum environmental impacts.The following figure illustrate on the use of data in supporting a decision making process.

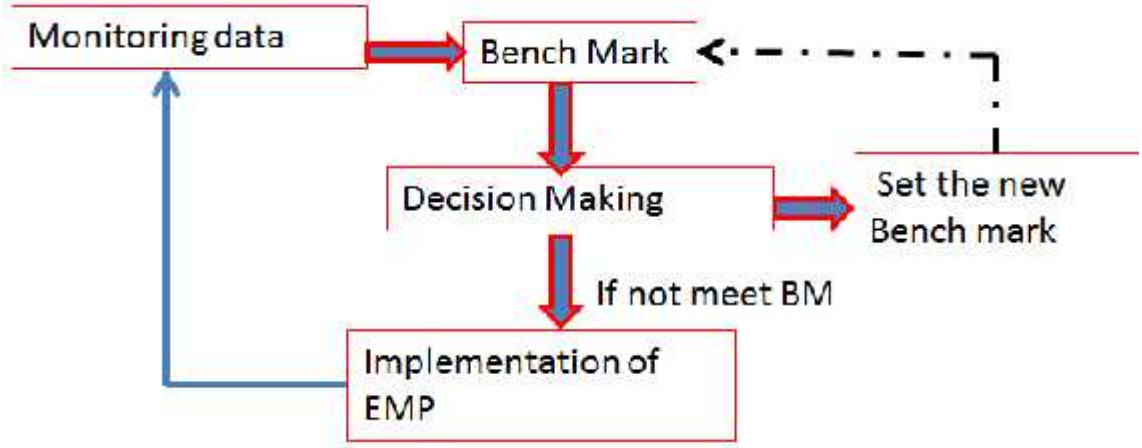


Figure 10.2 Process flow diagram on responding the Monitoring data

Monitoring data will be compared with the benchmark value of the performance indicator. The decision will be made on the action to improve the implementation of EMP or set the new benchmark. If the monitoring data indicated that the performance indicator is less than the benchmark, the improvement in the EMP implementation would be necessary. On the other hand, if the performance is within the benchmark, then new BM should be established.

11. REPORTING REQUIREMENTS

All the monitoring activities should be coordinated with relevant government agency to ensure that the parameters being collected meet regulatory requirement in place for that particular set of parameters. After data have been collected, they should be submitted to relevant authority as previously noted in the above tables.
At a minimum, the reporting should cover:

- Internal monitoring and inspection
- Incident, accident and emergency reporting
- Performance indicators and any follow up actions needed
- Wastewater treatment report (quality of untreated and treated effluent)
- Groundwater utilization report (pumping and monitoring within the facility)
- Training programs

The types of report, including formatting and reporting frequency should be coordinated with relevant authority. Per DNPCEI's rules, however, the environmental license of the project is only valid for one year and should be renewed every year by reporting on an updated EMP. Therefore, at a minimum, once a year reporting should be required. The following table presents the reporting requirement, frequency and agency that will review the report.

Table 11.1 Frequency Reporting Requirement

No	Type of Report	Frequency Monitoring and Report	Agency Responsible
1	Rate of water utilization	Online (sensor online of piping system) - Report should be done every month to be able to audit the water consumption	1. GOTA management 2. Ministry of Public Works (DNSA – water supply)
2	Groundwater pumping rate	Every Month – to be able to provide data on rate of groundwater pumping	1. GOTA management 2. Directorate National of water quality and control (DNCQA)
3	Energy utilization	Every Month – there data collection can be real time	1. GOTA management – for energy auditing purpose 2. EDTL
4	Wastewater discharge	Report should be done at least every 6 months but the data can be collected every day	1. GOTA management 2. Ministry of Health 3. Ministry of Public Works (Directorate National of Basic Sanitation)
5	Solid waste	Monthly report and annual report but the data collection would be conducted on the daily basis	- GOTA management - Dili district administration
6	Air quality	Every six month – the measurement and monitoring will	1. GOTA

		conducted at least once in six month	2. DNCPEI 3. MOH
7	Ambient Water quality	Report should be submitted every six month to DNCPEI	1. GOTA 2. DNCPEI
8	Incident rate	Every six month with monitoring every day	1. GOTA 2. MoH 3. SEPFOPE
9	Complaint rate (grievance)	Every six month	GOTA and committee
10	Climate parameters	Every year	
11	OHS standard	Every six month but monitoring in a daily basis	1. GOTA's management 2. MoH 3. SEPFOPE 4. Local police department
12	Community health and Safety	Every six month	1. GOTA 2. MoH

12. RESPONSIBILITIES FOR MITIGATION AND MONITORING

As previously noted in Section 3.2 Relevant Institutional Aspects, the following agencies within the government (Table 11.1) are responsible for environmental, social and economic safeguarding from impacts generated by the project.

Table 12.1 Relevant Institutions and Their Responsibilities

No	Responsibility	Relevant Institutes
1	Environment and Nature Protection (Terrestrial)	State Secretary of the Environment
		State Secretary of Forestry and Natural Protection
2	Marine and Coastal Environment	State Secretary for Fisheries and Aquaculture
3	Industrial standard, food and beverage.	Ministry of Commerce, Industry, and Environment
4	Public and Worker's Health and Safety	Ministry of Health
5	Fire hazard and emergency action	National Directorate for Civil Protection
6	Labor and related problem	State Secretary for Labor Protection and Training (SEPFOPE)
7	Wastewater quality control and standard	Ministry of Public Works and Communication – Directorate of Basis Sanitation program
8	Groundwater Monitoring program	Ministry of Public Works and Communication – Directorate of water quality control system

Coordination between project proponent and these institutions should happen right from the preparation of the project, site preparation, construction and operation and maintenance phase.

1. Project Preparation

During project preparation, design for the facility is being drawn. Project proponent should coordinate with several institutions for several purposes related to their competency. The institutions and coordination purpose are:

- EDTL should be consulted on the total power requirement that the company will be used during the operation of the plant
- DNPCEI for classification of environmental licensing requirements, preparation of environmental licensing.
- Civil Protection (Fire Fighter): to adjust fire protection layout and design to requirements set out by Civil Protection.

2. Site Preparation
   - DNPCEI: to report mitigation and monitoring measures in place for mitigation of environmental impacts during Site Preparation. To report on the results of mitigation and monitoring measures. Coordinate for inspection.

3. Construction
   - DNPCEI: to report mitigation and monitoring measures in place for mitigation of environmental impacts during Construction. To report on the results of mitigation and monitoring measures. Coordinate for inspection during construction.
   - The project owner to report on the construction of requirements relevant to protection and safeguarding of the facility, the operation and workers in the facility to the Ministry of Public Works. Report on the training arrangement for future staff of the facility will an internal policy of GOTA
   - Civil Protection: to report on the construction of fire protection apparatus as required by previous consultation.

4. Operation and Maintenance
   - DNPCEI: to report mitigation and monitoring measures in place for mitigation of environmental impacts during Operation and Maintenance. To coordinate on evaluating the effectiveness of previous mitigation measures implemented during Site Preparation and Construction phases. Effective mitigation measures should be continued while those that are not effective should be adjusted. To coordinate for inspection during Operation and Maintenance.
   - DNCQA (Ministry of Public Works) to monitor the groundwater pumping within the project facility and the company to report the water utilization rate regularly to DNCQA.
   - Civil Protection: in coordination with ANP, conduct initial testing of firefighting equipment, implement fire drill and coordinate on evaluation of emergency preparedness and evacuation plans.
   - SEPFOPE: coordinate on workers' health and safety issue including the need to wear workplace protection and the kind of workplace protection needs to be provided for this type of work. Also coordinate on contract preparation and other labor-related issues.

MSS, MOP, Civil Protection, and SEPFOPE: as a large complex industrial facility could have a risk of significant industrial accident to occur in the complex. Therefore, an large scale emergency preparedness plan should be prepared

5. Decommissioning Phase
   - GOTA may propose to convert the facility into other venue of business as the company own privately the land
   - DNPCEI to report mitigation and monitoring measures in place for mitigation of environmental impacts during the decommissioning phase. To coordinate on evaluating the effectiveness of previous mitigation measures implemented during deactivation.

Effective mitigation measures should be continued while those that are not effective should be adjusted. To coordinate for inspection during decommissioning process.

- SEPFOPE: coordinate on workers' that already unemployed and actively coordinate with other agencies to help issue. In addition to this role, the SEPFOE to also ensure that proper unemployed compensation will be given by GOTA to worker
- MSS to provide certain assistance to the worker who are affected by the closing of the project activity
- Government (Council of Ministry) to engage other foreign direct investment to take over the facility and make other investment

13. EMERGENCY PLAN

Emergency plan is an action plan to respond/ to be taken in case an emergency event. Emergency is not controllable but the hazard can be minimized. Very common emergency event that may occur consist of emergency due to fire, emergency of weather related, emergency related to pollution control. Emergency action plan for the beverage processing should include:

- Beverage emergency escape procedures and mapped routes
- Critical Operation for employees to follow prior to evacuation
- Procedure top account for all employees after evacuation
- Rescue and medical duties
- Procedure for reporting fire and other emergency

The company will provide the detail of the emergency plan and procedure of evacuation in case an emergency. The very common emergency situation that the company will likely encounter are:

- Emergency due to fire
- Emergency due to natural event such as flooding and severe weather condition
- Emergency due to social unrest

The emergency plan and mitigation measures for each type of emergency will be provided by GOTA as their company's policy in order to protect the sustainability of the business. For the large emergency, the company will purchase the insurance to cover and minimize the emergency damaged.

14. DECOMMISSIONING PLAN

No decommissioning plan has been specifically developed for the facility, as the project is being planned for long term operation and further expansion in the future. Therefore, decommissioning is only possible in the face of a force majeure for example, a natural disaster or severe impacts from the operation occurred leading to a significant damage to the facility. A large and extensive accident may also change the perception on the viability of a large facility like that in the location. Should this happened, a decommissioning plan should be developed by the operator/project proponent.

The decommissioning plan should be conducted in phases taking into consideration removal and disposal of material as well as potential for reuse, reduce and recycle of unused material. Such demolition plan should also incorporate measures to bring back conditions of the area at least close to the original state. Prior to the decommissioning of the facility the following plans should be carried out and executed:

- Estimate the value of the facility to know if third part can come and take over the business without decommissioning
- Inventories all the assets and identification of the quality to know which assessed to the demolished
- Provide the time plan for the execution or decommissioning the site

The major impacts during the decommissioning activity are primarily related to the OHS issue due to physical activities which should be managed properly in similar manner as during the construction period.

Other social and economic impacts as such loss employment and review should be managed prudently by the project owner to the workers by implementing proper compensation or sent them to any other industry that can absorb workers.

15. CAPACITY DEVELOPMENT AND TRAINING

GOTA is an international company with the high commitment of sustainability in doing the business and one of the important factors to enhance the concept of sustainability is the development of local engagement through various programs. The first step toward achieving this objective is to train the operators of the beverage plant from local Timorese in several similar plants in Indonesia.

1. Training of local operator

Currently, GOTA has water production facility, where most employees have already experience various training in operating the system production. GOTA will continue to train the operator of brewing and soft drink making to several suitable related industry in Indonesia to train operator prior to the opening of beer and soft drink production.

2. Training of Laboratory

Laboratory equipment and instrumentation are very important and integral part of the processing to ensure the quality of beverage production and quality of wastewater treatment and control system. The instrumentation and laboratory will need to be built first and staff at the laboratory will be required to be trained. The best approach to conduct the training program is to send the designated people/operators to the laboratory of GOTA in other places such as in Indonesia before the laboratory will be constructed. The experience technician will supervise the new laboratory in Timor Leste for certain period of time to ensure the local capacity is already met the work requirement.

3. Training of Hazardous and Safety Standard

Training of the hazardous material and safety standard is a requirement for all the workers who perform a specific work under certain hazardous condition. The occupational health and safety will require short term training in order to make all the workers be informed on the occupational health and safety standard to be followed. This type of training will also be required for the visitor to at least be informed before entering the facility and utilized proper self-protection equipment.

4. Training od environmental monitoring program

GOTA staff who will be involved in monitoring the EMP would also require training program, in the basic environmental issue and method of monitoring program. The objective is to get familiar of the parameters of the environmental monitoring program that will help him/her in the implementation.

5. Wastewater treatment plant operators training

The wastewater operators will also be required to be trained, particularly in knowing the danger of chemical and hazardous material involved. The control system and instrumentations will also be requiring great understanding of the knowledge of the wastewater treatment process. This type of training a long-term and continues training effort. With all the above training program, GOTA, is committed to build the local capacity, which ultimately build the local ownership to help more on the economics of Timor Leste.

16. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

Public and community consultation are important part of the environmental licensing process according to Decree law no. 5/2011 on environmental licensing in Timor Leste to ensure the transparency and accountability of the environmental impacts assessment process. The purpose of the consultation is to inform the public and community on the development of the project, so that public stakeholders and the community are aware of the upcoming activities and can provide input as well as help to monitor impacts to the environment and the community.

Particularly, the relevant public agencies will familiar and understand the nature of the project and potential impacts that may arise and related to their roles and responsibility. The awareness of the impacts are very important not only at the institutional level, but also at the individual level, and by sharing the proposed scoping study and potential result, the personnel involve will elevate his/her capacity of understanding the nature of the proposed industry and associate impacts that may arise during each stages of the project implementation. This knowledge built-up will eventually help the relevant agency to conduct better monitoring and evaluation after project is operating in many years.

On the other local community, that may be affected directly must be also informed and consulted. In addition to share knowledge information, as like the public consultation, the community consultation will inform the member of the community on the negative and positive impacts that they may encounter as a consequences of the proposed development in their location. The public and community consultation by nature also has an objective to negotiate and solve any issue that may be a concern during the project implementation, such as land title, water uses, and any other government plans related to the proposed project.

Take into consideration of the objectives and target agencies and community, the public and community consultation process, as part of this proposed EIA study will be conducted as followed:

1. The meeting of project proponent with the high level of government on the proposed investment project, local leader of municipio, and other relevant line ministries such as Ministry of Commerce, Industry, and Environment (MCIA).
2. Follow up this meeting with more technical level in the field to resolve any issue related to the project site
3. Consultation to the local and community leader on the proposed project
4. Consultation to government agencies on the proposed scoping study of the environmental impacts assessment
5. Consultation to government agencies on the result/finding of study of the environmental impacts assessment
6. Focus group discussion with the local community affected directly by the proposed project

The consultation and engagement are type of communication between the project owners, the public entity and community members on every step of the development. The EIS process is also one step, which required to be consulted with the relevant stakeholder and community. Relevant

stakeholders to the development consist of government agencies, private sector and Non-Governmental Organizations (NGOs) especially those that are actively involved in environmental programs. A list of stakeholders has been prepared as follows:

- National Directorate for Environment
- National Directorate for Biodiversity Protection
- National Directorate for Road, Bridges and Flood Control
- National Directorate for Fisheries and Aquaculture
- Chefi de Suco of Ulmera
- Chefi de Aldeia in nine areas
- National Directorate for Civil Protection
- NGOs

To ensure a transparent EIS development process as well as on-going consultation with relevant stakeholders and affected community, this EIS formulation process will take several necessary steps as follows:

- Conduct of stakeholder workshop – the first stakeholder workshop with the purpose of discussing draft Terms of Reference has been conducted. The workshop generated meaningful input and suggestions from stakeholders to the scope of environmental impacts assessment. These input and suggestion will be incorporated in the development of draft EIS and any necessary field measurement.
- One-on-one consultation will be conducted for the formulation of the EIS after the stakeholder workshop
- Community consultation in Ulmera to discuss the concern from the community and informed the potential impacts to the environment.
- Upon completion, draft EIS will be made available for public comments and input. Draft EIS has also being presented to the relevant line ministries of the Government of Timor Leste.

16.1 Stakeholder Engagement for Environmental Scoping Study

The first stakeholder consultation was conducted on June 14, 2017 to consult the scope of study of environmental impacts statement (EIS). The invited government agencies and NOGs took part in the stakeholder meeting in providing their opinion on the scope of the study the proposed by the consultant on behalf of the project owner. The following photos show the situational of the stakeholder workshop meeting of the TOR.

Figure 16.1 Photos of Workshop of Stakeholder Engagement Meeting of TOR in Hotel Dcity

Several important points of discussions made during the session of question and answer of the workshop was summarized as followed:

10. Water pumping from the groundwater system that includes the sustainability, public access to the clean water, and mechanism of monitor groundwater utilization.
11. Effect of stream flow (flooding) to the nature of the project, given the location of the project within the proximity of the small creek
12. System transportation of raw material and product from /to the facility
13. The scale and size of the project and categorization
14. Wastewater and mechanism of the wastewater handling
15. Land title and the impact of the project to the community and monitoring of the quality (product and wastewater) should be informed other relevant government agency such as SAS and Ministry of Health
16. The impact of above groundwater activity to the underground system such as groundwater
17. The distance of the project location to the nearest community
18. Recommendation of the treatment of the wastewater

The question and suggestion were clarified and answered by both consultant and representative from GOTA. The groundwater pumping test has been conducted to provide an overall idea of the groundwater sustainability in relation to the pumping rate of water supply for the processing plant. Hydrologic modeling could be optionally conducted as part of the study to understand the river flow (during the heavy rainy season) and impacts to the existence of the project. The project owner will construct the retaining wall within the creek to prevent the high water flow coming into the facility.

As become standard practice, in other places, that wastewater will be treated with the technological approach prior to discharging the effluent into the receiving environment (creek or marine water body). The combination of biological, physical, and chemical treatment processes will be used to treat the wastewater from the factory. Detail will be provided in the EIS and EMP. Regarding the project implementation, it is very important to control and monitor the project by both government as regulatory agencies on one hand and GOTA on the other to ensure that all the plan written in the EMP (Environmental Management Plan) will be implemented effectively. GOTA has very strong commitment to safety and environment and all the processing units, including the wastewater treatment plant will be controlled and monitoring worldwide to ensure that all standard and best practice has been properly complied. The company applied the KPI (key Performance Indicator) at each processing plant around the world to ensure that anywhere the processing will used the same standard of operating system, same standard of wastewater treatment, same standard of safety..

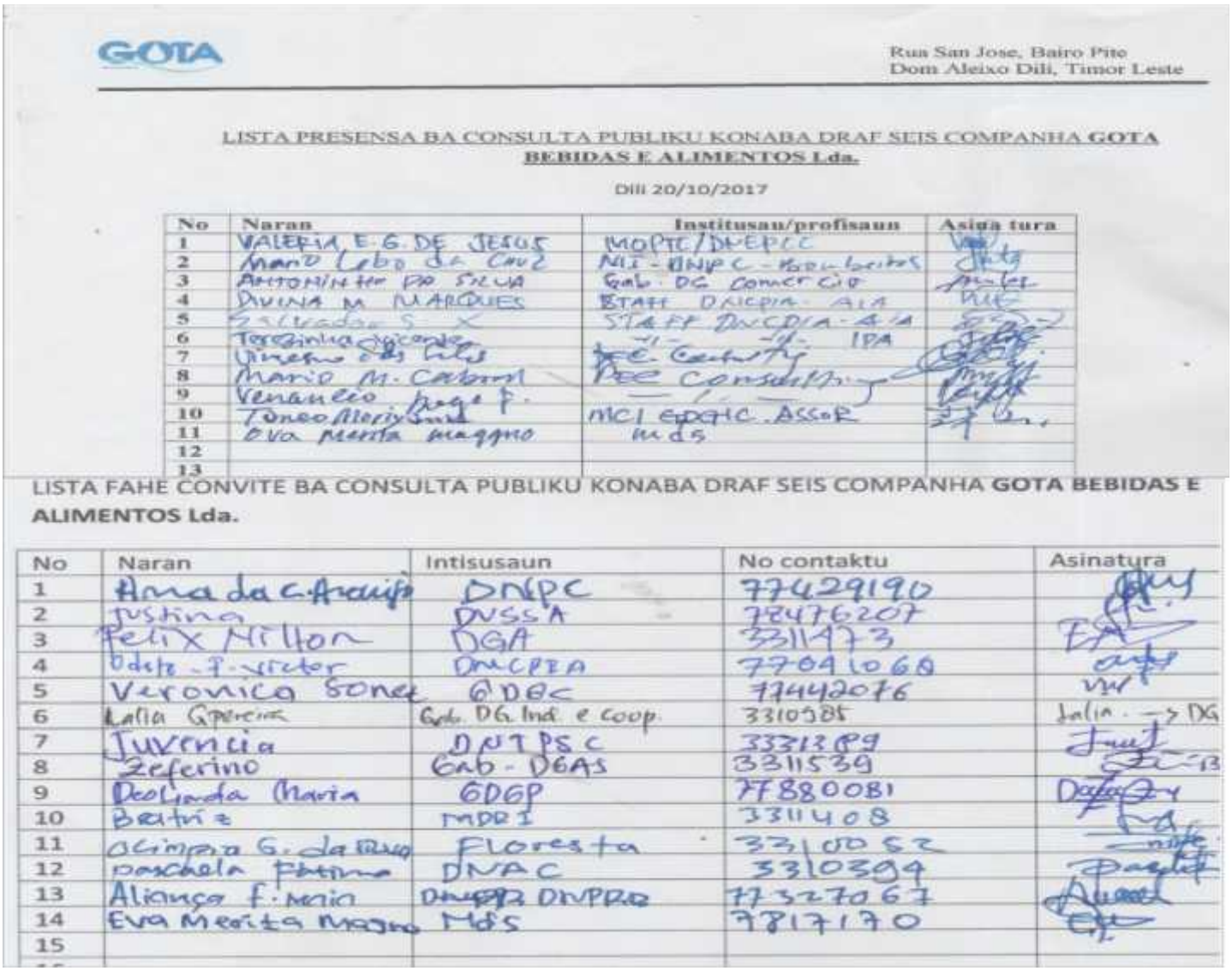
16.2 Stakeholder Engagement on Results of EIA

The second stakeholder engagement meeting as part of the environmental impact assessment study was conducted on October 20, 2017. The objective of the meeting was to present and share the findings of the EIA to relevant stakeholder or agencies where the impacts will affect their daily activity. The following agencies were invited and actively participated in the discussion on potential impacts and mitigation measures proposed in order to enhance implementation the EIS.

Table 16.1. List of Relevant Stakeholder Attended the meeting

Agency	Relevancy to Project
GOTA	Project Owner, who should know very well the impacts and mitigation measures
National Directorate of Water and Sanitation (DGAS)	Related to the water utilization and sanitation issue relate to the development project
National Directorate of Road and Flood Control	National road of Dili – Liquica and other rural roads that will be improved to support the private investment program.

National Directorate of pollution control and Environmental Impacts Assessment	Environmental Licensing
National Directorate of Industry and Commercial	Industrial development, as the proposed development is a type of industry
NGO	Non-government that has a concern in development and environmental
EDTL	Power consumption of GOTA is substantial and potentially can be fulfilled from power plant operated by EDTL
National Directorate of Forestry	Land clearance may take a way forest and required de-forestation
Directorate National of Fisheries	Marine fisheries will be affected by the project from the pollutant loading



GOTA

Rua San Jose, Bairo Pite
Dom Aleixo Dili, Timor Leste

LISTA PRESENSA BA CONSULTA PUBLIKU KONABA DRAF SEIS COMPANHA **GOTA BEBIDAS E ALIMENTOS Lda.**

Dili 20/10/2017

No	Naran	Institusaun/profisaun	Asina tura
1	VALERIA E. G. DE JESUS	MOPTC/DNEPTC	
2	Mario Lobo da Cruz	MJ - DNPC - Registos	
3	ANTONINHO DA SILVA	Gab. DG Comercio	
4	DIVINA M MARQUES	STAFF DAICPIA - AIA	
5	Salvador S. X	STAFF DNCDIA-AIA	
6	Terezinha Dacosta	IPA	
7	Vimeno dos Reis		
8	Mario M. Carvalho	PEC Consultoria	
9	Venancio Jorge F.		
10	Tomeo Alexio	MCI EDPTIC. ASSOR	
11	Eva Merita Magno	MdS	
12			
13			

LISTA FAHE CONVITE BA CONSULTA PUBLIKU KONABA DRAF SEIS COMPANHA **GOTA BEBIDAS E ALIMENTOS Lda.**

No	Naran	Intisusaun	No contaktu	Asinatura
1	Amadeo C. Araujo	DNSPC	77429190	
2	Justina	DNSSA	77476207	
3	Felix Nilton	DGA	3311473	
4	Odete F. Victor	DNCPIA	77041060	
5	Veronica Sonet	GDBC	77442076	
6	Lalia Gpereira	Gab. DG Ind. e coop.	3310385	Lalia -> DG
7	Juvencia	DNTPSC	3331389	
8	Zeferino	Gab - DGAS	3311539	
9	Deolinda Maria	GDGP	77880081	
10	Beatriz	MDRI	3311408	
11	Acimara G. da Silva	Floresta	33100552	
12	Pascoela Fatima	DNAC	3310394	
13	Alianca F. Maia	DNPPR DNPPR	77327067	
14	Eva Merita Magno	MdS	77817170	
15				

Figure. 16.2 List Agencies Invited and Attendances of the Public Consultation on October 20, 2017

Figure 16.3 Public Consultation Meeting to socialize the Finding of EIA study

The meeting took a place in Hotel Vila Verde, where the 8 agencies were sent each representative to the presentation and raise various question related to the project development and impacts to the environment. Particularly, the following issues and concerns were discussed related to the draft of Environmental Impacts Statement (EIS) that was presented. The following are the summary of concerns and issues raised:

- Emergency management system
- Design of drainage system that convey the treated wastewater
- Groundwater pumping test data and groundwater sustainable yield estimation
- The quantity of solid waste and management of solid waste system
- How this proposed brewing system will compete the GOTA brewing plant in Hera

The following table summarized the comment/questions raised during the stakeholder consultation meeting.

Table 16.2 Comment/Question and Response during the Meeting

Representative/Agency	Comment/Question	Response
Sr Mario Lobo da Cruz, Bombeiros, Timor Leste	1. How is the design of the drainage system that convey the treated wastewater to the sea 2. could the company provide the layout of the emergency plan to Bombeiros	PEC – Consulting, expressed that the design and construction system will be part of the project, with the facility and the impr natural – open drainage system. The project owner will provide the layout of emergency Bombeiros, further the realization of the construction
Sra. Devina M. Marque Devina M. Marques, DNCPIA	1. Advise to provide the information of the soil test, pumping test data, and other standard safety and environment in the EMP document 2. Required also to provide the groundwater modeling to know the sustainable yield of the groundwater aquifer	1. PEC – Consulting, LDA, that provide the consultancy service already all the necessary basic data such as groundwater pumpi and water quality, as well as air quality, which are used to prep EMP 2. The sustainable yield will be estimated has been conducted and be provided in the EIS and EMP document
Sr. Salvador, DNCPIA	1. Solid waste with the capacity of 5000 ton/year is large and required proper management system 2. How is the treated wastewater discharge to the environment	The solid waste will be managed through 3R (reused, recycle, a 1. Solid waste that can be used will be reused 2. Some solid waste such as can, plastic, can be recycle 3. Composting for soil/land improvement 4. The wastewater will be treated prior to discharge into environment
Sr. Tanco Moryond, advisor to MCI	How this proposed development will compete with GOTA brewing in Hera	The beer that will be produced from this factory is the one tha quality. While other soft drink will be slightly different from GOTA.

16.3 Community Engagement Meeting (Focus Group Discussion)

Local community consultation and engagement is very important and required by law of environmental license to know the concern and any input from the local community regarding the proposed development project. The purpose of the community consultation is to inform to the local community, local leaders, land owner, and community who live nearby the proposed project. Moreover, the community and local leaders will also have a formal opportunity to raise any concern or suggestion in relation to the project development. The meeting was held on August 26, 2017 from 9:00 AM to 12:00 PM local time and attended by local leader (chief of Suco, and leader of 9 aldeais, with all the representatives), local police offices, community's members, mean and women that considered as vulnerable but affected by the current proposed development. The local communities were very active and happy to know that the presence of the beverage processing plant in their community. The total participation of this consultation is equal to 75 people, including the consultant and representative from GOTA.

Figure 16.4 Photos of community meeting

During the community meeting in Ulmera, the members of the community raise a lot of concern and expectation related the project.

- Road access

The community member, raised road access that connect the main road to the project location, which is too narrow that cannot accommodate the larger vehicular that will deploy the construction material and others.

- Water issue

Currently, the community access water from spring water in the upland catchment system, where the volume of water declined significantly during the dry season. Therefore the community members and leaders of Suco and respective aldeais have asked the project owner, to potentially help their water issue.

- Job employment issue

The community members, include the chief of Suco and aldeais, proposed to project owner to give the first priority in job opportunity that available due to presence of the beverage processing plant. The project proponent should contact the local chief (Suco, Aldeia, and youth group) to find out the potential worker from the community to be part of the beverage processing plant.

- Impact of solid waste

The community members also concerned the issue of solid waste and declared GOTA to have proper solid waste management. The Environmental Impact Assessment team responded that the mitigation measures of solid waste has been proposed to reduced, reused, recycle, and dispose the solid waste that will be generated within the proposed facility.

- Wastewater to the mangrove, coral, and fisheries

The marine water and coastal ecosystem is valuable resources to the community and they are concerned with the wastewater that contains various chemicals that will affect the ecosystem. It was responded that the best available technology will be used to treat the wastewater prior to discharge into the multi-disposal pipes into the soil. The soil will retention as much treated effluent as possible, except during the rainy seasons, where the runoff will convey the diluted treated waste water into the marine ecosystem.

- Impact of dust

Community also raised issue of dust and air quality, especially during the construction activity.

- Environmental Impacts from groundwater Utilization

The local community was also raised the question related to the potential environmental problem, as a result of groundwater utilization.

The above issues were addressed by the project owner, as well as from the consultant team members of the environmental impact assessment. The response to the above mentioned issue and concern can be summarized as followed:

- The project owner is so happy to learn the active participation of the community members in the discussion of the issue and will be happy to discuss with community regarding what can be done by the project owner, which in-line with the social corporate reasonability of the company to give back to the community. According the representative from project owner, GOTA, as local company has always put more priority in the engagement of local worker, community, and local leader.

- Water issue can be solved later during the project implementation and the decision maker in GOTA will decide the help to the community in relation to the water need within the project location.

- The project owner, agrees that all the recruitment will become the local leader and trying to find the workers locally first prior to engaging outside

The following table show the question and concern from the community and response to the issue from project owner and respective consultant team.

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17. GRIEVANCE REDRESS MECHANISM

17.1 The Purpose for Grievance Redress Mechanism

GOTA, as the project owner, will establish a grievance redress mechanism (GRM) during the project implementation to facilitate resolution of complaints by affected people and grievances about the project's environmental performance, in line with the requirement of SPS. The GRM will be facilitated directly by the project manager of GOTA to the main contractor and all relevant sub-contractors during the pre- and construction and during construction period to maintain the grievance registry or record. The registration of the grievance during the operation will be facilitated by the Health, Safety, and Environmental (HSE) units of GOTA in Timor Leste, to all the employees of GOTA and management within the facility

The public and community will be made aware of the relevant contact numbers and contact person in GOTA operation and each contractor through media publicity, notice boards at the construction sites, and local authority offices. The public will be made aware that the contractors and GOTA has an open door policy and that the complainant can remain anonymous if requested. The GRM will address affected people's concerns and complaints promptly, using an understandable and transparent process based on traditional methods for resolving conflicts and complaints. The GRM shall provide a framework for resolving complaints at the project level as well as beyond the project (that is, involving relevant government offices such as District and Suco committees, NDPCEI, etc.), using the existing judicial or administrative remedies. The GRM will be detailed in the EMP report.

The GRM to be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints and grievances about the social and environmental performance at the level of the project. The office of project owner will maintain an open door policy to accept complaints at all levels concerning the environmental performance of the project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. A project information brochure will include information on the GRM and shall be widely disseminated throughout the project corridor by the safeguards officers. Grievances can be filed in writing or by phone with any member of the HSE unit (during the operation phase) and project manager of GOTA during the construction phase at the construction sites and other key public offices, all of which will accept complaints.Existing arrangements for redress of grievances for affected persons are through complaints to the village and Suco committees up to the district level and then through the GOTA officer (HSE unit) and back to the agency which implements a project. This indirect route will remain in place to preserve the usual administrative remedies. There will be a need to deal with complaints and grievances during construction for this project.

17.2 Steps and Procedures for the GRM

First layer of GRM. The contractor and/or GOTA project manager or facility are the first layer of GRM which offers the fastest and most accessible mechanism for resolution of grievances for both during the construction and operation of the facility. One of the two officers or designated specialist under GOTA management shall be the key officers for grievance redress. Resolution of complaints will be done within fifteen working (15) days. The officer or project manager officers in GOTA will provide the support and guidance in grievance redress matters. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, community, etc.).

Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included unless anonymity is requested.

A tracking number shall be assigned for each grievance, and it will be recorded including the following elements: (i) initial grievance record (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered; (ii) grievance monitoring sheet, describing actions taken (investigation, corrective measures); and (iii) closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed-off. The updated register of grievances and complaints will be available to the public at the GOTA office, construction sites and other key public offices along the project corridor (offices of the suco and districts). Should the grievance remain unresolved it will be escalated to the second layer for solution.

Second Layer of GRM. GOTA will activate the second layer of GRM by referring the unresolved issue (with written documentation) to the GOTA top level of management who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). The GRC shall be established by top level of GOTA management system before commencement of site works. The GRC will consist of the following persons: (i) Representation of GOTA designated top management; (ii) representative of District and Suco; (iii) representative of the affected person(s); (iv) representative of the local land office; and (v) representative of the NDPCEI (for environmental related grievances). A hearing will be called with the GRC, if necessary, where the affected person can present his/her concern. The process will facilitate resolution through mediation.

The GRC will meet as necessary when there are grievances that cannot be solved at the first layer of solving problem and within thirty (30) working days will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision and a timeframe that must be adhered to. The functions of the GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water consumption, groundwater level dropdown, wastewater discharge to the sea, waste disposal, traffic interference and public safety as well as social issues land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

The GOTA team in Timor Leste (project manager, HSE unit, and management) will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the GOTL's judicial or administrative remedies.

Third t Layer of GRM. In the event that a grievance cannot be resolved directly by the first and second layer, the affected person can seek alternative redress through the Suco or District committees under the existing arrangements for redress of grievances for affected persons. The project implementation representative of GOTA, GOTA officer or project manager or GRC will be kept informed by the district, municipal or national authority.

Monitoring reports shall include information about the GRM including: (i) the cases registered, level of jurisdiction (first, second and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) an appendix which lists cases in process and already decided upon may be prepared with details such as name, ID with unique case serial number, date of notice/registration of grievance, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, pending) and if it is a repeat of a previous grievance. The grievance redress mechanism and procedure is depicted in Figure 17.1.

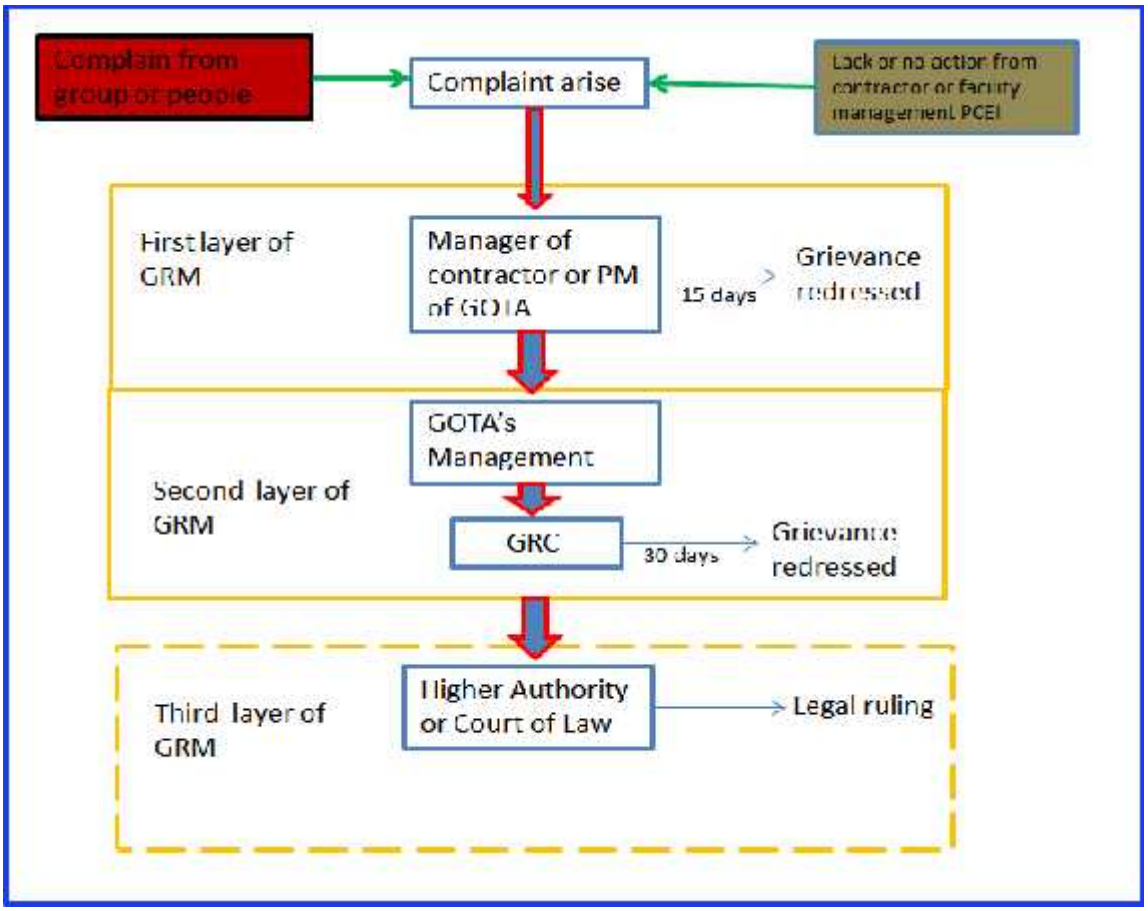

Figure 17.1 - Grievance Redress Mechanism

18. WORK PLAN AND IMPLEMENTATION SCHEDULE

The project implementation schedule is divided into three parts; (1). Pre-constructions; (2). Construction; and (3) Operation and therefore the work plan in timeline is arranged according this implementation schedule. The following table provides the summary of implementation schedule of every EMP that proposed in this study for each stage of project implementation.

The pre-construction EMP activity which may take 6 months to prepare all the important requirement for the project to commence the construction and operation after construction will be completed. The construction itself will take one and half year to be completed and the operation of plan to start immediately after the construction completed by the year of project implementation. The following shows the EMP activity in each stage of project implementation schedule.

Table 18.1 Work plan and Implementation Schedule

Activity of EMP	Year1				Year 2				Year 3				Year ~ N			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	Pre- Construction		Construction						Start of Operation				Decommissioning and deactivation			
Managing noise and vibration	●	●	●	●	●	●	●	●	→	→	→	→	→	→	→	→
Managing air quality	●	●	●	●	●	●	●	●	→	→	→	→	→	→	→	→
Managing soil erosion and sediment transport	●	●	●	●	●	●	●	●	→	→	→	→	→	→	→	→
Enforcing and Implement OHS – Worker	●	●	●	●	●	●	●	●	→	→	→	→	→	→	→	→
Managing Solid waste			●	●	●	●	●	●	→	→	→	→	→	→	→	→
Construction wastewater treatment plant			●	●	●	●	●	●								
Installation of various Instruments - for control and monitoring system in various section					●	●	●	●								
Managing Community Health and Safety	●	●	●	●	●	●	●	●	→	→	→	→	→	→	→	→
Monitoring and audit of water consumption									→	→	→	→				
Monitoring and audit of energy consumption									→	→	→	→				
Managing air emission									→	→	→	→				
Monitoring groundwater drawdown level									→	→	→	→				
Managing and Monitoring solid waste	●	●	●	●	●	●	●	●	→	→	→	→	→	→	→	→
Enforcing water conservation									→	→	→	→				
Enforcing Energy conservation									→	→	→	→				
Controlling and monitoring wastewater treatment									→	→	→	→				

19. COST ESTIMATES

To ensure that the mitigation measures and monitoring requirements are correctly implemented and funded, this section should contain the cost estimates.This section should include both the initial costs and recurring expenses for implementing all the measures defined in the EMP.The following table shows the cost that compose of capital development cost that put in the beginning of the project development and recurrent operation cost that put in every year to operate the system.

19.1 Capital Cost

The capital cost is a cost that required constructing asystem to support the implementation of EMP. The capital cost required to support the proposed project development in managing the environmental system:

- Wastewater Treatment plant and disposal
- Drainage System
- Sensors and Instrumentation
- PPE
- Fire Hazard system
- Floor level elevation
- Retaining wall protection
- Driveway improvement and traffic signal system

Table 19.1 Summary of capital cost of EMP

No	Item	Cost ($)
1	Wastewater Treatment plant and disposal	$ 3,500,000.00
2	Drainage System	$ 350,000.00
3	Sensors and Instrumentation	$ 50,000.00
4	PPE	$ 10,000.00
5	Fire Hazard system	$ 25,000.00
6	Floor level improvement	$ 100,000.00
7	Retaining wall protection	$ 500,000.00
8	Driveway improvement and traffic signal system	$ 250,000.00
	Total Capital Cost ($)	$ 4,785,000.00

19.2 Operating Cost

Cost component of operating cost consist of the funds required to implement both structural and non-structural mitigation measures. The operation cost to implement the EMP was roughly estimated to be 5% of the total capital cost, which is equal to $240,000. This fund will be allocated for the following sub-activity.

- Cost of wastewater treatment plant (construction and operation cost)
- Cost of multi-pipes of disposal system of treated wastewater effluent
- Cost of instrumentation (water measuring devices, energy measuring devices, groundwater level measurement, flow meter for groundwater pumping, fire alarm system, water quality sampling, PH monitoring, Turbidity measuring devices, NO_x measuring device,
- PPE
- Laboratory
- Salary of operator
- Cost damage of potential mangrove loss
- Cost damage of coral loss
- Cost damage
- Replanting tree

19.3 Social cost

In addition to the structural improvement cost, there is also a non-structural cost that the project owner has/will pay or disburses in relation to the project development and operation.

- Social corporate responsibility to the local and national
- Campaigning of responsible consumption of alcohol

The total EMP cost would the summation of capital, operation, and social cost.

Table 19.2 Summary of Social Impacts Cost

Item	Estimated Cost ($)
Social corporate responsibility to the local and national	$ 50,000.00
Campaigning of responsible consumption of alcohol	$ 30,000.00
Total	$ 80,000.00

The operational cost of the EMP of social cost is $80,000 per year.

Therefore, the total cost to implement the EMP during the project implementation was estimated to be roughly to be $4.8 million and operating cost was equal to $0.32 million, which only 5% of the total EMP cost.

19.4 Deactivation and Decommission Cost

The cost would include demolished and disposal of solid waste and land reclamation and also social cost such as compensation and offsetting permanent damage such as groundwater damages or land pollution. The following table summarized the cost figure during the decommissioning and deactivation phase:

Table. Summary of EMP Cost in Deactivation and Decommissioning Phase

Item	Estimated Cost ($)	
Cost of demolition (2% of total capital cost)	$	9,600.00
Land reclamation	$	100,000.00
Solid waste handling	$	50,000.00
Cost of offseting of damage	$	300,000.00
Social compensation	$	300,000.00
Total	$	759,600.00

20. REVIEW OF THE EMP

The EMP should be reviewed by project owner, updated and submitted to DNCPEI for re-approval every year. Project proponent can engage local consultants for update of the EMP. Data collection should take place as part of the EMP update focusing on near coast water quality assessment and air quality data.

DNCPEI can review results from monitoring activities and compare them with baseline results collected during EIS/EMMP preparation. Monitoring or data collection can also be taken on need basis when certain parameters have visually been observed to be elevated. Complains from community should also be taken into consideration and appropriate assessment and data collection take place to formulate proper ways to address the complaints.

21. NON-TECHNICAL SUMMARY

The proposed development of beverage production facility, with the annual capacity of 50,000 HL of beer, 50,000 HL of carbonated soft drink, and 500,000 HL of packaged mineral water, is a 100% of domestic investment from GOTA Bebidas e Alimentos, that will take 7 HA land in Ulmera, Postu administration of Bazartete, Municipio of Liquica, Timor Leste. The land was secured by the project owner with direct purchasing between the project proponent and the original land owner.

The component of the project with the scale and concern are presented in the following table.

Table. 21.1 Project Component and Scale

No	Project Component	Scale and Concerns
1	Water Resources and Consumption	Capacity of extraction is equal to 200 L/minutes. This rate is considered moderate and the monitoring of groundwater table suggested that the pumping rate with the capacity of 200 L/min, would not cause a significant drop on the groundwater table that may cause various environmental issue such as land subsidence, salt intrusion, groundwater contamination, and potential water crisis in the project area. The analysis of groundwater data and rainfall recharge, as well as pumping rate suggested that the above rate of pumping shall not cause any major issue of the groundwater.
2	Water Treatment	The measurement of groundwater quality from the constructed groundwater production well indicated that the quality is nearly pure and only required minor treatment to remove certain contaminant such as harness, heavy metal, etc. The capacity of the water treatment plant is at 110% of the total volume of water requirement, which is 1.2 million HL
3	Brewing Processing Plant	The Scale of this component is 50,000 HL. Issue that will become a major concern during the operation of the plant are; water consumption, energy consumption, wastewater, solid waste, and by product that will required comprehensive management system

4	Soft Drink Processing Plant	The Scale of this component is 50,000 HL. Issue that will become a major concern during the operation of the plant are; water consumption, energy consumption, wastewater, solid waste, and by product that will required comprehensive management system
5	Wastewater Treatment Plant	Wastewater will be designed and operated at the capacity of 100 L/minutes. Wastewater will become a major environmental concern. Since this plant will become a largest plant that discharge the wastewater into marine water in Timor Leste, a comprehensive assessment on the choice of process, level of treatment, and disposal mechanism would be important
6	Wastewater Disposal System	Capacity of 100 L/minutes and disposal to the marine water and level of treatment prior to disposal would be monitored comprehensively by the relevant regulator bodies

As each component of the project, as presented in the table, is a major one, then proper environmental impact assessment must be conducted in order to detect any potential environmental and social impacts. By knowing the environmental and social impacts, the proper environmental management plans (EMP) can be proposed to mitigate the negative impacts of environment and people. This environmental impacts assessment has been prepared and reported in the EIS report by PEC – Consulting, LDA on behalf of GOTA Bebidas e Alimentos, LDA, as the project owner and operator of the proposed plant.

The environmental impacts assessment was conducted based on guideline as presented in the decree law 5/2011 on the environmental licensing requirement and other relevant regulatory framework such as industrial and business development, food and beverage industry, and other relevant international law and best practice that are relevant and applicable to the project development activity. The environmental impacts assessment was conducted first by reviewing the existing environmental condition, which include, physical environmental such as climate, topographic, hydro-geology, and soil condition and marine ecological that will eventually become a recipient of the of the environmental discharge from the proposed development. Moreover, the existing socio-economic condition of Timor Leste in general and community that affected by the proposed project was reviewed. This background information of the existing will provide valuable information to formulate the scope of environmental impacts assessment and necessary field measurement. Secondly, by using the data and information related to the nature of the projects and the scale that were collected, the impacts assessment relative to the project was conducted.

The environmental and social impacts from the propose development were assessed in each stage of project development, namely the pre- and construction phases, operation stage, and decommission stage. While, the environmental impacts during the pre- and construction as well

as decommission stages, are temporary impacts which can be managed effectively onsite during the implementation, the impacts during the operation of the proposed facility is adverse and therefore required prospered mitigation measured to reduce the impacts, avoid, or prevent them. The major environmental impacts related to the operational of the beverage processing plant are related to the resource utilization such as water, energy, and raw material, and other supporting utilities of the processing plant.

Water Utilization

The water demand was fulfilled by pumping the groundwater from the groundwater aquifer. Though, the quality of groundwater is reasonable, for general consumption purposes, further advance water treatment system would be required to produce water that meet the specific requirement of the industry such as beverage and end-product mineral water. The process of the groundwater pumping, treatment, and distribution, would generate the environmental impacts that would need to be assessed and mitigated.

- Environmental Impacts on the aquifer
- Environmental impact related to treatment process (high energy consumption)
- Occupational Health and Safety

Various mitigation measures from these mentioned impacts have discussed in the impact analysis and mitigation measured, which should help minimize the impacts to the environment and while at the same time maximize the benefit gain from the development project. The mitigation measures as summarized and presented in the form of environmental management plan (EMP) would need to be implemented and monitored by the project owner and supervised by the government agencies. The monitoring and supervision of the implementation of the EMP would need the standard and performance guideline such as national or and international in case the national standard is not available.

Energy Utilization

Energy requirement to support the processing plants is substantial amount which can be fulfilled within the facility and purchased from the third party. Regardless of the sources, the consumption of energy will contribute to the greenhouse gas emission, which will contribute to the global climate change. Moreover, uncontrollable consumption of energy will be expensive and without conserving the energy, the sustainability of the proposed project will be in jeopardy. The environmental impacts and mitigation measured as presented earlier in the EMP suggested that by conserving the energy utilization, the contribution of the greenhouse gas emission can be reduced. The summary of Environmental Impacts due to energy utilization:

1. Energy is expensive
2. Greenhouse gas emission will contribute to the global climate change
3. Air quality

The impacts due to energy consumption that can be minimized by various mitigation measures as proposed.

Processing Related

The process related impacts would be the waste as byproduct that is generated during the process conversion of raw material into desired product. The potential impacts related to the process consist of process conversion of raw material into product, where other by product, solid waste, and liquid waste are also generated. The following table presented the major impacts and mitigation measure to control the impacts and minimized the risk.

Wastewater Treatment

Wastewater treatment as discussed is an important solution to the environmental issue related to the project implementation. The treatment system will help reduce the waste load that will enter the environment at the level, where the waste load enter the receiving environment will be at the rate below the assimilation capacity of environment. Moreover, the with the good quality of treated wastewater, the effluent can be used to irrigate the surrounding land or recharge the groundwater aquifer.

Solid waste management

Various types of solid wastes as discussed from the previous sections should be managed property in order to support the production system. There are several solid wastes classifications which are economically valuable so they can be recycle and reuse and solid waste that has not economic value which will be disposed to Tibar dumpsite area.

Table 21.2 . Summary of Major Environmental Impacts and EMP Requirement

Sources	Impacts	Environmental Management Plans
Water utilization	➢ Groundwater aquifer problem (potential land subsidence, sea water intrusion, groundwater contamination, potential irreversible damaged of aquifer) ➢ Increase water stress area ➢ Contribute to the greenhouse gas emission ➢ High energy cost for treatment process and pumping from the aquifer	• Monitoring the groundwater pumping and rate of pumping to be always below the sustainable yield • Reduce the ratio of water consumption by implementing various water conservation program • Perform water source protection in the upland catchment system to keep good storage for sustainable water resource • Apply rain harvesting system within the project location to harvest water during the rainy days
	Water Treatment process - high cost	Monitor and control the rate of water utilization
	Wastewater (brine disposal) – high contaminant	Proper treatment system
Energy Utilization	➢ Expensive ➢ Greenhouse gas emission contribution	➢ Measure the rate of energy utilization ➢ Apply the energy conservation program within the whole facility to reduce the rate of energy consumption ➢ Recover the energy within the system (boiler, cooing system, heating system)
Process related	Solid waste	Applies 3RD (reduce, Reused, Recycle, and Dispose) to manage the solid waste
	Wastewater	➢ Reduce volume of wastewater by reducing water consumption ➢ Applies the best available technology to treat the wastewater prior to discharging into the marine environment
	Greenhouse gas emission	➢ Recover the CO2, as much as possible ➢ Recovery the steam loss in the boiler ➢ Proper burning of methane
	OHS	Applies the proper OHS

22. ANNEXES

The appendixes of this document contain the following relevant information that were collected during the preparation of EIS and EMMP