VOLUME I
Baucau Cement Project
Environmental Impact Statement - Cement Plant, Jetty, Conveyor Belt and Associated Infrastructure

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## ABBREVIATIONS AND ACRONYMS

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<tr>
<td>$</td>
<td>American Dollar</td>
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<tr>
<td>%</td>
<td>Percentage</td>
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<tr>
<td>(WHO AQGs)</td>
<td>World Health Organization Air Quality Guidelines</td>
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<tr>
<td>&lt;</td>
<td>Less than</td>
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<td>&gt;</td>
<td>Greater than</td>
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<td>°C</td>
<td>Degrees Celsius</td>
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<tr>
<td>µg</td>
<td>micrograms</td>
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<td>µg/m³</td>
<td>Micrograms per cubic meter</td>
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<td>µm</td>
<td>Micrometer</td>
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<td>µScm</td>
<td>micro-Siemens per centimeter</td>
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<tr>
<td>3D</td>
<td>3 dimensional</td>
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<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
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<tr>
<td>ANFO</td>
<td>Ammonium Nitrate Fuel Oil</td>
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<td>ANZECC</td>
<td>Australian and New Zealand Environment and Conservation Council</td>
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<tr>
<td>AQGs</td>
<td>Air Quality Guidelines</td>
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<tr>
<td>ARI</td>
<td>Average Reoccurrence Intervals</td>
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<tr>
<td>BBS</td>
<td>Bita Bina Semesta</td>
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<tr>
<td>BP</td>
<td>Before Present</td>
</tr>
<tr>
<td>C&lt;sub&gt;10&lt;/sub&gt;H&lt;sub&gt;16&lt;/sub&gt;</td>
<td>Terpene</td>
</tr>
<tr>
<td>C&lt;sub&gt;5&lt;/sub&gt;H&lt;sub&gt;8&lt;/sub&gt;</td>
<td>Isoprene</td>
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<tr>
<td>CFB</td>
<td>Circulating Fluidized Bed</td>
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<td>CITES</td>
<td>Convention on International Trade in Endangered Species</td>
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<td>cm</td>
<td>Centimeter</td>
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<tr>
<td>CO</td>
<td>Carbon monoxide</td>
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<td>CO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Carbon dioxide</td>
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<td>Abbr.</td>
<td>Definition</td>
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<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organisation</td>
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<td>CSR</td>
<td>Corporate Social Responsibility</td>
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<td>dB</td>
<td>Decibels</td>
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<tr>
<td>dBA</td>
<td>Decibel</td>
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<td>DNGAR</td>
<td>Timor-Leste National Department of Water Resources</td>
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<td>DNSAS</td>
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<tr>
<td>DLPCS</td>
<td>Directorate of Land, Property and Cadastral Services</td>
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<td>e.g.</td>
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<tr>
<td>EA</td>
<td>Environmental Assessment</td>
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<td>Environment Basic Law</td>
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<tr>
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<td>Environmental Impact Statement</td>
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<td>Environmental Licensing Law</td>
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<td>EMP</td>
<td>Environmental Management Plan</td>
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<tr>
<td>ENSO</td>
<td>El Niño–Southern Oscillation</td>
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<td>EPA</td>
<td>Environmental Protection Authority</td>
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<tr>
<td>ETAP</td>
<td>East Timor Archaeological Project</td>
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<tr>
<td>etc.</td>
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<tr>
<td>GHGs</td>
<td>Greenhouse Gases</td>
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<tr>
<td>GL</td>
<td>Gigaliter</td>
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<tr>
<td>GL/yr</td>
<td>Gigaliter per year</td>
</tr>
<tr>
<td>GoTL</td>
<td>Government of Timor Leste</td>
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<td>GSHAP</td>
<td>Global Seismic Hazard Assessment Program</td>
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<tr>
<td>ha</td>
<td>Hectare</td>
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<tr>
<td>HAT</td>
<td>Highest Astronomical Tide</td>
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<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>HEME</td>
<td>Heavy Earth Moving Equipment</td>
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<tr>
<td>IFC’s</td>
<td>International Finance Corporation</td>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>ITs</td>
<td>Interim Targets</td>
</tr>
<tr>
<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
</tr>
<tr>
<td>kg</td>
<td>Kilogram</td>
</tr>
<tr>
<td>km</td>
<td>Kilometer</td>
</tr>
<tr>
<td>km/h</td>
<td>Kilometer per hour</td>
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<tr>
<td>km²</td>
<td>Square kilometers</td>
</tr>
<tr>
<td>KPK</td>
<td>Konsellu Polisia Komunitaria</td>
</tr>
<tr>
<td>L/s</td>
<td>Liters per second</td>
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<tr>
<td>LAT</td>
<td>Lowest Astronomical Tide</td>
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<td>Ld</td>
<td>Day Sound Level</td>
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<tr>
<td>Ldn</td>
<td>Day-Night Sound Level</td>
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<tr>
<td>Leq</td>
<td>Equivalent Sound Level</td>
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<tr>
<td>Ln</td>
<td>Night Sound Level</td>
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<td>Lp</td>
<td>Sound Pressure Levels</td>
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<tr>
<td>m</td>
<td>Meters</td>
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<tr>
<td>m³</td>
<td>Cubic meter</td>
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<tr>
<td>MAF</td>
<td>Timor-Leste Ministry of Agriculture and Fisheries</td>
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<tr>
<td>mg/L</td>
<td>Milligram per liter</td>
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<tr>
<td>MHWN</td>
<td>Mean High Water Neaps</td>
</tr>
<tr>
<td>MHWS</td>
<td>Mean High Water Springs</td>
</tr>
<tr>
<td>ML</td>
<td>Mega liters</td>
</tr>
<tr>
<td>ML/day</td>
<td>Mega liters per day</td>
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<td>MLWM</td>
<td>Mean Low Water Neaps</td>
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<td>Mean Low Water Springs</td>
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<tr>
<td>mm</td>
<td>Millimeter</td>
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<tr>
<td>MOF</td>
<td>Materials Offloading Facility</td>
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<td>MoT</td>
<td>Timor-Leste Ministry of Tourism</td>
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<tr>
<td>Mph</td>
<td>Miles per hour</td>
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<tr>
<td>MRAP</td>
<td>Marine Rapid Assessment Program</td>
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<tr>
<td>MSL</td>
<td>Mean Sea Level</td>
</tr>
<tr>
<td>mtpa</td>
<td>Million ton per annum</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatt</td>
</tr>
<tr>
<td>M_w</td>
<td>Moment magnitude</td>
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<tr>
<td>NAPA</td>
<td>Timor-Leste National Adaptation Programme of Action to Climate Change</td>
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<tr>
<td>NDPCEI</td>
<td>Timor-Leste National Directorate for Pollution Control and Environmental Impact</td>
</tr>
<tr>
<td>NEPC</td>
<td>Timor-Leste National Environment Protection Council</td>
</tr>
<tr>
<td>NEPM</td>
<td>National Environment Protection Measures (Australian)</td>
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<tr>
<td>NGO</td>
<td>Non-government Organisation</td>
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<tr>
<td>NMH</td>
<td>Non-Methane Hydrocarbons</td>
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<td>NMHC</td>
<td>Non-methane hydrocarbons</td>
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<tr>
<td>NO₂</td>
<td>Nitrogen dioxide</td>
</tr>
<tr>
<td>NOx</td>
<td>Nitrogen oxides</td>
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<td>NTS</td>
<td>Non-Technical Summary</td>
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<td>O₃</td>
<td>Ozone</td>
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<td>PAF</td>
<td>Project Affected Families</td>
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<tr>
<td>pcuph</td>
<td>passenger car units per hour</td>
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<tr>
<td>PM₁₀ and PM₂.₅</td>
<td>Particulate matter</td>
</tr>
<tr>
<td>Ppb</td>
<td>Parts per billion</td>
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<tr>
<td>Ppm</td>
<td>Parts per million</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>SEIS</td>
<td>Simplified Environmental Impact Statement</td>
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<tr>
<td>SEPFOPE</td>
<td>Timor-Leste State Secretary for Employment Policy and Vocational Training</td>
</tr>
<tr>
<td>SO₂</td>
<td>Sulphur dioxide</td>
</tr>
<tr>
<td>Suco</td>
<td>a village administration unit, many of which make up a District</td>
</tr>
<tr>
<td>SWL</td>
<td>Sound Power Level</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>UNTAET</td>
<td>United Nations Transitional Administration in East Timor</td>
</tr>
<tr>
<td>URI</td>
<td>Upper Respiratory Tract Infections</td>
</tr>
<tr>
<td>USD</td>
<td>United States Dollar</td>
</tr>
<tr>
<td>VOC</td>
<td>Volatile Organic Compounds</td>
</tr>
<tr>
<td>WA</td>
<td>Western Australia</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WHR</td>
<td>Waste Heat Recovery</td>
</tr>
<tr>
<td>WorleyParsons TL Unipessoal Lda</td>
<td>WorleyParsons office in Dili, Timor-Leste</td>
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</tbody>
</table>
1  EXECUTIVE SUMMARY

The purpose of this Executive Summary is to provide a summary of the key findings and conclusions of the Environmental Impact Statement (EIS) for the Baucau Cement Clinker Plant project considering all phases of the proposed Project.

1.1  Purpose and Scope of the EIS

1.1.1  Purpose and Extent of EIS

TL Cement LDA, a privately-owned company, proposes to construct a greenfield cement manufacturing project in Baucau Municipality, Timor-Leste. The Project will produce approximately 1.65 million tons per annum (mtpa) of Portland cement clinker.

The Environmental Authority for the Project is the National Directorate for Pollution Control and Environmental Impact (NDPCEI). Pursuant to Decreee Law 5/2011, the NDPCEI categorized the Limestone Mine component of the Baucau Cement Project as Category A.

For the purposes of the Environmental Licensing process, the NDPCEI has divided the Baucau Cement Project into several major components, as follows:

1. Cement Plant, Conveyor Belt, Marine Jetty, and associated infrastructure;
2. Limestone Mine and associated infrastructure;
3. Clay Extraction; and
4. Road Improvements and New Roads.

This EIS addresses only the Cement Plant, Conveyor Belt, Marine Jetty and associated infrastructure components.

TL Cement LDA and their EIA consultant, WorleyParsons TL have developed and delivered this EIS and the EMP under the guidance and instruction of the National Directorate for Pollution Control and Environmental Impact (NDPCEI). This document has been extensively reviewed by; and aligns with the expectations and direction of the advisors in the NDPCEI. WorleyParsons has compiled this document in good faith that the content will assist the NDPCEI in assessing the environmental and social impacts of the project in line with the requirements of Decreee Law 5/2011.

1.1.2  Brief Project Description

The proposed Cement Plant, Jetty, Conveyor Belt and Associated Infrastructure are located in Suco Tirilolo, Aldeia Osso-ua, in the Baucau administrative post of Baucau Municipality, Timor-Leste. The location is about 120 km east of Dili and approximately 16 km west of Baucau.

For the purposes of this EIS, the Project components are as follows:
1. Cement Plant;
2. Conveyor Belt;
3. Jetty; and
4. Associated infrastructure, which includes:
   a. Materials Offloading Facility (MOF);
   b. Captive Power Plant;
   c. Accommodation;
   d. Water Sources; and
   e. Internal roads.

The MOF is needed for bringing in materials, equipment and parts. In principle, the MOF is particularly needed during the construction phase. In order to make better use of the MOF after the initial construction period, the MOF can also be used for additional activities, such as:

- Import of fuel;
- Fueling of barges and tugs; and
- Parking of tugs.

The area of a Future Industrial Precinct has been proposed, however is not included in this EIS assessment. The Future Industrial Precinct is pending further investigation and assessment and will be subject of a separate environmental approval.

All of the items included in the Project are critical to the success of the Baucau Cement Project. The Cement Plant will process the raw materials to produce cement clinker for domestic use and international sale. The Jetty will be used to import raw materials not available locally including coal, iron ore, and gypsum and to export the clinker product. The Conveyor Belt will be used to transport materials to and from the Jetty. The MOF is needed for bringing in materials, equipment and parts during construction.

1.2 Summary of Activities Carried Out in EIS Phase

Specialist baseline technical investigations were undertaken to inform the Environmental Impact Assessment, including:

- Heritage, Archeological and Cultural surveys and investigations;
- Traffic impact baseline recording and impact assessment;
- Vegetation and Fauna field investigation and impact assessment;
- Air Quality and Noise baseline recording and impact assessment;
- Hydrogeological (groundwater) field investigation and impact assessment;
- Hydrological (surface water) numerical model and impact assessment; and
- Social and community surveys and impact assessment.
1.3 Alternatives Considered

The Cement Plant, Jetty, and Associated Infrastructure need to be located on a large area of relatively flat land near the Limestone Mine to reduce transport costs of the raw material (i.e. limestone). The EIS Report for the Limestone Mine component of the Baucau Cement Project addresses the reasons why the proposed location of the Limestone Mine at Bucoli Block I-1 has been chosen by the Proponent. As other feasible locations near Block I-1 would have similar existing environmental conditions and would result in similar environmental impacts and would render the Project commercially unviable.

A potential alternative site for the Project is an abandoned and derelict bulk cement import facility located at Caravela approximately 8 km west of the proposed Baucau Cement Project site along the Manatuto-Baucau road. This cement plant also had a concrete pier approximately 100 m long and 9 m wide. However, the alternative site does not avoid or reduce significant environmental or social impacts as compared to the proposed site. The environmental and social impact may be greater with the need to transport large volumes of limestone in large trucks to this alternative site which would lead to more traffic and dust emissions. The roads would need to be widened leaving a further negative environmental footprint. The Jetty site is also less suitable than the proposed location due to ocean depth which restricts vessel size. Commercially this location would render the project unviable.

The proposed Baucau Cement Project is designed to produce 1.65 mtpa of cement clinker. Of the 1.65 mtpa of clinker to be produced, the Proponent proposes to export around 1.15 mtpa and the remaining 0.50 mtpa clinker shall be used for cement manufacturing for domestic consumption and export. Potential alternatives would include sizing the production to meet only domestic demand or to provide for export markets (0.5 mtpa or 1.15 mtpa respectively). However, the Project Proponent indicates that the domestic market only alternatives would not be commercially viable and would not attract foreign investment. Similarly, the export only alternative would also have less commercial viability and would also not realize the Project objective of providing a lower-cost domestic cement supply.

In addition to the Jetty, a separate Material Offloading Facility (MOF) Jetty is required for bringing in construction equipment and materials. As planned, the MOF will be an earthen abutment located approximately 150 m to the southwest of the Jetty and extending approximately 70m into the sea. The EIS recommends an alternative design using piles and an alternative location to avoid the coral reef. The current Front End Engineering Design being prepared by consultants will contain provisions for piling and alternative locations to avoid coral reefs.

Finally, the EIS also considers the No Project Alternative as required by the Environmental Licensing Law. The No Project alternative provides a baseline for comparison of the proposed project impacts. The No Project alternative would avoid environmental impacts but would not realize the economic benefits of the proposed Project.
1.4 Affected Environment

The Jetty and Conveyor Belt area is located at the nearby beach and is flat and already highly modified by temporary dwellings, grazing and some agriculture. The general environment is characterised by sandy soils and established breadfruit *Artocarpus altilis* and *Corypha* sp. palm groves. The area is also severely infested with weeds. The Jetty area starts at the beach which slopes gently towards the ocean before projecting into the ocean. The overall site is dominated by a relatively uniform coastal Closed Tropical Forest (70%) which is most likely a combination of existing forest and mature plantation trees. The remaining area (30%) is cleared grazing land and residential farms. Overall, the site is a heavily modified plantation environment with a severe infestation of *Lantana camara* throughout. The biological diversity at these sites was very low and overall the site was not representative of a pristine coastal/beach forest (Trainor & Easton, 2015).

The Cement Plant site is located on NNE facing slopes and plains relatively close to the beach, road and proposed Jetty area. The site is characterized as hilly and slopes up away from the coast, with shallow limestone soils and scattered limestone rock outcrops, minor ridges and gullies sloping towards the beach. The site consists predominantly of very open savannah woodland (95%) which has been extensively modified for agriculture and grazing in places. The remaining areas were isolated patches of Closed Tropical Forest systems (5%), occurring in depressions and drainage floors and often surrounded by introduced *Lantana camara* (Trainor & Easton, 2015).

No permanent rivers exist within the Project site. Some small ephemeral watercourses flow through the area, mainly during the wet season. These tend to stop flowing in the dry season and are not considered suitable as full time water sources. The closest ephemeral stream is the Manulede River located approximately 9 km from the proposed Cement Plant site (WorleyParsons, 2015c).

The Project is located near the Caisido community of the *Aldeias* Parlamento, Caisido, Lialalieso, and Osso-Ua. The total population of the Caisido area (the Project Site) is 2,387 or 38% of the Suco Tirilolo population. There are 532 households in Caisido and the average size of a household is 5 people. Economic employment is mainly focused on agricultural sector. Most of the local populations in the areas surrounding Baucau Cement Project site are farmers. A small number of these farmers are also teachers, drivers and owners of small kiosks (vendors) within their villages/hamlets (BBS, 2015c).

1.5 Activities identified in each phase

The key significant environmental and social impacts area associated with the following key activities during pre-construction, construction and operation:

1. Clearing of Land resulting in Displacement / Resettlement of people
2. Clearing of Land resulting in loss of Cultural Heritage
3. Clearing of Land resulting in sedimentation and site drainage to ocean
4. Movement of vehicles and equipment resulting in increased traffic
5. Site activities such as plant and equipment operating which increases dust and noise
6. Pumping of water for the project resulting in decreased spring flow
7. Employment of local people resulting in increased economic participation

The key significant environmental and social impacts area associated with the following key activities during **decommissioning**:

1. Rehabilitation of Land resulting in movement of people back to the area
2. Changes in land use from industry to community use resulting in restored access to Cultural Heritage
3. Changes to employment numbers for local people resulting in decreased Economic participation

### 1.6 Environmental and Social Impacts

#### 1.6.1 Preconstruction

<table>
<thead>
<tr>
<th>Activity</th>
<th>Potential Impact</th>
<th>Level of impact</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearing of Land resulting in Displacement / Resettlement of people</td>
<td>Local people will be displaced and will require relocation in order for this Project land to be acquired.</td>
<td>This has a ‘High’ impact on local people, however this is to be addressed through the GoTL’s Resettlement Plan, which is to be adjudicated by the Directorate of Land, Property and Cadastral Services (DLPCS) via a separate process and the residual impacts are considered to be ‘Medium’.</td>
<td>TL Cement is currently working with the Directorate of Land, Property and Cadastral Services (DLPCS) to map affected households, farmland, and other property. Once TL Cement has secured the mining license and environmental licenses required for the Project, the GoTL will enter into discussions with those affected households and property owners. Where safe access cannot be guaranteed, those sites which are located adjacent to the Project will be fenced off, access restricted for the Project life or relocated. Where a site is located inside the location of the proposed Project footprint and the impact is unavoidable, the impact will be documented, exhumation of bones (where applicable) and relocated in consultation with the local community.</td>
</tr>
<tr>
<td>Clearing of Land resulting in loss of Cultural Heritage</td>
<td>The religious architectural and sacred heritage sites located near to or adjacent to the Jetty, Conveyor belt and Cement Plant site are unlikely to be directly impacted by the development of the Project.</td>
<td>Potential impacts of the Project on Cultural Heritage for the local area are considered to be ‘Low’.</td>
<td>Where safe access cannot be guaranteed, those sites which are located adjacent to the Project will be fenced off, access restricted for the Project life or relocated. Where a site is located inside the location of the proposed Project footprint and the impact is unavoidable, the impact will be documented, exhumation of bones (where applicable) and relocated in consultation with the local community.</td>
</tr>
<tr>
<td>Clearing of Land resulting in loss of flora and fauna</td>
<td>The Jetty site is a heavily modified plantation environment. The Cement Plant site has been extensively modified for agriculture and grazing.</td>
<td>Potential impacts of the Project on Flora and Fauna for the local area are considered to be ‘Low’.</td>
<td>Optimize design to prevent unnecessary excavation. Undertake stripping and stockpiling of topsoil. Dust suppression measures (e.g. water sprinkling) at all dust generating sites. Weed management activities including spraying.</td>
</tr>
<tr>
<td>Clearing of Land</td>
<td>During pre-construction</td>
<td>Impact is ‘Low’ because</td>
<td>Soil contamination should be avoided.</td>
</tr>
</tbody>
</table>

Page 5
## 1.6.2 Construction

<table>
<thead>
<tr>
<th>Activity</th>
<th>Potential Impact</th>
<th>Level of impact</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle movements resulting in noise and dust</td>
<td>During construction there is predicted to be an increase in vehicles using the site and unpaved roads</td>
<td>Impact is ‘Low’ because adverse impacts are considered unlikely</td>
<td>Minimising vehicle movement good planning and scheduling Employees housed on site Limit vehicle reversing Speed limits implemented and enforced. Vehicle idling time limited &amp; vehicles maintained regularly All raw materials storage will be in enclosed structures All materials transport will be by fully covered conveyor belts All areas with vehicle traffic shall be watered or have dust palliative applied as necessary for regular stabilization of dust emissions. Storage areas should be located away from sensitive receptors. Haulage of goods and movement of vehicles/people and equipment can be scheduled. Where required, noise barriers can be constructed to abate the noise impacts. Alternative operations methods and selection of less noisy equipment to do the tasks.</td>
</tr>
<tr>
<td>Construction and earthworks resulting in sedimentation</td>
<td>During construction there may be an increase in sedimentation in site runoff</td>
<td>Impact is ‘Low’ because adverse impacts are considered unlikely</td>
<td>Off-site contamination should be monitored as part of the Water Quality Monitoring Programme Minimizing of excavation during construction Soil contamination should be monitored through maintaining records of spill events Maintenance of site drainage systems</td>
</tr>
<tr>
<td>Movement of vehicles and equipment resulting in increased Traffic</td>
<td>During construction there is predicted to be an increase in vehicles using the local roads</td>
<td>Impact from the Jetty and Plant site is expected to be ‘Low’ because the roads are internal</td>
<td>Minimising vehicle movement good planning and scheduling Employees housed on site Limit vehicle reversing Speed limits implemented and enforced. Vehicle idling time limited &amp; Vehicles maintained regularly</td>
</tr>
<tr>
<td>Pumping of water for the project resulting in decreased spring flow</td>
<td>All water for the construction of the Project is to be abstracted from alluvial aquifer, abstraction will not disrupt the karst aquifers. The aquifer reservoirs are not monitored</td>
<td></td>
<td>Monitoring boreholes monitor the background water quality and levels Groundwater modelling for the water supply to manage abstraction and</td>
</tr>
</tbody>
</table>
### Activity
- **Potential Impact**: ground water.
- **Level of impact**: well understood, impacts are assumed to be 'Medium'.
- **Mitigation measures**: dewatering

### 1.6.3 Operations

<table>
<thead>
<tr>
<th>Activity</th>
<th>Potential Impact</th>
<th>Level of impact</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Movement of vehicles and equipment resulting in increased Traffic</strong></td>
<td>During operations there is predicted to be an increase in vehicles using the local roads</td>
<td>Impact from the Jetty and Plant site is expected to be 'Low' because the roads are internal and all employees will be housed on site</td>
<td>Minimising vehicle movement good planning and scheduling Employees housed on site Limit vehicle reversing Speed limits implemented and enforced Vehicle idling time limited &amp; Vehicles maintained regularly</td>
</tr>
<tr>
<td><strong>Plant and Jetty operating resulting in Dust and Noise</strong></td>
<td>During operations there is predicted to be an increase in dust and noise at the site</td>
<td>Impact is 'Low' because adverse impacts are considered unlikely</td>
<td>All raw materials storage will be in enclosed structures All materials transport will be by fully covered conveyor belts All areas with vehicle traffic shall be watered or have dust palliative applied as necessary for regular stabilization of dust emissions Storage areas should be located away from sensitive receptors Haulage of goods and movement of vehicles/people and equipment can be scheduled Where required, noise barriers can be constructed to abate the noise impacts Alternative operations methods and selection of less noisy equipment to do the tasks.</td>
</tr>
<tr>
<td><strong>Runoff from site during rainfall resulting in sedimentation to the ocean</strong></td>
<td>During operations there is a chance for sedimentation of the soil and ocean water</td>
<td>Impact is 'Low' because adverse impacts are considered unlikely</td>
<td>Maintenance of site drainage systems Management measures to control run off and erosion at the Topsoil Stockpile Soil contamination should be monitored through maintaining records of spill events Off-site contamination should be monitored as part of the Water Quality Monitoring Programme</td>
</tr>
<tr>
<td><strong>Operating resulting in spills and leaks</strong></td>
<td>During operations there is a chance for spills and contamination of the soil and water</td>
<td>Potential impact is 'Low'</td>
<td>Contamination of the aquifer from the Project will be mitigated through an Emergency Response Plan and all spills immediately cleaned up and disposed of appropriately All chemicals used on site are will be stored, handled and disposed of in a responsible manner</td>
</tr>
<tr>
<td><strong>Pumping of water for the project resulting in decreased spring flow</strong></td>
<td>All water for the operation of the Project is to be abstracted from groundwater.</td>
<td>Water will be supplied from alluvial aquifer, abstraction will not disrupt the karst aquifers. The aquifer reservoirs are not well understood, impacts are assumed to be 'Medium'.</td>
<td>Monitoring boreholes monitor the background water quality and levels Groundwater modelling for the water supply to manage abstraction and dewatering</td>
</tr>
<tr>
<td><strong>Employment of local people resulting in increased Economic participation</strong></td>
<td>1,000 permanent jobs expected during operations</td>
<td>Positive impact</td>
<td>Training centre will be established Local people will be employed on the project</td>
</tr>
</tbody>
</table>
1.6.4 Decommissioning

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Rehabilitation of Land resulting in movement of people back to the area</td>
<td>Local people may be able to return to the area on decommissioning.</td>
<td>This will have a positive impact on the local people with access to infrastructure.</td>
<td>Consultation with community regarding lifting of access controls</td>
</tr>
<tr>
<td>Changes in land use from industry to community use resulting in restored access to Cultural Heritage</td>
<td>Local people may be able to return to the area on decommissioning.</td>
<td>Any religious architectural and sacred heritage sites which had access restrictions will have their access restored.</td>
<td>Consultation with community regarding lifting of access controls</td>
</tr>
<tr>
<td>Changes to employment numbers for local people resulting in decreased Economic participation</td>
<td>Local people may be unemployed following decommissioning</td>
<td>Impact potentially high for local people</td>
<td>Encourage and create strategies for sustainable economic empowerment</td>
</tr>
</tbody>
</table>

1.7 Environment economic cost mitigation

Economic cost to the environment from project approaches to equipment and site selection

The environmental economic impacts of the Project are mitigated through the following best practice approaches:

- Selection of plant and equipment which meets emissions standards;
- Engineering and project design to limit the footprint area and thus impact from vegetation clearing and on heritage;
- Identification of key vegetated areas to be retained to reduce the impact on forest specialist birds;
- Site selection to limit the impacts of dust and noise on the communities and reduce the costs associated with noise attenuation and dust suppression measures;
- Selection of the Project implementation approach to ensure access to employment opportunities for the local people; and
- Selection of the Best Available Technology (BAT) for electricity generation and water supply.

1.8 Public Consultation Process

WorleyParsons and TL Cement have undertaken a process of consultation with the people who may be affected by the Project and the Project stakeholders. WorleyParsons and TL Cement have made efforts to ensure that the public, including affected people, women and vulnerable groups, have the opportunity to participate fully in the consultation process.

Newspaper readership is low in Baucau and thus other advertising methods are better suited to encourage broad public consultation. Therefore, all notices associated with the EIS public
consultation were advertised on national television (TVTL) in Dili between 4 - 10 December 2015. Notices were also advertised though local radio stations such Radio Popular Coulelemai Bucoli and Radio Komunidade Lian Matebian in Baucau commencing on the 27 November to 4 December 2015. A copy of the public notice was also posted on TL Cement’s website. Additionally, the notices were displayed at local government offices including Baucau Municipality, Baucau Administrative Post, Chief of Village, and PNTL Baucau Municipality. Lastly, a copy of all notices was provided to the NDPCEI.

Overall, the community members welcome the Project. The local leaders – i.e. Chief of village, F-FDTL (National Army), and Representative of the Baucau Administrator – who attended were very supportive of the Project as well. They encouraged the attendees to listen and engage, so to have a better understanding of the Project and the draft EIS presented.

In summary, most of the communities’ concerns revolve around their properties (including sacred sites) that may be taken or affected by the Project, job opportunities and environmental issues including air, noise and water pollution. In addition, other stakeholders have expressed concern regarding the climate change impacts of the project.

1.9 Summary of EIS Recommendations

The key recommendations from the EIS pertain to ensuring that the impacts on community livelihood and amenity are mitigated and managed throughout the Project life. Key processes are recommended for implementation to address the concerns associated with relocation and compensation. The EIS identifies environmental impacts from noise, dust and traffic as a result of the movement of trucks and equipment on the site. The mitigation measures for these include selection of equipment to minimize noise, dust management measures using suppression methods and project scheduling planning to limit vehicle movements on and around the Project area.

Implementation of the Emergency Response Plan (ERP) contained in the EMP will mitigate the risk to comminution of surface and groundwater resources near the Project area. The environmental and social risks from the development of the Project are readily mitigated and can be managed through the implementation of a robust Environmental Management Plan (EMP) and ongoing stakeholder consultation and management.
2 DETAILS OF PROJECT PROPOONENT

TL Cement LDA (the Proponent) was registered in Timor-Leste as a new company to develop the Baucau Cement Clinker Plant project. The contact details of the Project Proponent are given below:

**Name:** TL Cement LDA

**Dili Office**

**Address:** Rua Complexo
Hotel Ramelau
Aimutin Comoro, Dom Aleixo
Dili
Timor-Leste

**Phone:** +670 331 1206

**Perth Office**

**Address:** Level 5, 22 Mount Street
Perth, Western Australia 6000

**Phone:** +61 8 9261 1965

**Contact Person** Mr. James Rhee
Managing Director
Mob : +61 400 317 811

**Email:** james@tlcement.net
3 DETAILS OF EIA CONSULTANTS

WorleyParsons is responsible for leading the environmental assessment process, conducting the environmental and social baseline studies, and preparing the Environmental Impact Statement (EIS) and Environmental Management Plan (EMP).

Globally, WorleyParsons is a leading provider of professional services to the infrastructure and resource industries. WorleyParsons has been involved in environmental management for decades and has a proven track record of delivering innovative solutions for our customers. WorleyParsons offers a full suite of environmental services, which cover all aspects from planning to detailed design and implementation. Services include engineering and environmental services to assist in site selection, site analysis, site layout, and design. One of the key differentiators to WorleyParsons’ environmental assessment approach is our ability assemble multi-disciplinary, in-house teams, including but not limited to engineers, urban planners, GIS and mapping specialists, geotechnical engineers, environmental scientists, social impact specialists, and hydrological engineers. These teams are led by experienced environmental assessment professionals who are capable of integrating the technical aspects of all disciplines into a tailored solution. Our ability to draw upon all of these resources internally streamlines the project delivery process and ensures reliable quality for the customer.

3.1 Local presence

WorleyParsons established an office in Timor-Leste in 2010 to provide our customers with the advantages of local content and an ‘on-the-ground’ understanding of local conditions. WorleyParsons Timor-Leste has delivered several major projects nationwide for the Government of Timor-Leste, TIMOR GAP, and international development agencies, including engineering feasibility, engineering design, and environmental assessment projects.

As a local company employing local staff, WorleyParsons is intimately familiar with the Timorese environment and culture. Our local staff are fluent in Portuguese, Tetun, and other local languages and are experienced in community engagement. Our multi-disciplinary team has extensive experience in the delivery of environmental studies in Timor-Leste.
The development of the EIS and EMP has been led by Mr Daniel Hunter.

<table>
<thead>
<tr>
<th>Key Personnel</th>
<th>Qualifications and Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daniel Hunter</td>
<td><strong>B App Sci (Natural Resources Management), University of Melbourne</strong></td>
</tr>
<tr>
<td>EIA Specialist</td>
<td>Dan is a Project Manager and Scientist with over 20 years’ experience predominantly in the area of environmental assessment and management. He has extensive experience in managing multidisciplinary projects, including the assessment and management of cumulative environmental issues associated with large infrastructure projects such as mine and port developments, roads, rail corridors, land developments, pipelines and has worked pro-actively with environmental planning teams, project design teams, government regulators, construction personnel, consultants and the community to achieve environmental / sustainability objectives and the development of mitigation strategies and consents in accordance with regulatory requirements. One of Dan’s major roles on projects is to integrate environmental considerations into all aspects of decision making, planning, design, construction and operational processes and drive for sustainable outcomes. Dan has previously managed and led a study of the Timor-Leste local industry capability for ConocoPhillips.</td>
</tr>
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</table>

The environmental assessment has been undertaken by a team of specialists with world-class expertise and extensive experience in Timor-Leste.

<table>
<thead>
<tr>
<th>Key Personnel</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Chris Serjak</td>
<td><strong>MSc, Sustainable Development, University of London</strong></td>
</tr>
<tr>
<td>Study Manager</td>
<td>Chris is the Country Manager for WorleyParsons’ Timor-Leste operations. He has 18 years of experience in environmental management, infrastructure development, and sustainable international development. He has five years of experience in Timor-Leste working on environmental projects, community-driven development, local content, and offshore petroleum projects. Chris recently completed a year-long study of the environmental licensing process in Timor-Leste and is an expert on the local regulatory framework. He has led the Dili Airport Environmental and Social Scoping Study and provided consulting services on the environmental licensing process for the Suai Supply Base project. As a certified project-manager, Chris understands how to manage interdisciplinary teams to deliver projects that meet client expectations.</td>
</tr>
</tbody>
</table>
## Key Personnel

<table>
<thead>
<tr>
<th>Name</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Annette Jacobs</td>
<td>BSc (Hon) Geology, Rhodes University, Dip Project Management</td>
</tr>
<tr>
<td>ESIA and EMP Lead Author</td>
<td>Annette is trained as a Geologist and Environmental Scientist with 15 years' experience in environment and social impact assessment (ESHIA), management plans development, geology and hydrogeology. She has experience in delivering Environmental and Social assessments in Australia, Africa and Asia. Her technical expertise includes EIA, regulatory approvals and advanced spatial analysis using geographic information systems (GIS).</td>
</tr>
<tr>
<td>Alison Mratovich</td>
<td>BA Geography and Environment Management, University of Johannesburg</td>
</tr>
<tr>
<td>Community Consultation</td>
<td>Alison has over 10 years experience in stakeholder management providing consultancy and advisory services to government agencies and private companies on environmental and social impact assessments, community engagement and socio-economic baseline assessments. Her focus is on social and environmental impact assessments, stakeholder engagement programs and social investment strategies. Delivering assessments in accordance with WA, International Finance Corporation (IFC) and World Bank Standards.</td>
</tr>
<tr>
<td>Lindsay Furness</td>
<td>MA, Hydrogeology and Engineering Geology</td>
</tr>
<tr>
<td>Water Resources</td>
<td>Mr Lindsay Furness has over 38 years' experience in groundwater and water resource management in 14 countries for ADB, WB, UNESCO, WHO, AusAID, NZAID. He is a Fellow of the Australian Institute of Geosciences (Registered Professional Geoscientist), a member of the International Association of Hydrogeologist and the National Association of Ground Water Scientists and Engineers (US). Lindsay Furness made a preliminary study of the caves and springs of the Baucau Aquifer in 2004 under an ADB water resources assessment for Timor-Leste in relation to Agricultural irrigation. In 2010 he was appointed as the Timor-Leste Water Resources and Climate Adaptation Specialist in the National Department of Water Resources (DNGRA), where he was responsible for carrying out several surveys of the Baucau geohydrology.</td>
</tr>
</tbody>
</table>
## Key Personnel

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<tr>
<th>Name</th>
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</thead>
</table>
| **Stuart Atkinson**  | **Water Resources**  
|                | *MEngSc, BEng (Hons), MIEAust*  
|                | He has over 15 years’ experience in hydrology, hydrogeology and contaminated site assessment gained in Australia, Africa, the Middle East, UK and New Zealand.  
|                | Stuart’s Master’s degree research included water balance modelling in wet and arid environments.  
|                | He has worked as part of large multidisciplinary teams addressing all water resource issues on major projects, and also managing smaller projects requiring specialist technical expertise to resolve complex water resource problems. This has included working through all project phases using a variety of project delivery.  
|                | Stuart’s technical experience includes numerous hydrological investigations aimed at designing flood protection measures for new mine sites, residential and commercial developments, mine water management, flood mapping, water balance modelling, environmental hydrology, dam design, drainage system design and the preparation of bridge and culvert schedules for railway, roads and pipelines with lengths in excess of 1,000km. Stuart’s experience solving complex surface and groundwater issues on mining projects allows him to identify and address project risks associated with surface and groundwater while also considering associated geotechnical and civil engineering issues. |
| **Lekha Siraz**  | **Water Resources**  
|                | *PhD Hydrogeology, BSc Geology, MSc. Geology (Hydrogeology)*  
|                | Lekha’s fields of experience include groundwater assessments, environmental hydrogeology, hydrogeological and contaminated site assessments and groundwater modelling. She has worked on a number of hydrogeological reviews, feasibility/impact assessments and compliance monitoring for mining and industrial customers in Australia.  
|                | Lekha’s expertise also includes hydrogeological Interpretation and conceptualisation leading towards flow and contaminant transport Modelling. She has project managed and reviewed hydrogeological and groundwater modelling projects for the Victorian and New South Wales Government agencies, mining clients and waste management facilities. Besides these, her other projects have included landfill liner and cover design using industry standards such as the US EPA HELP model and alternate cover conceptualisation and design for landfills using vadose zone modelling. She also assisted a WA based contaminated sites auditor in audits of several sites, reviewing assessments, reports and preparing contaminated sites audit reports. |
### Key Personnel

<table>
<thead>
<tr>
<th>Name</th>
<th>Qualifications and Experience</th>
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</thead>
</table>
| Grant Hickson | **BSc (Hons) Physics and Computer Science**  
Grant Hickson has more than five years of air quality consulting and professional experience in environmental impact assessments. He is an Environmental Scientist specialising in pollutant and particulate matter dispersion modelling from major industrial works, emissions estimation / calculation, data analysis and management as well as data validation and quality control for reporting purposes. Grant has undertaken numerous air quality impact assessments in Australia and internationally. He has recently been the primary author for the air quality, meteorology and noise assessments for the Tasi Mane Environmental Impact Assessment project. In this assessment he was responsible for: the on-site collection of air quality samples; meteorological and noise measurements; location surveying; data management and interpretation; and reporting. All work was conducted to International Standards across multiple sites and allowed the client to assess any adverse environmental impacts from the proposed development. |
WorleyParsons is supported by the following specialist consultants, who have extensive experience in Timor-Leste, including:

- **Bita Bina Semesta (BBS):** BBS is based in Bandung, Indonesia and maintains a locally-registered project office in Dili, Timor-Leste. BBS specializes in 'front end' type works, including planning and environmental studies for transport, resources, urban development, infrastructure and industrial development. BBS has become a regional leader in the preparation of environmental impact assessments that meets international standards. BBS recently worked with WorleyParsons to deliver environmental studies in support of the Dili Drainage EIA for the Ministry of Public Works.

- **InSight Consulting:** Insight is a Timorese-owned organization based in Dili conducting research into public attitudes in the country. Their work is intended to advance the mutual interest of stakeholders, civil society and the people of Timor-Leste. They have a proven record as a credible research agency, based on sound principles of investigation and an intimate knowledge of the country. Their greatest emphasis is on compiling accurate information in a fully accountable way. Insight recently worked with WorleyParsons and BBS on the Dili Drainage EIA environmental studies.

- **Nuno Oliviera:** Dr. Nuno Oliveira is currently the Cultural Heritage Adviser for the Timor-Leste Secretary of State for Arts and Culture where he has led development of cultural heritage management programs and policies including the National Cultural Policy, Cultural Strategic Plan, Resolution on Protection of Cultural Heritage and ratification of UNESCO’s main conventions on cultural heritage. Prior to this role, Dr. Oliveira conducted extensive research in Timor-Leste for the Australia National University (ANU), completing his dissertation on early subsistence practices and agriculture in Timor-Leste. His research included extensive fieldwork and excavations near the proposed project location.

- **Dr Colin Trainor:** During 1997-2002, Colin worked internationally as an ecologist with BirdLife International, leading biodiversity assessments, particularly of forest birds, in Indonesia and East Timor (Timor Leste) (Timor-Leste). In Timor-Leste (2002-2014), work included a PhD thesis involving systematic survey of birds, mammals, reptiles, ants and trees across a 2,000 km2 district, and consulting projects on transmission and proposed hydropower works at Baucau and Iralalaro in Timor-Leste; shorebird and waterbird assessments; bird species rediscoveries. In Timor-Leste has worked on establishment of a protected area, wrote and published a field guide to the birds of East Timor (Timor Leste) and a site priority guide.
**Dr. Kania Dewi**
Air Quality

**PhD, Environmental Engineering**

Dr. Kania has 10 years’ experience as an Air Quality Expert conducting monitoring and modelling of air quality impacts for EIAs and EMPs. She has extensive experience with mining and hydrocarbons projects throughout Indonesia. Dr Kania has conducted multiple pollutant and GHG emissions inventories and completed climate change assessments. She has also completed modelling and assessment of impacts from cement plants. Dr. Kania recently completed a baseline air quality assessment for the Dili Drainage EIA environmental studies in association with WorleyParsons.

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**Dr. IB Ardhana Putra**
Noise

**PhD, Engineering**

Dr. Ardhana has 16 years of experience in noise impact assessment, modelling, and management. He has published nearly 40 papers on noise over the past 27 years and is a former Head of Academic Development Program at Bandung Institute of Technology and a current advisor to the Indonesian Ministry of Environment. He has extensive experience with measurement, analysis and mapping of noise condition at oil and gas facilities and power plants, as well as airports and roads.

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**Titi Liliani Soedirdjo**
Traffic

**MSc, Highway and Traffic Engineering**

Ir Titi has 34 years of experience in traffic engineering, traffic surveys, and traffic impact assessments. He has been a lecturer at Bandung Institute of Technology since 1981 and a consultant on traffic and railways. He has been involved in several studies in Timor-Leste, including modelling the traffic signalization and signage for Dili in 2002 and a traffic impact assessment for the Dili Drainage EIA.

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**Dr. Hisyam Achmad**
Social Impact & Resettlement

**PhD, Anthropology**

Dr. Hisyam has over 40 years’ experience in social sciences and anthropology. In the past 10 years, Dr. Hisyam has worked for BBS completing several socio-economic and resettlement impact studies for projects throughout Indonesia, including public consultation, field surveys, and resettlement planning. He has extensive experience with IFC Guidelines and Indonesian AMDAL. He recently completed a socio-economic and resettlement impact assessment for the Dili Drainage EIA project.

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**Joana Belo**
Public Consultation field officer

**BSc, Environmental Science (Management)**

Joana is an HSE Professional with experience in Australia, Malaysia and Timor-Leste. She has 7 years of experience health, safety and environment (HSE) including conducting risk assessment, developing emergency procedures in hydrocarbon and infrastructure industry. She also is participating in many environmental impacts and social assessments including, Field Officer for Worley Parsons Timor-Leste working on Dili Airport Environmental and Social Scoping Study, and Field officer for Tasi Mane EIA Study.
These specialists are supported by a team of local Timorese staff including environmental specialists, social specialists, and field surveyors. Field assistants have also been hired from the local area to ensure access to local knowledge and to promote public consultation.

In addition, wherever possible, the environmental assessment process has involved participation from local communities and mentoring of Timor-Leste university students, especially during field survey activities.
4 PROJECT DESCRIPTION

4.1 Project Identification

TL Cement LDA, a privately-owned company, proposes to construct a greenfield cement manufacturing project (hereafter referred to as the Baucau Cement Project) in Baucau Municipality, Timor-Leste.

The cement plant, Jetty, belt conveyor and associated infrastructure component of the Baucau Cement Project will be referred to as the “Project” within this EIS.

4.2 Project Category

The Environmental Authority for this Project is the National Directorate for Pollution Control and Environmental Impact (NDPCEI). WorleyParsons on behalf of the project proponent has consulted with the NDPCEI with regards to obtaining the Environmental Licensing Certificate for the Project. The Application for Environmental License and the Project Document were submitted to NDPCEI in June 2015. The Project Document was approved on 20 July 2015 and pursuant to Decreee Law 5/2011, the NDPCEI categorized the component of cement plant, Jetty, conveyor belt, construction of camp and 120 residential site, solar panel instillation and groundwater drilling of Baucau Cement Project as Category A.

4.3 Project Details

4.3.1 Project Location

The proposed cement plant and Jetty are located in Suco Tirilolo, Aldeia Osso-ua, in the Baucau administrative post of Baucau Municipality, Timor-Leste. The location is about 120 km east of Dili and approximately 16 km west of Baucau.

The geographical coordinates of Project components are detailed in Table 1 below. Figure 4-1 shows the location of the Project components.

Table 1: Coordinates of Project components

<table>
<thead>
<tr>
<th>Component</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement Plant</td>
<td>-8.4520</td>
<td>126.3424</td>
</tr>
<tr>
<td>Jetty</td>
<td>-8.4438</td>
<td>126.3433</td>
</tr>
<tr>
<td>Conveyor belt</td>
<td>-8.4520 to -8.4438</td>
<td>126.3424 to 126.3433</td>
</tr>
<tr>
<td>Accommodation</td>
<td>Adjacent to cement plant</td>
<td></td>
</tr>
</tbody>
</table>
As indicated in Section 4.1 – Project Identification above, the Limestone Mine, Clay Extraction and Road Improvements and New Roads and the proposed Industrial Precinct are not addressed in this EIS.
Figure 4-1: Location of Cement Plant, Jetty and Conveyor in the area
4.3.2 Nature of the project location

The project is located in an area with a small rural subsistence agriculture. Agricultural water sources are relatively rare, except in Osso-Ua where water is largely limited to domestic uses. The exploitation of natural resources depends heavily on the availability of rain, so the types of crops that can be cultivated are relatively limited.

The Jetty and Conveyor will be located at the nearby beach and is flat and already highly modified by temporary dwellings, grazing and some agriculture. The general environment is characterised by sandy soils and established breadfruit Artocarpus altilis and Corypha sp palm groves.

The Cement Plant site is located on NNE facing slopes and plains relatively close to the beach, road and proposed Jetty area. The Cement Plant site is characterized by shallow limestone soils with scattered limestone rock outcrops, minor ridges and gullies sloping towards the beach. The site consists predominantly of very open savannah woodland which has been extensively modified for agriculture and grazing in places.

There is no main stream and the community relies on springs for water. There are two springs in the settlement Osso-ua and Uaimatabai.

4.3.3 Project Components

For the purposes of this EIS, the Project components are as follows:

1. Cement Plant;
2. Conveyor Belt;
3. Jetty; and
4. Associated infrastructure, which includes:
   a. Materials Offloading Facility (MOF);
   b. 33 MW Captive Circulating Fluid Bed Power Plant;
   c. Accommodation;
   d. Water Sources; and
   e. Internal access roads.

Table 2 below provides details of the Project’s key characteristics.
### Table 2: The Project’s Key Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project purpose</td>
<td>To produce approximately 1.65 million tons per annum (mtpa) of Portland cement clinker</td>
</tr>
<tr>
<td>Project Life</td>
<td>50+ years</td>
</tr>
<tr>
<td>Plant Capacity</td>
<td>Approximately 1.65 million tonnes per annum of Portland cement clinker (0.5 mpta for domestic consumption &amp; 1.15 mtpa for export to Australia);</td>
</tr>
<tr>
<td>Area of Disturbance</td>
<td>Total area of disturbance for the Project will be approximately 82 ha, as required for each of the following components:</td>
</tr>
<tr>
<td></td>
<td>• Cement processing plant + captive power plant + camp = 80 ha</td>
</tr>
<tr>
<td></td>
<td>• Jetty + pipe conveyor = 1.5 ha</td>
</tr>
<tr>
<td></td>
<td>• Materials Offloading Facility = 0.23 ha</td>
</tr>
<tr>
<td>Plant and Jetty Operation</td>
<td>24 hours a day, 7 days a week, 52 weeks a year</td>
</tr>
<tr>
<td></td>
<td>Cement production 330 days per year</td>
</tr>
<tr>
<td>Power Supply</td>
<td>These following power supply facilities will be installed at the cement plant location:</td>
</tr>
<tr>
<td></td>
<td>• Captive Power Plant of 30 MW capacity based on Circulating Fluidized Bed (CFB) Boiler</td>
</tr>
<tr>
<td></td>
<td>• Waste Heat Recovery (WHR) Plant of 8-10 MW capacity shall also be installed to utilize waste flue gases.</td>
</tr>
<tr>
<td>Water Supply</td>
<td>Water Supply from bores at Uaidei River:</td>
</tr>
<tr>
<td></td>
<td>• 0.33 ML/day for construction; and</td>
</tr>
<tr>
<td></td>
<td>• 3.15 ML/day for operation</td>
</tr>
<tr>
<td>Project Timeline</td>
<td>• Pre-construction = 18 months;</td>
</tr>
<tr>
<td></td>
<td>• Construction = 2.5 years;</td>
</tr>
<tr>
<td></td>
<td>• Operations = 50 years+; and</td>
</tr>
<tr>
<td></td>
<td>• Decommissioning = 5 years</td>
</tr>
</tbody>
</table>
All of the above infrastructure and components are critical to the success of the Baucau Cement Project. The Cement Plant will process the raw materials to produce cement clinker for domestic use and international sale. The Jetty will be used to import raw materials not available locally including coal, iron ore, and gypsum and to export the clinker product. The Conveyor Belt will be used to transport materials to and from the Jetty. The Captive Power Plant, solar plant and WHR plant will be used to provide economical power to the entire Project.

4.3.4 Cement Clinker Plant

The Proponent proposes to establish a new state-of-the-art, modern, dry process Cement Plant with a capacity of 1,650,000 tonnes per annum (1.65 Mtpa) of cement clinker. The Cement Plant includes clinkerisation and cement grinding facilities with a rated capacity of 5,000 tonnes per day (tpd) of clinker and 100 tonnes per hour (tph) of cement.

The Cement Plant activities include raw material crushing and stocking, raw material grinding and stocking, clinkerisation, cement grinding, cement stocking and dispatch. A conceptual design of the Cement Plant is shown in Figure 4-2 and a layout plan is shown in Figure 4-3. The Cement Plant also includes a waste heat recovery (WHR) power plant that will capture unused waste heat from manufacturing processes and convert it into electricity.

It is also proposed to manufacture Ordinary Portland Cement (OPC) at the Cement Plant for the domestic market by blending imported gypsum with the clinker. Both the gypsum and clinker will be ground on site and blended at a ratio of 95% clinker and 5% gypsum. Out of the 1.65 Mtpa of clinker produced at the Cement Plant, approximately 0.5 Mtpa shall be ground at the Cement Plant into cement for domestic consumption in Timor-Leste (60%) and for export to the Australian market (40%). The remaining balance of 1.15 Mtpa of clinker shall be exported to Australia through the Jetty.

The conceptual view of the complete Cement Plant is shown in Figure 4-2 and its layout plan is shown in Figure 4-3. The flowsheets describing the process of raw meal production and clinker manufacture are shown in Figure 4-4 and Figure 4-5.

The details of the Cement Plant configuration are tentative and may change at detailed design stage, however it is anticipated the disturbance footprint will remain the same.
Figure 4-2: Conceptual view of Cement Plant
Figure 4-3: Layout of Plan of Cement Plant
Figure 4-4: Raw material production process
Figure 4-5: Cement production process
### 4.3.5 Equipment

Table 3 below lists the equipment required for construction of the Project and Table 4 lists the equipment required for the Cement Plant during the operational phase.

**Table 3: List of equipment required for construction**

<table>
<thead>
<tr>
<th>Item</th>
<th>Equipment Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobile Cranes</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Piling/drilling Rig (land)</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Tower Cranes</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Front End Loaders</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Back hoes</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Graders</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Bull-Dozers</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Excavators</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Batching Plants</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>200-300 KVA gensets</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>Fuel Tanker</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>Tipper Trucks (18-24 tonne)</td>
<td>10</td>
</tr>
<tr>
<td>13</td>
<td>Mining Truck 30-40 tonne</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>Piling Barges (Sea)</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Barge mounted Crane</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>Fork Lifts</td>
<td>4</td>
</tr>
<tr>
<td>17</td>
<td>Scaffolding</td>
<td>Lot</td>
</tr>
<tr>
<td>18</td>
<td>Welding machines</td>
<td>30</td>
</tr>
<tr>
<td>19</td>
<td>Slip Forming machine for Silos</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>Brick Laying Machine (for Kiln)</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>Cherry Pickers (Hydraulic Hoists)</td>
<td>4</td>
</tr>
<tr>
<td>22</td>
<td>Plare rolling Machine</td>
<td>1</td>
</tr>
</tbody>
</table>
TL CEMENT, LDA
BAUCAU CEMENT PROJECT
ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>Rebar bending Machine</td>
<td>3</td>
</tr>
<tr>
<td>24</td>
<td>Mobile Cement Mixers</td>
<td>6</td>
</tr>
<tr>
<td>25</td>
<td>Truck Mixers 7-10 m³</td>
<td>6</td>
</tr>
<tr>
<td>26</td>
<td>Truck mounted Concrete Pump</td>
<td>4</td>
</tr>
<tr>
<td>27</td>
<td>Roller</td>
<td>2</td>
</tr>
<tr>
<td>28</td>
<td>Dumpers</td>
<td>6</td>
</tr>
<tr>
<td>29</td>
<td>Hand Tools (drills, grinders, chain blocks, tifors, comealongs, cutting sets, spanners etc.)</td>
<td>lot</td>
</tr>
</tbody>
</table>

Table 4: List of equipment used in the Cement Plant during the operational phase

<table>
<thead>
<tr>
<th>SN</th>
<th>Package / Equipment</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Limestone Crusher</td>
<td>900 tph</td>
</tr>
<tr>
<td>2</td>
<td>Box Feeder for Clay</td>
<td>500 tph</td>
</tr>
<tr>
<td>3</td>
<td>Clay Crusher</td>
<td>1000 tph</td>
</tr>
<tr>
<td>4</td>
<td>Limestone Stacker/ Reclaimer</td>
<td>1200 / 550 tph</td>
</tr>
<tr>
<td>5</td>
<td>Corr / Add Stacker / Reclaimer</td>
<td>1000 / 2x150 tph</td>
</tr>
<tr>
<td>6</td>
<td>Coal Stacker / Reclaimer</td>
<td>1000 / 2x100 tph</td>
</tr>
<tr>
<td>7</td>
<td>Raw Material Grinding Mill</td>
<td>450 tph</td>
</tr>
<tr>
<td>8</td>
<td>Preheater / Kiln / Cooler</td>
<td>5000 tpd</td>
</tr>
<tr>
<td>9</td>
<td>Bulk Clinker Truck Loading</td>
<td>100 tph</td>
</tr>
<tr>
<td>10</td>
<td>Coal Grinding Mill</td>
<td>45 tph</td>
</tr>
<tr>
<td>11</td>
<td>Cement Grinding Mill</td>
<td>100 tph</td>
</tr>
<tr>
<td>12</td>
<td>Packers</td>
<td>2 x 90 tph</td>
</tr>
<tr>
<td>13</td>
<td>Truck Loaders</td>
<td>4 x 90 tph</td>
</tr>
<tr>
<td>14</td>
<td>Bulk Cement Loading</td>
<td>2 x 100 tph</td>
</tr>
<tr>
<td>15</td>
<td>Ship Loader</td>
<td>1000 tph</td>
</tr>
<tr>
<td>16</td>
<td>Ship Un-loader</td>
<td>1000 tph</td>
</tr>
<tr>
<td>17</td>
<td>Pipe Conveyor</td>
<td>1000 tph</td>
</tr>
</tbody>
</table>
SN | Package / Equipment | Capacity
--- | --- | ---
18 | Waste Heat Recovery System | Approx 5 MW
 | Turbine & Generator | 
 | Air Cooled Condenser | 
 | Cooling Tower | 
 | Preheater Boilers | 
 | AQC Boiler | 

Storage Areas

<table>
<thead>
<tr>
<th>SN</th>
<th>Package / Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Limestone Stockpile</td>
</tr>
</tbody>
</table>
| 2 | Corrective / Additive Stockpiles | Iron Ore - 1 x 10000 t
 | Clay - 1 x 6500 t
 | Gypsum - 1 x 10000 t
 | Limestone - 1 x 3200 t |
| 3 | Coal Stockpile | 2 x 15000 t |
| 4 | Raw Meal Silo | 1 x 18000 t |
| 5 | Clinker Silo | 1 x 80000 t |
| 6 | Off-Spec Clinker Silo | 1 x 1000 t |
| 7 | Cement Silo | 2 x 5000 t |

4.3.6 Organisational Manpower

It is estimated the Project Proponent will hire 25 expatriates and 20 locals during a two-year construction period and will create 700 new jobs during operations. See Table 5 below for more details on job creation.

**Table 5: Number of jobs created during construction and operation period of the Cement Plant**

<table>
<thead>
<tr>
<th>Category (s)</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expatriates*</td>
<td>Construction Period</td>
<td>Construction Period</td>
<td>Operations</td>
</tr>
<tr>
<td>1 : Top Management</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2 : Senior Management</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>
## Category (s) | Number of Jobs
--- | ---
| **Expatriates** | Year 1 | Year 2 | Year 3 |
| 3: Middle Management | 8 | 8 | 12 |
| 4: Specialist | 0 | 0 | 2 |
| 5: Engineers | 14 | 14 | 27 |
| **SUB TOTAL** | 25 | 25 | 47 |
| **Nationals** | Year 1 | Year 2 | Year 3 |
| 1: Supervisor | 11 | 11 | 40 |
| 2: Operators | | | 107 |
| 3: Attendents | | 143 |
| 4: Workmen | 4 | 4 | 163 |
| 5: Labour | 5 | 5 | 200 |
| **SUB TOTAL** | 20 | 20 | 653 |
| **TOTAL** | 45 | | 700 |

*Expatriates will be replaced over a 3-5 year period after commencement of operations based on training of Timorese
**NOTE: The above is the direct employment. There will be indirect employment also of approx. 2000.

### Managerial and Administrative Staff

- **Plant Manager**
  
  The Plant and Jetty is proposed to be worked under the supervision and control of a manager who shall be well qualified, possessing a relevant degree and operational experience. Besides performing the statutory duties as laid in Law/Regulation, he shall supervise and control the other related functions and shall be assisted by the requisite functional heads in the respective area. The plant manager shall be responsible for total operation, maintenance and production of the Cement Plant and Jetty.

- **Vocational Training and Safety Officer**
He is proposed to be responsible for the supervision of the training given to the workers from time to time and also work as Safety Officer. Apart from the mentioned duties, he shall be in-charge of the Time Office, First Aid and other such allied activities.

- **Shift Managers**

Each operational shift shall be in-charge of an Assistant Plant Manager who shall be assisted by a requisite number of foremen. Shift managers shall be qualified engineers with good experience of working in operational plant and jetties.

### 4.3.7 Personnel Training

Personnel training shall focus on ensuring:

1. Personnel safety during the operation of machinery and equipment;
2. Use of personal protective equipment;
3. Safe work practices and regular reviews of work procedures; and
4. Environmental and Social mitigation measures are implemented.

This training will take the form of:

- **Formal Health, Safety and Environment inductions for all personnel entering the Cement Plant, Jetty and Conveyor sites to do work;**
- **Instructions in the use of the spill response kits and fire suppression gear;**
- **Regular reviews and capability assessments through behaviour-based work observations; and**
- **Refresher and regular updates to training for all personnel incorporating environmental and safety requirements.**

### 4.3.8 Investment and Cost Production

The overall Baucau Cement Project represents a significant investment of approximately $400 million and will be the largest industrial project undertaken in Timor-Leste to date. It is anticipated to create 3,000 jobs at the peak of the construction. It will then continue to have 1,000 permanent employees during operation. The Baucau Cement Project aims to develop local capacity and will develop a training centre.

### 4.3.9 Raw Materials

The raw and fuel material requirements for the proposed Cement Plant are to be met from different sources as given in Table 6.
### Table 6: Raw Materials

<table>
<thead>
<tr>
<th>No.</th>
<th>Material</th>
<th>Source</th>
<th>Source Locality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Limestone</td>
<td>Local</td>
<td>Suco Tirilolo, Bahu, Caibada, Triloca, Bucoli, Wailili and Fatumaca in administrative post of Baucau in Baucau Municipality</td>
<td>Primary raw material. Transported from mine site to crusher by trucks.</td>
</tr>
<tr>
<td>2.</td>
<td>Clay</td>
<td>Local</td>
<td>Suco Wailacama, Baucau administrative post in Baucau Municipality</td>
<td>A corrective material. Transported from quarry to plant by road.</td>
</tr>
<tr>
<td>3.</td>
<td>Sand</td>
<td>Local</td>
<td>Suco Cairabela, Baucau administrative post in Baucau Municipality</td>
<td>A corrective material. Transported from quarry to plant by road.</td>
</tr>
<tr>
<td>4.</td>
<td>Iron Ore</td>
<td>Import</td>
<td>Australia</td>
<td>A corrective material. Transported to Timor-Leste by ship, offloaded at jetty, and transported to plant by covered pipe conveyor.</td>
</tr>
<tr>
<td>5.</td>
<td>Gypsum</td>
<td>Import</td>
<td>Thailand</td>
<td>A corrective material. Transported to Timor-Leste by ship, offloaded at jetty, and transported to plant by covered pipe conveyor.</td>
</tr>
<tr>
<td>6.</td>
<td>Coal</td>
<td>Import</td>
<td>Australia/Indonesia</td>
<td>Fuel source and corrective material. Transported to Timor-Leste by ship, offloaded at jetty, and transported to plant by covered pipe conveyor.</td>
</tr>
</tbody>
</table>

#### 4.3.10 Jetty

A dedicated Jetty is proposed at a distance of 2 km from the Cement Plant site. Inbound material, (e.g., coal, gypsum, iron ore) and outbound clinker shall be transported between the Cement Plant and the Jetty by a 2 km long Pipe Conveyer. The maximum load during unloading is estimated as 1000 tonnes per hour (coal bases) and during loading is estimated as 1600 tonnes per hour (clinker base). The conceptual plan of the Jetty is shown in Figure 4-6 and its layout is shown in Figure 4-7.

The Jetty will be an L-shaped steel trestle, extending approximately 120 meters from shore with a vessel berthing length of 260-390 meters. The Jetty will be equipped with rail-mounted material handling cranes. Final design is still pending.
4.3.11 Materials Offloading Facility (MOF)

The MOF is needed for bringing in materials, equipment and parts. In principle, the MOF is particularly needed during the construction phase. In order to make better use of the MOF after the initial construction period, the MOF can also be used for additional activities, such as:

- Import of fuel;
- Fueling of barges and tugs; and
- Parking of tugs.

The MOF will be located approximately 150 m to the southwest of the Marine Jetty but the final position is pending final design. The MOF concept is shown in Figure 4-8.
Figure 4-6: Jetty conceptual design
Figure 4-7: Jetty layout
4.3.12 Conveyor

A 2 km Pipe Conveyor is proposed to run from the Cement Plant to the Jetty. The Conveyor will be fully enclosed in the gallery / local hood covering over the belt. The Conveyor will have belt cleaners at feed and discharge ends. All transfer towers will be enclosed with side sheeting and unloading hoppers will have their own de-dusting units to reduce dust impacts.
4.3.13 Construction Camp and Worker Residential Area

Accommodation will be provided onsite near the Cement Plant site during construction and operation. The accommodation will made up of 35 pre-manufactured 40-foot container type units. These units will be flat-packed and assembled on-site.

The accommodation area will include one office unit, one cafeteria unit, and five accommodation units each providing 24 rooms for a total of 120 rooms.

During construction, two persons will use each room, and after the completion, one person per rooms as a permanent operations camp.
4.3.14 Internal roads

New internal roads will need to be constructed connecting Cement Plant and Jetty and the other supporting infrastructure.

4.3.15 Utilities

4.3.15.1 Power

The power requirement for the Baucau Cement Project shall be drawn from dedicated sources. A Captive Power Plant of 33 MW capacity based on Circulating Fluidized Bed (CFB) Boiler technology is proposed to be installed. Selection and development of Best Available Technology (BAT) through the use of CFB technology, which in addition to coal can burn biomass and other waste materials to reduce the carbon footprint. CFB has a greater direct Project cost than other similar technologies. TL Cement is committed to using the BAT for power generation for the Project.

A Waste Heat Recovery (WHR) Plant of 8-10 MW capacity shall also be installed to utilize waste flue gases. All of these facilities will be installed within the footprint of the Cement Plant location.
4.3.15.2 Water Supply

The water requirement for the Baucau Cement Project shall be met from groundwater by drilling borewells. The Proponent has approved a revised scope of works to drill, complete and test one production well at a site near the Plant (see Figure 4-12) for the purpose of investigating the site’s potential to provide water supply.
A makeup water supply of approximately 3.15 ML/day is required for operations. Water shall be required for:

- Process Water Circuit;
- Cooling water (required for machine cooling);
- Make-up water shall be provided while re-circulating water shall be in a close loop;
- Water required for camp;
- Water for on-site facilities; and
- Construction and operations (dust suppression).

WorleyParsons has conducted a review of the regional and local hydrogeology and identified a potential source for water supply from the alluvial groundwater aquifer near the site. Further investigation will be undertaken by the Project Proponent to confirm that supply is adequate to meet the Project demand.

### 4.3.16 Justification and Need for the Project

The proposed Baucau Cement Project will provide cement clinker for both domestic use and international sale.
Portland cement is the basic ingredient of concrete. Concrete is formed when Portland cement creates a paste with water that binds with sand and rock to harden. Cement is manufactured through a closely controlled chemical combination of calcium, silicon, aluminium, iron and other ingredients. Common materials used to manufacture cement include limestone, shells, and chalk or marl combined with shale, clay, slate, blast furnace slag, silica sand, and iron ore. These ingredients, when heated at high temperatures form a rock-like substance known as clinker. Clinker is then ground to a fine powder, along with gypsum and other substances to produce useable cement. Clinker, if stored in dry conditions, can be kept for several months without appreciable loss of quality. Because of this, and because it can easily be handled by ordinary mineral handling equipment, clinker is traded internationally in large quantities.

The proposed Baucau Cement Project represents a significant investment of approximately US $400 million and the largest industrial project undertaken in Timor-Leste to date. It is anticipated to create 3,000 jobs at the peak of the construction. It will then continue to have 1,000 permanent employees during operation. The Baucau Cement Project aims to develop local capacity and will develop a training centre in the region.

The indirect benefits of the Baucau Cement Project may include employment to local community, through the multiplier effect from downstream socio-economic benefits e.g. trades, cleaners, transport and accommodation, etc. The increase in local businesses is expected to improve the local economic conditions, leading to imporved living conditions.

In addition the availability of locally produced cement will be approximately 26% cheaper than current prices making available affordable building materials to improve current housing requirements both locally and nationally. Regional and national infrastructure projects will also be more affordable.

4.3.17 EIA Endorsement

The Baucau Cement Project proponent, TL Cement, has endorsed this EIS in writing. A copy of their written endorsement is included below.
25 February 2016

Sr. Antonio Lelo Taci
National Director
National Directorate for Pollution Control & Environmental Impact
Fomento Building
Mandarin, Dili
Timor-Leste

RE: Proponent Endorsement of EIS

Dear Director,

TL Cement has reviewed and endorses the contents of this Draft Environmental Impact Statement (EIS) and Environmental Management Plan (EMP) for the Baucau Cement Project – Cement Plant, Marine Jetty, Conveyor, and Associated Infrastructure Component as prepared by our Consultant, WorleyParsons Services Pty Ltd.

Sincerely,

James Rhae, Managing Director
TL Cement
4.3.18 EIA Structure

This EIS has been prepared in accordance with the template provided in Annex 4 of the Draft General Regulations (Draft 5 dated 22 April 2014). The contents of this EIS are listed below:

1. Executive Summary;
2. Details of the Project Proponent;
3. Details of the EIA consultants;
4. Description of the Project;
5. Policy, Legal, and Institutional Framework;
6. Description of the Environment;
7. Climate Change;
8. Alternatives;
9. Impact Assessment and Mitigation Measures;
10. Social Impact Assessment;
11. Economic Assessment;
12. Summary of Environmental Management Plan;
13. Public Consultation and Information Disclosure;
14. Difficulties encountered;
15. Conclusions and recommendations; and

The Environmental Licensing Law requires that the EMP is a separate stand-alone document from the EIS.
5 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This section identifies the legislation and guidelines governing the conduct of the EIA study and preparation of the EIS and EMP document. This section also identifies other applicable laws, regulations, guidelines, and standards governing environmental quality, health and safety, protection of protected areas and sensitive areas, protection of vulnerable and endangered species, land use control, and other environmental and social issues.

5.1 Constitution of the Republic of Timor-Leste

Timor-Leste’s environment and its valuable natural resources, represent a potential source of wealth that may support economic growth and community development (RDTL, 2011b). However, the GoTL recognises the need to develop these resources in a sustainable way and still provide a better quality of life for its citizens. The GoTL and the constitution recognise the importance of environmental protection as a fundamental task of the government and as a fundamental right of its citizens. The constitution of Timor-Leste provides the guiding principle for environmental protection in the country. Article 61 of the constitution states:

- Everyone has the right to a humane, healthy and ecologically balanced environment and the duty to protect it and improve it for the benefit of the future generations.
- The State shall recognise the need to preserve and rationalise natural resources.
- The State should promote actions aimed at protecting the environment and safeguarding the sustainable development of the economy.

Furthermore, the constitution states ‘the exploitation of the natural resources shall preserve the ecological balance and prevent destruction of ecosystems’.

5.2 Environmental Legislation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decree Law 26/2012 Environment Basic Law (EBL)</td>
<td>The EBL (also sometimes called the Environmental Framework Law / EFL) sets the overall framework for environmental protection in Timor-Leste. Articles 14, 15 and 16 of the Decree Law No. 26/2012 define the instruments for environmental standards, environmental assessment and licensing and environmental monitoring respectively for Environmental Assessment (EA).</td>
<td>Environmental Assessment study</td>
</tr>
</tbody>
</table>
The objective of the Decree Law is to create a system of environmental licensing for public and private projects likely to produce environmental and social impacts. This system of licensing is based on assessing the size of the potential impacts of projects taking account of their nature, size, technical characteristics and location. Decree-Law No. 5/2011 elaborates the licensing requirement and the EIA procedure in Timor-Leste. Article 4 of the Decree defines the categories of projects and the Type of EA procedure required. The classification of projects is made in accordance with Annex I and II of the Decree.

The proposed project has been classified by the NDPCEI as a ‘Category A’ project “that may potentially cause significant environmental impacts, and [is] subject to the procedure of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP).”

The Asian Development Bank (ADB) has prepared detailed requirements for Screening, Scoping and the Terms of Reference, Environmental Impact Statements and Environmental Management Plans for Environmental Assessment. Although these guidelines have not been formally adopted, they are in practical use by NDPCEI.

Environmental Assessment conducted in conformance with draft regulations. Format of EIS/EMP compliant with guidelines.

The Asian Development Bank (ADB) has prepared detailed requirements for Public Consultation Procedures and Requirements during the Environmental Assessment Process. Although these guidelines have not been formally adopted, they are in practical use by NDPCEI.

Public consultation conducted in conformance with draft regulations. Public Consultation conducted by proponent during preparation of draft ToR (scoping) and draft EIS/EMP.

### 5.3 Biodiversity and Protected Areas Legislation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNTAET Regulation 2000/19 on Protected Places</td>
<td>UNTAET Regulation 2000/19 is still in force and used by the Forestry Department, although it is intended to be replaced by a draft Decree Law on Protected Areas, a draft Decree Law on Forestry, and the draft Decree Law on Biodiversity. Section 3 provides for the protection of endangered species.</td>
<td>EIS Section 6.11.6 includes results of terrestrial ecology study focused on the flora and fauna in Timor-Leste, including mapping of vegetation, location and description of key habitats.</td>
</tr>
</tbody>
</table>
species and their habitats. The killing, injuring, harming, taking or disturbing of any endangered species is prohibited. The destruction in any way of the habitat of an endangered species is also prohibited.

Section 4 provides for the protection of coral and coral reefs. Section 5 provides for the protection of wetlands and mangrove areas.”

UNTAET Regulation 2000/17 also remains in force at present. Section 2 prohibits the cutting, removal, and logging of wood from land in East Timor. It also prohibits the burning or any other destruction of forests. These prohibitions are subject to Section 3 which allow for exemption to be authorized for certain logging activities.

Draft Decree Law on Forest Management, draft 7, received August 2013

The cutting of “forest trees” and harvesting of other forest products in any zone is prohibited unless specifically authorized by the National Director of Forestry (Article 61). The Director may give authorization for such cutting and harvesting if it would be in accordance with this law and other legislation, any community guideline agreements or with the forest management plan. The Director must take into consideration the forest management plan, conservation of the soil and water of the area, ecology and biodiversity of the area, and any other technical specifications determined by the National Director. Article 61.2 allows for community cutting of trees and harvesting other forest products without authorization, when used for traditional purposes.

Article 67 provides for measures to prevent deforestation. No-one is allowed to cut, damage, destroy, remove, transport, purchase, sell, donate or otherwise acquire or dispose of any tree, unless that tree is private property or the person has a Community Forestry Management Agreement or a permit/authorization from the National Director.

It is an offence under Article 86 for any person to
pollute or contaminate land in any Protected Area with chemicals, industrial waste or organic or other polluting substances.

Draft Decree Law on Biodiversity, dated March 2012

When preparing an SEA, EIS, EMP or any other environmental assessment, the proponent must include an assessment of the potential impacts of the proposal on biodiversity and biological resources. This assessment must include: (a) Impacts on any natural ecosystems and habitats located within or near the proposed site, in particular the habitat of any protected species and critical habitat; (b) Impacts on any legally protected areas, as well as any areas the subject of cultural or traditional protection mechanisms such as Tara Bandu; (c) Impacts associated with invasive alien species on or near the proposed site; (d) The sustainability of any proposed use of biological resources; and (e) Proposed measures to avoid, minimize, or mitigate identified impacts, and measures to offset or compensate for any affected biological resources and impacts on biodiversity.

In analyzing any environmental assessment and before deciding to grant an environmental license, the decision-maker must take into account whether granting approval for the proposed activity would be consistent with the purpose and principles of the draft Biodiversity Decree Law. In particular, the Decision-maker must be satisfied that: (a) Any adverse impacts and risks identified in the assessment are deemed satisfactory; (b) Adequate measures to avoid, minimize, or mitigate identified adverse impacts have been identified and will be implemented; (c) As a last resort, adequate compensatory measures, which are designed to achieve no net loss of biodiversity, have been identified and will be implemented by the proponent to offset or compensate for any impacts on biodiversity and affected biological resources; (d) The proponent has prepared, in close consultation with affected local communities, a
comprehensive plan that includes details about all necessary remedial and restoration efforts, and is satisfied that the plan will be implemented at the proponent’s expense.

**United Nations Convention for Biodiversity (1992)**

To develop national strategies for the conservation and sustainable use of biological diversity.

**Government Decree-Law 21/2003 on Quarantine and Sanitary Control on Goods Imported and Exported**

The Government Decree-Law 21/2003 on Quarantine and Sanitary Control on Goods Imported and Exported establishes the processes for sanitation control of the import and export of plants and animal and their derived products. The objective of the law decree states:

- Prevent and control the introduction, establishment and propagation of exotic plagues and diseases and other harmful organisms in the national territory.
- Protect the environment, agricultural production and livestock as well as aquaculture production originating from the country.
- Control the already existing plagues and diseases in the country.
- Protect human beings and the public health from diseases transmitted by animals, plants or their derivatives, or by other organisms.

**The Environmental Management Plan deals with Quarantine management.**
### 5.4 Ports and Shipping

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decree Law 3/2003</td>
<td>The Decree Law 3/2003 on the establishment of the Port Authority and on the approval of the bylaws thereof details the structure, nature and responsibilities of the Administração dos Portos de Timor-Leste or Port Authority of Timor-Leste (APORTIL). The annex to this law requires APORTIL to grant licences for works carried out within their jurisdiction. The marine facilities associated with the project will require the issuing of a port licence from APORTIL prior to commencement of construction.</td>
<td>The project will seek to comply with APORTIL requirements using the relevant information from the project design and construction plans.</td>
</tr>
</tbody>
</table>

### 5.5 Land Legislation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft Expropriation Law</td>
<td>Property may only be expropriated for the public interest and upon timely payment of fair compensation (Article 1). Only the State can order expropriation (Article 5). There must be public consultation on any project requiring expropriation of private or community property (Article 13), and the documents made available to the public for consultation and public hearings must include any environmental, social or economic impact assessment studies (Article 15.4).</td>
<td>If expropriation of private or community property is required, this EIS may be provided for public review in accordance with Article 15.4.</td>
</tr>
<tr>
<td>United Nations Convention to Combat Desertification</td>
<td>To combat desertification and mitigate drought in affected countries through international cooperation and partnerships.</td>
<td>EIS assesses impacts associated with climate change, geology and soils, terrestrial vegetation, surface water and groundwater.</td>
</tr>
</tbody>
</table>
### 5.6 Mineral Resources/Mining Legislation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministerial Diploma 01/2008 on Licensing of Mining Activities</td>
<td>The diploma sets out the procedure for granting of licenses for exploitation of mineral resources related to the construction industry, including sand, sandstone, andesite, basalt, diorite, limestone, and marble. The Environmental License for the project is a precondition of granting the mining license. The diploma requires reasonable environmental protection during the exploration process. The diploma prohibits the extraction of beach sand. The diploma sets out requirements for expropriation of private land or property.</td>
<td>This EIS is prepared in support of the Application for Environmental License. The License is a requirement of the Mining License.</td>
</tr>
<tr>
<td>Draft Mining Code</td>
<td>A draft Mining Code has been prepared which is still in its preliminary stages and has not yet been submitted for public consultation. It is understood that the Mining Code, as drafted, contains provisions requiring projects to adhere to the ELL and obtain an environmental license.</td>
<td></td>
</tr>
</tbody>
</table>
## 5.7 Aquaculture and Fishing Legislation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decree Law 6/2004 On General Bases of the Legal Regime for Fisheries and Aquaculture Management and Regulation (amended by Decree Law 4/2005)</td>
<td>The Decree-Law responds to the need of regulating fishing activities so as to contribute to the attainment of objectives on the economic and social development policies of the country while simultaneously ensuring the protection and conservation of species, as well as their continuous and sustainable exploitation. It also establishes the legal regime for aquaculture. Prohibits the introduction into national maritime waters and hydrographical basis of Timor-Leste of any substances or toxic objects likely to cause infection, and which poisons or destroys fishing resources, algae or any aquatic flora species. Any person, entity, factory or company is prohibited from discharging wastewaters originating from industrial or commercial activities into national waters if such wastewaters are likely to stun, poison or lead to the destruction of fishing resources or any other aquatic species. Any facility which intends to discharge wastewaters into maritime waters or hydrographical basins requires the prior opinion from the Minister responsible for fishing and aquaculture. The prior opinion from the Minister responsible for fishing and aquaculture is required for any intended works or installation in national maritime waters, on the seafront up to 100m from the coastline or in hydrographical basins where there are fishing or aquaculture activities.</td>
<td>Section 6.9 of this EIS provides the results of a coastal processes assessment include desktop coastal process study and a site visit undertaken by qualified marine scientist. Section 6.9 of this EIS provides the results of marine ecological surveys including a benthic habitat survey and fisheries assessment in the area of the proposed Jetty facility to assess potential direct and indirect impacts associated with the proposed infrastructure.</td>
</tr>
</tbody>
</table>
## 5.8 Labor Legislation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Law 4/2012 Labor Code</td>
<td>The duties of the employer include providing workers with good working conditions, prevention of risks from diseases and occupational accidents, providing workers with information and equipment necessary to prevent such risks. The employer is under a general obligation to provide appropriate health and safety conditions, to prevent accidents and dangers, and to reduce risks. Employers must ensure that workers are not exposed to risks that are harmful to their health, and must promote awareness programs. Where necessary, employers must provide safety equipment to workers.</td>
<td>Section 9 of this EIS provides the results of a comprehensive study of the project’s socio-economic impacts including labor force, public health and health facilities.</td>
</tr>
</tbody>
</table>

## 5.1 Cultural Legislation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constitution of the Democratic Republic of East Timor</td>
<td>Section 59 for Education and culture, ensure everyone has the right to cultural enjoyment and creativity and the duty to preserve, protect and value cultural heritage.</td>
<td>Section 9.32 of this EIS provides the results of a detailed cultural study to avoid or minimize impact on archeological and cultural sites, manage and to protect heritage sites</td>
</tr>
<tr>
<td>National Cultural Policy</td>
<td>Section 6.7 Legislation stated “The State Secretariat of Culture has initiated a partnership with the State Secretariat of environment in order to regulate the heritage component in environmental impact assessment studies. Besides this, the creation of a new Heritage Law, aiming at classifying the cultural heritage of East Timor and defining the actions to be taken by the nation, will allow to clarify the rights and duties of citizens towards cultural heritage.</td>
<td></td>
</tr>
</tbody>
</table>
## 5.2 Environmental and Social Sustainability Standard

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
</table>
Mine closure plan to assess the potential environmental and social impacts  
Socio Economic baseline study include educational level, labor force, Socio-cultural environment, community infrastructure, health and educational facilities, land use and land status |
5.3 Noise Regulation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Western Australian Environmental Protection (Noise) Regulation 1997 (WA) (DEC, 1997)</td>
<td>Regulation 7 of the Environmental Protection (Noise) Regulations 1997 states that ‘noise emitted from any premises when received at other premises must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind’.</td>
<td>Section 9.9 of this EIS provides the results of noise impact modeling to predict the likelihood of impacts on sensitive receptors. It also provides recommendations to mitigate or reduce noise impacts to acceptable levels and address any residual risk.</td>
</tr>
<tr>
<td>AS 2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites</td>
<td>The standard provides guidance on noise and vibration control in respect to construction, demolition and maintenance sites. The standard provides formulae which have been used to calculate predicted noise emissions.</td>
<td></td>
</tr>
<tr>
<td>UNTAET Guideline on Ambient Noise (2002)</td>
<td>This Guideline was introduced by UNTAET Administration to protect the public from nuisance associated with stationary sources of noise in outdoor environments and does not extend to Occupational and health issues. Its maximum admissible noise levels and abatement levels are identical to those in the World Bank Environmental Health and Safety Guidelines (reference for ADB projects)</td>
<td></td>
</tr>
</tbody>
</table>
5.4 Air Quality Guidelines

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Health Organization (WHO), 2006: Air Quality Guidelines (AQGs) for PM10</td>
<td>World Health Organization Air Quality Guidelines (WHO AQGs) provide an international reference that countries, particularly those without the resources to conduct their own assessment, can use to develop AAQSs. The 2006 WHO AQGs are composed of a single guideline value and interim targets (ITs). The interim targets provide as stepwise approach to achieving the air quality guideline value. The guideline values can be used by developed countries, with the capacity to implement a strict AAQS, while developing countries, with higher levels of air pollution, could select an interim target level achievable based on their own air quality management infrastructure, and progress towards the AQG value at own pace.</td>
<td>Section 9.8 of this EIS provides the results of air quality monitoring to establish the baseline ambient concentrations of the pollutants of concern and modelling of potential air quality impacts. It also provides recommendations to mitigate or reduce air quality impacts to acceptable levels and address any residual risk.</td>
</tr>
</tbody>
</table>
## 5.5 Climate Change and Kyoto Protocol

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Nations Framework to Combat Climate Change (1992) and the Kyoto Protocol</td>
<td>To stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Requires industrialized countries to reduce emissions by setting a mandatory emission limit. RDTL is currently exempt from the emission reduction target, based on their own air quality management infrastructure, and progress towards the AQG value at own pace.</td>
<td>Section 0 of this EIS assesses the potential Climate Change impacts on the project and environment and identifies necessary adaptation measures.</td>
</tr>
</tbody>
</table>

## 5.6 Ozone Layer and Montreal Protocol

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vienna Convention for the Protection of the Ozone Layer (1993) and the Montreal Protocol</td>
<td>To protect the ozone layer by controlling the production and consumption of specific chemicals and phasing out the production of numerous substances believed to be responsible for ozone depletion.</td>
<td>Section 6.5 and 9.8 of this EIS addresses compliance with the standards and protocols for chemical use.</td>
</tr>
</tbody>
</table>

## 5.7 Water Resources

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decree Law 4/2004 Water Supply for public consumption</td>
<td>The Law creates conditions for water distribution for domestic use for urban and non-urban areas. In accordance with the decree law, the Direcção Nacional Serviço de Agua e Saneamento or National Directorate for Water and Sanitation (DNSAS) facilitates, at the national level, the appropriate, secure and sustainable water supply for public consumption, outside of urban areas, by community-run water supply systems. The water supply system, outside of urban areas, is managed by water management groups, which are</td>
<td>Section XX and XX of this EIS addresses water supply requirements.</td>
</tr>
</tbody>
</table>
appointed by the community. The role of the water management group is to establish a number of procedures, including who, how and how much water is distributed to members of the water management group.

[Draft] National Water Resources

DNCQA has advised that they have prepared a Draft Water Resources Law which is currently under consideration by the Council of Ministers. When enacted, the law will require licensing for groundwater extraction, including addressing potential impacts on other users and the environment and compliance with specific conditions.

Section 9.11 of this EIS addresses the impacts of groundwater use by the Project.

5.8 Summary of Project Approvals

<table>
<thead>
<tr>
<th>Project Activities</th>
<th>Statutory Requirement</th>
<th>Relevant Legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jetty, Plant and Conveyor</td>
<td>Environment licence</td>
<td>Decree law 5/2011 on environment licensing law</td>
</tr>
<tr>
<td>Marine facilities</td>
<td>Port licence from APORTIL</td>
<td>Decree law 3/2003 on the establishment of the Port Authority and on the approval of the bylaws thereof</td>
</tr>
<tr>
<td>Cement Plant</td>
<td>Environment licence from DNSMA</td>
<td>Decree law 5/2011 on environment licensing law</td>
</tr>
<tr>
<td>Land facilities</td>
<td>Mining License</td>
<td>Ministerial Diploma 01/2008 on Licensing of Mining Activities</td>
</tr>
<tr>
<td>Water Supply for Public use</td>
<td>Decree law 2/2003 on basic law on the road transport system</td>
<td></td>
</tr>
<tr>
<td>Internal roads</td>
<td>Decree law 4/2004 on water supply for public consumption</td>
<td></td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Decree law 11/2003 on establishing the bases for the telecommunications sector</td>
<td></td>
</tr>
</tbody>
</table>
### 5.9 Summary of Environmental Standards

<table>
<thead>
<tr>
<th>Phase</th>
<th>Aspect</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Construction</td>
<td>Air Quality</td>
<td>World Health Organization (WHO), 2006: Air Quality Guidelines (AQGs) for PM10</td>
</tr>
<tr>
<td></td>
<td>Noise</td>
<td>UNTAET Guideline on Ambient Noise (2002)</td>
</tr>
<tr>
<td>Construction</td>
<td>Air Quality</td>
<td>World Health Organization (WHO), 2006: Air Quality Guidelines (AQGs) for PM10</td>
</tr>
<tr>
<td></td>
<td>Noise</td>
<td>UNTAET Guideline on Ambient Noise (2002)</td>
</tr>
<tr>
<td>Operation</td>
<td>Air Quality</td>
<td>World Health Organization (WHO), 2006: Air Quality Guidelines (AQGs) for PM10</td>
</tr>
<tr>
<td></td>
<td>Noise</td>
<td>UNTAET Guideline on Ambient Noise (2002)</td>
</tr>
<tr>
<td></td>
<td>Vibration</td>
<td>Regulation 11 Environmental Protection (Noise) Regulations 1997</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Air Quality</td>
<td>World Health Organization (WHO), 2006: Air Quality Guidelines (AQGs) for PM10</td>
</tr>
<tr>
<td></td>
<td>Noise</td>
<td>UNTAET Guideline on Ambient Noise (2002)</td>
</tr>
<tr>
<td></td>
<td>Vibration</td>
<td>Regulation 11 Environmental Protection (Noise) Regulations 1997</td>
</tr>
</tbody>
</table>
6 DESCRIPTION OF THE ENVIRONMENT

A detailed description of the physical, ecological, economic and social environment of the Project site is described below.

6.1 Climate

Timor-Leste lies in a tropical region where temperature varies by only 2 - 3 degrees Celsius (°C) between the warmest months and the coolest months. The average daytime temperature in coastal areas of the Baucau region is around 27°C and around 25°C in the highlands.

Timor-Leste has two distinct seasons, a dry season from June to November and a wet season from December to May. During the dry season, average monthly rainfall in Baucau is less than 70 mm, while during the wet season the monthly average rainfall is above 200 mm (Figure 6-2). The wet season is characterized by extreme rainfall over short periods created by the West Pacific Monsoon. The West Pacific Monsoon moves north to mainland Asia during the Southern Hemisphere winter and south to Australia during the Southern Hemisphere summer (CSIRO, 2011).

The normal south-easterly trade winds in Baucau are replaced by westerly winds from the monsoon during the monsoon season. The monsoon season is the wet season. Torrential rain storms and cyclones commonly occur in the country during the wet season. Meteorological data for the period April 2010 to March 2014 has been recorded at Baucau Observatory.

Timor-Leste’s climate is also affected by the El Niño–Southern Oscillation (ENSO), which is a natural part of the global climate system. Changes to the system create El Niño or La Niña events. These events occur when the Pacific Ocean and the atmosphere above it change from their ‘normal’ state for several seasons (BOM, 2015).

El Niño events are associated with a warming of the central and eastern tropical Pacific, while La Niña events are the reverse, with a sustained cooling of these same areas. In Timor-Leste, El Niño events generally bring drier conditions to Dili and Baucau, and often lead to a late onset and early finish to the wet season. During La Niña events, dry season rainfall tends to be above normal, and the wet season often starts earlier and finishes later (CSIRO, 2011).

During La Niña years, above normal rainfall can lead to increased flooding and landslides in Timor-Leste, while El Niño years are associated with droughts (CSIRO, 2011). The most significant impact on the population during El Niño years is reduced ground water availability (CSIRO, 2011).

Climate change is affecting these events and this is discussed at the end of the Climate section.
Temperature

The monthly average maximum temperatures are in the months of November and December, at around 31°C. August has the lowest monthly average temperature of around 16 °C. The variation in maximum and minimum monthly temperature recorded at Baucau Observatory between April 2010 and March 2014 is shown in Figure 6-1.

![Temperature Graph](image)

**Figure 6-1: Monthly average maximum and minimum temperatures recorded between April 2010 and March 2014 at the Baucau Meteorological Observatory**

Rainfall

The average annual rainfall recorded between April 2010 and March 2014 at the Baucau Meteorological Observatory is 1,643 mm. Ninety percent of the annual rainfall occurred each year between October and May. The average number of rainy days varied from 100 to 140 during this period with an average of 125 days each year.

During the dry season (June to November), average monthly rainfall in Baucau is less than 70 mm, while during the wet season (December to May) the monthly average rainfall is above 200 mm (Figure 6-2). Almost no rain was recorded during the month of August.
Figure 6-2: Monthly rainfall recorded between April 2010 and March 2014 at Baucau the Meteorological Observatory

Relative Humidity

The average relative humidity is high throughout the year, varying between 59% and 90%. The lowest relative humidity occurs from August to October and highest months are from December to March. The monthly average relative humidity recorded at Baucau Meteorological Observatory between April 2010 and March 2014 is shown in Figure 6-3.

Figure 6-3: Average relative humidity recorded between April 2010 and March 2014 at the Baucau Meteorological Observatory
Wind Speed and Direction

The average wind speed recorded between April 2010 and March 2014 varies from 5 km/hr to 11 km/hr. The predominant wind direction is south-east during April to November and west during monsoon season from December to March. The monthly average wind speed at Baucau is shown in Figure 6-4.

![Average Wind Speed](image)

**Figure 6-4: Average wind speed recorded between April 2010 and March 2014 at the Baucau Meteorological Observatory**

Maximum wind speeds have been derived from the National Oceanic and Atmospheric Administration (NOAA) as shown in Figure 6-5 below.

Between April and October the maximum wind speeds reach up to 43 km/hr - 54 km/hr, however these speeds only occur 0.03% of the time. Wind speeds of around 14 km/hr - 21 km/hr prevail over 42% of the time in the south-easterly direction.

Between December and March the maximum wind speed is between 54 - 72 km/hr, however these conditions occur relatively rarely with a percentage of only 0.05% of the time. The wind speed that prevails around 30% of the time is between 7 km/hr - 14 km/hr in a west-north-westerly direction.
Cyclones

Timor-Leste falls within the Southern Hemisphere cyclone zone (Figure 6-6). Tropical cyclones can affect Timor-Leste between November and April, however their effects tend to be weak (CSIRO, 2011). Between 1969 and 2010, 31 tropical cyclones passed within 400 km of Dili, which is less than 1 cyclone per year (CSIRO, 2011). Cyclones tend to be associated with heavy rain and very high winds.

The recorded minimum wind speeds in the area during a cyclone have been 110 km/hr, while maximum wind speed for a one in 500 year cyclone are 360 km/hr.
Climate Change

The Intergovernmental Panel on Climate Change (IPCC) published the Special Report on Emissions Scenarios in 2000. This report contains “scenarios” of future changes in emissions of greenhouse gases which have been used to project future changes in climate and their impacts, such as sea level rise and increases or decreases in temperature.

The Australian Government in conjunction with the Commonwealth Science and Industry Research Organisation (CSIRO) and the Timor-Leste National Directorate of Meteorology and Geophysics provides estimates of climate change for the Pacific Climate Change Science Program Region which includes Timor-Leste. A report published by the CSIRO in 2011 based on this collaboration, has the following predictions (CSIRO, 2011):

Figure 6-7 shows observed and projected relative sea-level change near Timor-Leste (CSIRO, 2011). The observed sea-level records are indicated in red (relative tide gauge observations from Wyndham in Western Australia) and light blue (the satellite record since 1993).
Reconstructed estimates of sea level near Timor-Leste (since 1950) are shown in orange. The projections for the A1B (medium) emissions scenario (representing 90% of the range of models) are shown by the shaded green region from 1990 to 2100. The A1B scenario is described by a balanced use of fossil and non-fossil energy sources and therefore represents a “medium” prediction of sea level rise (CSIRO, 2011).

Figure 6-7: Pacific Climate Change Science Program sea level rise estimates for East Timor. Source: CSIRO (2011)

Air temperature data for Dili are only available from 2003 which makes it very difficult to establish temperature trends. However, sea surface temperature in the Timor-Leste region has increased by 0.15 °C – 0.2°C per decade over the period 1950–2009 (CSIRO, 2011). It is likely that air temperature has increased by a similar amount over the same period (CSIRO, 2011).

Projections for all greenhouse gas emissions scenarios indicate that the annual average air temperature and sea surface temperature will increase in the future in Timor-Leste. By 2030, under a high emissions scenario, this increase in temperature is projected to be in the range of 0.4 °C - 1.0°C (CSIRO, 2011). Increases in average temperatures will also result in a rise in the number of hot days and warm nights, and a decline in cooler weather.
There is uncertainty around rainfall projections as model results are not consistent. However, projections generally suggest a decrease in dry season rainfall and an increase in wet season rainfall over the course of the 21st century. Wet season increases are consistent with the expected strengthening of the West Pacific Monsoon and model projections show extreme rainfall days are likely to occur more often. Little change is projected in the frequency of droughts throughout this century (CSIRO, 2011).

Tropical cyclones on a global scale are predicted to decrease in number by the end of the 21st century. But there is likely to be an increase in the average maximum wind speed of cyclones by between 2% and 11% and an increase in rainfall rates of about 20% within 100 km of the cyclone centre (CSIRO, 2011). In the Timor-Leste region, projections tend to show a decrease in the frequency of tropical cyclones by the late 21st century (CSIRO, 2011).

### 6.2 Topography

About one third of Timor–Leste is mountainous. These highlands are mainly concentrated in the Tatamailau Mountains area with the highest peak (Mount Ramelau 2,963 m) centrally situated within the highlands. The highland region averages more than 2,000 m above sea level and stretched from east to west.

The central and eastern parts of Timor-Leste contain several low plateaus and coastal lowlands fringed by the narrow coastal plain in the north and a wide coastal plain in the south. The topography of Timor-Leste is presented in Figure 6-8.

The topography of the different Project site locations are described below.
Jetty Area

The Jetty area includes the shoreline which slopes gently towards the ocean with a steep beach before projecting into the ocean (Figure 6-9). The main part of the Jetty where ships will be loaded runs parallel with the coastline in approximately 8 m of water on the shoreline side and between 15 m and 20 m of water depth on the ocean side. The bathymetry shows a significant increase in water depth beyond 150 m from shoreline. See Section 6.9 coastal and marine waters for detailed information on the bathymetry.

Plant Site

The area proposed for the Cement Plant site is characterized as hilly and slopes up away from the coast (Figure 6-10). It is approximately 40 m to 50 m above sea level and approximately 900 m to the south east of the proposed Jetty area.
Figure 6-9: Proposed Jetty site
6.3 Geology and Geomorphology

Jetty Area

Four boreholes were drilled offshore at the potential location of the Jetty to identify the geology down to approximately 50 m below the seabed. Based on this data, generally the soil consists of sandy soils, corals and gravels, with limited indication of very weakly cemented soils. Most soil layers have indication to be calcareous (contain calcium carbonate) (Royal Haskoning DHV, 2015).

The conservative general soil layers and properties are shown in Table 7.

Table 7: Conservative general soil profile at the proposed Jetty area (Royal Haskoning DHV, 2015)

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
<th>Soil type</th>
<th>Density</th>
<th>(kN/m³)</th>
<th>C’ (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 17.5</td>
<td>Silty sand</td>
<td>Sand</td>
<td>Medium</td>
<td>8</td>
<td>32.0</td>
</tr>
<tr>
<td>17.5 - 35</td>
<td>Silty gravel</td>
<td>Sand</td>
<td>Medium</td>
<td>8</td>
<td>30.0</td>
</tr>
<tr>
<td>35 - 50</td>
<td>Coral and gravel</td>
<td>Sand</td>
<td>Very Dense</td>
<td>9</td>
<td>40.0</td>
</tr>
<tr>
<td>50 - ?</td>
<td>Silty gravel</td>
<td>Sand</td>
<td>Dense</td>
<td>8</td>
<td>37.0</td>
</tr>
</tbody>
</table>

Cement Plant Site

The Cement Plant site is characterized by shallow limestone soils with scattered limestone rock outcrops, minor ridges and gullies sloping towards the beach (Trainor & Easton, 2015).
6.4 Seismic Conditions and Tsunamis

Timor-Leste is one of many Pacific Island countries located along the Pacific Rim. It is located in an area of high seismic activity and is exposed to both earthquakes and tsunamis (The World Bank, 2015). Timor-Leste is located on the edge of the Sunda plate close to a subduction zone where the Australian plate subducts at approximately 70 mm/year (Rong et al., 2012). In addition, two other plates in the Pacific Rim area, the Pacific plate and the Philippine Sea plate also converge above Indonesia and Papua New Guinea, adding to increased seismicity in the region.

Past studies on likelihood of earthquake damage put Timor at a classification VIII (UNDP, 2010). This classification indicates that the country is exposed to earthquakes with intensities classified as “Destructive”\(^1\) and which could cause significant damage and loss of life (UNDP, 2010). The classification also indicates a 20% probability of exceeding a level VIII and experiencing a “Ruinous” to “Catastrophic” intensity earthquake within a 50 year period (UNDP, 2010).

Figure 6-11 shows the seismic hazard map for Timor-Leste derived from the Global Seismic Hazard Assessment Program (GSHAP). The boundary of the two seismic zones is delineated in pink. Since 2000, 15 earthquakes of moment magnitude (\(M_w\)) greater than or equal to 7.5 have occurred in the region, with four having \(M_w>8.0\) (Rong et al., 2012).

\(^{1}\) Damage likely to be slight in specially designed structures with considerable damage in ordinary substantial buildings including partial collapse. Damage expected to be great in poorly built structures. Expect fall of chimneys, factory stacks, columns, monuments, walls. Also, heavy furniture moved.
Figure 6-11: Maximum peak ground acceleration (mm/year) over the last 475 years

An earthquake along the Pacific Rim can cause a tsunami. In general, only an earthquake of 7.0 on the Richter scale or higher that occurs at sea has the potential to generate a considerable tsunami.

Based on tsunami zone produced by Puslitbang SDA (2004), as indicated in Figure 6-12 the risk of a tsunami hitting the coastline and marine facilities is high, being ZONE 3 (Return Period of 100 years). An indicative wave height for a 100 year tsunami is 4 - 6 meters.
Figure 6-12: Tsunami mapping zone with return period of 100 years. Source: Pustlibang SDA (2004)
6.5 Air Quality

Air quality has been assessed at seven sensitive receptor locations located in proximity to the Project site. These locations are detailed in Figure 6-13: Figure and location of air quality test.
below. These sites have been assessed in order to determine the background air quality for human health and the environment in the area (BBS, 2015a).

Air quality standards or goals cover six common pollutants: Carbon monoxide (CO), particulate matter (PM$_{10}$ and PM$_{2.5}$), nitrogen dioxide (NO$_2$), sulphur dioxide (SO$_2$), ozone (O$_3$) and lead. Hydrocarbons are also described. Each of these are described below.

Table 8: Sampling location for collecting primary air quality data (BBS, 2015a)

<table>
<thead>
<tr>
<th>Location</th>
<th>Zone</th>
<th>Easting</th>
<th>Northing</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AQ-3 Aldeia Parlementu</td>
<td>S2L</td>
<td>212219</td>
<td>9065491</td>
<td>School Area</td>
<td>East of cement plant At the school</td>
</tr>
<tr>
<td>AQ-4 Aldeia Osso-ua</td>
<td>S2L</td>
<td>209130</td>
<td>9065049</td>
<td>Settlement Area</td>
<td>Close to the Plant Area Near the house</td>
</tr>
<tr>
<td>AQ-5 Jetty Plan</td>
<td>S2L</td>
<td>207556</td>
<td>9065473</td>
<td>Jetty Area</td>
<td>Within the Jetty Area</td>
</tr>
</tbody>
</table>
Figure 6-13: Figure and location of air quality test
Carbon Monoxide

CO is a colourless, odourless, tasteless, and very stable gas that has a lifetime of between two and four months in the atmosphere. It is the second most abundant gas in the lower atmosphere after carbon dioxide. Its natural sources include volcanos and natural forest fires; resulting in a typical concentration around 0.2 parts per million (ppm) or 229 µg/m³. Anthropogenic sources of CO largely originate from the incomplete combustion of fossil fuels or combustion of fuels in motorized vehicles.

The results of CO measurements at the seven sensitive receptor locations are shown in Figure 6-14. The one hour concentrations were measured between 218 µg/m³ and 481 µg/m³, which is well below the 1 hour standard health limit of 30,000 µg/m³ as recommended by the World Health Organisation WHO (2010). These concentrations are closer to the concentration of natural CO levels, which indicates that the current anthropogenic activities in the area are generating only a slight increase the ambient concentration of CO (BBS, 2015a).

![Carbon Monoxide (CO)](image)

**Figure 6-14: One-hour ambient concentration of carbon monoxide (CO)**

PM₁₀ and PM₂.₅

Particulate matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles (EPA, 2015b).

The size of particles is directly linked to their potential for causing health problems. Of particular concern are particles that are 10 micrometers in diameter or smaller because those are the particles
that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. The US Environmental Protection Authority (EPA) groups particle pollution into two categories:

- "Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter; and
- "Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.

Results of the in-situ measurement of 24 hour ambient concentrations of PM\textsubscript{10} and PM\textsubscript{2.5} at the seven locations listed in Table 21 are shown in Figure 6-15 and Figure 6-16. All measured PM\textsubscript{10} concentrations are below the standard health limit of 150 µg/m\textsuperscript{3} recommended by the US EPA (2015a) and WHO (2005). Similarly, 24 hour ambient concentrations of PM\textsubscript{2.5} are also below the standard health limits of 75 µg/m\textsuperscript{3} recommended by WHO (2005), and 35.75 µg/m\textsuperscript{3} recommended by the US EPA (2015a).
Nitrogen Dioxides

Nitrogen dioxides (NO$_2$) are produced from the reaction of nitrogen, oxygen and sometimes hydrocarbons (during combustion), especially at high temperatures. In areas of high motor vehicle traffic, such as large cities, the amount or NO$_2$ emitted into the atmosphere as air pollution can be significant. NO$_2$ is also produced naturally by lightning as well as through the natural oxidation of NO with the help of ozone.

NO$_2$ often appears as a brownish gas and is a strong oxidizing agent that plays a major role in the atmospheric reactions with volatile organic compounds (VOC) that produce ozone (smog) on hot summer days (EPA, 2015c).

One hour nitrogen dioxide concentrations recorded at the seven locations listed in Table 21 can be seen in Figure 6-17. All measurements were below the standard limit of 200 µg/m$^3$ are recommended by WHO (2005) and European Union (2015). The measured concentration recorded ranged between 7 µg/m$^3$ and 28 µg/m$^3$ (BBS, 2015a).
Sulphur Dioxide

Sulphur dioxide (SO$_2$) is a colourless, non-flammable, not explosive gas. It is one of a group of highly reactive gasses known as “oxides of sulfur.” The largest sources of SO$_2$ emissions are from fossil fuel combustion at power plants particularly from coal, smelting processes, pulp and paper production and incineration of waste containing Sulphur (BBS, 2015a). Smaller sources of SO$_2$ emissions include industrial processes such as extracting metal from ore, and the burning of high sulfur containing fuels by locomotives, large ships, and non-road equipment. SO$_2$ is linked with a number of adverse effects on the respiratory system.

SO$_2$ can easily react with other components to form dangerous compounds such as sulphite acid, sulphate acid, and other sulphate particles. Natural resources of SO$_2$ include volcanos, the ocean, decomposition processes and natural forest fire. The 24 hour average concentration of SO$_2$ originating from natural sources is about 10 µg/m$^3$ (EMEP-MSC-W, 1995).

The results of SO$_2$ measurements at the seven locations show that SO$_2$ concentrations are well below the recommended standard limit of 196 µg/m$^3$ recommended by WHO (2005) (Figure 6-18). The measured concentrations range between <8.5 µg/m$^3$ to 18 µg/m$^3$, which is around the level of natural concentration.
Hydrocarbons

Hydrogen and carbon can form volatile organic compounds (VOCs) that are harmful to human health. VOCs are described as organic chemicals that have a high vapor pressure at room temperature. Some VOCs are hazardous substances due to their toxicity, bio-accumulation or odour characteristics. Some VOCs are extremely hazardous substances that are carcinogenic, mutagenic, teratogenic, highly toxic or highly persistent.

Hydrocarbons exist as trace gases in the atmosphere at very low concentrations. The VOC methane has the highest concentration, around 1.7 ppm (1,110 µg/m$^3$). Other types of hydrocarbons that are measured in the very low concentrations include isoprene (C$_5$H$_8$) at 0.6 ppb – 2.5 ppb (2-7 µg/m$^3$) and terpene (C$_{10}$H$_{16}$) at 0.03 ppb – 2 ppb (0.2 µg/m$^3$ – 11 µg/m$^3$).

VOCs are major contributors to the formation of photochemical smog. Smog is formed by photochemical reactions between VOCs, sunlight and oxides of nitrogen to form ozone. VOCs have varying potential to participate in photochemical smog formation.

VOCs may also act directly or indirectly (following dissociation into water and carbon dioxide) as greenhouse gases. Some VOCs may be ozone depleting compounds and as such, contribute to the depletion of the ozone layer.

Results of measurements of non-methane hydrocarbons (NMHC) at the seven locations presented in Figure 6-19. The figure shows the 3-hour ambient concentrations are well below the standard limit of 160 µg/m$^3$ which is recommended by the US EPA (EPA, 2015). All measured concentrations were also below the detection of the method, i.e. less than 1 µg/m$^3$ as shown in Figure 6-19.
Ozone ($O_3$)

Ozone is naturally found in small concentrations in the stratosphere, a layer of the Earth’s upper atmosphere. Here it protects the earth’s surface from ultraviolet light. In a lower layer, the troposphere, ozone is also found at low concentrations of around 20 ppb (40 µg/m$^3$). In this lower layer ozone can mix and react with other elements such as hydrocarbons, nitrogen oxide and sunlight to form photochemical smog.

Ozone formation in the troposphere typically results from anthropogenic activities such as industrial emissions, power plant outputs or car exhaust.

Results of ozone measurement at the seven locations in Figure 6-20. The figure shows that the ozone concentration is far below the standard limit of 235 µg/m$^3$ recommended by the US EPA (1997). The measured ozone at the seven locations was between < 2.5 µg/m$^3$ and 19 µg/m$^3$. The monitoring of ozone concentration is an important part of air quality monitoring, because ozone is a secondary pollutant. It is not directly emitted from the source, but formed in the atmosphere due to photochemical reactions of primary air pollutants (NO$_2$ and hydrocarbon) in the present of sunlight.
Lead

Lead is a naturally occurring heavy metal that is found in the Earth’s crust. Lead can be released into soil, air and water through soil erosion, volcanic eruptions, sea spray and bushfires. The natural concentration of lead in the air is less than 0.1 ug/m$^3$ (DotE, 2015). As no Project activities will produce lead emissions, no background levels have been recorded and it is not further discussed within this EIS.

6.6 Noise

The perception of sounds in daily life is an important part of human well-being and safety (WHO, 1999). Hearing impairment is typically described as an increase in the threshold of hearing as clinically assessed by audiometry (Goines & Hagler, 2007). Impaired hearing and the eventual result of hearing losses can result in loneliness, depression, impaired speech discrimination, impaired school and job performance, limited job opportunities and a sense of isolation (Goines & Hagler, 2007).

To analyse the noise baseline conditions within the study area, seven locations representing sensitive noise receptors around the project area were chosen (and Figure 6-22) and baseline data collected at each (BBS, 2015b). The selection of the sites was carried out based on the following considerations:

- Locations which will be impacted by the noise from the project activities; and
- Locations which are occupied by local people.
The US EPA adopted a system of four sound descriptors to summarise how people hear sound to determine the impact of environmental noise on public health and welfare (EPA 550/9-74-004). These four descriptors are A-weighted Sound Level, A-weighted Sound Exposure Level, Equivalent Sound Level and Day-Night Sound Level.

The baseline study used the Equivalent Sound Level (Leq) and Day-Night Sound Level (Ldn) measurements. The Leq is a measure of the average environmental noise levels to which people are exposed. It is an indication of amount of sound energy equivalent to the energy of a continuous sound. This measurement correlates reasonably well with the effects of noise on people. It is used when only the duration and noise of sound, and not their times of occurrence (day or night) are relevant.

The Day-Night Sound Level (Ldn) is the average sound level in a residential area throughout the day and night.

Table 9: Coordinates of noise baseline measurement points (representative locations of sensitive receptors)

<table>
<thead>
<tr>
<th>Measurement Point</th>
<th>Location</th>
<th>Description</th>
<th>Zone</th>
<th>Easting</th>
<th>Northing</th>
</tr>
</thead>
<tbody>
<tr>
<td>N03</td>
<td>Aldeia Parlementu</td>
<td>School Area</td>
<td>52L</td>
<td>212220</td>
<td>9065492</td>
</tr>
<tr>
<td>N04</td>
<td>Aldeia Osso-ua</td>
<td>Settlement Area</td>
<td>52L</td>
<td>209131</td>
<td>9065049</td>
</tr>
<tr>
<td></td>
<td>Figure 6-21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N05</td>
<td>Jetty Plan</td>
<td>Jetty Area</td>
<td>52L</td>
<td>207557</td>
<td>9065473</td>
</tr>
</tbody>
</table>
Figure 6-22: Noise baseline measurement locations
Noise baseline was measured every 5 seconds for 10 minutes for each measurement. The measurement is carried out to determine the equivalent noise level (Leq). Measurement of Leq was repeated multiple times and calculation of Day Sound Level (Ld), Night Sound Level (Ln), and Ldn was then undertaken.

Based on these measurements, the value of Ldn at the seven measurement points was between 50.99 dBA and 59.48 dBA. A summary of the baseline measurement results is presented in . It was noted that vehicular traffic was a significant contributor to local noise measurements. To compensate, measurements that were influenced by incidental traffic noise were omitted from the calculations (BBS, 2015b).

Table 10: Noise baseline measurement data Leq and the calculated Ld, Ln, and Ldn with incidental noise eliminated (BBS, 2015b)

<table>
<thead>
<tr>
<th></th>
<th>N03</th>
<th>N04</th>
<th>N05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ldn (dBA)</td>
<td>50.20</td>
<td>54.83</td>
<td>51.92</td>
</tr>
<tr>
<td>Ld (dBA)</td>
<td>49.17</td>
<td>52.80</td>
<td>49.83</td>
</tr>
<tr>
<td>Ln (dBA)</td>
<td>46.57</td>
<td>51.66</td>
<td>48.78</td>
</tr>
</tbody>
</table>

Figure 6-23: Simple estimated noise baseline at Jetty and Cement Plant area with incidental noise eliminated (in dBA) Legend: Blue <55 dBA Green >55dBA
6.7 Surface water

No permanent rivers exist within the Project site. Some small ephemeral watercourses flow through the area, mainly during the wet season. These tend to stop flowing in the dry season and are not considered suitable as full time water sources. There are a number of coastal swamps containing fresh water from rain and groundwater discharge, but these also dry up in the dry season.

The closest ephemeral stream is the Manulede River located approximately 9 km from the proposed Cement Plant site. The river only flows when there is rainfall, and is quite extensive as it drains the western side of the Baucau Plateau (WorleyParsons, 2015c).

In the event of rainfall, surface runoff from the higher ground south of the Project site flows downhill, north toward the ocean. These create ephemeral streams and can create erosion. A picture of the drainage direction across the site is in Figure 6-25.
Figure 6-25 Plant and Jetty drainage direction (towards the coast)

Figure 6-26 Creek near the road adjacent to the Cement Plant Site (WorleyParsons, 2015c)

6.8 Groundwater
The Baucau region has an underground limestone karst aquifer. The Baucau limestone karst groundwater aquifer has been studied from 2004 to the present to identify the karst features that are likely to supply water to Baucau, New Baucau, the airport, Triloca and the Baucau Cement Project. It has been observed that the limestone has karst features of springs, caves, collapsed caves, sink holes, and sharp outcrop.

In the area there are a number of springs. They are depicted in Figure 6-27.

**Figure 6-27: Springs and drainage near Cement Plant, Jetty and Conveyor**

**Recharge, Flow and Discharge**

The aquifer is recharged by infiltrating rainfall on the plateau during the wet season. The infiltration rate is very high (Jocson et al., 2002) due to the exposed karst features and probably about 40% of the annual rainfall that varies from about 1,200 mm in Bacau (1956 – 1992) to 1,764 mm on the plateau (Venilale 1952 – 1974) (Lindsay, 2015). Recharge only takes an hour or two in a storm to infiltrate to a cave stream (about 6 metres below ground level) (Lindsay, 2015).
The flow of the Baucau Plateau has been conceptualised based on observations of the elevations of the ground surface and the elevation of water in caves and springs. The general flow pattern of groundwater in the karst is from the high in the south-west to the low in the north-east at Baucau, but also there is lateral movement to the springs in the east and west of the plateau (Lindsay 2015).

**Water Quality**

The karst water is very fresh (based on Timor and WHO standards) and is suitable for all uses except for the boiler where it will need treatment prior to use to remove calcium and possibly silica (WorleyParsons, 2015c). A typical analysis of metals and metalloids from a spring at Baucau is in Table 11.

**Table 11: Karst water analysis for metals and metalloids from Uailia Spring at Baucau**

<table>
<thead>
<tr>
<th>Sample Description</th>
<th>Aluminium</th>
<th>Boron</th>
<th>Barium</th>
<th>Beryllium</th>
<th>Calcium</th>
<th>Cadmium</th>
<th>Cobalt</th>
<th>Chromium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baucau Town Uailia Spring</td>
<td>0.01</td>
<td>&lt;0.04</td>
<td>0.008</td>
<td>&lt;0.0002</td>
<td>51</td>
<td>&lt;0.004</td>
<td>&lt;0.005</td>
<td>&lt;0.004</td>
</tr>
<tr>
<td>Copper</td>
<td>0.005</td>
<td>0.007</td>
<td>&lt;0.01</td>
<td>&lt;0.001</td>
<td>3</td>
<td>&lt;0.005</td>
<td>&lt;0.1</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>&lt;0.01</td>
<td>3.2</td>
<td>&lt;0.07</td>
<td>&lt;0.04</td>
<td>6.1</td>
<td>&lt;0.02</td>
<td>&lt;0.04</td>
<td>&lt;0.04</td>
</tr>
</tbody>
</table>

6.8.1.1 CAISIDU SPRINGS

The village of Caisidu lies at the northern end of the proposed Cement Plant and Jetty area. There are 4 sub-villages located close to the karst water springs. The karst water discharges below the main escarpment along a spring line, probably associated with a major fault in the Baucau Limestone. At highest elevation is the Uaimatabai Spring which emerges from a limestone cave (170 m elevation) along an overhang (WorleyParsons, 2015c). The discharge is about 5 L/s and the water is fresh although probably hard (WorleyParsons, 2015c) (Figure 6-28).

The major spring discharge (142 m elevation) is located about 400 m downslope along the spring line. It is called the Uaisa Spring (Figure 6-29) and is close to the Caisidu School and surrounded by very tall breadfruit and rainforest trees (WorleyParsons, 2015c). The discharge is approximately 10 L/s and
the water is fresh at 633 µScm. Water is piped and run in open channels to the sub-villages at lower elevation.

Figure 6-28: Uaimatabai Spring

Figure 6-29: Uaisa Spring
6.8.1.2 Uaiono Spring

The third spring in the line is Uaiono (Figure 6-30) and this discharges into the sea at the proposed Jetty area through a fracture in beach rock (WorleyParsons, 2015c). The spring is only observed at low tide and anecdotal evidence suggests that this spring is used by the local community as an alternative water source is not practical as a water supply.

![Uaiono Spring](image_url)

Figure 6-30: Uaiono Spring

6.8.1.3 Coastal Alluvial Aquifer

From a survey of wells along the north coast it was found that the aquifer contains fresh water where there are significant rivers and karst water recharging the aquifer (WorleyParsons, 2015c). Elsewhere, the aquifer is salty due to the limited recharge area, high evaporation and direct connection with the sea. Most of the alluvial aquifer in the vicinity of the cement plant is likely to contain fresh water based on monitoring of shallow wells near Caravelha and measurements of salinity in the coastal streams and swamps (WorleyParsons, 2015c).
A review of borelogs from H2O Drilling revealed that the coastal alluvial aquifer near the Manulede River contains fresh water in gravel aquifers (WorleyParsons, 2015c). A water supply bore for the village of Caravelha was constructed near the bridge over the Manulede River to a depth of 54 m and the drilling log indicated two gravel layers separated by marine clay formations. The water in the aquifer was fresh (743 µScm) and was tested by a step pumping test indicating a specific capacity of 1 L/s per metre of drawdown, establishing that the bore could continuously pump about 30 L/s (Lindsay, 2015). The bore is fitted with a pump capable of 10 L/s, but this is only used for about 1 hour per day to meet the needs of the small village of Caravelha (WorleyParsons, 2015c).

6.8.1.4 MANULEDE RIVER

The Manulede River 9km from the Cement Plant is quite extensive and drains the western side of the Baucau Plateau collecting the karst aquifer discharge. The river is approximately 14 km long with a catchment of roughly 100 km². It is concluded that the alluvial aquifer is recharged by the Manulede River and would be capable of supplying the water for the cement plant at 3.15 ML/day or 35 L/s continuously without impacting on the village water supply, provided that sufficient separation (400 m) is made between bores (WorleyParsons, 2015d).

The Manulede River is about 9 km from the proposed cement plant and this would necessitate a major pipeline. An alternative site has been located within 1 km of the site on the Uaidei River alluvium (WorleyParsons, 2015d).
Figure 6-31: Location of Caravelha Bore Potential Plant water supply

A camp water supply may be possible close to the plant area on the Uaidei River at the location marked on Figure 6-32, if successful an additional 1 or 2 bores could supply the whole water demand for the Baucau Cement Project. The Uaidei River was flowing at 10 L/s at the site at the time of inspection on 6 May 2015 with fresh water (409 µScm). During the dry season, this river is likely to stop flowing and aquifer salinity increase. The river is about 6 km long, originating upslope of Bucoli and has a catchment area of about 10 km².
Figure 6-32: Site of water supply bore
6.9 Coastal and marine waters

Bathymetry

A hydrographic survey was undertaken to map the bathymetry of the seabed from the shoreline to 800 m offshore. The area covered approximately 1500 m x 800 m (Figure 6-33) (WorleyParsons, 2015b).

Note that the survey equipment used (compact high resolution shallow water system) was limited to a maximum of 200 m depth, hence there is a gap in the north-west of the survey area where the seabed is deeper than 200 m (WorleyParsons, 2015b).

The results of the survey confirmed that the shoreline at the Jetty site have very sharp transition into deeper water, making it a highly suitable location to construct a jetty with no need to undertake any dredging activities.

Figure 6-33: Bathymetry survey area (WorleyParsons, 2015b)
Tides

Tides are semi-diurnal, which means during a 24-hour period there are approximately two high and low tides.

Tide levels shown in Table 12 have been obtained from the Australian Tide Tables (AHS, 2014) at Port No. 54178 Karabela which is located approximately 9 km to the southwest of the Project site (WorleyParsons, 2015a).

Table 12: Tide levels

<table>
<thead>
<tr>
<th>Level</th>
<th>LAT/CD (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest Astronomical Tide (HAT)</td>
<td>+2.3</td>
</tr>
<tr>
<td>Mean High Water Springs (MHWS)</td>
<td>+2.3</td>
</tr>
<tr>
<td>Mean High Water Neaps (MHWN)</td>
<td>+1.3</td>
</tr>
<tr>
<td>Mean Sea Level (MSL)</td>
<td>+1.3</td>
</tr>
<tr>
<td>Mean Low Water Neaps (MLWN)</td>
<td>+1.3</td>
</tr>
<tr>
<td>Mean Low Water Springs (MLWS)</td>
<td>+0.3</td>
</tr>
<tr>
<td>Lowest Astronomical Tide (LAT)</td>
<td>+0.00</td>
</tr>
</tbody>
</table>

Sea Level Rise

Based on the Intergovernmental Panel on Climate Change (IPCC) Special Report on Emissions Scenarios (2000) described in the Section 6.1 under Climate Change, predicted sea level rise measurement for Timor-Leste have been calculated. Table 13 provides recommended estimate of sea level rise for 50-year and 100-year planning timeframes based upon the A1B scenario (WorleyParsons, 2015a).

Table 13: Recommended allowance for sea level rise

<table>
<thead>
<tr>
<th>Year</th>
<th>Planning Timeframe</th>
<th>Sea Level Rise (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present day</td>
<td>0 years</td>
<td>+0.00m</td>
</tr>
<tr>
<td>2070</td>
<td>50 years</td>
<td>+0.12m</td>
</tr>
<tr>
<td>2110</td>
<td>100 years</td>
<td>+0.37m</td>
</tr>
</tbody>
</table>

Storm Surge

Storm surge is the variation in sea level brought about by the effect of wind stress at the sea surface and variations in atmospheric pressure. Storm surge for the area was calculated from an estimate of
the extent of these two effects at the site after reference to published data on surge events in the region (WorleyParsons, 2015a). Storm surge heights for Average Reoccurrence Intervals (ARI) of 1, 10 and 100 years are presented in Table 14.

Table 14: Storm surge summary for the site

<table>
<thead>
<tr>
<th>ARI (years)</th>
<th>Storm Surge (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>10</td>
<td>0.5</td>
</tr>
<tr>
<td>100</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Coastal Winds and Waves

As discussed in Section 6.1, the region experiences a monsoon-type climate with a seasonal reversal in wind and wave direction. Along the northern coastline of Timor-Leste during the monsoon, winds and waves both arrive from the north-west. During the remainder of the time the winds are from the north-east to east.

Since this coastline is generally protected from long periods of swell from the Indian Ocean, the local wind climate provides the primary forcing for the wave climate. For this reason, the wave climate closely mimics the wind climate (WorleyParsons, 2015a).

Waves along the coastline tend to be largest during the Northwest monsoon, with waves arrive from the NW direction with Significant Wave Height (Hs) between 0 m - 1.5 m. While during the Southeast monsoon, waves arrive from the NE to ENE direction with Hs between 0 m - 1.0 m (WorleyParsons, 2015a).

Extreme events can occur during strong Northwest monsoon conditions as well as tropical lows, however the Northern coastline is too far north to be impacted by cyclones. During extreme events, waves with Hs between 2 m and 3 m can be anticipated and are typically associated with Annual Recurrence Interval (ARI) of 1 year and 100 years respectively (WorleyParsons, 2015a).

Currents

Currents within Selat Wetar are not well known, however they are generally less than 0.5 knots. Currents direction tends to follow the monsoon directions; i.e. currents tend to flow towards the WSW during the Southeast monsoon and ESE during the Northwest monsoon. This will be particularly true in the nearshore environment. Since the currents are generated by the monsoonal winds, surface currents are expected to be larger than the currents at the seabed. In the nearshore areas this difference will be minimized (WorleyParsons, 2015a).
Extreme currents near the surface are expected to be from 1.5 knots to 2 knots corresponding to 1-year and 100-year ARI, respectively. Near the seabed in deeper waters, currents are not expected to exceed 0.5 knots (WorleyParsons, 2015a).
Sediment Transport

Sediment transport near the Project area is comprised of longshore and cross-shore elements. Longshore sediment transport follows the coastline alignment near the Project area. Direction of the longshore sediment transport along the Project area coastline most likely closely follows the seasonal fluctuations of the winds and waves (WorleyParsons, 2015a).

This means that during the Northwest monsoon, sediment will tend to be transported towards the Northeast. While, during the Southeast monsoon, the direction of sediment transport will tend towards the southwest. As it does not appear that the Project area is experiencing a sediment deficit, the longshore sediment transport is generally balanced on an annual basis (WorleyParsons, 2015a).

Cross-shore sediment transport is most likely be dominated by fluctuations of wave heights during a given season. Meaning that during more energetic wave conditions, sediment would tend to be transported in the offshore direction. Due to the relatively steep bathymetry, it is expected that offshore sediment transport would be limited to no more than 50 m. During less energetic conditions, sediment would tend to be re-deposited on the shoreline (WorleyParsons, 2015a).

6.10 Soil

Jetty Area

The shoreline near the Jetty is comprised of medium to coarse grained riverine and limestone sands and gravels. In addition to sands and gravels, there is a high percentage of both small and large riverine detritus. Entire pieces of coral are also visible on the shoreline (WorleyParsons, 2015a). Figure 6-34 presents the various sediment types on the shoreline.

The beach slope is moderately steep in excess of 1V:10H as seen in Figure 6-35. A moderately steep slope in conjunction with relatively coarse shoreline sediment is indicative of deep water close to the shore, a moderate tidal range, and relatively energetic wave and current conditions occurring regularly (WorleyParsons, 2015a).

In certain areas, particularly lower in the beach profile, there are areas of significantly finer sand visible. The clear delineation between the coarse and fine sand is indicative of regularly occurring calm conditions that alternate with energetic conditions causing the marker sorting (WorleyParsons, 2015a). This is show in Figure 6-36.

The beach slope appears to be underlain by a layer of calcareous rock or limestone. It is more visible on the eastern beach segment, however it is likely that this is a persistent feature which becomes exposed or buried at various locations depending on seasonal fluctuations in wind, waves, and nearshore currents. The visible limestone layer is shown on Figure 6-37.
Figure 6-34: Beach sediment composition at the Jetty Site

Figure 6-35: Beach slope at the proposed Jetty site.
Figure 6-36: Sorting arrangement of fine and course sand at the proposed Jetty site

Figure 6-37: Calcareous layer on the eastern portion of the proposed Jetty site
Plant Site

The Cement Plant site is located on the north-north-east facing slopes and plains located relatively close to the beach, road and proposed Marine Jetty area. The Cement Plant site is characterized by shallow limestone soils with scattered limestone rock outcrops, minor ridges and gullies sloping towards the beach (Trainor & Easton, 2015).

6.11 Ecological components

Timor-Leste has unique and diverse biodiversity, and the wider region in which it lies is characterized by a large number of endemic species, including at least 1,500 plants, 262 birds, 127 mammals, 33 frogs, 99 reptiles and 50 freshwater species which are found nowhere else on earth (Wikramanayake et al., 2002a; and Wikramanayake et al., 2002b).

6.11.1 Wetlands

Twelve important wetlands for birds have been identified in Timor-Leste, none of which are in or near the Project area (Trainor & Easton, 2015) and therefore have not been discussed further.

6.11.2 Mangroves

Mangroves are an important coastal habitat. Mangrove extent has been reduced from 9,000 ha in 1940 to 3,035 ha in 2000 (FAO, 2003) to 1,802 ha recorded in 2008 (CDU, 2009). This is an approximate 80% mangrove habitat loss since 1940. The decline in mangroves can generally be attributed to the harvesting of mangrove trees for timber and fuel wood and in some instances, hinterland mangroves have been removed for brackish water shrimp and/or fish ponds (CDU, 2009).

No mangroves were identified within or adjacent to the Project area (Trainor & Easton, 2015) therefore mangrove habitats have not been discussed further.

6.11.3 Coral

The shallow coastal waters of Timor-Leste include the important benthic habitat of coral. To understand and identify the coral that may be affected by the Jetty construction, a benthic habitat survey was undertaken (WorleyParsons, 2015b). The survey showed that the primary benthic types (Figure 6-38) in relation to the Jetty site are:

- Hard and Soft Coral2;
- Sand;

2 The difference between hard and soft corals is that hard corals produce a rock-like skeleton made of calcium carbonate. Soft corals do not have a skeleton structure.
The dominant benthic group found in the Jetty footprint is sand, rubble and rock. The majority of the hard and soft coral communities growing in the broader survey area are located on rocky outcrops to the north and south of the proposed Jetty footprints (WorleyParsons, 2015b).

The percentage cover of coral in relation to the Marine Jetty site is presented in Figure 6-40. The relative percentage cover of hard coral at each survey site is represented by the size of the dot symbol (see the legend in the figure).

The fringing coral communities are not continuous and are generally growing in shallower water (< 30 m) and are associated with small bommies, areas of hard underlying substrate of either terrigenous nature or existing coral reef framework. The seafloor to the south and north of the jetty footprint contains the highest areas of coral cover. At some survey sites, the percentage of hard coral cover exceeded 40% of all benthic habitat types, however primarily the coral cover was in the >10% - 20% range (WorleyParsons, 2015b).

Hard coral communities are mixed group of different genus and species including, in order of the most dominate to the least dominate; *Porites* spp. (both branching and massive), *Acropora* spp (branching, corymbose and tabulate), *Seritapora* spp., *Pocillopora* spp., *Goniastrea* spp, *Favia* spp, *Favites* spp and *Pectinia* spp.

The majority of coral colonies are small to medium-sized (approximately 20 cm - 30 cm in diameter); occasionally very large *Porites* bommies or mixed assemblage bommies (>5m in diameter) were observed, mainly in deeper water. The *Acropora* spp. colonies are generally small (<30 cm diameter) and tended to grow in slightly deeper water. Coral communities near the shore were more robust with predominately encrusting or massive colonies shapes. The rock near shore often had large numbers of small coral recruits from the *Portiidae* and *Faviidae* family of coral (WorleyParsons, 2015b).

Associated with the hard coral community is a prolific soft coral community. The soft coral community is associated with bommies and hard substrate and the shallower water closer to shore. The soft coral community is associated with the hard coral community thus the distribution of soft corals in the Jetty area mirror that of hard corals. Only a small area of the Jetty footprint (as with hard corals) has areas of soft coral (WorleyParsons, 2015b). Soft coral communities are dominated by *Sarcophyton, Sinularia* and *Xenia* spp. The presence of *Xenia* spp, a species associated with good water quality conditions (Fabricius & Alderslade, 2001), also indicates that the water quality in the survey area is good.

Other benthic habitats were also surveyed, though no large areas of macroalgae were observed (WorleyParsons, 2015b). Some nearshore boulders had coralline and turfing algae growing in patches. Only two instances of recent coral mortality possibly caused by coral disease, Crown of
Thorns Starfish or *Drupella* spp were observed, both on *Acropora* branching colonies. Occasional sea pens were observed growing in coarse sandy areas (WorleyParsons, 2015b).
Figure 6-38: Examples of Dominant Benthic Habitats at the proposed Jetty location (WorleyParsons, 2015b)

Figure 6-39: Examples of the coral community at site #176 within the jetty footprint (WorleyParsons, 2015b)
Figure 6-40: Percentage cover of hard coral in relation to the Jetty site (WorleyParsons, 2015b)
6.11.4 Fisheries

A Marine Rapid Assessment Program (MRAP) of Timor-Leste was undertaken in August 2012 (Conservation International 2013). Twenty-two sites were surveyed around the northern coastline of Timor-Leste recording fish abundance and diversity, two of which were located 20 km to the west and 60 km to the east of the proposed Jetty footprint. As such, the Jetty footprint area is highly likely to be similar to the MRAP results when compared to the surveyed sites in terms of coral and fish biodiversity.

The biodiversity of reef fishes was assessed for 20 of the 22 survey sites using underwater visual census from 1 m - 70 m depth. A total of 741 species were recorded, representing 234 genera and 61 families. The current known reef fish fauna of Timor-Leste includes 814 species (Conservation International, 2013).

In addition, a fisheries assessment was undertaken in the Jetty area by WorleyParsons (2015b) and 11 different species of fish were caught by the local fishermen as part of the days catch and photographed for identification (Figure 6-41) (WorleyParsons, 2015b). All the fish captured by the fishermen were small and primarily associated with coral reef communities, either swimming within the matrix (Rabbitfish and Squirrelfish) or in the water column above (Fusilier, Unicorn fish Surgeonfish, Trevally) (WorleyParsons, 2015b).

The economic aspect of fishing in Timor-Leste is discussed below in Sections 9.22 and 9.23.
<table>
<thead>
<tr>
<th>Fish Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellowfin Surgeonfish</td>
<td>Acanthurus xanthonopterus</td>
</tr>
<tr>
<td>Whitemargin Unicornfish</td>
<td>Naso sp.</td>
</tr>
<tr>
<td>Yellow back Fusilier</td>
<td>Caesio teres</td>
</tr>
<tr>
<td>Tailspot Squirrelfish</td>
<td>Sargocentron caudimaculatum</td>
</tr>
<tr>
<td>Copper Sweeper</td>
<td>Pempheris oualensis</td>
</tr>
<tr>
<td>Checkered Seaparach</td>
<td>Lutjanus decussatus</td>
</tr>
</tbody>
</table>
There are 15 ‘Protected Wild Areas’ in Timor-Leste, one National Park: the Nino Konis Santana National Park in the Monte Pitchau-Iralalaro area, and a further 12 areas identified for legislative protection. None of these protected areas or national parks fall within or adjacent to the Project site. Therefore, they have not been discussed further.

6.11.6 Flora and fauna

Limited flora and fauna scientific studies have been carried out in Timor-Leste. However, the studies have found that the island fauna is characterised by low overall species richness but high levels of...
endemism (Grantham et al., 2010). A terrestrial flora and fauna survey was undertaken across the proposed Jetty area, Cement Plant area and Limestone Mine areas in May 2015 by Colin Trainor and Brett Easton.

6.11.6.1 VEGETATION ASSEMBLAGES

Jetty and Conveyor

The Jetty and Conveyor will be located at the nearby beach and is flat and already highly modified by temporary dwellings, grazing and some agriculture. The general environment is characterised by sandy soils and established breadfruit Artocarpus altillis and Corypha sp palm groves (Figure 6-42). The area is also severely infested with weeds (Trainor & Easton, 2015).

The overall site is dominated by a relatively uniform coastal Closed Tropical Forest (70%) which is most likely a combination of existing forest and mature plantation trees. The remaining area (30%) is cleared grazing land and residential farms (Trainor & Easton, 2015).

Overall, the Jetty site is a heavily modified plantation environment with a severe infestation of Lantana camara throughout. The biological diversity at these sites was very low and overall the site was not representative of a pristine coastal/beach forest. No plant species listed by the IUCN were recorded at the Jetty site (Trainor & Easton, 2015).
Cement Plant Site

The Cement Plant site is located on NNE facing slopes and plains relatively close to the beach, road and proposed Jetty area. The Cement Plant site is characterized by shallow limestone soils with scattered limestone rock outcrops, minor ridges and gullies sloping towards the beach. The site consists predominantly of very open savannah woodland (95%) which has been extensively modified for agriculture and grazing in places. The remaining areas were isolated patches of Closed Tropical Forest systems (5%), occurring in depressions and drainage floors and often surrounded by introduced Lantana camara (Trainor & Easton, 2015).

The open woodland site had an 80% level of disturbance from weed infestations and grazing. The Closed Tropical Forest area had a 30% level of disturbance from weeds on its edges but was relatively weed free and undisturbed at its centre. The dominant weeds across the two sites include, Tecoma stans, Lantana camara, Jatropha gossypifolia, Chromolaena odorata and Hyptis suaveolens. Intsia bijuga (Borneo Teak) was present at survey site P002 (Figure 6-43 below) and is listed as ‘Vulnerable’ by the IUCN Red List (Trainor & Easton, 2015).
Figure 6-43: *Intsia bijuga* (Borneo Teak) was recorded at the Plant site survey location P002.
6.11.6.2 Terrestrial Fauna

A large proportion of the recorded fauna, especially among amphibians, reptiles and mammals consisted of introduced/tramp or invasive species which are not native to Timor-Leste. Some introduced species were common e.g. Black-spined Toad (*Bufo melanostictus*), Tokay Gecko (*Gekko gecko*), with livestock species such as Water Buffalo, Banteng/cattle, horse and sheep regularly observed grazing within the Baucau Cement Plant site. All 12 bat species recorded were native species (Trainor & Easton, 2015).

A total of 43 fauna species was recorded at the Jetty, Conveyor and the Cement Plant. Only two individual native frogs were recorded. At least 10 echolocating bat species were present in the Project site, with four species able to be identified to species-level. At least four species of cave roosting bat were recorded and identified to species-level (two species of *Rhinolophus; Hipposideros diadema, Miniopterus australis*), with several others likely (other *Miniopterus* spp.; *Taphozous* spp.) to occur. Thus, up to a maximum of eight out of ten echolocating bat species recorded on the survey use caves for daytime roosting (Armstrong & Konichi, 2015).
Jetty Area

The Indonesian Short-nosed Fruit Bat (*Cynopterus titthaecheilus*) was the only native mammal directly recorded with small numbers under palm fronds at the Jetty site. The Timor Inornate Bronzeback snake (*Dendrelaphis inornatus*) was observed in the leaf litter at the site. The Jetty site is characterized with low to moderate fauna habitat quality owing to the extensive disturbance to the natural vegetation (Trainor & Easton, 2015).
Figure 6-47: Indonesian Short-nosed Fruit Bat (*Cynopterus titthaecheilus*) under a *Corypha* palm frond at the Jetty site (Trainor & Easton, 2015)

Figure 6-48 Timor Inornate Bronzeback snake (*Dendrelaphis inornatus*) observed under leaf litter at the Jetty Site (picture credit: inaturalist.org)
The survey completed by Colin Trainor and Brett Easton in 2015 recorded one International Union for Conservation of Nature (IUCN) fauna listed species within the Cement Plant area (Trainor & Easton, 2015a) (refer to Figure 6-52 below):

- **Todiramphus australasia** – Near Threatened. (Cinnamon Banded Kingfisher)

![Image of Cinnamon Banded Kingfisher](image-credit: orientalbirdimages.org)

**Figure 6-49 Tokay Gecko (Gekko gecko) at Plant Site (Trainor & Easton, 2015)**

![Image of Tokay Gecko](image-credit: orientalbirdimages.org)

**Figure 6-50 Cinnamon Banded Kingfisher (image credit: orientalbirdimages.org)**

Overall it is considered the Cement Plant site provides relatively low to moderate fauna habitat based on the lack of Closed Tropical Forest, the limited vegetation structure and absence of sharp topographic relief, cliffs, caves, logs and leaf litter (refer to Figure 6-51 below) (Trainor & Easton 2015a).

Table 15 shows the number of species recorded at the Jetty, Conveyor and Cement Plant sites. The number of introduced or livestock species is shown in parentheses. In addition three landsnail taxa were recorded at proposed Cement Plant site (Trainor & Easton 2015a).

**Table 15: Fauna species richness at the Jetty and Cement Plant sites**

<table>
<thead>
<tr>
<th></th>
<th>Amphibians</th>
<th>Reptiles</th>
<th>Mammals</th>
<th>Birds</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jetty and Conveyor Area</td>
<td>0</td>
<td>4(2)</td>
<td>11(1)</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>Plant Site</td>
<td>0</td>
<td>2(2)</td>
<td>4(3)</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>6(4)</td>
<td>15(4)</td>
<td>22</td>
<td>43</td>
</tr>
</tbody>
</table>
Figure 6-51: Limestone outcrop habitat recorded at the Cement Plant site.
Figure 6-52: Threatened Flora and Fauna recorded within the Project area
6.11.7 Marine Fauna

Timor-Leste’s north coast sits on the edge of an underwater precipice, the Wetar Strait, a marine trench approximately 3 km deep, which provides a corridor for pelagic and migrating marine megafauna (i.e. whales, dolphins, turtles, tuna, sailfish, rays) that patrol offshore (Edyvane K et al., 2009).

Recent aerial surveys of marine megafauna conducted in the nearshore waters of Timor-Leste have identified a total of 13 different cetacean species, including the Blue Whale, Sperm Whale, Bryde’s or Sei whale, Short-finned Pilot whale (Globicephala macrorhynchus), False Killer whale (Pseudorca crassidens), Pygmy Killer whale (Feresa attenuata), Melon-headed whale (Peponocephala electra), Curvier’s Beaked whale (Ziphius cavirostris), Risso’s dolphin (Grampus griseus), Fraser’s dolphin (Lagenodelphis hosei), Spotted dolphin (Stenella attenuata), Rough-toothed dolphin (Steno bredanensis), and the spinner dolphin (Stenella longirostris) (Dethmers K., et al., 2012).

In the literature, there is a record of a megafauna survey was undertaken at a distance of 2 nautical mile (nm) from the coastline, with at least seven of the marine mega fauna recorded, including three of the whales, the dugong, hammerhead shark, whale shark and turtles are listed in the IUCN Red List of Threatened Species™ (2007) as facing a higher risk of global extinction (Endangered or Vulnerable status). Five of the cetacean species are not evaluated because of insufficient information (Data Deficient) and six cetaceans have been evaluated to have a low risk of extinction and are classified as Least Concern (IUCN 2007) (Dethmers, K., et al., 2012).

The diversity and abundance of cetaceans peaked during November 2008 when very large pods (several hundreds of animals) were observed along the coast. This suspected migration event coincided with an increase in Surface Sea Temperature (SST), a flow reversal in the surface currents of the Indonesian Through-Flow (ITF) and a slackening in the flow through the Ombai-Wetar Strait, located to the north of Timor-Leste (Dethmers, K., et al., 2012). It has not been confirmed by further study whether this is an annual migration event.

The cumulative sightings across all months suggest that the highest diversity of marine megafauna occurs in north-western coastal waters, west of Baucau (Dethmers, K., et al., 2012).

Along the coastline adjacent to Baucau, dolphins, whales, dugong and rays have been recorded, including a turtle adjacent to Laga. A crocodile siting was recorded at Uatatatu Beach, located 14 km east of the Jetty site (Edyvane, K., et al., 2009).

Turtle nesting beaches are known and recorded in Nino Konis Santana National Park (94 km east of the Baucau Cement Project) and on Atauro Island (85 km west of the Baucau Cement Project). The presence of other significant beaches adjacent to the of the Baucau Cement Project site are not known from the literature review and should be confirmed prior to construction commencing so that the Environmental Management Plan can be updated accordingly.
6.11.8 Coastal resources

Coastal resources refer to the natural resources found in coastal areas that are used by people today or in the coming future, including land, forests, coastal waters and wetlands, minerals or hydrocarbons, and living coastal organisms. Coastal resources in the Baucau region have been described in detail in the following sections. No additional coastal resources have been identified other than those described in the following sections of this report:

- Coral – Section 6.11.3;
- Terrestrial and Marine Flora and Fauna - Sections 6.11.6 and 6.11.7;
- Fisheries – Section 6.11.4;
- Surface water springs – Section 6.7;
- Groundwater aquifers – Section 6.8; and
- Land – Section 6.13.3.

6.12 Marine Ecology

Marine ecology is the scientific study of marine-life habitat, populations, and interactions among organisms and the surrounding environment including their abiotic (non-living physical and chemical factors that affect the ability of organisms to survive and reproduce) and biotic factors (living things or the materials that directly or indirectly affect an organism in its environment).

The waters of the northern coast of Timor-Leste tend to consist of a shallow continental shelf of approximately 10 m – 20 m deep. The shelf then drops off steeply to more than 200 m. The benthic habitat of the shallow coastal shelf waters consists of sand, rubble and rock, which supports various hard and soft corals, some seagrass and small patches of algae (WorleyParsons, 2015b). The marine ecology off the northern coast of Timor-Leste in relation to the proposed Project site is hard and soft coral, sand, rubble and rock, described in detail in Section 6.11.3– Coral, which supports shallow water reef fish described in detail in Section 6.11.4 - Fisheries.

6.13 Economic Component

6.13.1 Employment sectors

The total population of the Baucau Administrative Post is 37,613 spread among 7,523 households (i.e. approximately 5 people per household). The population of Suco Tirilolo (near the Baucau Cement Project site) is 6,441 or approximately 2% of the total population of Baucau Administrative Post.

The total population of the Caisido area (the Project Site) is 2,387 or 38% of the Suco Tirilolo population. There are 532 households in Caisido with Osso-ua having 123 households or 23% of the total. The average size of a household in Caisido is 5 people. The total number of men and women of
productive age (age 15 – 64 years, as per Timor-Leste Census, Directorate of Statistics) in the Caisido area is 1,225 or roughly half of its total population. Out of this total, the number of men at productive-age in the area is 613, or approximately 18% of the total number of men at productive-age in Suco Tirilolo (3364).

Among the productive age of the Caisido and Suco Tirilolo areas, the economic employment is mainly focused on the agricultural sector. Most of the local populations in the surrounding Baucau Cement Project site are farmers. A small number of these farmers are also teachers, drivers and owners of small kiosks (vendors) within their villages/hamlets (BBS, 2015c).

Self-employment

The majority of the locals in Caisido and Suco Tirilolo areas are self-employed farmers who mainly grow potato, yams, cassava, jicama, taro root, peanut, corn, soybean and pumpkin. They usually sell these produce in local market in Baucau and along the Bucoli-Triloca road (BBS, 2015c).

Institutional employment

In addition to working their farms, a small number of the locals also work as public servants, school teachers, police officers or as public sector employees (BBS, 2015c).

6.13.2 Infrastructure facilities

There is minimal existing infrastructure in the Baucau Cement Project site. In fact, the existing infrastructure is limited and of low quality.

Amenity

The following amenities are present in Suco Tirilolo (Baucau Cement Project site):

- One community hall;
- One Catholic Church;
- One primary school located in both Caisido and Osso-au; and
- One health center located in Caisido (Edmundo and Ricardo Ernesto Belo pers. comm.).

Table 16 below lists in detail, the existing facilities and their capacities.

**Table 16: Description of facilities in the Baucau Cement Project Site**

<table>
<thead>
<tr>
<th>School</th>
<th>School</th>
<th>Health Center (Clinic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Sao Francisco de Assis Primary School (private catholic School)</td>
<td>Branch of São Francisco de Assis Primary School (private catholic School)</td>
</tr>
<tr>
<td>Location</td>
<td>Aldeia Caisido</td>
<td>Aldeia Osso-Ua (wai-Sa)</td>
</tr>
</tbody>
</table>
### School

<table>
<thead>
<tr>
<th>Capacity/Size</th>
<th>Health Center (Clinic)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>School</strong></td>
<td><strong>School</strong></td>
</tr>
<tr>
<td><strong>Capacity/Size</strong></td>
<td><strong>Capacity/Size</strong></td>
</tr>
<tr>
<td>348 students</td>
<td>48 students</td>
</tr>
<tr>
<td>7 permanent teacher</td>
<td>1 permanent teacher</td>
</tr>
<tr>
<td>2 temporary teacher</td>
<td>1 temporary teacher</td>
</tr>
<tr>
<td><strong>Condition</strong></td>
<td><strong>Condition</strong></td>
</tr>
<tr>
<td>8 school room</td>
<td>4 school rooms (semi-</td>
</tr>
<tr>
<td>1 teacher room</td>
<td>Concrete building)</td>
</tr>
<tr>
<td>1 room for coordinator</td>
<td>1 chapel</td>
</tr>
<tr>
<td>1 library</td>
<td>No toilet</td>
</tr>
<tr>
<td>1 Warehouse</td>
<td></td>
</tr>
<tr>
<td>8 separate toilet (2  for teachers)</td>
<td></td>
</tr>
</tbody>
</table>
Figure 6-53 School in Tirilolo (Osso-ua)

Figure 6-54 School in Parlemento
Other Facilities

Other nearby infrastructure facilities include the national Dili-Baucau road located south of the Cement Plant site, local roadways, Baucau Airfield (in use as a military base) south of the Dili-Baucau road, piped water supply and small water tanks near airfield above mine area, and abandoned jetty and port facility at Kairabela approximately 8 km west of the Cement Plant site.
Figure 6-56 Telephone cable infrastructure near Osso-ua (Caisido/Tirilolo)
The existing paved national road (Dili-Baucau road) is about 5 m wide. There is also an unpaved road linking from the national to the Limestone Mine, Cement Plant and Jetty. Vehicles can travel to the Project site fairly easily in most section at a rate of 20 km/hr - 40 km/hr) (see Figure 6-58).

Road improvements will be required for the existing access road from Kairabela to the Cement Plant site. In addition, new internal roads will need to be constructed connecting on the Cement Plant and Jetty site (see Figure 6-59).

As discussed, in Section 4 – Project Identification Road Improvements and New Roads are not addressed in this EIS.
Figure 6-58: Paved road from Dili to Baucau

Figure 6-59: Unpaved road from Baucau to Project Site
Figure 6-60: Road network (blue lines) between the main towns or places around the Project site
6.13.3 Land use

In terms of land use, the local population distinguishes between four categories, namely paddies / rice fields, forests, gardens / orchards, and bush/scrubland.

Paddy Fields

A small rice field of approximately 0.5 ha exists in Adeia Osso-Ua, near the Project site. This field draws water from a local water source.

Rice fields in the area depend heavily on rain. Once land has been used to grow rice, it cannot be reused for other crops due to the lack of water for further cultivation. Some sucos have ricefield plots watered from springs in Bucoli (Palmer, 2011:145).

Land cultivation is done in a very simple manner; once the land has been watered, a water buffalo is used to churn up the soil until it is suitable for planting. The government has provided aid in the form of tractors for rice cultivation, however due to the limited training the local population finds it difficult to use the machines effectively, so their use remains very limited. Rice field owners who do not own buffaloes may cooperate with the owner of a buffalo in cultivating his land. In this arrangement, the owner of the buffalo gets the same share as the owner of the field. The owner of the buffalo becomes responsible for the cultivation of the land until harvest. This system is rarely used, since landowners are often reluctant to share their produce.

For the most part, rice field owners also own a buffalo (or more), so their land cultivation work is done with the use of their own buffalo by the head of the family (male). The next phase is to plant cultivated rice seedlings with the aid of several workers. Most of the workers in this phase are women, and are generally relatives or neighbors of the owners. Non-related workers are paid about $5/day while relatives only receive food during the planting work and a discretionary amount of the produce during or following harvest, based on their contribution during planting and their economic status. Once the rice has been planted, it is generally left without any further care or fertilizers until it is ready for harvest. This simple rice cultivation regime results in very low productivity. Calculations during the field study indicate that a 0.5 ha field planted with three sacks’ worth of rice seeds would produce 60 sacks of rice of the same quality. After the rice has been dried, the end result is 30 sacks weighing 25 kg each.

Forests

Forested areas around the Cement Plant site are mostly located in the Osso-Ua Aldeia of suco Tirilolo.

Gardens and Orchards

Horticultural lands (gardens and orchards) are the main source of subsistence for the Caisido people (Aldeia’s Parlamento, Caisido, Lialailes, and Osso-Ua) and is mostly dry land planted during the rainy season. Garden and orchards are normally located close to the owners’ houses or settlements. Cultivated orchards are usually protected with stone fences to prevent interference by livestock. Most
residents own more than one fenced orchard located close to each other, or alternatively a single large orchard (about 1 ha) divided into smaller plots with stone fences. The division into multiple sub-plots usually correlates with the planting and cultivation strategy. Most gardens / orchards are worked for 2 - 3 years and then moved to a different location for the same interval. This rotation is meant to restore soil fertility since the orchards do not use fertilizers. The only measure for increasing soil fertility is burning the brush growing on the land. There is no effort to use livestock manure as fertilizers either since most livestock are not kept in pens but rather left to roam free in the scrublands around the village.

Cultivation of orchards begin in August-October or November. Planting is completed by December or January. In the event that the rains begin in December, the planting process is more likely to fail. The work from August to November mostly consists of land clearance and burning of felled vegetation. Vegetation clearance can be done with the aid of unpaid labor from close relatives in return for help in clearing relatives’ land in turn. Despite this extra labor, the amount of land opened is still limited according to how much land the owner can realistically manage independently. Management of the orchards is generally performed only by members of the nuclear family. Every person / household has an associated garden or orchard. Climate change or early rains inevitably influence the choice of crops to plant and how much land is able to be cultivated.

After the land has been burned, it is tilled with hoes. Planting tends to occur in an irregular manner to utilize the non-rocky patches of soil. The most important crops are maize and groundnuts. The maize is normally consumed by the family and livestock, while the groundnuts are primarily used as a cash crop. Other crops commonly planted in the area include tubers (e.g. cassava and sweet potatoes) and vegetables (e.g. green tomatoes and chili peppers). The tubers are primarily a subsistence crop while the vegetables are usually intended for both subsistence and cash.

Although each plot is designated for only one specific kind of crop, usually the larger plots are reserved for subsistence staple crops. The amount of land planted depends on estimations of subsistence requirements. This strategy is usually adopted when there is a considerable need for a cash income.

The horticultural situation in Osso-ua is relatively better than in Parlemento, Caisido, dan Lialailes. The gardens and orchards in Osso-Ua are suitable for vegetable crops such as shallots, upland rice, and capsicum. All of these are regarded as cash crops. The relative remoteness of the area from the closest public transportation facility (around 4 km from the closest point served by public transportation cars going to Caisido) limits the farmer’s ability to sell their produce at market. The produce is normally sold to buyers who travel from the city (the old market) to pick up the commodities at Osso-Ua.

The productivity of local gardens / orchards is not readily calculated since the harvest is normally performed in several stages. Most owners do not know how much horticultural land they have and use, and for the most part they only count how many fenced plots they have. Therefore, the calculation of horticultural income is done by the number of fenced plots.
The Lia nain of the suco describes a set of ritual strictures for the management of gardens and orchards from the land clearing phase, burning, tilling, planting, harvesting, and storing of the produce.

**Bush and scrubland**

Bush and scrublands are usually regarded as reserve lands for the 3-year plot rotation system. These lands are covered in long grasses and bushy growths (especially *Imperata cylindrical*, *Cromolaena adorata*, and *Lantana camara*). These sites are also used as pastures for buffaloes, oxen, and goats. Bush and scrub areas do not cover the land in a fully continuous manner, so external parties are prone to categorize the land as uncultivated wastelands or government property. Linear piles of stones usually define field boundaries and indicate the land is reserved for future use. Each farmer knows the boundaries of their plots. Most of the bush and scrubland area in Caisido are located outside the Project sites.

### 6.13.4 Traffic and Transportation

A traffic assessment was undertaken in the Baucau Municipality (BBS, 2015c). The assessment included a review of the existing transport network, its current use and an analysis of the expected demand on the network for the proposed project. The assessment included the following:

- Identification of the existing road and public transport network in Baucau and around the proposed Project site;
- Assessment of the road network condition, including at intersections and assessment of the existing road furniture;
- A traffic count survey of the roads and intersections of the transport network;
- Use the survey results to predict and calculate the current generation (outbound) and attraction (inbound) traffic for each destination of the transport network;
- Conduct trip assignment and travel time surveys;
- Analyse the traffic circulation of both external traffic use of the road network and intersections in surrounding area;
- Analyse option of entry/exit gate configuration of the proposed plant site, and report on options including proposals for modification as needed; and
- Planning of proposed street furniture for alternatives.

The final two points will be discussed in the Impact Section 9.

**Identification of Road Network**
Twelve towns or places were identified as main hubs of activity and allocated as a centroid i.e. a point within a Traffic Assessment Zone from which all trips are assumed to start or end (i.e. a home, shopping Centre, church, etc.).

The roads that joined these centroid points were classified into two functional classes: either an arterial road or a collector road. An arterial road is typically defined as a high-capacity urban road. The primary function of an arterial road is to deliver traffic from collector roads to freeways or expressways, and/or between urban centers at the highest level of service possible. Collector roads are defined as low-to-moderate-capacity road which serves to move traffic from local streets to arterial roads. Unlike arterial roads, collector roads are designed to provide access to residential properties.

These centroids and roads along with the settlement areas are shown in Figure 6-61.
Figure 6-61: Road network (Blue lines) between the main towns or places around proposed Project site
Road Network Condition

The existing roads are typically four to five meters wide, which is relatively narrow for a standard road. A standard arterial road in the USA consists of two lanes of a minimum of 3.3 m wide each and a collector road is a minimum of 3.0 m wide per lane (US DOT, 2014). This makes it difficult for two vehicles to pass each other (BBS, 2015c). The roads also have an unpaved shoulder and some shoulders are covered by plantation crops. Generally it was noted that the arterial roads are paved by asphalt, but collector roads are unpaved (BBS, 2015c). In addition, some segments of roads were found damaged or contained potholes ranging in size from small to big (BBS, 2015c).

The Coastal Road to the west of the Project site is largely unpaved and only suitable for a four wheel drive (BBS, 2015c). The point at which it passes the Uaisai River mouth, the road is unpassable at high-tide (Figure 6-62). The majority of the eastern portion of the coastal road is however paved and in good condition (BBS, 2015c). The Coastal Road terminates at a T-junction, where it intersects the Dili-Baucau road in Caravela.

Figure 6-62: Coastal Road condition adjacent to the mouth of the Caravela River. (Source: BBS, 2015c)
Road Furniture

The road network within the Baucau Municipality generally lacks road furniture\(^3\) such as road lighting, road markings, road signs and road barriers (BBS, 2015c). In addition, some of the road geometry is of a substandard design, indicated by:

- Small radii curvatures;
- Short lateral clearance; and
- High gradients (steep up - and down-gradients).

BBS (2015c) noted that almost all of the intersections in the road network are uncontrolled intersections, with no road markings and no road signs.

Traffic Volume and Vehicle Type

Results of the traffic count showed that the majority of vehicle use within the traffic network is by motorcycles. Unmotorised vehicles such as bicycles were counted in the traffic surveys (Table 17 and Figure 6-63), however have been excluded in any of the further analysis as it was considered to be side friction\(^4\) (BBS, 2015c).

Table 17: Total vehicles counted for 2 hours in the morning, at lunchtime and in the evening around the Baucau Municipality. (Source: BBS, 2015c)

<table>
<thead>
<tr>
<th>Time</th>
<th>Dili-Baucau Kota Baru</th>
<th>Baucau Kota Baru-Baucau Kota Lama</th>
<th>Baucau Kota Lama-Baucau Kota Baru</th>
<th>Baucau Kota Lama-Dili</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 - 9:00</td>
<td>400</td>
<td>436</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td>12:00 – 14:00</td>
<td>312</td>
<td>464</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>16:00 – 18:00</td>
<td>396</td>
<td>248</td>
<td>72</td>
<td>72</td>
</tr>
</tbody>
</table>

Figure 6-63 shows that with Baucau, busses are also largely used for travel within the city (between Ciabada and Flamboyan (also known as “Pousada” which is a hotel within Baucau). Trucks and cars

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\(^3\) Street furniture is a collective term used for objects and pieces of equipment installed on streets and roads for various purposes. It includes benches, traffic barriers, bollards, post boxes, phone boxes, streetlamps, traffic lights, traffic signs, bus stops, tram stops, taxi stands, public lavatories, fountains, watering troughs, memorials, public sculptures, and waste receptacles. An important consideration in the design of street furniture is how it affects road safety.

\(^4\) Side friction in traffic analysis is defined as all the actions related to the activities taking place by the sides of the road and sometimes within the road, which interfere with the traffic flow on the travelled way. They include but not limited to pedestrians, bicycles, non-motorised vehicles, parked and stopping vehicles.
make up a small percentage of the road traffic within and outside the study area (typically less than 20%) (BBS, 2015c).

Figure 6-63: Traffic flow as percentage by vehicle type. (Source: BBS, 2015c)

**Generation and Attraction of Traffic**

The generation (outbound) traffic from each centroid (town/place) and attraction (inbound) traffic were modelled. It can be seen from Figure 6-64, that some zone centroids attract more vehicles (green bar) than it generates (purple bar). Caibada (within Baucau) generates more than it attracts, as does the East Zone and the South Zone centroids. Note that the zone centroids are also divided into two zone types, internal to the study area and external to the study area. The three centroid zones that are external to the study area are the ‘West Zone’, ‘South Zone’ and ‘East Zone’, all others are internal.

The ‘West Zone’ includes destinations such as Lospalos and the ‘South Zone’ includes Dili as a destination.
Figure 6-64: Trip attraction and generation for the Baucau Municipality. (Source: BBS 2015c)

Trip Assignment and Travel Speed

The main purpose of trip assignment modelling is to identify which routes are used by current road users for each origin to each destination. This also allows the identification of the number of trips each link in the road network currently has. Factors influencing trip assignment are the current characteristics of the study area, alternate routes, road user behavior and traffic congestion (BBS, 2015c).

The results of the trip assignment and traffic use of the current road network is presented in Figure 6-65. As can be seen in the figure, the highest use road is between Caibada (within Baucau) and the East Zone (external destination). The other relatively high use roads are between the South Zone and Tirlolo.
Travel speed was estimated at four locations: L1, L2, L3, and TC03 (see Figure 6-61). The mean speed for each of these four locations is approximately 40 km/hr between Bucoli and Tirilolo (L1), approximately 45 km/hr between Tirilolo and Bahu/Baucau (L2), approximately 20 km/hr between Tirilolo and Caisido (L3) and 63 km/hr between Bucoli and Vemasse/Western Zone (TC03).

Mean speed between destinations nodes has been plotted in Figure 6-66. Top line colour corresponds to the mean travel speed from the eastern node to the western node, while the bottom line colour corresponds to the mean travel speed from the western node to the eastern node. One link recorded less than 20 kmph, however, it is a minor and very short road near node 68 and therefore has not been included on the figure. As can be seen from Figure 6-66, the majority of roads recorded mean speeds of between 40 and 60 kmph, and therefore the traffic network is considered in a good condition (BBS 2015c).
Figure 6-66: Mean travel speed within the road network of the Baucau Municipality. (Source: BBS, 2015c)

Road Network Capacity

The road network currently has a calculated road capacity of 900 passenger car units per hour (cpuph) on its arterial roads and 1,227 pcuph on its collector roads (BBS, 2015c). This is based on the roads being one of two functional classes (arterial or collector) and the road widths varying from 4 to 5 m.

The calculated volume capacity ratio (the ratio of the traffic flow rate to the capacity of the road) is between 0.5 and 0.7 on the link roads between node 86 and node 68 and between node 74 to node 68 (Figure 6-67). A volume capacity ratio of between 0.2 and 0.5 occurs on seven link roads within the study area network, shown as red lines in Figure 6-67. The remainder of the link roads have a volume capacity ratio of less than 0.2. This illustrates that the traffic demand for the existing road network is below the calculated road capacity (BBS, 2015c).
6.13.5 Use of forests and other natural resources

Sandalwood *Santalum album* is used to make salves (herbal ointments) and harvested for timber. Subsistence farmers practice swidden agriculture by clearing forests for new fields in a cyclical manner. At low human population densities and long fallow periods, swidden systems are sustainable. However, despite relatively low population density in Timor-Leste, the amount of suitable agricultural land available per person is insufficient. Farmers regularly cultivate areas with slopes of more than 40 degrees and landslides and flash floods are common (Grantham *et al.* 2010).
Fishing

Fishing undertaken off the north coast of Timor-Leste is characterised by small-scale artisanal fisheries (<200 m from the coastline). The general lack of infrastructure at landing sites compels fishermen to sell their catch fresh. Local traders tend to buy the fresh fish directly from the boat and try to sell it on through small stalls along the roadside to travelers or other traders who will take the fish to the next larger town for sale (WorleyParsons, 2015b). About 75% of fish landed is sold fresh; with the remainder being dried, often on makeshift racks, before being transported to inland markets for sale.

Fishery resources off the southern coast of Timor-Leste are considered of greater commercial value than those found off the north coast such as Baucau (WorleyParsons, 2015b).

Development and expansion of commercial and subsistence fisheries are top priorities for economic development in Timor-Leste (Grantham et al., 2010). Short-term and medium term plans are in place to facilitate the development of the fisheries sector so that it contributes to economic growth, incomes, employment and export earnings (of which fisheries is currently 0%). In the short term, the north coast
of Timor-Leste will be the main focal area for industry development. Currently the maximum sustainable yields are unknown for most fisheries (Grantham et al., 2010).
Figure 6-69 Fishing at the Jetty Site
Agriculture is the main activity in Timor-Leste, providing subsistence to an estimated 80% of the population (MAFF, 2004). It also generates an average of 90% of the exports, mainly due to coffee. Most farmers practice subsistence farming, planting and harvesting what they need for a simple lifestyle, collecting wild foods and traditional medicines, and the animals are very much left free to grow and reproduce. There are almost no large scale farms except for missions (MAFF, 2004).

In 2010, it was reported that about 85% of the population of Timor-Leste is related to cultivated land or the cultivation of land (Valdivieso, 2001) with poverty levels higher among the rural population than urban populations (Grantham et al., 2010). Approximately 50% of the population lives in rural areas and most of these practise subsistence agriculture.

The main agricultural crops are rice, corn, tubers with some livestock. In 2010 was estimated that a rural family holds on average about 1.2 ha of land (Grantham et al., 2010).
Agriculture is the chief occupation of the people in the Project site. The crops being cultivated include peanuts, coconut, corn and vegetables, such as beans, tomatoes, cassava, and potatoes, etc. The important fruit trees are banana and papaya (Visual observation, WorleyParsons, 2015).
Figure 6-72 Irrigated rice fields typical of the Caisido area

Figure 6-71 Sheep grazing in fields at Cement Plant site
6.13.7 Tourism

Tourism in the Baucau area benefits from its geographical location on the route from Dili to the eastern parts of the country. In particular, the Watabo’o Beach (see Figure 6-73 below) has been the stopover/transit spot for many tourists and local visitors who are visiting other municipalities such as Lospalos and Viqueque.

There are very few tourism areas and/or activities found near or adjacent to the Project site. However, there are some recreational areas including Watabo’o and Asa-Lai-Ana Beaches that are anticipated to become tourism destinations in the future. These two beaches are located in Suco Bahu and Tirilolo, respectively. Asa-Lai-Ana Beach is located near the Jetty site but is not yet well known by tourists for its beautiful beach.

The National Directorate of Tourism Planning and Development (DNPDT), Ministry of Tourism (MT) and the State Secretary for Employment Policy and Vocational Training (SEPFOPE) have jointly developed a plan to set up community-based tourism in the Caravela area approximately 8km west of the Project site.

![Figure 6-73: The white sand Wataboo beach in Bahu, Baucau](image)

6.13.8 Other industries

There is no presence of large scale industry in Baucau. There are several small scale and family-owned businesses spread around Bucoli-Tirilolo area. They are all more than 10km away from the Cement Plant and Jetty.
The existing identified businesses are:

- Carpentry / Woodwork;
- Brick production;
- Silk farming;
- Strawberry farming;
- Small scale limestone quarrying;
- Small machete (blacksmith) factory; and
- Coconut and candlenut oil production.

Most industries produce and sell their produce for the local market, with the exception of candlenut oil which is being exported to Hawaii.
6.14 Social component

6.14.1 Population and communities

The population of the sub-districts around the Jetty and Cement Plant area is 41,895 for the Baucau Sub-district. Compared to the census figures from 2010, the Baucau population has experienced a 4% decline.

Nearly all sucos in the Baucau Sub-district exhibited population growth within the last five years, varying between 0.3% - 7% per year with the highest figure being found in Tirilolo (as the directly affected area) at 18%/year, followed by Salamari at 7%/per year and Buibau at 5%/year. Meanwhile, Baruna saw a sharp population decline (-28%/year) (Table 18).
BBS (2015d) postulates that the population records in most sucos are poorly kept, with the exception of Tirilolo where the suco administration keeps family card records for the population in its aldeia. The village secretary explained that the population numbers cited in village monography is recapitulated from these family card records.

The family card provides a complete record of each family member’s age, level of education, and occupation. Other sucos have not undertaken such a complete recording of family cards as in Tirilolo. As such, social assessment of the general picture of the subdistrict’s working-age population, educational status, and occupations has to rely on data from the 2010 census (BBS, 2015d).

6.14.2 Health profiles

Since the establishment of an auxiliary community health clinic in Caisido, the number of visits by local people to the clinic has been relatively high (BBS, 2015d). There has been an average of 3000 visits per year to the clinic; the proportion of genuine medical complaints is also high, ranging from 50% to 98% of the total number of visitors (see Table 19 and Figure 6-75 and Figure 6-76 below). The clinic is staffed by a doctor (educated in Cuba) and three nurses. The clinic serves the
community’s health needs except for the lepers, who are specifically under the care and
custodianship of church sisters. The clinic’s doctor stated that he would have liked to keep tabs on the
lepers’ medical situation and development but the information has been hard to get. The information
is deemed necessary for early warning and prevention against such contagion.

Amidst such difficulties, the government is planning to conduct a census on family health. This census
will probably be very useful in informing disease prevention, education, and treatment efforts along
with the provision of adequate and appropriate medical supplies to the clinic.

Table 19: Health table by age group per year

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>12</td>
<td>27</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
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Source: Tabulation from Clinic Caisido Statistical Report 2015 (BBS 2015d)

Figure 6-75: Health data by age group. Source: Tabulation from Clinic Caisido Statistical Report 2015 (BBS 2015d)
Reports from the clinic indicate that, since the opening of the clinic (2011) to the present (March 2015), nearly the entire Caisido population has visited the clinic and there are probably even some visits by outsiders (since the total is 108% – 144% of the Caisido population). The proportion of people with actual diseases or medical complaints is 56% - 98% of all visitors.

Patients came from all age groups. Among children under 1 year old who visited in 2011 – 2015, 9%-13% had actual medical complaints; so did 16% - 26% of the visitors aged 1 – 4 years, 4% - 19% of visitors aged 5 – 14, and 54 – 67% of visitors aged 15 years and above. This seems to indicate an increasing incidence of disease as people age. The number of medical complaints from infants under 1 year old is relatively low, probably since they still consume breast milk and thus their health is relatively well-maintained. As children enter the 1 - 4 years age bracket, the number of medical complaints begin to increase while they are being weaned. The next age bracket (5 – 14 years) sees further reduction in adaptive capability. In the final age bracket (15 years and over), the predominant complaints are those of old age; a large number of anemia, rheumatism, bronchitis, and gastritis cases hints that the local people’s physical condition tend to deteriorate as they enter advanced age (BBS, 2015d).

The most common types of diseases among all age groups are the big three (Upper Respiratory Tract Infections/URI/ISPA), other skin diseases, and other diseases not classified in the table before. There is an increased incidence of diarrhea among children 1 – 4 years old. This may be due to difficulties with the weaning process or hygiene. Similarly, the prevalence of URI can be attributed to the dry and dusty environment or use of wood for fuels. There appears to be a prevalence of diseases and disorders associated with dehydration due to the limited supply of clean water. There are no indications of malnutrition despite the uncertain state of the local population’s subsistence. The subsistence category essentially means that the people are able to fulfill their calorific needs, but not to excess. However, the natural disasters or disturbances may render the local population vulnerable to mass famine (BBS, 2015d).
6.14.3 Institutions, schools and health facilities

There is one primary school, St. Francis of Assisi Primary School, and a health clinic located in Caisido. There is also a secondary technical school in Suco Uailili of the Baucau sub-district that accepts student from the entire Baucau region (BBS, 2015d).

The community health is an auxiliary clinic in the Caisido Aldeia, Tirilolo Village. This auxiliary clinic provided medical services for the people in four aldeia. The clinic lies within the area likely to incur direct impacts from the Project (BBS, 2015d).

6.14.4 Community structures, family structures

Basic social structure of the community

Within the Caisido communities (the Aldeias Parlemento, Caisido, Lialailes, and Osso-Ua), the use of baptismal surnames as the signifier of social territorial units gives the impression that the inhabitants of a single hamlet or suco form a single kinship group descended from the same ancestor. This is misconception as despite their social and territorial unity, they are not always closely related by blood or by marriage (BBS, 2015c).

Within the uniform surname shared by all members in a hamlet, there are smaller kin-based social units made up of individuals descended from a common ancestor. The members of such groups are aware of their closer bonds as kinsfolk to each other. In anthropological terms, this kind of social unit is known as lineages. The lineage unit is led by the oldest male member of the kin group. In Caisido, membership in the same kin group is signified by affiliation to a particular customary house (rumah adat) (BBS, 2015d).

The customary house serves not only to remember and maintain a spiritual relationship with ancestors and deceased lineage members; it also acts as a nexus of identification for the living members of the kin group. Within a customary house, a lineage member is known and identified by his/her original traditional name and the ancestor’s original name. This identity is an important fixture for validating each person’s rights and obligation as a hamlet resident and a group member. When the lineage group gathers in the customary house, the traditional chieftain/elder (lia nain) – the oldest male member of the lineage – recites the traditional name of every member. All lineage members must know their ancestor’s traditional name. Customary houses are normally situated together with other customary houses, as in the case of the houses owned by the people of the aldeia closest to the mine and plant site. However, in some cases the customary house may be built outside the consolidated site. This variation does not seem to be viewed as a transgression against customs and traditions (BBS, 2015d).

This difference has not resulted in friction from other villagers. Neither the chefe aldeia nor the customary head of the relevant lineage considers the owner aloof or asocial. They seem to be able to accept the reason offered, which is to make it easier to care for the customary house (BBS, 2015d).
Nevertheless, the customary house (*rumah adat*) continues to play an important role as a symbol of identity and the people’s reaffirmation as native residents of a hamlet. As a member in a hamlet/suco, the control and possession over the limited resources available in the hamlet/suco is a critical factor in ensuring survival. The customary house can be theoretically viewed as a response to the Church’s attempts to impose a new identity by compressing social strata into a single egalitarian layer without any distinction in power between one class and the next.

**Marriage system and the debt of exchange**

It has been explained above that the basic social structure of the Caisido communities is the patrilineal and patrilocal lineage. This group consists of a set of nuclear families led by related males. If a daughter/sister and her husband continues to live with the group, her household does not count towards the reproduction of the lineage group, or in other words the children of female descendants are not regarded as members of the parent lineage (BBS, 2015d).

The reproduction of the lineage is conducted through the marriage of a male member with a woman from another lineage. There are no rules or restrictions about which lineage’s women are deemed suitable for marriage. Neither is there any prohibition against marrying people from the same hamlet, or in other words with the same group. For instance, a Belo may marry with another Belo as long as the two do not come from the same lineage (samecustomary house/*rumah adat*). However, the sons of a certain lineage (such as Belo) are generally encouraged to find a mate from a surname group (such as Soares). This is meant to build wider-ranging social networks, which at the same time expands the web of socio-economic exchange and mutual political protection. However, this does not guarantee the possibility of resource exploitation within the territory owned by the parents of the *fetosaun* (daughter-in-law). The establishment of social networks through marriage bonds will provide greater social security through a perpetual exchange arrangement (BBS, 2015d).

Marriage not only allows reproduction for the members of lineage groups but also forms a perpetual exchange relationship between the two lineages (*ummane-fetosaun*). There are few or no customs that dictate whom one might marry or how the lineage might arrange marriages. Young men are generally free to choose their prospective mates. The marriage procedure is quite long and involved (BBS, 2015d).

First, when a man wishes to propose marriage with a woman, the man’s family must make an initial approach or state a preliminary wish to propose to the woman’s family (‘*ketok pintu*’ or ‘knocking the door’). After the proposal has been accepted, the male side must offer livestock – usually buffalo or oxen – as *pembuka jalan* (‘opening the way’). The livestock will then be used in a ceremony in the customary house to inform the ancestors of the woman’s family about the plan; once this has been accomplished, the two parties will then discuss the size of the bridewealth (*belis*). When they have reached an agreement the male side will pay the bridewealth (*belis*). The demanded *belis* is always rather costly, but the male side does not always have to pay it immediately. In addition, even if the male side is capable of paying the entire sum at once, such a one-time payment would be rejected as being inappropriate and a customary transgression. The male side usually makes an initial payment of the *belis* in the form of a buffalo, ox, horse, or goat depending on their financial capabilities. The
rest of the *belis* would be paid later after the marriage as some sort of debt repayment. The *belis* debt is called and paid when the female side needs it, whether to provide *belis* for a male member of their own lineage, to conduct ceremonies in the customary house, to defray funeral expenses, or to fulfill some similar need. The payment should ideally be in the form of livestock as in the initial *belis* payment. Neither side is allowed to make an exact reckoning of whether the debt has been paid in full or not. Any discussion about calculating the debt, especially when initiated by the male side, is regarded as a breach of taboo and a transgression against longstanding customs. If it happens anyway, a customary fine is levied upon the male side in the form of livestock similar to the original *belis* payment (BBS, 2015d).

After receiving the *belis*, the female side reciprocates by giving a *modo* (or *sayur*) in the form of a pig, a chicken, a piece of cloth, etc. The relative position between the two lineages remains the same; that is, if one side wishes to throw a feast for the other, then it must remember its original role as either the woman-giving or the woman-receiving side. Any mistake in the kind or amount of payment made at any point is seen as a customary violation and the transgressor must pay a fine (BBS, 2015d).

Even when the *belis* has not been completely paid out, any children from the union is regarded as a descendant of the male lineage. The children of a female member of the lineage does not count as a member of the mother’s lineage, but may request baptism by one of the mother’s male relatives if he/she wishes to use both the paternal and the maternal baptismal surname. Similarly, when a woman marries into a different baptismal surname, she would continue to use her original baptismal surname by appending it before her husband’s surname, e.g., Maria Belo Suares. In this case Belo would be the baptismal surname of Maria’s parents, while Soares is her husband’s baptismal surname appended at the end of her own. This naming signifies identification and respect for both surnames (BBS, 2015d).

The use of baptismal surnames as personal identity is closely intertwined to rights to partake of the resources in a traditional/customary territory. Today the demand for this is largely economic in nature, especially in terms of membership in the parents’ customary house (*rumah adat*) and lineage grouping. The political side of these rights (such as eligibility to become a *chefe suco*) is no longer influenced by particular traditional identities, and tends to depend more on the ability to connect with ordinary people (BBS, 2015d).

Although female members of the lineage have been ‘released’ to their husbands’ respective lineages, they still maintain some degree of connection with their parental families through brother-sister relationships. For instance, if a married woman dies, some of the first people the husband would inform are the wife’s parents or lia nain. In the process the husband or the male side of the exchange is supposed to send livestock in a similar manner to the payment of the *belis*. Similarly, if the husband dies and the wife would like to remarry, the new husband-to-be should ask for permission from the widow’s parents or lineage elders, not from the oldest male member of the late husband’s lineage. In either case, the bonds of exchange between the lineages are not severed upon the death of either party in the marriage. The presence of the woman-giving side (regarded as the life-giving
side) and the woman-receiving side are required for joint funeral arrangements. This involvement by both sides is deemed important not only for the sake of the soul of the departed, but also for those left behind to gain some closure. Hicsk (1976) states “that the passing of information to the woman-giving lineage is related to beliefs about how to take care of the soul of the departed so that it can rest in peace in the afterlife and so that the living members of the lineage can come to terms with the loss.” (BBS, 2015d).

This explanation can be summarized in that the role of female members of the lineage is not limited to being reproductive agents but also as the means for the establishment of a web of exchange relationships that can have beneficial effects to her lineage of origin. In the religious-magic sense, she plays a major role in death-related rituals as a representative of the life-giving lineage. Her rights in her own lineage may seem quite weak since she does not have inheritance rights, but she is an important asset to her lineage in the establishment of extensive social security networks through a system of her perpetual exchange and her role in taking care of death- and funeral-related arrangements. The customary exchange system through marriage can be seen as a socioeconomic burden to the male side, while at the same time providing the customary lineage group with the social capital to accumulate surplus in the face of resource scarcity (BBS, 2015d).

Under all this customary pressure, the traditional system allows the opportunity to answer economic challenges (subsistence needs) with the aid of a complex exchange network. In this context, it would appear that the apportioning of customary lands through baptismal surname groups and the harsh ecological conditions have influenced the modes of social organization. From the spatial perspective, the territory of the baptismal surname group is a ‘place produced through the interaction of social relation, expression of identity and the practice of culture.’ (Appadurai, cite from Panneli, 2011: 220) (BBS, 2015d).

Women's position and gender

Women's position and role in the Suco Tirilolo community in general and the Caisido region in particular (the Aldeias Parlemento, Caisido, Lialaileso, and Osso-ua) – and even among the Baucau population as a whole – appear to be rather contradictive. As a member of the lineage group, her presence is an important asset for the rest of the kin group in establishing social relationships, especially for economic purposes. On the other hand, she lacks the right to inherit subsistence resources (particularly land) from her lineage group (BBS, 2015d).

The patrilineal and patrilocal system in Tirilolo (and Baucau in general) is rather unique. In a normal patrilineal system, the woman’s bridewealth (belis) must be paid in full, and afterwards neither she nor her husband retains any obligation to aid in the provision of dowries or bridewealth for her male relatives who would like to marry. If the husband dies, the woman (and her children) fully becomes the ward of the husband’s family (BBS, 2015d).

In Baucau, although the woman has to be ‘purchased’ by her husband, custom dictates that the man should not pay the requested bridewealth (belis) in full even if he is capable of doing so. The outstanding sum becomes a perpetual debt that the husband must stand ready to repay throughout
the marriage, and also creates a bond of mutual indebtedness between the lineage groups that will last for generations. Neither side is supposed to raise the point of whether the price has been paid in full or not. Any discussion of the matter is seen as a taboo (BBS, 2015d).

Once a bond has been formed between woman-giving and woman-receiving lineages (ummane – fetosaun), the relationship is perpetuated in the form of occasional exchanges. Each side must keep its original role in mind in performing later exchanges or offering aid. The woman-givers (ummane) would give something commensurate to the original “sayur”, such as pigs, chicken or something similar. On the other hand, the male side must offer contributions or aid of similar form and value as the belis, such as buffaloes, oxen, goats, or horses. These customary obligations also apply in offering meals (or throwing a feast) for either the woman-giving or woman-receiving side. Mistakes in offering gifts or serving food would require the party at fault to pay customary fines (BBS, 2015d).

Although a woman has been given by her lineage to her husband’s lineage, she is required to maintain elder-younger sibling (maun – alin) or brother-sister bonds. If the woman dies, the husband must promptly break the news to the wife’s family, especially her elder siblings. This communication is accompanied with a gift of livestock similar to the original belis. The notification is mostly about the process of taking care of the deceased spouse’s body. Similarly, if a woman gets widowed and another man wishes to marry her afterwards, the new husband-to-be should put forth his proposal to the oldest male member of the woman’s lineage. The agreement does not have to wait for consent from the woman or her late husband’s family. Afterwards the remarried woman will reside according to the terms of the agreement, sometimes with her new husband’s lineage and sometimes back with her original lineage on land managed by the oldest male member in her lineage group (lia nain) (BBS, 2015d).

On one hand, women do not have equal status with their male relatives, but their role is very important in building social security networks for her lineage’s descendants and in achieving closure in matters that touch the world of the afterlife. Amidst these ambiguities, women/wives need to develop strategies to guarantee their futures (BBS, 2015d).

Local natural and ecological circumstances that do not support market-oriented intensive farming, stagnant subsistence patterns, the lack of local investment opportunities outside traditional sectors, the burden of mutual indebtedness between ummane and fetosaun and elder and younger siblings – all of these are challenges that must be overcome by lineage groups and especially the women in order to be able to accumulate surplus and invest them for the future (BBS, 2015d).

Decision making among kin groups and the neighborhood

It has been explained in previous sections that the patrilineal lineage constitutes the basic social structure in the Caisido community. This kind of structure places decision-making power in the hands of the oldest male member of the lineage. Although the oldest male holds the power, he must consult with his male relatives. Husbands of female relatives living with her lineage group are not counted in the consensus, and even if present they do not have the right to express their opinions (BBS, 2015d).
In relation to the project, any major decisions related to land purchases and or resettlement/relocation will require several consultative meetings, since it is possible that the solutions/suggestions chosen in the local meetings may fail to garner official government approval. By the same token, any decisions or suggestions made by governmental authorities must be discussed and mooted with male relatives in the lineage group; the process goes back and forth until an agreement is reached (BBS, 2015d).

At the hamlet level, the *Chefe Aldeia*’s office as the head of the hamlet does not give him the authority to make unilateral decisions, especially when it may affect fellow villagers’ assets. Any decisions must be made together by the lineage as a whole. It may take multiple meetings to reach a final decision since, as mentioned above, the decisions made by the lineage’s *lia nain* cannot be implemented unilaterally without consulting with male relatives within the lineage (BBS, 2015d).

Hamlet-level consultative meetings involve all *lia nain* according to the number of customary houses (*rumah adat*). Since every lineage group has decision-making authority, there is probably going to be some differences in opinion between the lineages. However, in dealing with the project, the decisions of the most directly-affected lineages should be prioritized, while the remaining lineages should not have the authority to speak for the affected lineages or for the hamlet as a whole. The chief of the *Aldeia* does not have the authority to interfere with any villager’s interests. His role as the leader of the *Aldeia* or suco is merely to facilitate the meeting and pass suggestions from the other parties that he represents. The chief of the *Aldeia* and/or suco cannot impose his will and can only offer recommendations. Should the matter fall into a deadlock, the decision would be referred to the Regent/District Administrator. The Regent’s decision is binding and final, and the villagers treat the District Administrator (*Bupati*) as the symbol of the government’s ultimate power, but the decision must inevitably take account of the interests of all parties without unfairly benefiting any single party over the others. Still, the lack of any written and legal proof of possession over the land resources managed by the villagers places these villagers in a relatively weak bargaining position (BBS, 2015d).

### 6.14.5 Land ownership, including informal and customary land ownership, and any other rights over land

The land as the main resource for the fulfillment of the local population’s subsistence needs is usually obtained through ancestors from the people’s forebears. There is no clear indication of when the ancestral settlers began to reside in the Caisido region. Theoretically speaking, given the lineage-based social structures, it is likely that the ancestors only go two generations back (current residents’ fathers and grandfathers). As such, the Caisido region was probably settled around 75-100 years ago (BBS, 2015d).

Separately to this, the local residents’ assertions that their land ownership proceeds from ancestral rights shows that they feel that they have the rights of possession. This possession usually comes without any form of written or formal proof. The local population generally does not feel any pressing need to obtain formal acknowledgement of their land ownership since the legal status of their claim to the land has never been seriously disputed before. Only with the plans for the acquisition of land does the issue of ownership come to the fore. This is particularly relevant to the bushes and
scrublands since there is some concern that the lands being left fallow might be claimed as
government property despite the existence of ownership markers in the form of stone fences or
boundaries (BBS, 2015d).

Apart from these individual ownership claims, the local population would also like to stake out their
communal rights as members of the Belo group. The Belo group is a territorial control identity for all
the people acknowledged as members of the Belo group. Other baptismal surnames will find
difficulties or may even be barred from claiming possession of lands within Belo territories even if they
choose to marry a woman from the Belo territory. The only kind of opportunity that may be made
available is as a temporary borrower in lands owned by the wife’s family (BBS, 2015d).

Ownership and possession of land is passed down through inheritance. Only sons receive
inheritance rights while daughters do not, although the latter remain the ward of the oldest son in the
family (lia nain). All sons have a claim to the inheritance but the control of the land is given to the
oldest son, who will then arrange for the distribution of workable land; if any son is a minor or is
uninterested in farming (such as if they have already a job in the city), the right to manage the land is
handled by the lia nain who also takes responsibility for the distribution of subsistence needs. In this
case the wife usually regulates the management and fulfillment of common subsistence needs (BBS,
2015d).

When a son relinquishes possession rights to the land, such as by selling off his share, his economic
and political status as a lineage member is no longer under the lia nain’s responsibility and he loses
the right to participate in decision-making at the kinship and hamlet/aldeia level. Therefore, the
relinquishment of land possession rights is a decision that cannot be taken unilaterally and must
involve both the lia nain in the kinship group and the lia nain for the village as a whole (BBS, 2015d).

Daughters do not get inheritance rights since they will eventually fall under their husbands’ custody. If
the husband dies without descendant, the husband’s property will fall under the management of the
oldest male in the husband’s kin group. However, if the property comes in the form of land, the widow
may still have rights to make use of the land. In this regard, interview results indicate that most wives
and mothers would invest the property of a deceased husband towards their children’s education.
These children represent the mother’s principal hope for future livelihood (BBS, 2015d).

If the widow wishes to return to her parents’ kin group, she becomes a ward of her group’s lia nain. If
she wishes to remarry and the new husband would like to move in with the wife’s kin group/family, he
must seek the approval of the woman’s lia nain (the oldest male in the lineage elder) (BBS, 2015d).

In any case, no matter who dies in the relationship, customary exchanges between woman-giving and
woman-receiving parties remain in force. Additionally, if the widow chooses to remarry, it only
creates a larger network of exchange relationships. Local informers state that it is very difficult to
avoid the customary burden brought about by these obligations (BBS, 2015d).
6.14.6 *Any other types of common or individual rights on natural resources*

Traditional fisheries are undertaken at the coast, though these will not be impacted by the Cement Plant and Jetty.

Forested areas are found in the Wailacama *aldeia* (formerly part of suco Ostico). The forests are fairly thick and are currently exploited by the residents of Ostico a place to hunt and to harvest wood for building materials (whether for their own use or for sale) or for firewood. All the immigrant families (44 households) in this jurisdiction collect firewood as their primary livelihood. There is no definite information about how many trees have been cut down for their wood, but most locals pick firewood from already fallen trees. There is no clear information about the average income of firewood collectors, but each collector has been estimated to be able to earn $10-$15 per harvesting trip at a price of $0.5 per firewood bundle (BBS, 2015d).

6.15 *Cultural component*

An archaeological and cultural heritage sites investigation was undertaken in the areas proposed for the Baucau Cement Project. The report by Oliveira (2015) involved a desktop study into any known sites of archaeological importance within the proximity of the Baucau Cement Project site, including consultation with the local community and a field survey to investigate whether any cultural heritage or archaeological sites exist within the Baucau Cement Project site.

The report showed that the Baucau region has a history of human occupation for the last ca. 30,000 years. This has been documented by both archaeological and anthropological investigations. Prior to the report, the previous archeological investigations in the Baucau region have focused on rock shelters and caves along the uplifted terraces lying on the western side of the Baucau Plateau. In this region, two archaeological sites have been comprehensively excavated and described individually by Glover between 1972 and 1986 (Oliveira, 2015). Dating has put the use of the excavated sites from 4500 years before present (BP) to approximately 31,600 years BP.

More recently the East Timor Archaeological Project (ETAP) carried out four field seasons, between 2000 and 2002, and their work has resulted in the discovery of a diverse range of archaeological sites, from aceramic shell middens\(^5\) to caves and rock shelters, some of them with evidence of rock paintings. In 2001, extensive fieldwork along the uplifted coral plateau west of Baucau where Glover had undertaken his work has identified a number of additional caves and rock shelters with good potential for archaeological excavation (Oliveira, 2015).

3500 BP is when the first domestic animals and the first pottery is estimated to have been introduced to Timor. This period also includes the introduction of various kinds of vegetables, fruits, tubers, cereals (in particular rice and corn) and cash crops like coffee.

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5 Shell middens are places where the debris from eating shellfish and other food has accumulated over time.
The study undertaken by Oliveira (2015) revealed that the Baucau Cement Project-related areas investigated in the suco of Tirilolo (which forms part of the Baucau Municipality) have many archaeological and ethnographic sites, with many caves, rock shelters and sacred sites, including traditional altars related to agricultural practices, springs and burial sites. Some of the caves and rock shelters that were excavated in the second half of the 20th century date back to thousands of years (Oliveira 2015). Many other such sites, identified during the 2015 assessment, contain material culture that suggest a similar antiquity or are intrinsically related to community’s living memory, relating to a more recent past.

Overall, the information available suggests that this area has for a long time attracted groups of people, who arrived and set up their homes using caves as shelter, drinking from nearby springs (later using them for agricultural purposes) and taking advantage of the natural resources existing in the vicinities, such as molluscs and fish from the sea, or game, tree crops and wood from nearby forests (Oliveira, 2015).

The sites have been described, but to protect the sites, their locations have not been provided in this EIS.
6.15.1 Cultural heritage

Cultural heritage sites are listed as architectural heritage sites in the report by Oliveira (2015). There were three types reported, including religious, civil and traditional.

**Figure 6-77 Cultural Heritage Sites around the Cement Plant, Jetty and Conveyor site**

**Jetty and Conveyor**

The religious architectural heritage sites found near the proposed Jetty and Conveyor locations consist of mostly grave sites. The grave sites are visited at least once a year, typically on All Soul’s Day (2nd November). Civil architectural heritage site consists of a water well constructed of limestone and coral which is regularly visited for water, but is also used for ceremonial purposes. The sites are in Good to Fair condition (Oliveira, 2015).
Figure 6-78 Entrance to Sacred Heritage site near the Jetty site

Figure 6-79 View from the sacred heritage site at the Jetty to the coast
Cement Plant

One religious architectural heritage site is found adjacent to the proposed plant site. This is a large communal Christian cemetery with older gentile and more recent Christian burials used by the village of Ossu-ua (Oliveira 2015). More than 50 individual graves have been observed, some dating back to...
the Portuguese period, and others from more recent times. The cemetery is visited at least once per year on All Soul's Day. The site is in Good condition (Oliveira, 2015).

Figure 6-82 Graves near the Cement Plant and Jetty site

6.15.2 Archeological sites

The report by Oliveira (2015) identified four archeological site types in the Tirilolo area. These are cave/rock shelters of which 24 were identified as archeological, one rock art site, one shell midden site and one open air archeological site.
Jetty and Pipe Conveyor

One site was identified within 200 m of the proposed road and conveyor site area. It was located by O’Connor in 2001, however was not visited by Oliveira (2015). It does not have a condition rating, but the shell midden, where the debris from eating shellfish and other food has accumulated over time, includes marine shell of *Strombus*, *Conus* and *Labmis* sp. and the shell showed clear evidence of having been processed (Oliveira, 2015).

No archeological sites were identified within the proposed Jetty or Conveyor Belt footprint.

Cement Plant

No archeological sites were identified within the plant site footprint (Oliveira, 2015).

6.15.3 Historical sites

Historical sites refer to the location of a specific historic event or a specific person or group. Examples of historical sites in Timor-Leste would include the Balibo Fort, the Santa Cruz Cemetary, and the village of Creras as well as the Tasi Tolu monument to the visit of Pope John Paul. No historical sites were identified within the proposed Baucau Cement Project site (Oliveira, 2015).

6.15.4 Sacred sites

Sacred sites found in or around the proposed Baucau Cement Project site include springs, ceremonial altars, cave/rock shelters and stones. Of these, three sacred spring sites, fifteen ceremonial alters, 5 cave/rock shelters and one sacred heritage stone was identified in the Tirilolo area (Oliveira, 2015).

Jetty and Conveyor

Eight sacred heritage sites were identified within 500 m of the proposed Jetty and Conveyor Belt area. One is directly within the Jetty area, and this site is a sacred site consisting of a stone platform with a wooden ceremonial pole under a large Pandanus palm tree. This sacred site is accessed for ceremonial purposes and is in Good condition, being cleared of vegetation each year for ceremonial purposes (Oliveira, 2015).
Figure 6-83 Sacred heritage site nearby to the Jetty (Photo 1 of 2)
Figure 6-84 Sacred heritage site nearby to the Jetty (Photo 2 of 2)

Figure 6-85 Sacred heritage site 140m north of the Jetty on the beach (behind the bush) (photo 1 of 2)
A further sacred site near the Jetty location, also consists of a stone platform and wooden ceremonial pole, though this is under thick shrub. This sacred site is used to perform ritual ceremonies related to the harvest of corn when the rainy season comes late. It is in Fair condition and the shrub is thick, being used only once per year for ritual purposes (Oliveira, 2015).

Further along the beach, on the south west facing rock face, there is a small hole, which shows evidence of a fireplace, indicating that it is still used to conduct a traditional ceremony. According to local informants, community elders use this site once a year to conduct a traditional ceremony. This ceremony is a ritual prohibition (“Tara Bandu”, in Tetum) that aims at preventing communities to cook corn at the beach, in believing that by not doing so the rain will come. It is used in close associate with the previously described site, but is in Bad condition as it is washed by the sea (Oliveira, 2015).

A fourth sacred site located nearby is a hole in a limestone formation with a high platform/terrace in front of it. It is used by the local community during maze or rice harvest traditional ceremonies and to cook sacrificed animals. The condition of it is Good as it is maintained by the community and visited once a year for ritual purposes (Oliveira, 2015). This site is used in close association with the following two sacred sites.

The fifth sacred site is a large set of coral stone blocks at the base of a large tree. It is used during traditional maize and rice harvest ceremonies to cook scarified animals (Oliveira, 2015). It is in Good condition and is also maintained by the local community and used once a year for ritual purposes. An additional site consists of a stone platform with a wooden ceremonial pole. The site is again used during the maize and rice harvest traditional ceremonies and used to cook scarified animals. It
represents the last stage of the ritual process after it passes through the previous two sites (Oliveira, 2015). This site is in Good condition.

A seventh sacred site consists of a small shelter covered by large fig trees, located within and old walled garden with palm trees. It is used once a year for ceremonial purposes, when the rainy season comes late. It is in Good condition and is used once a year for ritual purposes (Oliveira, 2015).

A final sacred site consists of a stone platform with a wooden ceremonial pole. It is a site from where traditional custodians collect wood when they need to build a new house. During the ceremony, communities come and play traditional hand-drums and perform a ritual before cutting down the trees. The site is used to perform annual rituals associated with agriculture when the rainy season comes late (Oliveira, 2015). It is in Good condition and is cleared from vegetation every year for ceremonial purposes.

**Cement Plant**

No sacred sites are located within the Cement Plant site. Six of the abovementioned sacred sites lie within 500 m of the Cement Plant site and are described above (Oliveira, 2015).

**6.15.5 Unique landscapes**

No unique landscapes were identified in or around the proposed Baucau Cement Project site.
7 CLIMATE CHANGE IMPACTS

This section describes relevant climate change considerations relevant to the construction, operation and decommissioning of the proposed Baucau Cement Project. Most of the background information in this section is based on the Timor-Leste National Adaptation Programme of Action to Climate Change (NAPA) adopted in December 2010.

7.1 Description of the historic weather observations and trends

According to the NAPA, there are no national country-specific studies and insufficient historical weather data for Timor-Leste to provide comprehensive analysis and evidence of how its climate has changed. However, a number of preliminary studies, including analysis of data from West Timor, can be used to provide indication of possible changes in climate in the region. In addition, global models are also used to extrapolate information to Timor-Leste level. IPCC global models indicate that in South-East Asia extreme weather events associated with El-Niño have been both increasing in frequency and intensity in the past 20 years. This has had an impact on Timor-Leste climate patterns with estimated decreases in mean rainfall indexes, in particular for the dry season and increased incidences of extreme weather events.

7.1.1 Temperature

An analysis of global data by the IPCC shows that in the Timor-Leste region, temperature from 1901 - 2005 has increased 0.5 °C – 0.8 °C over the century, while data for 1979 - 2005 suggests a lower decadal increase of 0.1 °C - 0.3 °C with a mild acceleration over the later decades.

The Seeds of Life/Finis ba Moris program in the Timor-Leste Ministry of Agriculture and Fisheries (MAF) used Portuguese era climate data for 7 weather stations across the country from 1954 to 1974 and compared these to automated weather stations in the same locations for the period of 2004 to 2012.6 This comparison showed an average increase in maximum temperature of 1.7 °C; however, there was considerable variability between sites based largely on elevation. The nearest and most similar location to the project site is Manatuto which experienced a much greater temperature increase of 2.6 °C.

The maximum temperature recorded at the Baucau Meteorological Station in 2014 was 32.4 °C.

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7.1.2 Rainfall

Analysis of total rainfall in Timor-Leste indicates a reduction in mean annual rainfall from 1961 - 1990 as compared to the 1931 - 1960 period, the decrease being mostly felt in the December-February rain period. Since 1976 there has been a tendency for the El Niño - La Niña normal alternation to be dominated by El Niño events that associated with lower levels of monsoonal rainfall.

The MAF Seeds of Life study found that, on average, mean annual rainfall decreased by 19% in 2004 - 2012 compared to the 1954 - 1974 period. However, similar to temperature, there was a great deal of regional variability. Manatuto, the closest recording site in the study, had an increase in mean annual rainfall of 23%.

The 2014 annual rainfall total for the Baucau Meteorological Station was 756.3 mm.

7.2 Future projections of climate change

7.2.1 Temperature

The projections for temperature indicate a trend towards temperature increases for the target years of 2020, 2050 and 2080 in the order of 0.8 °C, 1.5 °C and 2.2 °C respectively, in relation to the 1961 - 1990 reference period. Extreme temperature events are also expected to increase. By 2050, 7-day or 30-day heat wave events can be expected to increase by up to 2.3 °C and that the length of such events can be expected to increase by two days.

7.2.2 Rainfall

Rainfall is also expected to increase, in relation to the 1961 - 1990 reference period, by 2%, 4% and 6% by 2020, 2050 and 2080, respectively. This is different to the scenario in Indonesia where decreased rainfall is projected, but is similar to northern Australia. Due to the lack of specific studies on Timor-Leste and the coarseness of the climate models, the NAPA cautions that these projections may be inaccurate.

In addition to an expected overall increase in rainfall for Timor-Leste, extreme rainfall events are expected to increase. Overall, rainfall events are expected to become less frequent but more intense.

7.2.3 Sea Level Rise and Acidification

Sea level rise figures for Timor-Leste are expected to be close to the global averages. However, it should be taken into consideration that Timor-Leste is estimated to have an annual uplift of 1cm given tectonic activity. Globally, IPCC forecasts the following scenario for sea level rise relative to 1990 data:

- 3.2 cm to 10 cm by 2020;
- 8.9 cm to 27.8 cm by 2050; and
18 cm to 79 cm by 2095.

It is also expected that given an increase in absorption of carbon dioxide (CO₂), sea water pH will lead to acidification, impacting upon marine life. Projections indicate a pH decline of -0.16 to -0.17, by the 2070s, relative to 1990s in the Timor-Leste region.

7.3 Implications for the proposed project, or the environment as a result of these trends and projections

The NAPA process identified potential climate change vulnerabilities and adaptation options. These vulnerabilities (impacts) are described in Table 20. A discussion of how these relate to the proposed project and/or local environment is also provided.
Table 20: Vulnerabilities for Climate Change Impacts

<table>
<thead>
<tr>
<th>Phase</th>
<th>Affected Aspect</th>
<th>Climate Change Impact</th>
<th>Environmental Factor impacted</th>
<th>Relationship to Proposed Project and/or local environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Level</td>
<td></td>
<td>• Inundation of lower lying areas</td>
<td>Groundwater</td>
<td>• Potential impacts to the coastal infrastructure associated with the Limestone Mine and Plant facilities, making the jetty and MOF inaccessible or unsafe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Changes to flow and flooding regimes of rivers and drainages</td>
<td>Flora</td>
<td>• Potential impacts to the water supply for the Limestone Mine and Plant from increased salinity due to intrusion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Saltwater intrusion of aquifers</td>
<td>Fauna</td>
<td>• Potential impacts to the post-closure land use and decrease in success of rehabilitation due to inundation</td>
</tr>
<tr>
<td>Rainfall</td>
<td></td>
<td>• Changes to rainfall patterns with increased or decreased rainfall</td>
<td>Surface Water Groundwater</td>
<td>• Potential impacts to the Limestone Mine and Plant infrastructure and accommodation from flooding and cyclones</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase in extreme rainfall events e.g. cyclones</td>
<td>Flora</td>
<td>• Potential impacts to the productivity of the Limestone Mine and Plant due to extreme weather delays (e.g. shipping)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Changes to flow and flooding regimes of rivers and drainages</td>
<td>Fauna</td>
<td>• Potential impacts to the post-closure land use and decrease in success of rehabilitation due to a drying climate</td>
</tr>
</tbody>
</table>
# TL CEMENT, LDA

**BAUCAU CEMENT PROJECT**

**ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Affected Aspect</th>
<th>Climate Change Impact</th>
<th>Environmental Factor impacted</th>
<th>Relationship to Proposed Project and/or local environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air temperature</td>
<td></td>
<td>• Changes to ambient temperature</td>
<td>Community Health</td>
<td>• Potential impacts to human health and comfort due to increasing temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increased evaporation</td>
<td>Infrastructure</td>
<td>• Potential increase in power consumption due to increased use of air conditioning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Flora</td>
<td>• Potential impacts to the post-closure land use and decrease in success of rehabilitation due to a hotter climate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fauna</td>
<td></td>
</tr>
</tbody>
</table>

---
7.4 Any necessary adaptation measures required to mitigate any potential adverse impacts to the proposed project or the environment

The NAPA process identified priority adaptation strategies for food security, water supply, and human health. Any project-related mitigation measures recommended in this EIS and the project EMP should reflect these priorities in addressing climate change impacts. Adaptation measures required to mitigate potential adverse climate change related impacts to the proposed project or affected environment are described in Table 21.

**Table 21: Climate Change Adaptation Measures**

<table>
<thead>
<tr>
<th>Potential Climate Change Impact</th>
<th>Proposed Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water</td>
<td>Refer to mitigation measures recommended for impacts related to stormwater and flooding described in Section 9.10 Surface Water. The mine plan should consider the potential adverse effects of future climate change. In particular, quarry benches and slopes should be designed to address the increased potential for landslides. Mine plan should also account for an increased need for dewatering and flood control.</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Refer to mitigation measures recommended for impacts to water supply described in Section 9.11 Groundwater.</td>
</tr>
<tr>
<td>Flora and Fauna</td>
<td>Refer to mitigation measures recommended for impacts to terrestrial ecology described in Section 9.13 and 9.16.</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Refer to mitigation measures recommended for impacts to infrastructure described in Section 9.21 Infrastructure.</td>
</tr>
<tr>
<td>Community Health</td>
<td>Workers should be provided with adequate shade, water and appropriate clothing including wide-brimmed hats and long-sleeves. Workers should be closely monitored for symptoms of heat sickness and dehydration. During extreme heat events, working hours should be adjusted to avoid the hottest parts of the day. Refer to mitigation measures recommended for impacts to community health in Section 9.27 Community Health.</td>
</tr>
</tbody>
</table>
7.5 Management Objectives

The following international standards may be applicable in relation to climate and greenhouse gas emissions:

- To ensure the atmospheric emissions (i.e. carbon monoxide) are minimised as much as practicable; and
- To ensure design of project components accommodate climate change, including sea level rise and severe weather events etc.).

7.6 Applicable Standards and Legislation

The following international standards may be applicable in relation to climate and greenhouse gas emissions:

- United National Framework to Combat Climate Change (1992) and the Kyoto Protocol; and
- Australian National Greenhouse and Energy Reporting Act (2007);
- Intergovernmental Panel on Climate Change; and
- Australia Clean Energy Act, 2011 detailing similar industry emissions in the Liable Entities Public Information Database.
7.7 Climate Change Impact Assessment

It is considered that the development of the Project will have a limited and insignificant impact on the regional and local climate through its contribution of greenhouse gases and resulting effect on global climate.

An assessment of the potential greenhouse gas emissions was undertaken and approximately 293 kTe- per annum would potentially be generated based on the worst case scenario of emissions from a cola power station. The Project proposes to use a Captive Power Plant (CPP) using Circulating Fluidized Bed Technology (CFB) boiler to produce 33 MW. A Waste Heat Recovery (WHR) Plant of 8 - 10 MW capacity shall also be installed to utilize waste flue gases. The CPP proposes to use biomass as a fuel source. The best case scenario is 2 kT e- per annum from the CPP burning biomass and alternative fuels (NGER Act, 2007).

The construction and operational phase of the Project is likely to see a localised increase in CO$_2$ emissions, which is considered to be the main greenhouse gases (GHG) contributing to man-made global warming. The following are the main sources of direct CO$_2$ emissions from the Cement Plant:

- Calcination of carbonates, and combustion of organic carbon contained in raw materials;
- Combustion of kiln fuels related to clinker production and combustion of non kiln fuels;
- Combustion of conventional fossil kiln fuels;
- Combustion of alternative fossil kiln fuels and mixed fuels with biogenic carbon content;
- Combustion of biomass fuels and biofuels (including biomass wastes);
- Combustion of fuels for on-site power; and
- Combustion of carbon contained in wastewater (WBCSD, 2011).

In accordance with the NGERS Facility reporting threshold (NGER Act, 2007), facilities with an emissions of 25 kt or more of greenhouse gases (CO$_2$ –e_) are required to report emissions to the regulator. There is no similar mechanism in place in Timor-Leste. Depending on the fuel and technology type, Australian power stations emit between 0.37 and 1.38 tonnes of carbon dioxide equivalent (CO$_2$e) per megawatt-hour (tCO$_2$e/MWh) and an emissions target of 0.86 tCO$_2$e/MWh has been proposed for all new power stations in Australia. ([http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BN/1011/PerformanceStandardsemissions](http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BN/1011/PerformanceStandardsemissions)).

A calculation of the predicted MWh for the CPP results in a predicted worst case scenario of 0.5 tCO$_2$e/MWh. This is lower than the proposed emissions target for new power stations in Australia.

The emissions from the operation of vehicles and plant equipment, which uses diesel fuel, are expected to be negligible.
The meteorological parameters of concern which relate to climate change for the Project site are: sea level rise, cyclone intensity and frequency, rainfall and extreme wind speed. Within the lifetime of this Project (50+ years), climate change projections in CSIRO, 2010 indicate that the following may occur:

• Projections for sea level rise are 3.2 cm - 10.0 cm by 2020; 8.9 cm – 27.8 cm by 2050, and 18 cm - 79 cm by 2095, relative to 1990;
• Cyclone frequency is to reduce but the intensity is projected to increase; and
• Extreme rainfall events are to become fewer, but more intense, with similar trends projected for extreme wind speeds (CSIRO, 2010).

These projections are uncertain and by nature are subject to change. However, as the Project is located in a coastal region, the engineering design will need to take into account the following factors for the lifespan of the Project:

• The projected rise in sea level;
• Cyclones and severe storms, which can potentially cause widespread damage to property and endanger human life.;
• High-energy waves may interfere with construction and/or operational activities for the jetty and may pose a safety risk to site personnel.; and
• Lightning can also pose a safety risk for personnel, particularly where tall metal structures or machinery can attract lightning strikes.
• Adequate stormwater management.

Pre-construction, Construction and Decommissioning

Based on the impact assessment the potential impacts to climate during the pre-construction, construction, and decommissioning phases is considered to be ‘Low’ due to the negligible potential impacts.

Operations

The potential impacts to climate during the operation of the Project are considered to be ‘Medium’ based on the localised and short-term nature of the potential impacts associated with the increased emissions of greenhouse gases.

The potential for climate change to impact on the project is addressed in Section 7 Climate Change Impacts.

7.8 Mitigation Measures

The following general mitigation measures will be implemented for the duration of the Project (i.e. pre-construction through to decommissioning).
• Potential cyclone/earthquake/tsunami identification methods and warning systems;
• Communication methods for workers and local populace;
• Cyclone and earthquake proofing for all structures/objects/machinery (temporary and permanent);
• Construction and operational policies for lightning strikes and high energy waves;
• Lock down procedures for securing all structures/objects/machinery (temporary and permanent);
• Emergency action plans and evacuation procedures; and
• Distress notification if additional aid is required

Operation

• Adoption and implementation of clean technology to ensure emissions of greenhouse gases are minimised.
• Ensure vehicles and equipment are regularly serviced and maintained to minimise potential emissions of greenhouse gases.
• Limit vehicle idling time and keep vehicles well maintained to minimise gaseous emissions.

7.9 Monitoring and Reporting

It is recommended that an automated weather station (AWS) is installed near the Project site to record and monitor the following parameters on an hourly basis for the duration of the Project (i.e. construction, operation and decommissioning):

• Station identification number;
• Date and time of record/observation;
• Air, wet bulb and wet dew point temperatures.
• Precipitation and evaporation;
• Relative humidity;
• Wind speed and direction;
• Solar radiation;
• Barometric pressure (relative, absolute, and QNH (Barometric pressure adjusted to sea level for aviation purposes));
• Visibility;
• Cloud cover; and
• Cloud ceiling height, if practicable.

The recording and monitoring of these parameters will provide input information for various environmental management measures (including, but not limited to, dust suppression and cyclone management) and reporting requirements on the Project. It may also provide valuable information to agricultural workers for planning and optimising crop yields.

The installation of the AWS should be conducted in accordance with AS 3580.14-2011 - Methods for sampling and analysis of ambient air Part 14: Meteorological monitoring for ambient air quality monitoring applications, or an equivalent guideline.

Until the GoTL implements a Carbon Pricing mechanism or issues a National Communication (NC) under the UNFCCC, there is no formal requirement in place to record, monitor and report on greenhouse gas emissions at a country level.

Monitoring of greenhouse gas emissions is therefore not recommended for this Project.

### 7.10 Summary Climate Change Mitigation

<table>
<thead>
<tr>
<th>Type of Activity</th>
<th>Preconstruction</th>
<th>Construction</th>
<th>Operation</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Generation</td>
<td>Power Generation</td>
<td>Power Generation</td>
<td>Captive Power Plant (CPP) using Circulating Fluidized Bed Technology (CFB)</td>
<td>None</td>
</tr>
<tr>
<td>Diesel Generators</td>
<td>Diesel Generators</td>
<td>Diesel Generators</td>
<td>Diesel Generators</td>
<td>Diesel Generators</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Preconstruction</th>
<th>Construction</th>
<th>Operation</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse Gas increase</td>
<td>Greenhouse Gas increase</td>
<td>Greenhouse Gas increase</td>
<td>Greenhouse Gas increase</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mitigation Measure</th>
<th>Preconstruction</th>
<th>Construction</th>
<th>Operation</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential cyclone/earthquake/tsunami identification methods and warning systems; Communication methods for workers and local populace; Cyclone and earthquake proofing for all structures/objects/machinery (temporary and permanent); Construction and operational policies for lightning strikes and high energy waves;</td>
<td>Potential cyclone/earthquake/tsunami identification methods and warning systems; Communication methods for workers and local populace; Cyclone and earthquake proofing for all structures/objects/machinery (temporary and permanent); Construction and operational policies for lightning strikes and high energy waves;</td>
<td>Adoption and implementation of clean technology to ensure emissions of greenhouse gases are minimised. Ensure vehicles and equipment are regularly serviced and maintained to minimise potential emissions of greenhouse gases. Limit vehicle idling time and keep vehicles well maintained to minimise gaseous emissions. Potential</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
**Preconstruction**
- Lock down procedures for securing all structures/objects/machinery (temporary and permanent);
- Emergency action plans and evacuation procedures; and
- Distress notification if additional aid is required

**Construction**
- Lock down procedures for securing all structures/objects/machinery (temporary and permanent);
- Emergency action plans and evacuation procedures; and
- Distress notification if additional aid is required

**Operation**
- Cyclone/earthquake/tsunami identification methods and warning systems;
- Communication methods for workers and local populace;
- Cyclone and earthquake proofing for all structures/objects/machinery (temporary and permanent);
- Construction and operational policies for lightning strikes and high energy waves;
- Lock down procedures for securing all structures/objects/machinery (temporary and permanent);
- Emergency action plans and evacuation procedures; and
- Distress notification if additional aid is required

**Decommissioning**
- Lock down procedures for securing all structures/objects/machinery (temporary and permanent);
- Emergency action plans and evacuation procedures; and
- Distress notification if additional aid is required
8 ALTERNATIVES CONSIDERED

This section provides a summary description of the realistic alternatives to the proposed Baucau Cement Project.

Potential alternatives identified and described below include Alternative Locations, Different Project Sizes or Designs, and Alternative Technologies/Methods. In addition, this section also considers the “no-project” alternative which establishes the likely outcomes if the proposed Baucau Cement Project were not to proceed.

Sufficient detail has been provided to enable all potential environmental, social, economic and cultural impacts to be identified or predicted and assessed. A comparative assessment for each of the identified alternatives is provided in Table 22.

The Proponent’s rationale for selecting the chosen alternative is also provided.

8.1 Description of Alternatives

8.1.1 Alternative Locations

The Cement Plant, Jetty, Pipe Conveyor and Associated Infrastructure need to be located on a large area of relatively flat land near the Limestone Mine to reduce transport costs of the raw material and thus make the project commercially viable. The EIS Report for the Limestone Mine component of the Baucau Cement Project addresses the reasons why the proposed location of the Limestone Mine at Bucoli Block I-1 has been chosen by the Proponent. As other feasible locations near Block I-1 would have similar existing environmental conditions and would result in similar environmental impacts, alternative locations for the Cement Plant, Marine Jetty, and Associated Infrastructure are not further assessed.

There is an abandoned and derelict bulk cement import facility located at Caravela approximately 8 km west of the proposed Baucau Cement Project site along the Manatuto-Baucau road. This cement plant also had a concrete pier approximately 100 m long and 9 m wide. The abandoned site was reportedly intended as a terminal to serve the Indonesian transmigration program. The water depth is shallow and the fendering on the two mooring dolphins has deteriorated. An adjustable ramp at the landing point is not operational. Remaining shore facilities are limited to a dilapidated administration building and internal roadways. To the south of the Caravela site, there are extensive rice paddies which could provide sufficient space for the 80 ha of cement plant facilities. The existing Jetty would need to be replaced with a longer jetty reaching deeper waters to support larger vessels. The use of the Caravela site would require transport of up to 2 million tons of raw limestone from the Bucoli mine site either via roadway or conveyor.
8.1.2 Different Project Sizes or Design

The proposed Baucau Cement Project is designed to produce 1.65 mtpa of cement clinker. Of the 1.65 mtpa of clinker to be produced, the Proponent proposes to export around 1.15 mtpa clinker and the remaining 0.50 mtpa clinker shall be used for cement manufacturing for domestic consumption. Potential alternatives would include sizing the production to meet only domestic demand or to provide for export markets (0.5 mtpa or 1.15 mtpa respectively).

8.1.2.1 Domestic Production

Reducing the scale of production to meet only domestic production target of 0.5 mtpa would reduce the limestone demand from 2.10 mtpa by approximately 70 percent to approximately 0.64 mtpa. This would also reduce area disturbed by the mine at the same planned 50-year operating life. It is assumed that if the smaller production alternative was chosen, the proponent would choose to mine the area closest to the plant site to minimize haulage distances.

- **Physical Impacts:** Physical impacts would be significantly reduced due to the smaller mining footprint. In particular, the smaller scale of the project would reduce impacts on geology, topography, air quality, surface water and groundwater.

- **Ecological Impacts:** Ecological impacts would be significantly reduced due to the smaller mining footprint. In particular, it is likely that the mine plan could be designed to avoid areas of closed forest and higher habitat values which would also likely reduce impacts on fauna.

- **Economic Impacts:** The project commercial feasibility study suggests that the cement plant would not be profitable with production for only domestic use. In addition to not being commercially feasible, this option would reduce the potential beneficial economic impacts including job creation and increased government revenues compared to the proposed project.

- **Social Impacts:** The smaller scale of a domestic-production facility would result in reduced negative social impacts. The reduced employment generation would reduce impacts on local institutions, schools and facilities. It would like also have less beneficial impacts on local population and communities.

- **Cultural Impacts:** The smaller mining footprint allowed by this alternative could allow the mine plan to be redesigned to avoid at least some of the identified archaeological and sacred sites.

8.1.2.2 Export Production

If the Project was reduced in size to only provide export quantities of clinker, the cement grinding facility could be eliminated and gypsum would no longer be required to be imported. However, the scale of the Cement Plant, Jetty, Pipe Conveyor and Associated Infrastructure would not be significantly different than the proposed Project. In addition, this alternative would not realize the project objective of providing a lower-cost domestic cement supply. Thus, the alternative of limiting
8.1.3 Alternative Technologies/Methods

8.1.3.1 CEMENT PLANT

Currently all the cement coming into the country today is imported from Indonesia or elsewhere and is 70% more expensive than the country it has been produced in. The Project Proponent is proposing to produce cement locally at a significantly lower cost and in order to achieve project efficiencies and has considered several alternative technologies and/or methods of production.

Option 1 - Bulk Import Terminal where cement is imported in bulk, packed and distributed nationally.

Under Option 1, there would be no limestone mining or cement manufacturing involved but packing and distribution would still be done in Timor-Leste. There is a similar project currently under construction in Liquica District. Without the need for power for the kiln, the project would not include a power plant. As the largest domestic market for cement is in Dili, it is likely that this alternative plant would be located closer to the capital city and not in Baucau. As a similar project is currently nearing completion, it is unlikely that additional bulk import capacity would be commercially feasible at this time. Thus, this alternative is not considered further.

Option 2: Grinding Station where clinker is imported from outside and the grinding is done in Timor-Leste

Under this option, cement clinker would be imported and ground with gypsum locally to make ordinary Portland cement, then packed and distributed. The impacts would be comparable to those of Option 1; however, this option is not considered feasible. First the investment cost for the low Timor-Leste domestic volume would be too high. The export market is not feasible as the Australian market can import clinker directly so no need for an intermediary grinding facility in Timor-Leste. Thus, this option is not considered further.

Other alternative technologies and/or methods for the cement plant are discussed further below.

Fuel Type

Coal is the preferred fuel in the kiln since it is the most cost effective and is widely available. However, if an existing supply of Natural gas was readily available nearby, it would be the preferred fuel source as it has lower greenhouse gas and air pollutant emissions. However as there is currently no gas facility nearby, this alternative is considered unfeasible and this alternative is not considered further.

Fuel Efficiency
Besides power consumption, fuel comprises almost 40% of the cost of production. To reduce fuel costs, the cement industry has developed ways to reduce fuel use such as:

- Use of waste gases for raw material drying through hot gas generators, and gas reticulation technology;
- Use of waste gases for power generation; and
- Use of Alternative fuels such as biomass, rubber tires, Refuse derived Fuel (RDF) from Municiple pits and industrial waste.

Reuse of waste gases and waste heat has been incorporated into the cement plant design. Note fuel substitution from alternative fuels (AF) can replace coal in the kilns by 30% as long as alternative fuels are available in the region. Thus, the Project Proponent has a commercial incentive to use alterantive fuels in place of coal. While AF may not be available in sufficient quantities in Timor Leste, it could be sent back on ships that are delivering clinker to Australia. Current design incorporates AF usage.

*Cement Plant Design*

As cost of production is a critical factor to profitability for what is regarded a base commodity item, energy efficiency is a primary focus as is maintenance cost, break downs and maximum through put.

As such, the proposed Project incorporates the following alternative technologies to mitigate these risks:

- Wide use of energy efficient machines to allow more throughput with least energy consumption. A similar plant built in the 1980's would consume 29 MW - 30 MW of power. Today the same plant will consume 23 MW. All critical high energy equipment on this project will be best in class to reduce energy which reduces project operating costs;
- Revised plant design minimizing foot print in the region with ergonomic materials handling systems;
- Combined crushing systems for clay and limestone to reduce a crusher for each material;
- Sourcing of crushed gypsum to eliminate a gypsum crusher;
- Use of variable speed drives to reduce power consumption of key heavy equipment, mostly large fans and motors;
- Use of high quality insulation to retain heat and lower coal consumption; and
- 6 - 5 stage pre heater and calciner to reduce coal consumption.
8.1.3.2 Jetty

For options 1 and 2 above, a Jetty may not be required if they are built in Dili, but then also there is no need to start any cement operation in Baucau. If the plant is based in Baucau as proposed, there is no other option other than the marine jetty because the current road will not allow affordable transport by road for the equipment during construction (even if a terminal or grinding plant were to be built in Baucau) but also for transport of the finished products.

Alternative equipment will be used on the Jetty for ship loading and unloading including pneumatic systems and shore-to-ship cranes. These systems have been considered but are not fast enough to load and offload the required volumes of material. These alternatives are not considered further.

8.1.3.3 Marine Offloading Facility

In addition to the Jetty, a separate Material Offloading Facility (MOF) Jetty is required for bringing in construction equipment and materials. As planned, the MOF will be located approximately 150 m to the southwest of the Jetty. The conceptual design for the earthen abutment includes 5 m wide concrete paved driveway extending approximately 70 m past the coastline. A 24 m wide by 25 m wide concrete paving area is located at the end of the MOF, which sits in approximately 7 m deep water. As a potential alternative, the MOF could be designed as a pile jetty similar to the main loading/unloading jetty. Use of this alterantive design would reduce impacts to coastal processes, including coastal erosion. Similarly, the assessment of marine habitats has identified the proposed location of the MOF as potentially impacting on corals. As a result, an alternative location is recommended. The alternative design and location of the MOF is considered further below.

8.1.3.4 Pipe Conveyor

The proposed Baucau Cement Project will use a pipe Conveyor Belt which is considered the best possible way to transport material while minimizing dust. Other options for transport of material from the Marine Jetty to the Cement Plant would include using:

1) Trucks to transport it along a dedicated haul road; and
2) A standard conveyor.

Using trucks to deliver the material would result in a greater level of noise and dust pollution. It would also create a significant public safety and worker hazard due to the traffic. It would also significantly slow ship loading and unloading times resulting in additional ship waiting times and higher costs.

A standard conveyor system would result in a greater level of dust pollution, even if fully covered. Thus, this alternative is not further considered.

8.1.3.5 Power Plant

The power requirement for the Baucau Cement Project shall be drawn from captive sources. A Captive Power Plant of 30 MW capacity based on Circulating Fluidized Bed (CBD) Boiler technology
is proposed to be installed. A Waste Heat Recovery Plant of 8 MW - 10 MW capacity shall also be installed to utilize waste flue gases. Alternative power supply options include the following:

- **Option 1- Increased renewable energy.** The option remains to use wind and solar energy to offset project demand but this is only viable during the day (when Sun is available) or when wind is available. A cement and clinker plant runs 24-hours a day. Power storage systems (i.e., batteries) can be used but result in higher costs. If renewable energy is used during the day and grid power at night, the total power cost will also be higher even with grid synchronicity (on average 12 - 14 US cents/kWh). More land would be required for solar panels and wind farms which would not be close to the plant- Additional environmental impact would result from the need to build power transmission lines.

- **Option 2: Using Existing National Grid Power.** There is currently excess supply in the national grid produced by generators operated at Hera and Betano power plants. These plants are fueled by imported Heavy Fuel Oil which is very expensive resulting in very high tariffs for industrial users (22 - 26 US cents/kWh). By comparison, the proposed CFB captive power plant is expecting to generate electricity at a cost of approximately 6 cents/kWh. Any government subsidy to reduce the electricity cost below the cost-recovery level would reduce the benefits of the project to Timor-Leste and would not be recommended under good economic policy.

- **Option 3- Gas Fired Power Plant-** As explained above for fuel type, if gas was available, it could be used in the Kiln to make clinker and for the power plant as well. At this time, there is no domestic or nearby natural gas supply to Timor-Leste.

The power plant will be designed to operate on a range of fuels in order to be flexible with the use of different fuel sources. The power plant will be designed to meet international emission standards.

Therefore, alternative power plant designs and power supply solutions are not considered further at this time. In the future, if domestic gas supplies were made available, or if the cost of production from the national grid was reduced, power supply options to the cement plant could be further considered.

**Water Supply**

General water consumption by the Cement Plant is comparatively low as it uses a “dry process”. Water for the Cement Plant is currently proposed to be sourced from the adjacent alluvial plains without impacting the ground water for the local community.

The power plant adds to total project water consumption because of the cooling requirements and this consumption can be reduced by the following options:

- **Option 1 - Air Conditioning Tower -** This system uses a cooling tower and circulated water to cool the power plant. However, since plant is located near the sea and the humidity is very high, a Cooling tower would not work as efficiently.
• Option 2 - Water Conditioning Tower: This system uses a cooling tower and circulated Sea water for cooling. For this option, sea water is pumped to the power plant and is used for cooling in a closed circuit. The seawater intake is only for makeup water lost due to evaporation. There are minimal environmental impacts with this system and it is quite common to use such cooling water systems if the ocean is nearby. However, the plant cooling systems need to be designed to withstand the corrosive effects of seawater resulting in additional costs.

Another solution to obtaining water instead of using boreholes, is to build a desalination plant which treats raw sea water for cement and power plant requirements. However, desalination plants require large power inputs resulting in additional electrical demand for the project.

As the project water demand is not expected to be a significant impact to local water supplies, these alternative water sources are not considered further.

**Construction / Worker Camp**

Baucau is a small city with limited space and rental possibilities. As such the Proponent has proposed a workers camp that provides comfortable accommodation for its senior managers to stay. Without such a camp, it would be hard to attract experienced workers who would be more interested to stay in Dili or work elsewhere. Experienced workers will be sourced globally and they will train local the workers. The camp also provides some family facilities which may not be available in rental accommodation in town. Cement operation will operate 24-hours Camp accommodation close to the Cement operations, is a much safer alternative during shift work. As employees will not have to drive on the unsafe local roads at night.

The alternative would be to build a camp near Baucau or rely on rental in town but this may be expensive for employees and there may not be enough suitable rental accommodation available. Currently there is only 1 hotel with 10 rooms in Baucau and this accommodation would be better suited for tourist visiting the area. A camp is a one-time fixed cost with operating expenses and is manageable but to rent would be more costly and may make the project unfeasible. Thus, an alternative to the construction/worker camp is not considered further.

**8.1.4 No-Project Alternative**

The “No Project Alternative” would result in no Cement Plant, Jetty, Power Plant, Water Supply, Limestone Mine, or Construction Camp being developed as part of the overall Baucau Cement Project.

**8.2 Comparison of Impacts**

The potential impacts of each alternative have been identified, assessed, and compared to the proposed project as described below. A summary of the comparative impacts is provided in Table 22.
8.2.1 Alternative Location (Caravela Site)

A summary of the potential impacts from Alternative 1: Caravela Site is provided below.

- **Physical Impacts**: The Caravela alternative site would likely result in similar physical impacts, including climate impacts, topography, geology, surface and groundwater, coastal and marine waters, and soil (i.e. dust and trucks). It is likely the Caravela alternative site would result in an increase in air quality impacts due to the need to haul a large volume of raw materials a greater distance.

- **Ecological Impacts**: The Caravela alternative site would likely result in greater ecological impacts, especially impacts to corals and fisheries. Although there is an existing pier at the site, it has deteriorated and does not reach sufficiently deep water to service larger vessels needed for the Baucau Cement Project. As a result, a new jetty would need to be constructed and would extend significantly further offshore than the proposed site. The Caravela site is known to have extensive coral bommies and is a recreational scuba diving site.

- **Economic Impacts**: The Caravela alternative site would likely result in similar economic impacts associated with employment, infrastructure, land use, natural resources, fishing, and other industries. However, it would displace a significant area of productive rice paddies resulting in a greater negative economic impact to agriculture.

- **Social Impacts**: The rice paddies to the south of the Caravela alternative site are not inhabited based on a review of aerial imagery. Likewise, the abandoned cement plant and jetty area are also not inhabited. As a result, development of the Baucau Cement Project at this alternative site would not result in the displacement of local dwellings. However, converting the rice paddies would result in a loss of livelihood for the local community. It would also result in a significant change in land ownership, including informal or customary land ownership.

- **Cultural Impacts**: As both the jetty area and the rice paddies are heavily used, it is unlikely that there are any archaeological resources of significance at the Caravela alternative site that would be impacted by the Baucau Cement Project. The site may have some historical value due to its role in the Indonesian transmigration program; however, the historical artifacts have likely not been preserved. There are likely to be sacred sites associated with the rice paddies and any natural springs providing water for the paddies. There are also likely to be grave sites located in the area. It is likely that cultural impacts would be similar to that of the current proposed Baucau Cement Project site.

8.2.2 Different Project Size or Design

A summary of the potential impacts from Alternative 2: Domestic Production is provided below.

- **Physical Impacts**: A reduced production of cement would result in a significant reduction in climate change and air quality impacts. A Project, based on local supply, would result in
significant reduction in water for processing. A reduction in size of the Marine Jetty would reduce impacts on coastal processes and marine waters.

- **Ecological Impacts**: A reduction in the size of the Cement Plant footprint would reduce impacts to terrestrial ecology. Reduction in the size of the Marine Jetty would result in less adverse to corals and marine habitats.

- **Economic Impacts**: The Project would create significantly less employment (-70%) and local business engagement than the current proposed Project. The Project would result in less training and capacity building. The Project would result in less foreign private sector investment. The Project would also result in less government revenue through taxes, duties and royalties.

- **Social Impacts**: The Project would result in less community social investment by the Project Proponent as a result of the lower return on investment.

- **Cultural Impacts**: The Project would result in similar or slightly reduced cultural impacts due to the smaller footprint.

### 8.2.3 Alternative Technology/Methodology

A summary of the potential impacts from Alternative 4: Bulk Packaging Plant is provided below.

- **Physical Impacts**: Eliminating the cement manufacturing component of the project would result in significantly less physical impacts. Demand for processed water would be considerably lower due to a smaller Project. There would be less energy required and a new power plant would not be required. There would be significantly less air pollutants released, although dust emissions would be similar. There would be less noise pollution from manufacturing; however, there would be more noise impacts from traffic. Traffic impacts would increase as cement would be transported domestically via truck instead of seaborne barge. A jetty would be required for unloading the imported bulk cement; however, this would be located elsewhere along the coast. The location and design of the jetty would determine its impact on coastal processes and the overall marine environment.

- **Ecological Impacts**: There is little impact on terrestrial ecology from the proposed project and it is likely that any site closer to Dili would also be comparatively disturbed. A jetty would be required for unloading of imported bulk cement; however, this would be located elsewhere along the coast. The impact would depend on the location of the new jetty and whether it impacted on coral, mangrove, or seagrass habitats.

- **Economic Impacts**: This alternative would result in less private sector investment in Timor-Leste. Timor-Leste will be dependent on external supply from other countries which is not reliable so shortages are possible. Cement price will still be very high which would threaten local projects and increase the cost of individual housing. This alternative would result in significantly less employment creation (maximum 50 people) with limited training and
educational opportunities. This alternative would not support creation of downstream Industries such as distribution, retailing, and block and concrete product manufacturing.

- **Social Impacts:** Alternative would not be constructed in Baucau so would not result in social impacts to these communities. The Baucau area would not benefit from social investment from the project. Areas near Dili are undergoing relatively more rapid development that in rural Baucau, so it is likely that beneficial social impacts would be less under this alternative.

- **Cultural Impacts:** As the packaging plant would not be located in the culturally rich area west of Baucau, it is likely that cultural impacts would be less under this alternative, but would depend on the location. Eliminating the mining component of the Project under this alternative would also result in significantly less physical impacts, as described in the No Project Alternative discussion in the EIS for the Limestone Mine component.

### 8.2.4 No Project Alternative

A summary of the potential impacts from a “No Project Alternative” is provided below.

- **Physical Impacts:** No physical impacts would result from the non-development of the Baucau Cement Plant Project. There would be limited effects of climate change on local communities and the environment. Other physical features would remain the same.

- **Ecological Impacts:** No ecological impacts would result from the non-development of the Baucau Cement Project. Local habitat would continue to be degraded through the current over-grazing, subsistence farming practices, and firewood harvesting.

- **Economic Impacts:** No beneficial economic impacts would occur. No jobs would be created, no training or educational opportunities would be realized and no government or local community revenues (via royalty and taxes) would be generated. There would be no Secondary Industry creation downstream associated with the Baucau Cement Project. Cost of cement would remain high in Timor-Leste, reducing the viability of other infrastructure and economically beneficial projects. Building an individual house will remain expensive. No foreign investment in Timor-Leste would be realized.

- **Social Impacts:** No social impacts would occur as a result of the non-development of the Baucau Cement Project. If the Project is not developed, local communities may be disappointed at the loss of potential jobs. Future development initiatives in the area may be treated with distrust.

- **Cultural Impacts:** No cultural impacts would result from the non-development of the Baucau Cement Plant Project. No graves or other sacred sites would need to be relocated. The ‘No Project Alternative’ would not result in disturbance to archaeological sites; however, an opportunity would be lost to investigate these sites and learn more about the history of the region.
<table>
<thead>
<tr>
<th>Component</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
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## TL CEMENT, LDA
## BAUCAU CEMENT PROJECT
## ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE

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<th>Component</th>
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**RED**: Alternative results are more significant negative impact or reduced beneficial impact compared to the proposed configuration.

**YELLOW**: Alternative results in a similar negative or beneficial impact compared to the proposed configuration.

**GREEN**: Alternative results in a less significant negative impact or an enhanced beneficial impact compared to the proposed configuration.
8.3 Rationale for Selection of Chosen Alternative

As shown in Table 22, the alternative project site at Caravela (Alternative 1) may result in reduced impacts to terrestrial flora and fauna compared to the proposed project site, but would result in increased impacts to marine habitat. It would also have increased impacts to air quality, livelihoods, and land ownership compared to the proposed location. The Project Proponent has also indicated that the site is not viable for the Project.

A reduction in scale of the project to only meet domestic production demands (Alternative 2) would result in reduced physical, ecological and cultural impacts, but would also result in less beneficial impacts to employment, infrastructure, and populations. Alternative 2 may also not be commercially feasible due to the small size of the domestic market.

An alternative approach to meet domestic cement demand through bulk supply (Alternative 3) would likely not be commercially feasible as there is a competing project nearing completion in Liquica. Any similar project would likely be located nearer to the larger market in Dili.

It is recommended that the Project Proponent adopt the recommended alternatives for the MOF (Alternative 4), including a redesign from an earthen structure to a jetty pile design. It is also recommended that the MOF be relocated to avoid existing coral habitat.

The No Project Alternative (Alternative 5) would not realize the employment and economic benefits of the proposed project. There would be no private sector investment resulting from the project. No additional employment would be realized for the local communities. There would be no reduction in the price of domestic cement.

Based on careful consideration of all project alternatives, the project proponent has selected the proposed project as it is the most commercially feasible while maximizing potential economic and employment benefits and minimizing potential environmental and social impacts.
8.4 Project component equipment and technology

A picture which shows the Cement Plant and export via the Jetty is included below.
Figure 8-1 Cement Plant, Conveyor and Jetty for export – Flow diagram
8.4.1 Pre Construction

During pre construction, excavators and graders will be used to clear vegetation and level the ground for the construction phase.

Pre-construction also requires the establishment of a camp for workers.
Figure 8-3 Example of excavator to be used to clear vegetation during pre-construction
8.4.2 Construction

During construction, heavy plant and equipment will be used to construct the Cement Plant, Jetty and Conveyor. Examples of this equipment is included below.
Figure 8-5 Example of excavator loading a dump truck
Figure 8-6 Example of jetty during construction (photo: marineandcivil.com)
8.4.3 Operation

During operation, the plant will be operational and the jetty will load ships for export. Trucks and other vehicles will be used around the site to transport material and people to and from the workplace.
Figure 8-8 Example of Cement Plant showing bituminised surface for mitigation of dust

Figure 8-9 Example of Conveyor showing covered conveyor for mitigation of dust
Figure 8-10 Example of power infrastructure showing housing for mitigation of noise

Figure 8-11 Example of crusher in the plant with mitigation (cover for dust)
Figure 8-12 Example of crusher in plant (inside) – mitigation measure cover for dust

Figure 8-13 Example of raw mill grinding (Cement plant) – mitigation measure safety barriers
8.4.4 Decommissioning

During decommissioning, equipment and buildings will be dismantled following consultation with the community and GoTL.

The area will be revegetated with native species.
Figure 8-16 Example of decommissioning process (implosion of a power station) (Photo: sandiegouniontribune.com)

Figure 8-17 Example of revegetation process (Image: Google Images)
9 IMPACT ASSESSMENT AND MITIGATION MEASURES

9.1 Overview
The following impact assessment section has been developed in accordance with the regulations and guidelines set by NDPCEI. The Timor-Leste environmental regulations do not currently establish criteria or indicators for assessing the significance of environmental impacts. The Annexes to the General Regulations, The Regulation on the Detailed Requirements for Screening, Scoping and Terms of Reference, Environmental Impact Statements and Environmental Management Plans for Environmental Assessment (Draft 5, 2012) states:

9. Impact assessment and mitigation measures
The proponent shall identify the impacts of the project for each phase of the project, as relevant (design/pre-construction, construction, operation, deactivation/decommissioning), and assess the significance of the impacts using appropriate methodologies and criteria. This section must include direct and indirect impacts, cumulative impacts, climate change impacts, short, medium and long term impacts, temporary and permanent impacts, positive and negative impacts. This section should include:

a. methodology and approach
b. scope of the assessment
c. identification of impacts
d. determination of significance of those impacts
e. mitigation measures
f. incorporation of mitigation measures into project design
g. determination of any residual impacts

The key statement which requires the proponent to assess the significance of the impacts using appropriate methodologies has resulted in the development of a modified risk-based assessment of project environmental and social impacts. This approach is discussed further in the next section.

9.2 Impact Assessment Framework
Environmental and social impacts of the Project have been assessed based on the level of impact the activity has on each factor, e.g. water, vegetation, heritage. The baseline condition of the factors has been determined from the specialist investigations on site, which are detailed in Section 5.8 – Description of the Environment. In the Impact Assessment (this Section), the impacts are assessed based on which phase the impact occurs in, i.e. pre-construction, construction, operation and decommissioning. The significance of the impact is considered in relation to the baseline condition.

An impact is quantified based on:

1. Duration of the impact, i.e. permanent (beyond the life of the Project) or short term (<10% of the Project life);
2. Environmental cost, i.e. cost of restoring to baseline condition or relative loss of habitat; and
3. Location of the impact, i.e. localized or regional relative to the Project location and size.

Mitigation measures are then developed for those impacts which are deemed significant or readily mitigated. The post-mitigation impact assessment is undertaken based on the likely success of the mitigation measures. This is termed the ‘residual impact’.

9.3 Significance-based Impact Assessment Framework

Quantifying the impact of the development of the Baucau Cement Project has been undertaken using a modified ‘Significance Assessment Framework’ similar to that used in Western Australia (EAG9, 2010). In order to quantify the environmental and social impact of activities associated with the Baucau Cement Project; it is necessary to describe what would constitute acceptable and unacceptable risks. When compared to a traditional risk assessment model (e.g. AS/NZS 4360-1999), it is clear that this approach has omitted the “likelihood” or statistical chance of the impact occurring. This approach has been taken because it was necessary only to consider the base case that the Project proceeds as it is currently planned to and it will have an impact on the aspects involved. This results in an assessment of the degree or extent of the impact, categorized from low-extreme over 4 gradations.

The significance of the impact has been considered in the context of its:

1. Duration: long or short term, permanent or non-permanent;
2. Extent: area of influence limited to the impact site only, its immediate vicinity or local or the wider regional area;
3. Qualitative criteria: The measurement of the factor in the field and compared against internationally acceptable criteria and standards for that factor; and
4. Environmental cost: Ease of remediation following impact.

The results from the assessment of significance classifies the potential impacts from ‘Low’ to ‘Extreme’ (Table 24). The Projects’ environmental and social impacts can then be evaluated, from the perspectives required by GOTL legislation, including:

- Distinguish between significant positive and negative impacts;
- Direct and indirect impacts;
- Cumulative impacts;
- Cross-border impacts;
- Global impacts including climate change impacts;
- Long-term, medium-term and short term impacts;
- Describe impacts in quantitative terms; and
- Describe impacts terms of environmental cost and benefits.
### Table 23: Definitions

| Aspect                     | Land clearing, spills, dredging, emissions, discharge, construction works, concrete pouring  
|                           | Used interchangeably with "Activity" in other texts |
| Factor                    | Flora, Fauna, wetlands, groundwater, surface water, heritage |
| Policy / Regulatory       | Regulatory requirements, stakeholder expectations |
| Framework                 |                                       |
| Environmental impact      | Loss of flora and fauna, damage to mangroves, contamination of water, effect on heritage areas or artefacts |
| Effect                    | Water quality decline, reduction in coral cover %, reduction in new annual mangrove growth, dust fallout greater than safe environmental levels, noise levels cause health issues in local community |
| Consequence               | Magnitude of the loss of flora and fauna, damage to mangroves, contamination of water, effect on heritage areas or artefacts. |
| Direct impact             | Impact which is caused by the project activity within the Project site or its impact envelope  
|                           | e.g. increased vehicle activity resulting in congestion of access roads in a community |
| Indirect impact           | Impact which is a consequence of a primary impact  
|                           | e.g. Loss of access to a footpath as a secondary impact of increased vehicle activity from construction. |
| Risk                      | Chance of the loss/impact occurring on the project during its lifetime |
| Mitigation                | Rehabilitation, fauna relocation, spill response, waste treatment |
| Residual environmental    | Chance of the loss of flora and fauna, damage to mangroves, contamination of water, effect on heritage areas or artefacts AFTER management/mitigation measures have been implemented |
| risk level                |                                       |
| Uncertainty               | The level of confidence in the determined environmental risk level  
|                           | Linked to the level of data collection and its quality |
| Long term                 | Greater than the project life or duration  
|                           | Irreversible |
| Short term                | Less than 10% of the project life or duration |
| Significant               | Result which is large enough to matter or be noticed such that the stakeholders may object |
| Has a large effect on which is noticeable when compared to the baseline or before case. Environmental cost is high |
| Insignificant Result which is small and one that most rational stakeholders should not object to Has minor effect which is barely noticeable when compared to the baseline or before case. Environmental cost is low |
| Environmental cost The cost associated with restoring baseline conditions via rehabilitation The cost to the economy (per capita GDP) e.g. destruction of the habitat used for tourism, removal of fishing grounds for subsistence fishing etc. Quantity of loss of natural resources as % of whole natural resource availability |
| Environmental benefit The net improvement to the environment as a result of project action or actions e.g. installation of WWTP reduces reliance on pit sanitation systems |
| Periodic Definitive period occurring sporadically during the project life or duration |
| Regional The area within 200km of the project boundary Cross border impact zone Global impact |
| Sensitive receptors The settlements of Caisido and Aldeia Osso-Ua in suco Tiriloco The settlements located along the coastline at the Jetty site |
| Localised / Local The Project site and the area within 20 km from the Project boundary |
| Long term Permanent in duration Indefinite duration More than double the project life duration i.e. 100 years |
| Unique Endemic Locally significant population of a protected species/habitat type In a conservation reserve Afforded special protection under local laws and regulations |
| Landform Naturally formed area having characteristic features |
| Habitat Natural, undisturbed area supporting native vegetation and fauna |
### TL CEMENT, LDA
BAUCAU CEMENT PROJECT
ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE

<table>
<thead>
<tr>
<th>Factor</th>
<th>Significance</th>
<th>Extreme</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical components</td>
<td></td>
<td>Regional long term change in climate as a result of project activities through GHG emissions &gt; e.g. Kyoto pre-1990 levels of CO2 emissions in TL**</td>
<td>Some change to the CO2 contribution from TL as a result of this project</td>
<td>Negligible change to the CO2 contribution from TL as a result of this project</td>
<td>No change to the CO2 contribution from TL as a result of this project</td>
</tr>
<tr>
<td>Climate</td>
<td></td>
<td>Regional Soil Contamination that cannot be readily remediated</td>
<td>Local contamination of soil which requires local long term or regional short term remediation</td>
<td>Local soil contamination which can be readily remediated</td>
<td>Localised and short term disturbance of soils and landforms which are readily remediated</td>
</tr>
<tr>
<td>Topography, Geology, and Soils</td>
<td></td>
<td>Long term impact on landforms and soils regionally which require ongoing, comprehensive remediation</td>
<td>Extensive erosion of landforms leading to local loss of unique habitat</td>
<td>Minor erosion effects</td>
<td>No measurable air quality impacts</td>
</tr>
<tr>
<td>Air quality &amp; Dust(excl. GHG)</td>
<td></td>
<td>Regional long term change in air quality</td>
<td>Ground level concentrations significantly higher than baseline at sensitive receptors</td>
<td>Localised, short term exceedance of NEPM standards</td>
<td>No measurable air quality impacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continuous &amp; frequent exceedance of ambient air quality standards (NEPM)</td>
<td>PM2.5 exceeds EPA standards &gt;10% of the time or greater at sensitive receptors</td>
<td>PM2.5 exceeds EPA standards at sensitive receptors 10% of the time or fewer</td>
<td>No measurable air quality impacts</td>
</tr>
<tr>
<td>Factor</td>
<td>Significance</td>
<td>Extreme</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
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</tr>
<tr>
<td>Noise &amp; Vibration</td>
<td></td>
<td>Regional long term change in noise levels</td>
<td>Ambient noise levels are significantly higher than baseline at sensitive receptors</td>
<td>Localised, short term exceedance of Noise Regulation</td>
<td>No measurable noise impacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continuous &amp; frequent emission of noise beyond permissible levels (AS 2436-2010)</td>
<td>Ambient noise levels exceed UNTAET (2001) : Leq = 70dB more than 10% of the time of the project duration at sensitive receptors</td>
<td>Ambient noise levels exceed UNTAET (2001) : Leq = 70dB less than 10% of the time of the project duration at sensitive receptors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface water</td>
<td></td>
<td>Permanent/ long term changes to water quality of local resources in excess of applicable guidelines (e.g. drinking, agriculture, WWTP discharge)</td>
<td>Localised, short term changes to water quality exceeding applicable guidelines</td>
<td>Minor changes to local water resources resulting in local short term reduction in water quality but not exceeding guidelines</td>
<td>Local short term impact on quality and surface water flows which can be easily remediated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Long term, local and major changes to catchment surface hydrology i.e. baseflow</td>
<td>Local and minor changes to sub catchment surface hydrology</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor</td>
<td>Significance</td>
<td>Extreme</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
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<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Long term effects on groundwater supply, groundwater quality in a the regional area requiring extensive remediation or cannot be readily remediated</td>
<td>Long term, local and major changes to groundwater supply, groundwater recharge i.e. Ecological Water Requirements (EWR)</td>
<td>Minor changes to local groundwater resources resulting in local short term reduction in water quality but not exceeding guidelines</td>
<td>Local and minor changes to recharge</td>
<td>Local short term impact on quality and groundwater recharge which can be easily remediated</td>
</tr>
<tr>
<td>Coastal and Marine Waters</td>
<td>Regional short term and long term exceedance of background water quality standards (e.g. ANZECC) Regional long term change not easily remediated</td>
<td>Localised long term exceedance of background water quality standards (e.g. ANZECC) Localised short t term change readily remediated</td>
<td>Localised short term exceedance of background water quality standards (e.g. ANZECC) Localised long term change not easily remediated</td>
<td>No detectible impact to water quality from the aspect</td>
<td>No detectible impact to water quality from the aspect</td>
</tr>
<tr>
<td>Flora (Terrestrial)</td>
<td>Local and regional extinction of a species Local and regional extinction of a IUCN species Local long term reduction in abundance of an IUCN or regionally significant species</td>
<td>Local short term reduction in the abundance of a significant species Introduction of non-native species e.g. weeds Short term perimeter impacts Closed Tropical Forest occurs on perimeter of</td>
<td>Local short term reduction of flora species Local loss of a species or vegetation community</td>
<td>Local short term reduction in the abundance of a species or vegetation community</td>
<td>Local short term reduction in the abundance of a species or vegetation community</td>
</tr>
</tbody>
</table>
## TL CEMENT, LDA
## BAUCAU CEMENT PROJECT
## ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE

<table>
<thead>
<tr>
<th>Factor</th>
<th>Significance</th>
<th>Extreme</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetlands</td>
<td>Clearing, Drainage, dewater or water quality impacts on wetland ecosystem which cannot be rehabilitated to pre-impact condition or better.</td>
<td>Clearing, Drainage, dewater or water quality impacts on wetland ecosystem which through extensive effort and management, can be rehabilitated to pre-impact condition</td>
<td>Short term, localized clearing, Drainage, dewater or water quality impacts on wetland ecosystem which can readily be rehabilitated and managed by the project.</td>
<td>No impact on any Wetland habitat through clearing, drainage, or water quality impacts</td>
<td></td>
</tr>
<tr>
<td>Mangroves</td>
<td>Clearing, Drainage, dewater or water quality impacts on mangrove ecosystem which cannot be rehabilitated to pre-impact condition or better.</td>
<td>Clearing, Drainage, dewater or water quality impacts on mangrove ecosystem which through extensive effort and management, can be rehabilitated to pre-impact condition</td>
<td>Short term, localized clearing, Drainage, dewater or water quality impacts on mangrove ecosystem which can readily be rehabilitated and managed by the project.</td>
<td>No impact on any mangrove habitat through clearing, drainage or water quality impacts</td>
<td></td>
</tr>
<tr>
<td>Fauna (Terrestrial)</td>
<td>Local and/or regional extinction of a species</td>
<td>Local short term reduction in the abundance of a significant species</td>
<td>Local short term reduction of fauna species</td>
<td>Local short term reduction in the abundance of a species or habitat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Local and/or regional extinction of a IUCN species</td>
<td>Introduction of non-native species e.g. feral animals</td>
<td>Local loss of a species or habitat / community</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Factor Significance

<table>
<thead>
<tr>
<th>Factor</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>abundance of an IUCN or</strong></td>
<td>High</td>
</tr>
<tr>
<td><strong>regionally significant species</strong></td>
<td>High</td>
</tr>
<tr>
<td><strong>Long term perimeter impact</strong></td>
<td>High</td>
</tr>
<tr>
<td><strong>Long term Impact on a specific protected fauna species e.g. Canuts Horseshoe Bat, Crocodiles</strong></td>
<td>Low</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marine fauna, including fisheries</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extinction of one or more species</strong></td>
<td>High</td>
</tr>
<tr>
<td><strong>As consequence of this project, the species meet criteria for listing as threatened (IUCN)</strong></td>
<td>Low</td>
</tr>
<tr>
<td><strong>Regional, long term and irreversible impact to communities and populations</strong></td>
<td>Low</td>
</tr>
<tr>
<td><strong>Species of marine fauna become regionally extinct</strong></td>
<td>Low</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marine habitats, including corals</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long and short term loss to benthic habitat</strong></td>
<td>High</td>
</tr>
<tr>
<td><strong>Damage to local unique landform habitat</strong></td>
<td>Low</td>
</tr>
<tr>
<td><strong>Reversible, short term loss (5 years since initial impact) of benthic habitat</strong></td>
<td>Low</td>
</tr>
<tr>
<td><strong>Localised seasonal reduction in benthic habitat growth</strong></td>
<td>Low</td>
</tr>
<tr>
<td><strong>Does not threaten the viability of the community and population</strong></td>
<td>Low</td>
</tr>
<tr>
<td>Factor</td>
<td>Significance</td>
</tr>
<tr>
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</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Economic components</strong></td>
<td></td>
</tr>
<tr>
<td>Traffic and Transport</td>
<td>Long and short term negative impact on community mobility and livelihood</td>
</tr>
<tr>
<td>Employment</td>
<td>Long and short term negative impact on community livelihood</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Long and short term negative impact on existing local infrastructure</td>
</tr>
<tr>
<td>Economic Use of Forests and Other Natural Resources</td>
<td>Long and short term negative impact on community livelihood</td>
</tr>
<tr>
<td>Fishing</td>
<td>Permanent loss to more than 20% of fishing areas in the</td>
</tr>
<tr>
<td>Factor</td>
<td>Significance</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------------------------------</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Socio Economic Agriculture</td>
<td>Long term impact on subsistence crops / grazing (Not re-established, access eliminated altogether)</td>
</tr>
<tr>
<td></td>
<td>Short term impact on subsistence crop / grazing (Re-established elsewhere, access maintained, area not broadly suitable, no assistance provided)</td>
</tr>
<tr>
<td></td>
<td>Local, periodic impact on subsistence crop / grazing (Alternative planting location provided, assistance provided to re-establish, water and soil broadly suitable)</td>
</tr>
<tr>
<td></td>
<td>No impact on subsistence crop / grazing</td>
</tr>
<tr>
<td></td>
<td>Positive impact on agriculture due to provision of alternative and assistance/training</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Significant threat to independent and commercial  tourism in the local area</td>
</tr>
<tr>
<td>Social components</td>
<td>Regional, long and/or short</td>
</tr>
<tr>
<td>Population and Community</td>
<td></td>
</tr>
<tr>
<td>Factor</td>
<td>Significance</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Community Health</td>
<td>Regional, long and short term permanent negative changes to community health</td>
</tr>
<tr>
<td></td>
<td>which cannot be addressed by administrative mechanisms</td>
</tr>
<tr>
<td></td>
<td>Infrastructure temporarily negatively impacted by the activity such that it cannot function to maintain community health without significant investment</td>
</tr>
<tr>
<td>Institutions, Schools, and Health Facilities</td>
<td>Regional, long and short term, permanent changes to access to schools, institutions and health facilities cannot be addressed by administrative mechanisms</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
## TL CEMENT, LDA
## BAUCAU CEMENT PROJECT
## ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE

<table>
<thead>
<tr>
<th>Factor</th>
<th>Significance</th>
<th>Extreme</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community and Family Structures</td>
<td>Regional long and short term changes to community and family structures composition which can be addressed by administrative mechanisms</td>
<td>Local short term changes to community and family structures composition which can be addressed by administrative mechanisms</td>
<td>Local periodic changes to community and family structures composition which can be addressed by administrative mechanisms</td>
<td>No discernable local or regional impact of the project on the community and family structures from the status quo</td>
<td></td>
</tr>
<tr>
<td>Land Ownership and Land Rights</td>
<td>Permanent removal of land rights for local peoples which cannot be addressed by administrative mechanisms and requires a change in law</td>
<td>Short term, local changes to land ownership and land rights which can be addressed by administrative mechanisms</td>
<td>Short term, local changes to land ownership and land rights which can be readily addressed by administrative mechanisms</td>
<td>No impact on Land Ownership and Land Rights for local peoples</td>
<td></td>
</tr>
<tr>
<td>Natural Resource Rights</td>
<td>Permanent removal of natural resources rights for local peoples which cannot be addressed by administrative mechanisms and requires a change in law</td>
<td>Short term, local changes to natural resources rights which can be addressed by administrative mechanisms</td>
<td>Short term, local changes to natural resources rights which can be readily addressed by administrative mechanisms</td>
<td>No impact on Natural Resources Rights for local peoples</td>
<td></td>
</tr>
<tr>
<td>Cultural heritage, archaeological sites, sacred sites</td>
<td>Short term or long term regional or local impact on heritage and cultural values</td>
<td>Short term local impact on heritage and cultural values and artefacts Information and data insufficient for the area or</td>
<td>Localised, single point impact on heritage values with some destruction or relocation of cultural artefacts required</td>
<td>No impact on heritage values, cultural artefact or significance in the project area</td>
<td></td>
</tr>
<tr>
<td>Factor</td>
<td>Significance</td>
<td>Extreme</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>site; to adequately assess the impact of the activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unique Landscapes</td>
<td></td>
<td></td>
<td>Long or Short term reduction in amenity for stakeholders</td>
<td>Long term, insignificant reduction in amenity</td>
<td>Insignificant reduction in amenity for stakeholders</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Short term, significant reduction in amenity for stakeholders</td>
<td>No reduction in amenity for stakeholders</td>
</tr>
</tbody>
</table>
Table 24: Significance based assessment of impact category

<table>
<thead>
<tr>
<th>Significance</th>
<th>Acceptability</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme</td>
<td>Impact not acceptable</td>
<td>Impact is permanent and regional</td>
</tr>
<tr>
<td>High</td>
<td>Impact may be partially acceptable</td>
<td>Impact is permanent and local</td>
</tr>
<tr>
<td>Medium</td>
<td>Impact generally acceptable</td>
<td>Impact is short term and local</td>
</tr>
<tr>
<td>Low</td>
<td>Impact acceptable</td>
<td>Impact is short term and local</td>
</tr>
</tbody>
</table>

The environmental impacts and factors of interest associated with the project were identified during the scoping process, with the Project Document and Terms of Reference approved by the NDPCEI. Consulting key stakeholders and the wider community was an integral part of identifying the key issues and concerns regarding the Project.

9.4 Characterising Impacts

Environmental and social impacts may vary in magnitude from no change or only a slight discernible change, to a significant change in the status of the environment or social setting. The significance of an impact is determined as a function of the importance or sensitivity of the receiving environment and the magnitude of the impact.

To assess environmental and social impacts for the Project, the following measures were undertaken:

- Relevant legislation, standards and guidelines for each of the environmental and social factors were identified and applied to the assessment of impacts where applicable;
- The receiving environment (baseline conditions) was described in detail and potential impacts to the environment were identified, and based on the specialist environmental and social investigations undertaken by experienced and qualified personnel;
The Significance based framework (Section 9.2) was applied and resulting classification from ‘Low’ to ‘Extreme’ was determined;

Feedback received during community consultation was used to identify areas of concern for the local community and key stakeholders, and suitable management and mitigation measures were identified;

Mitigation and management solutions were identified to minimise environmental and social impacts to “As Low As Reasonably Practical” and to aim for “Best Practice”; and

The residual impacts were determined in consideration of the likely effectiveness of the mitigation measures.

Where possible, environmental control measures have been integrated into the design development of the Project, with a particular focus on avoiding or minimising impacts to as low as reasonably practical, e.g. minimising emissions through using clean technology at the processing plant and power plant, reducing dust impacts etc.

Residual impacts associated with the construction and operation of the Project will be addressed through the implementation of an Environmental Management Plan for construction and operations.

This section provides a detailed impact assessment of each of the factors described in Section 5.8 (existing environment) and includes a discussion of:

- Methodology and approach (including criteria and indicators and data sources);
- Scope of the Assessment;
- Identification of Impacts;
- Determination of significance of those impacts and residual impacts;
- Proposed mitigation measures to be implemented; and
- Monitoring and reporting requirements, if applicable.

As directed by NDPCEI, the potential impacts from the Project have been assessed based on the following phases:

<table>
<thead>
<tr>
<th>Preconstruction</th>
<th>Construction</th>
<th>Operation</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearing of fence lines &amp; Installing fences</td>
<td>Clearing of the plant site/area – excavation, piling of concrete foundations and permanent establishment of accommodation, offices and workshops</td>
<td>Plant operation 24 hours a day, 7 days a week week</td>
<td></td>
</tr>
<tr>
<td>Clearing of access roads internal to the Project site</td>
<td>Building structures in concrete and</td>
<td>Blasting</td>
<td>Cement Plant, Jetty and Limestone Mine Closure and Rehabilitation</td>
</tr>
<tr>
<td>Establishment of Laydown areas and preliminary office infrastructure such as portable toilets and shipping</td>
<td></td>
<td>Truck hauling</td>
<td>Revegetation activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Decommissioning and removal of plant and</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Preconstruction</th>
<th>Construction</th>
<th>Operation</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>containers for storage</td>
<td>steel for cement equipment</td>
<td>Operating conveyor transportin material to/from Jetty</td>
<td>equipment</td>
</tr>
<tr>
<td>Relocation of people and animals within the Project site</td>
<td>Establishment of bunds, drainage areas and mine stope markers ahead of plant operations commencing</td>
<td>Operational cement plant</td>
<td></td>
</tr>
<tr>
<td>Exploratory water source drilling and installation of water supply wells</td>
<td>Installation of cement plant equipment</td>
<td>Operational power plant operational</td>
<td></td>
</tr>
<tr>
<td>Installation of power supply infrastructure corridors via clearing, excavation and pegging</td>
<td>Haulage of building materials and supplies by truck</td>
<td>Operational jetty and MOF</td>
<td></td>
</tr>
<tr>
<td>Geological studies including bore drilling and pit surveys</td>
<td>Construction of power plant</td>
<td>Maintenance clearing (e.g. tree lopping for power lines)</td>
<td></td>
</tr>
<tr>
<td>Establishment of exclusion zones around fishing areas, boreholes and springs (known impact, appropriation of natural asset)</td>
<td>Installation of conveyor system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction of material offloading facility (construction jetty)</td>
<td>Piling and construction of jetty</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction of internal access roads and haul roads</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 9.5 Impact Assessment Summary Table

<table>
<thead>
<tr>
<th>Climate</th>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre construction</td>
<td>Construction</td>
</tr>
<tr>
<td>Climate</td>
<td>Limited impact on climate change from greenhouse gases. Sources include vehicles and plant used for pre-construction site works.</td>
<td>Limited impact on climate change from greenhouse gases. Sources include vehicles and plant used for construction site works.</td>
</tr>
</tbody>
</table>

*Ensure vehicles and equipment are regularly serviced and maintained to minimise potential emissions of greenhouse gases.*
<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre construction</td>
<td>Soil management measures</td>
</tr>
<tr>
<td>Construction</td>
<td>Controlled storage areas for oils, chemicals and hydrocarbons</td>
</tr>
<tr>
<td>Operations</td>
<td>Drainage management across the site</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Regular maintenance and servicing of plant and equipment</td>
</tr>
<tr>
<td></td>
<td>Soil management measures</td>
</tr>
<tr>
<td></td>
<td>Controlled storage areas for oils, chemicals and hydrocarbons</td>
</tr>
<tr>
<td></td>
<td>Drainage management across the site</td>
</tr>
<tr>
<td>Topography</td>
<td>Soil management measures</td>
</tr>
<tr>
<td>Geology and Soil</td>
<td>Controlled storage areas for oils, chemicals and hydrocarbons</td>
</tr>
<tr>
<td></td>
<td>Drainage management across the site</td>
</tr>
<tr>
<td></td>
<td>Regular maintenance and servicing of plant and equipment</td>
</tr>
<tr>
<td>Reshaping and excavation of</td>
<td>Soil management measures</td>
</tr>
<tr>
<td>landforms in order to</td>
<td>Controlled storage areas for oils, chemicals and hydrocarbons</td>
</tr>
<tr>
<td>prepare for construction</td>
<td>Drainage management across the site</td>
</tr>
<tr>
<td>will impact the current</td>
<td>Regular maintenance and servicing of plant and equipment</td>
</tr>
<tr>
<td>topography</td>
<td>Soil management measures</td>
</tr>
<tr>
<td>Vegetation clearing</td>
<td>Controlled storage areas for oils, chemicals and hydrocarbons</td>
</tr>
<tr>
<td>resulting in increased</td>
<td>Drainage management across the site</td>
</tr>
<tr>
<td>erosion and run-off</td>
<td>Regular maintenance and servicing of plant and equipment</td>
</tr>
<tr>
<td>Plant and equipment may</td>
<td>Soil management measures</td>
</tr>
<tr>
<td>leak oils and hydrocarbons</td>
<td>Controlled storage areas for oils, chemicals and hydrocarbons</td>
</tr>
<tr>
<td>which pollute the soil</td>
<td>Drainage management across the site</td>
</tr>
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<td></td>
<td>Regular maintenance and servicing of plant and equipment</td>
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<td>Soil management measures</td>
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<td>Controlled storage areas for oils, chemicals and hydrocarbons</td>
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<td>Drainage management across the site</td>
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<td>Regular maintenance and servicing of plant and equipment</td>
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<td>Soil management measures</td>
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<td></td>
<td>Controlled storage areas for oils, chemicals and hydrocarbons</td>
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<td>Drainage management across the site</td>
</tr>
<tr>
<td></td>
<td>Regular maintenance and servicing of plant and equipment</td>
</tr>
</tbody>
</table>

Soil management measures: Controlled storage areas for oils, chemicals and hydrocarbons.
Drainage management across the site.
Regular maintenance and servicing of plant and equipment.

Decommissioning: Controlled storage areas for oils, chemicals and hydrocarbons.
Drainage management across the site.
Regular maintenance and servicing of plant and equipment.

Revegetation during decommissioning and rehabilitation will be supported by a plan to source local native vegetation seeds and root stock for planting.
## Impact Mitigation

<table>
<thead>
<tr>
<th>Impact</th>
<th>Pre construction</th>
<th>Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
<th>Pre construction</th>
<th>Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Quality</strong></td>
<td>Dust from earth moving and vegetation clearing activities; Direct emissions from vehicles and plant in the form of fuel combustion (i.e. exhaust fumes) and brake wear.</td>
<td>Dust from earth moving and vegetation clearing activities; Direct emissions from vehicles and plant in the form of fuel combustion (i.e. exhaust fumes) and brake wear.</td>
<td>Direct emissions from vehicles and plant in the form of fuel combustion (i.e. exhaust fumes)</td>
<td>Direct emissions from vehicles and plant in the form of fuel combustion (i.e. exhaust fumes)</td>
<td>All roads and material excavated, stockpiled, or graded will be sufficiently treated and watered Watering will occur at least twice daily All land clearing, grading, earth moving activities on the Project site will be suspended when winds are expected to exceed 20 mph. Speed limits. Reduce the number of vehicle movements. All heavy duty vehicles will meet the performance guarantee of suitably designed Bag filters. Efficiency of each air pollution control equipment Continuous dust monitoring. Perfomance guarantee of SO₂, NOₓ, and CO emissions.</td>
<td>All roads and material excavated, stockpiled, or graded will be sufficiently treated and watered Watering will occur at least twice daily All land clearing, grading, earth moving activities on the Project site will be suspended when winds are expected to exceed 20 mph. Speed limits. All heavy duty vehicles will meet the performance guarantee of suitably designed Bag filters. Efficiency of each air pollution control equipment Continuous dust monitoring. Perfomance guarantee of SO₂, NOₓ, and CO emissions.</td>
<td>Ensure maximum efficiency of combustion in kiln. Performanc e guarantee of suitably designed Bag filters. Efficiency of each air pollution control equipment Continuous dust monitoring. Perfomance guarantee of SO₂, NOₓ, and CO emissions.</td>
<td>All roads and material excavated, stockpiled, or graded will be sufficiently treated and watered Watering will occur at least twice daily All land shaping and decommissioning activities on the Project site will be suspended when winds are expected to exceed 20 mph. Speed limits. All heavy duty vehicles will meet the performance guarantee of suitably designed Bag filters. Efficiency of each air pollution control equipment Continuous dust monitoring. Perfomance guarantee of SO₂, NOₓ, and CO emissions.</td>
</tr>
<tr>
<td>Impact</td>
<td>Mitigation</td>
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<td>Pre construction</td>
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<td>Decommissioning</td>
<td>Decommissioning</td>
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<tr>
<td>Noise and Vibration</td>
<td>All equipment and noise emission sources are rated at 85dB 1m from source</td>
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<tr>
<td>Impact from Vehicle movements and earthworks</td>
<td>Storage areas located away from sensitive receptors</td>
<td></td>
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<tr>
<td>Noise Impact from processing plant activities</td>
<td>Placement and design of the Waste Rock Stockpile to act as a noise barrier</td>
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<tr>
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<td>Impact from Vehicle movements and earthworks</td>
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<tr>
<td>All noise emission sources are rated at 85dB 1m from source</td>
<td>Equipment modification, such as dampening of metal surfaces</td>
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<tr>
<td>Impact from Vehicle movements and earthworks</td>
<td>Storage areas located away from sensitive receptors</td>
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<tr>
<td>Surface Water</td>
<td>Impact</td>
<td>Mitigation</td>
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<td></td>
<td>Pre construction</td>
<td>Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
<td>Pre construction</td>
<td>Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
</tr>
<tr>
<td></td>
<td>Changes to drainage behavior and quality</td>
<td>Changes to drainage behavior and quality</td>
<td>Changes to drainage behavior and quality</td>
<td>Changes to drainage behavior and quality</td>
<td>Establish weir and surface water stream flow gauges up- and down-gradient from the Cement Plant site to determine the baseline condition and monitor subsequent changes.</td>
<td>Diversion trenches and soakwells</td>
<td>Paving and bitumen ground cover</td>
<td>Drains down-gradient</td>
</tr>
<tr>
<td></td>
<td>Diversion trenches and soakwells</td>
<td>Paving and bitumen ground cover</td>
<td>Drains down-gradient</td>
<td>Waste water treatment plant</td>
<td>Establish weir and surface water stream flow gauges</td>
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<tr>
<td></td>
<td>Contouring and decommissioning of waste material to reduce ongoing impact from to drainage.</td>
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<tr>
<td>Groundwater</td>
<td>Impact</td>
<td>Mitigation</td>
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<td>Pre construction</td>
<td>Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
<td>Pre construction</td>
<td>Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
</tr>
<tr>
<td></td>
<td>Changes to spring flow and quality</td>
<td>Changes to spring flow and quality</td>
<td>Changes to spring flow and quality</td>
<td>Long term changes to spring flow and quality after decommissioning</td>
<td>Implementation of an Emergency Response Plan</td>
<td>Monitoring boreholes will be drilled at strategic locations around the infrastructure</td>
<td>Monitoring boreholes will be drilled at strategic locations around the infrastructure</td>
<td>All chemicals used on site will be stored, handled and disposed of in a responsible manner</td>
</tr>
</tbody>
</table>
## Impact and Mitigation

<table>
<thead>
<tr>
<th>Coastal and Marine</th>
<th>Pre construction</th>
<th>Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
<th>Pre construction</th>
<th>Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of the MOF resulting in changes to coastal processes</td>
<td>Development of the Jetty resulting in changes to coastal processes</td>
<td>Shipping impacts to water quality</td>
<td>Decommissioning returning the beach to pre-development condition</td>
<td>Contouring and movement of vehicles on the beach to minimize scour and erosion</td>
<td>Vessel approach to the MOF to minimize discharge of ballast</td>
<td>Storage of construction materials to minimize disturbance of beach processes</td>
<td>Contouring and movement of vehicles on the beach to minimize scour and erosion</td>
<td>Vessel approach to the MOF to minimize discharge of ballast</td>
</tr>
</tbody>
</table>
### TL CEMENT, LDA
### BAUCAU CEMENT PROJECT
### ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre construction</td>
<td>Construction</td>
</tr>
<tr>
<td><strong>Flora</strong></td>
<td>Direct loss of vegetation due to clearing</td>
</tr>
<tr>
<td></td>
<td>Pre construction</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>Fauna</strong></td>
<td>Direct loss of habitat through vegetation clearing;</td>
</tr>
<tr>
<td></td>
<td>Harm/death/displacement of individual IUCN listed species;</td>
</tr>
<tr>
<td></td>
<td>Increased susceptibility of native fauna to predation</td>
</tr>
<tr>
<td></td>
<td>Soil disturbance and potential refuge destruction for ground dwelling animals</td>
</tr>
<tr>
<td></td>
<td>Changes to natural drainage affecting fauna and their habitat;</td>
</tr>
<tr>
<td></td>
<td>Disturbance fauna activities due to</td>
</tr>
</tbody>
</table>

**Impact**

**Mitigation**

- Minimise the disturbance footprint as far as practicable.
- Undertake stripping and stockpiling of vegetation and topsoil.
- Site clearing will be conducted sequentially.
- Prior to site entry all vehicles, plant and equipment will be cleaned down.
- Fauna to be relocated by ecological experts prior site clearing and construction.
- Implementati

**Implementation of the Biodiversity Action Plan**

**Page 236**

**02 February 2017**
### Marine Fauna inc. Fisheries

**Impact**
- **Pre construction**: Construction and operation of the MOF is likely to have an impact on local fish populations and invertebrates
- **Construction**: The Jetty and shipping operations has the potential to affect marine life and marine habitats, including fish and marine fauna
- **Operations**: The Jetty and shipping operations has the potential to affect marine life and marine habitats, including fish and marine fauna
- **Decommissioning**: Positive impact due to decommissioning rehabilitation

**Mitigation**
- **Pre construction**: Collection of additional baseline environmental data to confirm the habitat distribution
- **Construction**: Project scheduling to limit shipping movements during the key mammal migration period typically June, August and November annually, particularly in November of each year.
- **Operations**: Implementation of the Biodiversity Action Plan
- **Decommissioning**: Ballast water management
<table>
<thead>
<tr>
<th>Marine Habitat</th>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre construction</td>
<td>Construction</td>
</tr>
<tr>
<td>The movement of ships and machinery within the project footprint has the potential to introduce marine pests and disease which impacts coral health</td>
<td>The movement of ships and machinery within the project footprint has the potential to introduce marine pests and disease which impacts coral health</td>
<td>The movement of ships and machinery within the project footprint has the potential to introduce marine pests and disease which impacts coral health</td>
</tr>
<tr>
<td>Traffic</td>
<td>Impact</td>
<td>Mitigation</td>
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</tr>
<tr>
<td>Traffic</td>
<td>Pre construction: Increase in traffic to the area due to pre-construction</td>
<td>Decommissioning: Increase in traffic due to decommissioning</td>
</tr>
<tr>
<td>Traffic</td>
<td>Construction: Increase in traffic due to construction</td>
<td>Construction: Minimising vehicle movement</td>
</tr>
<tr>
<td>Traffic</td>
<td>Operations: Limited traffic increase during operations, mainly on the project site</td>
<td>Operations: Minimising vehicle movement</td>
</tr>
<tr>
<td>Traffic</td>
<td>Decommissioning: Increase in traffic due to decommissioning</td>
<td>Decommissioning: Minimising vehicle movement</td>
</tr>
<tr>
<td>Traffic</td>
<td>Traffic signage will be clearly and prominently displayed</td>
<td>Traffic signage will be clearly and prominently displayed</td>
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<tr>
<td>Traffic</td>
<td>Speed limits will be implemented and enforced.</td>
<td>Speed limits will be implemented and enforced.</td>
</tr>
<tr>
<td>Traffic</td>
<td>Minimising vehicle movement</td>
<td>Minimising vehicle movement</td>
</tr>
<tr>
<td>Traffic</td>
<td>Limit vehicle reversing</td>
<td>Limit vehicle reversing</td>
</tr>
<tr>
<td>Traffic</td>
<td>All traffic signage will be clearly and prominently displayed</td>
<td>All traffic signage will be clearly and prominently displayed</td>
</tr>
<tr>
<td>Traffic</td>
<td>Speed limits will be implemented and enforced.</td>
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</tbody>
</table>
### TL CEMENT, LDA
### BAUCAU CEMENT PROJECT
**ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre construction</strong></td>
<td><strong>Construction</strong></td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td>Some short term employment and training opportunities</td>
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<tr>
<td>Infrastructure</td>
<td>Pre construction</td>
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<tr>
<td>Increasing pressure on existing infrastructure e.g. roads and water</td>
<td>Reduced impact on existing infrastructure as project infrastructure construction has commenced</td>
</tr>
<tr>
<td>Impact</td>
<td>Pre construction</td>
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<tr>
<td><strong>Economic Use of Forestry</strong></td>
<td>Loss of access to land by community</td>
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<tr>
<td>Impact</td>
<td>Mitigation</td>
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<td>---------------------------------------------------------------------------</td>
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<tr>
<td>Fishing</td>
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<tr>
<td>Pre construction</td>
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<tr>
<td>Construction</td>
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<td>Operations</td>
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<tr>
<td>Decommission</td>
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<td>Pre construction</td>
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<tr>
<td>Construction</td>
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<td>Operations</td>
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<td>Decommission</td>
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<td>Fishing</td>
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<tr>
<td>Pre construction</td>
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<td>Construction</td>
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<td>Operations</td>
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<td>Decommission</td>
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<td>Fishery</td>
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<tr>
<td>Pre construction</td>
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<tr>
<td>Construction</td>
<td></td>
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<tr>
<td>Operations</td>
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<tr>
<td>Decommission</td>
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</tbody>
</table>

Access control excludes a portion of the ocean from access by local fishermen.

Ongoing access control to sections of the beach and ocean.

Ongoing access control to sections of the beach and ocean.

Positive impact as access controls are lifted and the jetty becomes available for community use.

Providing alternative access locations, providing safe passage zones.

Timeline for implementation of access controls is communicated to the families who are directly impacted by the access restrictions.

Providing alternative access locations, providing safe passage zones.

Timeline for implementation of lifting of access controls is communicated to the families who are directly impacted by the access restrictions.

Providing alternative access locations, providing safe passage zones.

Ensuring that the timeline for implementation of lifting of access controls is communicated to the families who are directly impacted by the access restrictions.
<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre construction</strong></td>
<td><strong>Construct</strong></td>
</tr>
<tr>
<td>Access controls and reduction in available agricultural land</td>
<td>Minimise the disturbance footprint as far as practicable.</td>
</tr>
<tr>
<td>Access controls and reduction in available agricultural land</td>
<td>Monitor the GoTL’s Implementation of the Resettlement Action Plan</td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td><strong>Operations</strong></td>
</tr>
<tr>
<td>Access controls and reduction in available agricultural land</td>
<td>Minimise the disturbance footprint as far as practicable.</td>
</tr>
<tr>
<td>Access controls and reduction in available agricultural land</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
</tr>
<tr>
<td><strong>Operations</strong></td>
<td><strong>Decommission</strong></td>
</tr>
<tr>
<td>Access controls and reduction in available agricultural land</td>
<td>Monitor the GoTL’s Implementation of the Resettlement Action Plan</td>
</tr>
<tr>
<td>Positive impact with removal of access controls and increase available agricultural land</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
</tr>
<tr>
<td><strong>Decommission</strong></td>
<td><strong>Pre construction</strong></td>
</tr>
<tr>
<td>Minimise the disturbance footprint as far as practicable.</td>
<td>Minimise the disturbance footprint as far as practicable.</td>
</tr>
<tr>
<td>Undertake stripping and stockpiling of vegetation and topsoil</td>
<td>Monitor the GoTL’s Implementation of the Resettlement Action Plan</td>
</tr>
<tr>
<td>Topsoil to be stock piled separately</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
</tr>
</tbody>
</table>

**Socio Economic Agriculture**

Minimise the disturbance footprint as far as practicable.
<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre construction</td>
<td>Construction</td>
</tr>
<tr>
<td>Resettlement of affected families</td>
<td>Influx of workers to the construction site</td>
</tr>
<tr>
<td>Influx of workers to the pre-construction site</td>
<td></td>
</tr>
<tr>
<td>Changes to the income source of people in the community due to project decommissioning</td>
<td>Monitor the GoTL's Implementation of the Resettlement Action Plan</td>
</tr>
<tr>
<td></td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
</tr>
<tr>
<td>Pre construction</td>
<td>Construction</td>
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<tr>
<td></td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
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<tr>
<td>Decommissioning</td>
<td>Decommissioning</td>
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<tr>
<td>Early development of alternative livelihood strategies for employees</td>
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</tr>
<tr>
<td></td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
</tr>
<tr>
<td>Impact</td>
<td>Mitigation</td>
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</tr>
<tr>
<td>Pre construction</td>
<td>Construction</td>
</tr>
<tr>
<td><strong>Communi ty Health</strong></td>
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</tr>
<tr>
<td>Increase in respiratory ailments due to an influx of people; Increase in the level of respiratory ailments due to increased dust; Increase in vector-related ailments such as malaria due to increase in population density; Increase in sexually transmitted infections such as the human immunodeficiency virus due to population influx</td>
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</tr>
</tbody>
</table>
## TL CEMENT, LDA
### BAUCAU CEMENT PROJECT
#### ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE

<table>
<thead>
<tr>
<th></th>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Institutions</strong></td>
<td>Pre construction: Increased pressure on health services infrastructure</td>
<td>Regular water sprinkling on the roads and application of dust suppressants</td>
</tr>
<tr>
<td></td>
<td>Construction: Increased pressure on health services infrastructure due</td>
<td>Impacts from influx of workers on health facilities can be mitigated by</td>
</tr>
<tr>
<td></td>
<td>to population influx</td>
<td>developing a MOU with the Local Healthcare Centers</td>
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<td>Operations: Increased pressure on health services infrastructure due</td>
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<td></td>
<td>to population influx</td>
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<td></td>
<td>Decommissioning: Positive impact on community health with legacy</td>
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<td><strong>Schools</strong></td>
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<td><strong>and Health</strong></td>
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<td><strong>Facilities</strong></td>
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<td></td>
<td>Pre construction: Increase in the level of respiratory ailments due to</td>
<td>Positive impact on community health with legacy investments</td>
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<td></td>
<td>increased dust</td>
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<tr>
<td></td>
<td>Construction: Increase in the level of respiratory ailments due to</td>
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<td></td>
<td>population influx</td>
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<td></td>
<td>Operations: Increase in the level of respiratory ailments due to</td>
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<td></td>
<td>population influx</td>
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<td></td>
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<tr>
<td>Prior to decommissioning and closure,</td>
<td>Impacts from influx of workers on health facilities can be mitigated by developing a MOU with the Local Healthcare Centers</td>
<td></td>
</tr>
<tr>
<td>consultation with all stakeholders (relevant authorities, government and local community) regarding any health facilities associated with the Project to be retained and/or demolished</td>
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</tr>
<tr>
<td>Impact</td>
<td>Mitigation</td>
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<tr>
<td>Pre construction</td>
<td>Construction</td>
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<tr>
<td>Construction</td>
<td>Operations</td>
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<tr>
<td>Decommissioning</td>
<td>Pre construction</td>
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<tr>
<td>Construction</td>
<td>Operations</td>
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<tr>
<td>Decommissioning</td>
<td>Decommissioning</td>
<td></td>
</tr>
</tbody>
</table>

**Community and Family Structure**

- **Impact:** The acquisition of land for the Cement Plant and Jetty and the construction of internal roads may cause impacts on the community and family structure.
- **Mitigation:** Monitor the GoTL's Implementation of the Resettlement Action Plan. Grievance redress mechanism in place to monitor community concerns. Encourage and create strategies for sustainable economic empowerment.
<table>
<thead>
<tr>
<th>Land Ownershi and Land Rights</th>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre construction</td>
<td>Construction</td>
</tr>
<tr>
<td>The acquisition of land for the Cement Plant and Jetty and the construction of internal roads may cause conflict around land owners and communities.</td>
<td>Limited ongoing impact on land rights during construction</td>
<td>Limited ongoing impact on land rights during construction</td>
</tr>
</tbody>
</table>
### Natural Resource Rights

#### Pre construction
- Limited impact due to limited use of the vegetation area of the Plant and Jetty. The acquisition of land for the Cement Plant and Jetty and the construction of internal roads may potentially cause conflict around land use and harvesting of wood before clearing.

#### Construction
- No additional impact once construction commences and resettlement has occurred.

#### Operations
- No additional impact once operations commences and resettlement has occurred.

#### Decommissioning
- The change in land use and decommissioning of the Cement Plant and Jetty and the may potentially cause conflict around land owners and communities.

#### Mitigation
- Monitor the GoTL's Implementation of the Resettlement Action Plan
- Grievance redress mechanism in place to monitor community concerns.
- Develop strategies to address the provision of sustainable, alternative livelihoods upon cessation of operations, decommissioning and closure.
- Implement the Closure Plan
### Cultural Heritage and Archeology

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre construction</strong></td>
<td><strong>Access to the sites during the life of the Project will be considered in the context of the importance of the sites to the local community. Where safe access cannot be guaranteed, those sites which are located adjacent to the Project will be fenced off, access restricted for the Project life or relocated.</strong></td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td><strong>Grievance redress mechanism in place to monitor community concerns</strong></td>
</tr>
<tr>
<td><strong>Operations</strong></td>
<td><strong>Grievance redress mechanism in place to monitor community concerns</strong></td>
</tr>
<tr>
<td><strong>Decommissioning</strong></td>
<td><strong>Implement the Closure Plan</strong></td>
</tr>
<tr>
<td>No sites destroyed as a result of the Cement Plant, Jetty and Conveyor</td>
<td>Grievance redress mechanism in place to monitor community concerns</td>
</tr>
<tr>
<td>Access to sites may be restricted for safety reasons</td>
<td>Access restrictions for safety reasons</td>
</tr>
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<td>No sites destroyed as a result of the Cement Plant, Jetty and Conveyor</td>
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</tr>
<tr>
<td>Access to sites may be restricted for safety reasons</td>
<td>Grievance redress mechanism in place to monitor community concerns</td>
</tr>
<tr>
<td>Positive impact, Sites with restricted access for safety reasons will be lifted</td>
<td>Access restrictions for safety reasons</td>
</tr>
<tr>
<td>Access to the sites during the life of the Project will be considered in the context of the importance of the sites to the local community. Where safe access cannot be guaranteed, those sites which are located adjacent to the Project will be fenced off, access restricted for the Project life or relocated</td>
<td>Grievance redress mechanism in place to monitor community concerns</td>
</tr>
<tr>
<td>Access restrictions for safety reasons</td>
<td>Grievance redress mechanism in place to monitor community concerns</td>
</tr>
<tr>
<td>Implement the Closure Plan</td>
<td>Grievance redress mechanism in place to monitor community concerns</td>
</tr>
<tr>
<td>Consultation with community regarding lifting of access controls</td>
<td>Grievance redress mechanism in place to monitor community concerns</td>
</tr>
</tbody>
</table>
9.6 Climate

9.6.1 Management Objectives

The following international standards may be applicable in relation to climate and greenhouse gas emissions:

- To ensure the atmospheric emissions (i.e. carbon monoxide) are minimised as much as practicable; and
- To ensure design of project components accommodate climate change, including sea level rise and severe weather events etc.

9.6.2 Applicable Standards and Legislation

The following international standards may be applicable in relation to climate and greenhouse gas emissions:

- United National Framework to Combat Climate Change (1992) and the Kyoto Protocol; and
- Australian National Greenhouse and Energy Reporting Act (2007);
- Intergovernmental Panel on Climate Change; and
- Australia Clean Energy Act, 2011 detailing similar industry emissions in the Liable Entities Public Information Database.

9.6.3 Impact Assessment

It is considered that the development of the Project will have a limited and insignificant impact on the regional and local climate through its contribution of greenhouse gases and resulting effect on global climate.

An assessment of the potential greenhouse gas emissions was undertaken and approximately 293 kTe- per annum would potentially be generated based on the worst case scenario of emissions from a coal power station. The Project proposes to use a Captive Power Plant (CPP) using Circulating Fluidized Bed Technology (CFB) boiler to produce 33 MW. A Waste Heat Recovery (WHR) Plant of 8 - 10 MW capacity shall also be installed to utilize waste flue gases. The CPP proposes to use biomass as a fuel source. The best case scenario is 2 kT e- per annum from the CPP burning biomass and alternative fuels (NGER Act, 2007).
The construction and operational phase of the Project is likely to see a localised increase in CO₂ emissions, which is considered to be the main greenhouse gases (GHG) contributing to man-made global warming. The following are the main sources of direct CO₂ emissions from the Cement Plant:

- Calcination of carbonates, and combustion of organic carbon contained in raw materials;
- Combustion of kiln fuels related to clinker production and combustion of non kiln fuels;
- Combustion of conventional fossil kiln fuels;
- Combustion of alternative fossil kiln fuels and mixed fuels with biogenic carbon content;
- Combustion of biomass fuels and biofuels (including biomass wastes);
- Combustion of fuels for on-site power; and
- Combustion of carbon contained in wastewater (WBCSD, 2011).

In accordance with the NGERS Facility reporting threshold (NGER Act, 2007), facilities with an emissions of 25 kt or more of greenhouse gases (CO₂ –e_) are required to report emissions to the regulator. There is no similar mechanism in place in Timor-Leste. Depending on the fuel and technology type, Australian power stations emit between 0.37 and 1.38 tonnes of carbon dioxide equivalent (CO₂e) per megawatt-hour (tCO₂e/MWh) and an emissions target of 0.86 tCO₂e/MWh has been proposed for all new power stations in Australia. ([http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BN/1011/PerformanceStandardemissions](http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BN/1011/PerformanceStandardemissions)).

A calculation of the predicted MWh for the CPP results in a predicted worst case scenario of 0.5 tCO₂e/MWh. This is lower than the proposed emissions target for new power stations in Australia.

The emissions from the operation of vehicles and plant equipment, which uses diesel fuel, are expected to be negligible.

The meteorological parameters of concern which relate to climate change for the Project site are: sea level rise, cyclone intensity and frequency, rainfall and extreme wind speed. Within the lifetime of this Project (50+ years), climate change projections in CSIRO, 2010 indicate that the following may occur:

- Projections for sea level rise are 3.2 cm - 10.0 cm by 2020; 8.9 cm – 27.8 cm by 2050, and 18 cm - 79 cm by 2095, relative to 1990;
- Cyclone frequency is to reduce but the intensity is projected to increase; and
- Extreme rainfall events are to become fewer, but more intense, with similar trends projected for extreme wind speeds (CSIRO, 2010).
These projections are uncertain and by nature are subject to change. However, as the Project is located in a coastal region, the engineering design will need to take into account the following factors for the lifespan of the Project:

- The projected rise in sea level;
- Cyclones and severe storms, which can potentially cause widespread damage to property and endanger human life.;
- High-energy waves may interfere with construction and/or operational activities for the jetty and may pose a safety risk to site personnel.; and
- Lightning can also pose a safety risk for personnel, particularly where tall metal structures or machinery can attract lightning strikes.
- Adequate stormwater management.

Pre-construction, Construction and Decommissioning

Based on the impact assessment the potential impacts to climate during the pre-construction, construction, and decommissioning phases is considered to be ‘Low’ due to the negligible potential impacts.

Operations

The potential impacts to climate during the operation of the Project are considered to be ‘Medium’ based on the localised and short-term nature of the potential impacts associated with the increased emissions of greenhouse gases.

The potential for climate change to impact on the project is addressed in Section 7 Climate Change Impacts.

9.6.4 Mitigation Measures

The following general mitigation measures will be implemented for the duration of the Project (i.e. pre-construction through to decommissioning).

- Potential cyclone/earthquake/tsunami identification methods and warning systems;
- Communication methods for workers and local populace;
- Cyclone and earthquake proofing for all structures/objects/machinery (temporary and permanent);
- Construction and operational policies for lightning strikes and high energy waves;
Lock down procedures for securing all structures/objects/machinery (temporary and permanent);

Emergency action plans and evacuation procedures; and Distress notification if additional aid is required

Operation

Adoption and implementation of clean technology to ensure emissions of greenhouse gases are minimised.

Ensure vehicles and equipment are regularly serviced and maintained to minimise potential emissions of greenhouse gases.

Limit vehicle idling time and keep vehicles well maintained to minimise gaseous emissions.

9.6.5 Monitoring and Reporting

It is recommended that an automated weather station (AWS) is installed near the Project site to record and monitor the following parameters on an hourly basis for the duration of the Project (i.e. construction, operation and decommissioning):

- Station identification number;
- Sate and time of record/observation;
- Air, wet bulb and wet dew point temperatures.
- Precipitation and evaporation;
- Relative humidity;
- Wind speed and direction;
- Solar radiation;
- Barometric pressure (relative, absolute, and QNH (Barometric pressure adjusted to sea level for aviation purposes));
- Visibility;
- Cloud cover; and
- Cloud ceiling height, if practicable.

The recording and monitoring of these parameters will provide input information for various environmental management measures (including, but not limited to, dust suppression and cyclone
management) and reporting requirements on the Project. It may also provide valuable information to agricultural workers for planning and optimising crop yields.

The installation of the AWS should be conducted in accordance with AS 3580.14-2011 - Methods for sampling and analysis of ambient air Part 14: Meteorological monitoring for ambient air quality monitoring applications, or an equivalent guideline.

Until the GoTL implements a Carbon Pricing mechanism or issues a National Communication (NC) under the UNFCCC, there is no formal requirement in place to record, monitor and report on greenhouse gas emissions at a country level.

Monitoring of greenhouse gas emissions is therefore not recommended for this Project.

9.7 Topography, Geology and Soils

9.7.1 Management Objectives

The key objectives for the management of landforms, geology and soils for the Project are to:

- Maintain the integrity, ecological functions and environmental values of landforms, geology and soil;
- Minimise permanent landform alterations; and
- Ensure that the modifications to landforms are physically and environmentally stable and sustainable.

9.7.2 Applicable standards and legislation

The standard which is used to assess the extent of impact on soil quality is contained in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Interim Sediment Quality Guidelines), (ANZECC and ARMCANZ 2000)

For this EIS, the standard used to assess the extent of contamination of soil and water by hydrocarbons, metals and biological contaminants is contained in the Contaminated sites guidelines: Assessment and management of contaminated sites (Department of Environment and Regulation, 2014).

The standard used to assess ground and surface water quality is contained in the Water Decree Law 2004/04 Quality of drinking water which is based on the WHO standards Drinking water quality guidelines.

Contamination of the soil and geology may likely be identified through monitoring of water resources around the site. Sampling and assessment methodology is contained in the Contaminated sites
9.7.3 Impact Assessment

Pre-construction

Potential impacts on the topography, geology and soils associated with the pre-construction activities are:

- Reshaping and excavation of landforms in order to prepare for construction will impact the current topography. This impact is expected to be high because the earthworks required to level the ground in the area of the conveyor corridor and plant are substantial. The plant and conveyor are located on terraced area.

- Vegetation clearing resulting in increased erosion and run-off, changing the water quality of the ocean, springs and rivers. The changes to downstream water quality by contaminant transport through the soil are expected to be low, because the Cement Plant site is more than 2 km to the nearest drainage channel.

- Vegetation clearing resulting in a permanent change to soil type and arability. The area to be cleared for the Conveyor Belt corridor and Cement Plant is 28 ha. The Cement Plant site is not currently used for agriculture and the Pipe Conveyor area is currently highly degraded.

- Earthworks and soil ripping will change the soil surface, permeability and type. The plant area will be paved or bitumised and soil conditions will be permanently changed. The area of the Conveyor Belt corridor is 1ha and the soil will not be used for agriculture post construction.

- Removal of the topsoil overburden will permanently change existing soil conditions. Topsoil will be stockpiled and the current proposed location is within an ephemeral drainage line. The likelihood of erosion of the stockpiled soil is high and increase in suspended solids in the water course is high.

- Construction of the Materials Offloading Facility (MOF) has the potential to impact the topography of the beach.

- Plant and equipment may leak oils and hydrocarbons which pollute the soil; however the number of vehicles is relatively minor.

The overall potential impacts have been assessed as ‘Low’ because the impacts are localised; soil contamination during the pre-construction phase is relatively easily remediated and highly localised.
Construction

Potential impacts on the topography, geology and soils associated with the construction activities are:

- Increased erosion and run-off from a bituminised Cement Plant area will likely change the water quality of the ocean, springs and rivers. The changes to downstream water quality by contaminant transport through the soil are expected to be low, because it is more than 2 km to the nearest drainage channel from the Cement Plant.

- Earthworks will change the soil surface, permeability and type. The plant area will be paved or bitumised and soil conditions will be permanently changed. The area of the Conveyor Belt corridor is 1 ha and the soil will not be used for agriculture post construction.

- Plant and equipment may leak oils and hydrocarbons which pollute the soil; however the number of vehicles is relatively minor.

The overall potential impact on soil, geology and topography is expected to be ‘Low’ given the potential for localised changes to topography and soil condition and localised, readily remediated contamination of soil.

Operation

Potential impacts on the topography, geology and soils associated with the operational activities are:

- Increased erosion and run-off from a bituminised Cement Plant area will likely change the water quality of the ocean, springs and rivers. The changes to downstream water quality by contaminant transport through the soil are expected to be ‘Low’ because it is more than 2 km to the nearest drainage channel from the Cement Plant site.

- Earthworks will change the soil surface, permeability and type. The plant area will be paved or bitumised and soil conditions will be permanently changed. The area of the conveyor corridor is 1 ha and the soil will not be used for agriculture post construction. The impact on the soil type is permanent and localised and therefore is ‘Medium’.

- Plant and equipment may leak oils and hydrocarbons which pollute the soil, however the number of vehicles is relatively minor.

- The operational site of the Cement Plant and Conveyor Belt will have permanently altered the topography and further impact is not anticipated once the Marine Jetty, Cement Plant and Conveyor are operational.

The overall potential impact on soil, geology and topography is expected to be ‘Low’ with localised contamination of soil and erosion and minor erosion impacts.
Decommissioning

Potential impacts on the topography, geology and soils associated with the decommissioning activities are:

- Decommissioning of the Cement Plant, Marine Jetty and Conveyor site will involve the rehabilitation of the soil to an acceptable level in accordance with Contaminated Sites regulations which govern remediation of soil and water impacts. This is expected to have a positive impact on the soil resources at the site.

- Movement of vehicles, plant and equipment across the site during decommissioning will have a soil quality impact from hydrocarbon and chemical spills. This is expected to be localised and of short duration.

- Decommissioning of the infrastructure will involve dismantling, removal and transport of components for disposal. The disposal has the potential to contaminate the soil locally to the disposal site. This impact is expected to be low and readily mitigated through appropriate management measures.

The overall potential impact on soil, geology and topography is expected to be ‘Low’ with localised contamination of soil and erosion and minor erosion effects.

9.7.4 Mitigation Measures

Pre-Construction

In order to minimise the impact of reshaping and excavations on landforms during pre-construction, the Cement Plant infrastructure in the construction footprint should be sited taking into account the amount of overburden that needs to be excavated to level the ground surface and prepare for construction. Areas of the site with higher topography should be avoided and natural contours and landscaping be designed to minimise the earthworks required.

The impacts on soil quality and arability as a result of clearing of native vegetation and topsoil are inevitable on the Cement Plant and Conveyor corridor sites. Soil management measures will be included in the EMP which identify the locations of good quality soil on the site before clearing occurs and details where and how topsoil is to be stockpiled and preserved for use in the future rehabilitation activities.

Contaminant impacts on soil will be mitigated through the implementation of controlled storage areas for oils, chemicals and hydrocarbons; an emergency response plan for the treatment of accidental spills and selecting plant and equipment which is fuel efficient, built and maintained to minimise chance for spills, leaks and drips. The plant design calls for oil-water separators to minimize ground water or soil contamination.
The impact of the topography at the beach and subsequent erosion during construction of the MOF is to be minimised through best practice engineering design which includes sand retention walls and features which mitigate major sand movements during extreme weather and wave action events.

Drainage management will be implemented across the site. This includes drainage design to minimise scour and control runoff across the site. The site will be kept well drained and undergo dust suppression (e.g. water spraying) to minimise wind erosion of soil prior to paving and bituminisation.

Regular maintenance and servicing of plant and equipment will help reduce the likelihood of oil leaks.

Staged clearing of vegetation will be considered to minimise soil erosion.

**Construction**

Contaminant impacts on soil should be mitigated through the implementation of controlled storage areas for oils, chemicals and hydrocarbons, an emergency response plan for the treatment of accidental spills and selecting construction plant and equipment which is fuel efficient, built and maintained to minimise chance for spills, leaks and drips. The plant design calls for oil-water separators to minimize ground water or soil contamination.

The impact of the topography at the beach and subsequent erosion during construction of the Marine Jetty is to be minimised through best practice engineering design which includes sand retention walls and features which mitigate major sand movements during extreme weather and wave action events.

The impact from soil erosion will be mitigated by drainage management implemented across the site. This includes drainage design to minimise scour and control runoff across the site.

The site will be kept well drained at all times and undergo dust suppression (e.g. water spraying) to minimise wind erosion of soil prior to paving and bituminisation.

Regular maintenance and servicing of plant and equipment will help reduce the likelihood of oil leaks.

Staged clearing of vegetation will be considered to minimise soil erosion.

**Operation**

The EMP will include soil management measures which detail where and how topsoil is to be stockpiled and preserved for use in the future rehabilitation activities.

Contaminant impacts on soil should be mitigated through the implementation of controlled storage areas for oils, chemicals and hydrocarbons, an emergency response plan for the treatment of accidental spills and selecting plant and equipment which is fuel efficient and constructed and maintained to minimise chance for spills, leaks and drips. The plant design calls for oil-water separators to minimize ground water or soil contamination.
The impact from soil erosion will be mitigated by drainage management implemented across the site. This includes drainage design to minimise scour and control runoff across the site.

The EMP includes a section on reclamation and rehabilitation which details progressive rehabilitation of soils and topography during the operations phase. This includes planting of revegetating waste rock areas to minimise runoff and soil erosion. It also includes measures to maintain the soil quality in the overburden stockpile.

Regular maintenance and servicing of plant and equipment will help reduce the likelihood of oil leaks.

The site will be kept well drained at all times and undergo regular dust suppression (e.g. water spraying) to minimise wind erosion of soil prior to paving and bituminisation.

**Decommissioning**

In order to minimise the impact from reshaping and excavations of landforms during decommissioning, Mine Closure Plan will be implemented, which includes mitigation measures to occur during site closure and decommissioning.

Revegetation during decommissioning and rehabilitation will be supported by a plan to source local native vegetation seeds and root stock for planting.

Contaminant impacts on soil during decommissioning will be mitigated through the implementation of controlled storage areas for oils, chemicals and hydrocarbons, an emergency response plan for the treatment of accidental spills and selecting plant and equipment which is fuel efficient and constructed and maintained to minimise chance for spills, leaks and drips.

To minimise long term soil contamination, all material waste including building materials, plant infrastructure, materials from services etc. are disposed of off-site in a responsible manner. There will be no backfilling or dumping of waste locally.

### 9.7.5 Monitoring and Reporting

**Pre-Construction**

Soil contamination will be monitored through maintaining records of spill events. Spills will be investigated in accordance with the company’s Health, Safety and Environmental management system.

Off-site contamination will be monitored as part of the Water Quality Monitoring Programme which includes borehole and surface water sampling. A review of sampling results before and after pre-construction is recommended.
Construction

Soil contamination will be monitored through maintaining records of spill events. Spills will be investigated in accordance with the company's Health, Safety and Environmental management system.

Off-site contamination will be monitored as part of the Water Quality Monitoring Programme which includes borehole and surface water sampling. A review of sampling results before and after construction is recommended.

Operation

Soil contamination will be monitored through maintaining records of spill events. Spills will be investigated in accordance with the company's Health, Safety and Environmental management system.

Off-site contamination will be monitored as part of the Water Quality Monitoring Programme which includes borehole and surface water sampling. A review of sampling results at least quarterly is recommended.

Decommissioning

Soil contamination will be monitored through maintaining records of spill events. Spills will be investigated in accordance with the company's Health, Safety and Environmental management system.

Off-site contamination will be monitored as part of the Water Quality Monitoring Programme which includes borehole and surface water sampling. A review of sampling results at least quarterly is recommended.

9.8 Air quality

9.8.1 Management Objectives

The key objectives for the management of air quality impacts are to:

- To ensure that atmospheric emissions do not impact on the health, welfare and amenity of the population and land uses and the environment.
- To use all reasonable and practicable measures to minimise airborne dust.
9.8.2 Applicable Standards and Legislations

The International Ambient Air Quality Standards (IAAQS) have been used to measure the predicted emissions for Carbon Monoxide, Nitrogen dioxide, photochemical oxidants, sulphur dioxide and particles as PM 2.5. The standard values are replicated in Table 26 and Page 23 of Appendix 1.

Table 26: IAAQS standards (1998)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>International best practice standard</th>
<th>Proposed interim target limit (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide</td>
<td>International Ambient Air Quality Standards (IAAQS)</td>
<td>1 hour = 40,000 µg/m³(^b)</td>
</tr>
<tr>
<td></td>
<td><a href="http://www3.epa.gov/ttn/naaqs/criteria.html">http://www3.epa.gov/ttn/naaqs/criteria.html</a></td>
<td>Not to be exceeded more than once per year</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>International Ambient Air Quality Standards (IAAQS)</td>
<td>1 hour = 200 µg/m³(^a,c)</td>
</tr>
<tr>
<td></td>
<td><a href="http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf">http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf</a></td>
<td>Annual = 40 µg/m³(^a,c)</td>
</tr>
<tr>
<td>Photochemical oxidants</td>
<td>International Ambient Air Quality Standards (IAAQS)</td>
<td>1 hour = 235 µg/m³(^d)</td>
</tr>
<tr>
<td>(as ozone)</td>
<td><a href="http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf">http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf</a></td>
<td></td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>International Ambient Air Quality Standards (IAAQS)</td>
<td>1 hour = 350 µg/m³(^c)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 hour = 125 µg/m³(^a)</td>
</tr>
<tr>
<td>Particles as PM2.5</td>
<td>International Ambient Air Quality Standards (IAAQS)</td>
<td>24 hour = 75 µg/m³(^a)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual = 70 µg/m³(^a)</td>
</tr>
</tbody>
</table>

\(a\) World Health Organization Air Quality Guidelines, 2005

\(b,d\) USEPA National Ambient Air Quality Standards, 2015

\(c\) European Union Air Quality Standards, 2005

9.8.3 Impact Assessment

The air quality impact assessment of the construction and operation of the Project used modelling tools which looked at the Projects emission inventory and predicted future ambient air quality. ISC
AERMOD View, a steady state plume model was used to predict the ambient concentration surrounding the Project site during the construction and operation phase. The results of the models prediction are presented in the form isopleth maps to describe the dispersion of potential air pollutants over the Project surrounding areas and sensitive receptors.

Figure 9-1, Table 27 and
Table 28 below details the sampling locations, equipment, sampling method and air quality parameters measured for the Air Quality Impact Assessment Study (BBS, 2015a).

Table 27: Sampling Location

<table>
<thead>
<tr>
<th>Sampling Location No.</th>
<th>Location Name</th>
<th>Easting (Zone 52L)</th>
<th>Northing (Zone 52L)</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Aldeia Parlementu</td>
<td>212219</td>
<td>9065491</td>
<td>School area</td>
<td>East of Cement Plant</td>
</tr>
<tr>
<td></td>
<td>Aldeia Osso-ua</td>
<td>209130</td>
<td>9065049</td>
<td>Settlement area</td>
<td>Close the Cement Plant area</td>
</tr>
<tr>
<td></td>
<td>Jetty Plan</td>
<td>207556</td>
<td>9065473</td>
<td>Jetty area</td>
<td>Within the Jetty area</td>
</tr>
<tr>
<td>Parameter</td>
<td>Sampling Method</td>
<td>Sampling Duration (Hours)</td>
<td>Type</td>
<td>Equipment example</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------------------------------------------</td>
<td>---------------------------</td>
<td>--------------------</td>
<td>---------------------------------------</td>
<td></td>
</tr>
<tr>
<td>PM</td>
<td>Gravimetric method, Japan International Standard (JIS)</td>
<td>24</td>
<td>Low Volume Sampler</td>
<td>Low Volume Sampler</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Iodine Pentoxide Method</td>
<td>1</td>
<td></td>
<td>Midget Impinger, Spectrophotometry, Fritted bubbler</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Griess Saltzman Method, ASTM D1607 - 91(2011)</td>
<td>1</td>
<td></td>
<td>Midget Impinger, Spectrophotometry, Fritted bubbler</td>
<td></td>
</tr>
</tbody>
</table>
### Parameter Sampling Method Sampling Duration (Hours) Type Equipment example

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sampling Method</th>
<th>Sampling Duration</th>
<th>Type</th>
<th>Equipment example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur Dioxide</td>
<td>Pararosaniline Method, ASTM 2914 (2007)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## TL CEMENT, LDA
### BAUCAU CEMENT PROJECT
#### ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sampling Method</th>
<th>Sampling Duration (Hours)</th>
<th>Type</th>
<th>Equipment example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone</td>
<td>Methods of Air Sampling and Analysis, 1989</td>
<td>1</td>
<td></td>
<td><img src="image.png" alt="Image" /></td>
</tr>
<tr>
<td>Hydrocarbon</td>
<td>NIOSH 1501, 2003</td>
<td>3</td>
<td>Absorber, Gas Chromatography</td>
<td><img src="image.png" alt="Image" /></td>
</tr>
</tbody>
</table>

*Figure 1-4. Spiral Absorber*
The full Air Quality Impact Assessment Study Report (BBS, 2015a) is provided in Appendix 1. The report provides full details of the:

- methodology for collection of ambient air quality data;
- emission inventory of potential air pollutants generated from the Project activities;
- prediction of potential impacts on air quality based on the modelling input and outputs; and
- mitigation measures during the construction and operational phase of the Project.
Figure 9-1: Location of Air Quality Measurement (BBS, 2015a)
During the construction and operation of the Project there will be various activities which may contribute emissions of air pollutants to the ambient air. These mainly relate to the following activities:

- **Pre-construction and Construction phase:**
  - earth moving and vegetation clearing activities;
  - use of construction equipment mobilizing particulate emissions from paved and unpaved roads and material stock piling; and
  - direct emissions from vehicles and plant in the form of fuel combustion (i.e. exhaust fumes) and brake wear.

- **Operational Phase:**
  - mining activities;
  - mobilization of raw materials;
  - indirect emissions from vehicles and plant via the mobilization of particulate emissions from paved and unpaved roads and material stock piling;
  - direct emissions from vehicles and plant in the form of fuel combustion (i.e. exhaust fumes) and brake wear; and
  - plant operation.

- **Decommissioning Phase:**
  - earth moving and vegetation clearing activities;
  - use of construction equipment mobilizing particulate emissions from paved and unpaved roads and material stock piling; and
  - direct emissions from vehicles and plant in the form of fuel combustion (i.e. exhaust fumes) and brake wear.

**Pre-construction**

The potential air quality impacts during the pre-construction phase of the Project is perceived to be localised and short term in nature. Therefore, based on the risk assessment the potential impacts to air quality during the pre-construction phase are considered to be ‘Low’.

**Construction**

Table 29 provides a summary of the predicted 1st high 1 hour, 24 hour and annual concentrations for each pollutant during the construction phase.

The modelling results indicate that for the construction phase:
The 24 hour average concentration for PM$_{10}$ is predicted to be as high as 114 µg/m$^3$ (Figure 4.2 in Appendix 1); which does not exceed the IAAQS standard of 150 µg/m$^3$ for a 24 hour period;

- The highest annual average concentration of PM$_{10}$ is predicted to be 17 µg/m$^3$ (Figure 4.3 in Appendix 1 which is within the IAAQS standard;

- The highest 24 hour average concentration for PM$_{2.5}$ during construction is calculated to be 25 µg/m$^3$ (Figure 4.4 in Appendix 1), which is within IAAQS standard of 75 µg/m$^3$ for a 24 hour period;

- The annual average of PM$_{2.5}$ concentration is calculated to be about 35 µg/m$^3$ (Figure 4.5 in Appendix 1), which is lower than the standard of 35 µg/m$^3$ for a year; and

- The highest 1 hour average concentrations of CO, NO$_2$ and SO$_2$ are 287 µg/m$^3$, 109 µg/m$^3$ and 0.7 µg/m$^3$ respectively (Figures 4.6 to 4.14 in Appendix 1); and

- All the pollutants modelled (PM$_{10}$, PM$_{2.5}$, CO, NO$_2$ and SO$_2$) tend to disperse to the north west of the plant and jetty as the prevailing winds are from a south easterly direction.

- The modelled values used were the specifications provided in the BOD and the design used will most likely result in emissions which comply with the IAAQS target values (BBS, 2015a).

- Overall the study found that the predicted concentrations are compliant with the standards. Hence, the project should be considered compliant with the standards used.

It is anticipated that any impacts to air quality during construction of the Cement Plant and Marine Jetty would be localised and short term in nature. In addition, the prevailing winds indicate that the dispersal plume would be out to sea and away from most sensitive receptors. Therefore, based on the risk assessment the potential impacts to air quality during this phase are considered to be ‘Low’ due to the localized and short term nature of the impact.

**Operations**

The main sources of emissions during plant operation are from the:

- stacks of the kiln system;
- cooler ESP;
- cement mill;
- coal mill; and
- CFB power plant.

Table 30 provides a summary of the predicted 1st high 1 hour, 24 hour and annual concentrations for each pollutant during the operations phase. The modelling results indicate that for the operational phase:
The highest 24 hour and highest annual concentration of PM\(_{10}\) during operations are predicted to be 114 µg/m\(^3\) inside the plant and jetty area (Figure 4.15 and Figure 4.16 in Appendix 1). This is less than the IAAQS standard of 150 µg/m\(^3\) once in a 24 hour period;

- The predicted highest 1 hour average concentrations for CO, NO\(_2\) and SO\(_2\) are 659 µg/m\(^3\), 222 µg/m\(^3\); and 265 µg/m\(^3\), respectively (Figures 4.15 to 4.28 in Appendix 1);

- The dispersal pattern for PM\(_{10}\) and PM\(_{2.5}\) is similar to construction phase with pollutants dispersing to the north west of the Cement Plant and Marine Jetty as the prevailing winds are from a south-easterly direction; and

- The dispersal pattern for CO, NO\(_2\) and SO\(_2\) is to the north-west but the pollutants may dispersed slightly further than PM\(_{10}\) and PM\(_{2.5}\) as the dominant source for these gases is from the Cement Plant operation (stack sources) which has a higher height of discharge (BBS, 2015a).

- The modelled values used were the specifications provided in the BOD and the design used will most likely result in emissions which comply with the IAAQS target values (BBS, 2015a).

- Overall the study found that the predicted concentrations are compliant with the standards used, with 1 exception of 1 hour averaged NO\(_2\) during operation. This is however, measuring the absolute maximum concentration of 1 hour averaged data, which is unlikely to be exactly representative of reality. Hence, the project should be considered compliant with the standards used.

Based on the risk assessment the potential impacts to air quality during operations phase is considered to be 'Medium' due to concentrations of NO\(_2\) slightly exceeding IAAQS standards in one instance. However, this is mitigated somewhat by the prevailing winds which result in dispersment to the northwest and out to sea avoiding impacts to sensitive receptors.

**Decommissioning**

The potential air quality impacts during the decommissioning phase of the Project is perceived to be localised and short term in nature. Therefore, based on the risk assessment the potential impacts to air quality during the decommissioning phase are considered to be 'Low'.

Table 29: Predicted 1st High Air Pollutant Concentrations for One hour, 24 hours, and Annual Average Concentration during Construction Phase (BBS, 2015A)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Averaging time</th>
<th>Standard (µg/Nm³)</th>
<th>First High Concentration (µg/Nm³)</th>
<th>Modelling Output</th>
<th>Coordinate Location</th>
<th>Description Area</th>
<th>Figure Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM₁₀</td>
<td>24 hours</td>
<td>150</td>
<td>114</td>
<td></td>
<td>203171.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>70</td>
<td>17</td>
<td></td>
<td>203171.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9058782,81</td>
<td>Mining and cement plant area, north west of sources</td>
<td>Figure 3.2</td>
</tr>
<tr>
<td>PM₂₅</td>
<td>24 hours</td>
<td>75</td>
<td>25</td>
<td></td>
<td>203171.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>35</td>
<td>3.81</td>
<td></td>
<td>203171.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9058782,81</td>
<td>Plant and Jetty area, north west of sources</td>
<td>Figure 3.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40000</td>
<td>287</td>
<td></td>
<td>207662,54</td>
<td></td>
<td>Figure 3.4</td>
</tr>
<tr>
<td></td>
<td>24 hours</td>
<td>73</td>
<td></td>
<td></td>
<td>207662,54</td>
<td></td>
<td>Figure 3.5</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>4.67</td>
<td></td>
<td></td>
<td>207662,54</td>
<td></td>
<td>Figure 3.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9065361,09</td>
<td>Plant and Jetty area, north west of sources</td>
<td>Figure 3.7</td>
</tr>
<tr>
<td></td>
<td>1 hour</td>
<td>200</td>
<td>109</td>
<td></td>
<td>207662,54</td>
<td></td>
<td>Figure 3.8</td>
</tr>
<tr>
<td>NO₂</td>
<td>24 hours</td>
<td>28</td>
<td></td>
<td></td>
<td>207662,54</td>
<td></td>
<td>Figure 3.9</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>28</td>
<td></td>
<td></td>
<td>207662,54</td>
<td></td>
<td>Figure 3.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>1.96</td>
<td></td>
<td>207662,54</td>
<td></td>
<td>Figure 3.11</td>
</tr>
<tr>
<td>SO₂</td>
<td>24 hours</td>
<td>0.2</td>
<td></td>
<td></td>
<td>207662,54</td>
<td></td>
<td>Figure 3.12</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>0.012</td>
<td></td>
<td></td>
<td>207662,54</td>
<td></td>
<td>Figure 3.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9065361,09</td>
<td></td>
<td>Figure 3.14</td>
</tr>
</tbody>
</table>
Table 30: Predicted 1st High Air Pollutant Concentration for One hour, 24 hours, and Annual Average Concentration during Operation Phase (BBS, 2015A)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Averaging time</th>
<th>Standard (µg/Nm³)</th>
<th>1st High Concentration (µg/Nm³)</th>
<th>Coordinate Location</th>
<th>Description Area</th>
<th>Figure Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM₁₀</td>
<td>24 hours</td>
<td>150</td>
<td>30</td>
<td>209159.48</td>
<td>9064264.71</td>
<td>Figure 3.15</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>70</td>
<td>5</td>
<td>209159.48</td>
<td>9064264.71</td>
<td>Figure 3.16</td>
</tr>
<tr>
<td>PM₂₅</td>
<td>24 hours</td>
<td>75</td>
<td>13</td>
<td>209159.48</td>
<td>9064264.71</td>
<td>Figure 3.17</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>35</td>
<td>1.11</td>
<td>203171.72</td>
<td>9058782.81</td>
<td>Figure 3.18</td>
</tr>
<tr>
<td>CO</td>
<td>1 hour</td>
<td>40000</td>
<td>659</td>
<td>207662.54</td>
<td>9062071.64</td>
<td>Figure 3.19</td>
</tr>
<tr>
<td></td>
<td>24 hours</td>
<td>40000</td>
<td>100</td>
<td>207662.4</td>
<td>9062071.64</td>
<td>Figure 3.20</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>6</td>
<td>207662.54</td>
<td>9062071.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO₂</td>
<td>1 hour</td>
<td>200</td>
<td>222</td>
<td>209159.48</td>
<td>9064264.1</td>
<td>Figure 3.21</td>
</tr>
<tr>
<td></td>
<td>24 hours</td>
<td>200</td>
<td>44</td>
<td>209159.48</td>
<td>9064264.71</td>
<td>Figure 3.22 and 3.23</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>40</td>
<td>203171.72</td>
<td>9058782.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO₂</td>
<td>1 hour</td>
<td>350</td>
<td>265</td>
<td>207662.54</td>
<td>9062071.95</td>
<td>Figure 3.26</td>
</tr>
<tr>
<td></td>
<td>24 hours</td>
<td>125</td>
<td>40</td>
<td>207662.54</td>
<td>9062071.95</td>
<td>Figure 3.27</td>
</tr>
<tr>
<td>Parameter</td>
<td>Averaging time</td>
<td>Standard (µg/Nm³)</td>
<td>Modelling Output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>------------------</td>
<td>------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1st High Concentration (µg/Nm³)</td>
<td>Coordinate Location</td>
<td>Description Area</td>
<td>Figure Number</td>
</tr>
<tr>
<td>Annual</td>
<td>1,66</td>
<td>206165.60</td>
<td>906657.47</td>
<td>Easting</td>
<td>Northing</td>
<td>Figure 3.28</td>
</tr>
</tbody>
</table>


9.8.4 Mitigation Measures

The following general mitigation measures will be implemented for the duration of the Project (i.e. pre-construction through to decommissioning):

- All material excavated, stockpiled, or graded will be sufficiently watered, treated, or covered to prevent fugitive dust from leaving the property boundaries and causing a public nuisance or a violation of an ambient air standard.
- Watering will occur at least twice daily, with complete site coverage.
- All land clearing, grading, earth moving, or excavation activities on the Project site will be suspended as necessary to prevent excessive windblown dust when winds are expected to exceed 20 mph.
- All areas with vehicle traffic will be watered or have dust palliative applied as necessary for regular stabilization of dust emissions.
- All on-site vehicle traffic will be limited to a speed of 15 mph on unpaved roads.
- All material transported off-site will be either sufficiently watered or securely covered to prevent public nuisance, and there must be a minimum of six (6) inches of freeboard in the bed of the transport vehicle.
- No vehicles or plant will be left idling for long periods unnecessarily.
- Reduce the number of vehicle movements through better planning.
- Set an appropriate speed limit on haul routes.
- All heavy duty vehicles will meet certain emission regulation from local Environmental Protection Agency.
- Use a good quality of fuel (e.g. with low sulphur content).
- Engines and exhaust systems will be regularly serviced according to manufacturer’s recommendations and maintained to meet statutory limits/opacity tests.
- All workers onsite will undertake environmental awareness training to highlight potential issues specific to air quality impacts associated with the Project.
- The contractor will provide appropriate personal protective equipment (PPE) to the workers based on the nature of the work.
- Ensure correct working methods are employed for the Project.

The following mitigation measures will be implemented at the Cement Plant during operations:

- Ensure maximum efficiency of combustion in kiln.
Performance guarantee of suitably designed Bag filters/ ESP will limit the dust concentration to <30 mg/ Nm$^3$ in all emissions.

In the event of failure of any pollution control equipment, automatic tripping in the control system should be provided.

Efficiency of each air pollution control equipment will be ensured to more than 99%.

Continuous dust monitor should be installed on kiln stack.

Performance guarantee of SO$_2$, NO$_x$, and CO emissions from stacks is within the norms of 200 mg/ Nm$^3$, 800 mg/ Nm$^3$, and 500 mg/ Nm$^3$ respectively as specified.

A well-designed low NOx burner system will limit the core flame temperature to ensure a low value of NO$_x$.

Regular preventive maintenance of pollution control equipment.

All vehicles and their exhausts will be well maintained and regularly tested for emission concentration.

Drop distances will be minimized by adjusting the conveyors.

Dust suppression system by water sprinkler at dump hopper of raw materials.

9.8.5 Monitoring and Reporting

In order to collect data which is required to interpret the air quality monitoring and the hydrology information, it is recommended that an automated weather station (AWS) is installed close to the Project site to record and monitor the following parameters on an hourly basis for the duration of the Project (i.e. construction, operation and decommissioning):

- Station identification number;
- Date and time of record/observation;
- Air, wet bulb and wet dew point temperatures;
- Precipitation and evaporation;
- Relative humidity;
- Wind speed and direction;
- Solar radiation;
- Barometric pressure (relative, absolute, and QNH (Barometric pressure adjusted to sea level for aviation purposes));
- Visibility;
• Cloud cover; and
• Cloud ceiling height, if practicable.

The recording and monitoring of these parameters will provide input information for various environmental management measures (including, but not limited to, dust suppression and cyclone management) and reporting requirements on the Project.

The installation of the AWS should be conducted in accordance with AS 3580.14-2011 - Methods for sampling and analysis of ambient air Part 14: Meteorological monitoring for ambient air quality monitoring applications, or an equivalent guideline.

A monitoring and reporting program (once every six months during construction and operation) should be implemented to monitor the air quality in the following sensitive receptors:

• AQ3 - School area in Aldeia Parlemento, east of Cement Plant;
• AQ5 - representing the construction area at the Jetty;
• AQ4 - settlement area in Aldeia Osso-ua; and

The monitoring program should assess and report on the following air quality parameters to the local Environmental Protection Agency:

Figure 9-2 Air quality monitoring location near Jetty (AQ5)
• PM$_{10}$;
• PM$_{2.5}$;
• CO;
• NO$_2$;
• SO$_2$; and
• Ozone.

A monitoring and reporting program (once every six months during operation) should be implemented at the following Cement Plant facilities:

• Emission stacks;
• Kiln stacks;
• Thermal power plant stacks;
• Cooler ESP stack;
• Cement mill bag house stack; and
• Coal mill bag house stack.

The monitoring and reporting program should record, assess and report the following air quality parameters: to the local Environmental Protection Agency (i.e. NDPCEI):

• PM$_{10}$;
• PM$_{2.5}$;
• CO;
• NO$_2$; and
• SO$_2$.

9.9 Noise and Vibration

9.9.1 Management Objectives

The key objectives for the management of noise and vibration impacts are to:

• To ensure that noise and vibration emissions do not impact on the health, welfare and amenity of the population, land uses and environmental values.
• To ensure that noise and vibration emissions, both individually and cumulatively, comply with the appropriate statutory requirements.
To ensure design and procurement activities incorporate measures for minimising noise and vibration emissions during all phases of the Project; and

To ensure that all reasonable and practicable measures are undertaken during construction and operations to minimise noise and vibration emissions.

9.9.2 Applicable Standards and Legislation

The standards referenced in the assessment are:

- UNTEAT (2001) No. 8 Guideline on Ambient Noise
- Australian Standard AS 2436-2010 Guide to Noise and Vibration control on construction, demolition and maintenance sites

below outlines the sound levels applicable for the durations of noise emission.

The influencing factor is applied to account for noises which include tonality, modulation and impulsiveness. This relates to sounds which produce an additional impact as a result of their characteristics.

For the purpose of this assessment, the value corresponding to Residential within outside space and farm residence (55dBA) was used as the assessment threshold for industrial noise exposure. This is due to the sensitive receptors being residences, schools and subsistence farms in an outdoor setting and the 24 hour nature of the Limestone Mine operations. Threshold values for nighttime hours are typically lower than for daylight hours.

**Table 31: Noise Standards (maximum) from UNTEAT (2001)**

<table>
<thead>
<tr>
<th>Sensitive Receptor Type</th>
<th>Noise Exposure Value (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential, Institutional and Educational Receptors</td>
<td>50 – 55 dB(A)</td>
</tr>
<tr>
<td>Commercial Receptors</td>
<td>70 dB(A)</td>
</tr>
<tr>
<td>Industrial Receptors</td>
<td>7 dB(A)</td>
</tr>
</tbody>
</table>

9.9.3 Impact Assessment

Pre-construction

The Noise Impact Assessment Study Report (BBS, 2015b) did not assess potential pre-construction impacts. However, it is likely that if there are any potential noise and vibration impacts during this phase of the project they would be localised and short term in nature. Therefore, based on the significance framework assessment the potential impacts to noise quality during the pre-construction phase are considered to be ‘Low’.

Construction
As shown in Table 32 the predicted cumulative potential noise levels due to simultaneous construction activities at the Plant, Jetty and Limestone Mine areas result in significant noise level increases (BBS, 2015b).

It is important to note that the estimated noise emission values were determined to be very conservative in nature; hence, the model is likely to significantly overestimate the predicted cumulative noise impacts at the sensitive receptors. Due to the conservative nature of the model, the predicted cumulative noise impacts are likely to be more representative of potential maximum noise levels ($L_{A,max}$) than time-weighted average levels.

Table 32: Predicted noise levels during construction phase

<table>
<thead>
<tr>
<th>Sensitive Receptor</th>
<th>Baseline Noise Level (dB)</th>
<th>Predicted Cumulative Noise Level (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N01 (Bahu)</td>
<td>56.27</td>
<td>64</td>
</tr>
<tr>
<td>N02 (Check Point Triloca)</td>
<td>55.52</td>
<td>67</td>
</tr>
<tr>
<td>N03 (Aldeia Parlementu)</td>
<td>50.20</td>
<td>68</td>
</tr>
<tr>
<td>N04 (Aldeia Osso-ua)</td>
<td>54.83</td>
<td>74</td>
</tr>
<tr>
<td>N05 (Jetty area)</td>
<td>51.92</td>
<td>81</td>
</tr>
<tr>
<td>N06 (Wailacama)</td>
<td>46.34</td>
<td>68</td>
</tr>
<tr>
<td>N07 (Bucoli)</td>
<td>50.71</td>
<td>69</td>
</tr>
</tbody>
</table>

As detailed in Table 5.1 in Appendix 2, the anticipated noise levels for the project construction activities are predicted to exceed the UNTEAT (2001) noise limits at the seven sensitive receptors.

Since the completion of the specialist noise study, the plant design basis was mandated to ensure all equipment noise emissions would be at maximum 85 dB(A) at 1 metre distance (Holtec, 2015b). This is a significant reduction to the noise emissions modelled during the specialist study and is likely to result in a significant reduction in predicted noise exposure levels at the sensitive receptors. In accordance with the equations provided in AS 2436-2010 (AS 2436, 2010) the predicted noise levels from a single 85dB at 1m emission source, is 45dB 100m away from the source. This falls below the noise standard of 55 dB (A) (UNTAET, 2001).

Based on the risk assessment the potential impacts from noise and vibration during the construction phase is considered to be ‘Low’ due to the localised and short term nature of the impacts.

The residual impacts from noise and vibration are expected to be ‘Low’ given the recommended noise impact mitigation measures in Section 9.9.4.

**Operation**
Table 33 shows that the noise modelling predicts that the simultaneous operation of the Plant, Jetty and Limestone Mine will result in noise level increases, but less than during the construction phase (BBS, 2015b).

**Table 33: Predicted noise levels during operation phase**

<table>
<thead>
<tr>
<th>Sensitive Receptor</th>
<th>Baseline Noise Level (dB)</th>
<th>Predicted Cumulative Noise Level (dBA) Standard = 55 dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>N01 (Bahu)</td>
<td>56.27</td>
<td>56</td>
</tr>
<tr>
<td>N02 (Check Point Triloca)</td>
<td>55.52</td>
<td>61</td>
</tr>
<tr>
<td>N03 (Aldeia Parlentu)</td>
<td>50.20</td>
<td>62</td>
</tr>
<tr>
<td>N04 (Aldeia Osso-ua)</td>
<td>54.83</td>
<td>68</td>
</tr>
<tr>
<td>N05 (Jetty area)</td>
<td>51.92</td>
<td>73</td>
</tr>
<tr>
<td>N06 (Wailacama)</td>
<td>46.34</td>
<td>60</td>
</tr>
<tr>
<td>N07 (Bucoli)</td>
<td>50.71</td>
<td>63</td>
</tr>
</tbody>
</table>

As with the construction phase assessment, since the completion of the specialist study, the plant design basis was mandated to ensure all equipment noise emissions would be at maximum 85 dB(A) at 1 metre distance (Holtec, 2015b). This is a significant reduction to the noise emissions modelled during the specialist study and is likely to result in a significant reduction in predicted noise exposure levels at the sensitive receptors. In accordance with the equations provided in AS 2436-2010 (AS 2436, 2010) the predicted noise levels from a single ‘85dB at 1m’ emission source, is 45dB 100m away from the source. This falls below the noise standard of 55 dB (A) (UNTAET, 2001).

The risk assessment the potential impacts from noise and vibrations during the operational phase of the project is considered to be ‘Low’ as adverse impacts are considered unlikely.

The residual impacts from noise and vibration are expected to be ‘Low’ given the recommended noise impact mitigation measures in Section 9.9.4.

**Decommissioning**

The Noise Impact Assessment Study Report (BBS, 2015b) did not assess potential decommissioning impacts. However, it is likely that if there are any potential noise and vibration impacts during this phase of the project they would be localised and short term in nature. Therefore, based on the risk assessment the potential impacts from noise during the decommissioning phase are considered to be ‘Low’.

**9.9.4 Mitigation Measures**

Pre-construction, Construction, Operation and Decommissioning
The following mitigation measures should be implemented for all project phases to mitigate noise impacts:

- Confirmation that all equipment and noise emission sources are rated at 85dB 1m from source as per the Basis of Design (Holtec, 2015b)
- Storage areas should be located away from sensitive receptors. Where this is not possible, the storage of waste materials, earth and other supplies may be positioned in a manner that may function as a noise barrier
- Placement and design of the Waste Rock Stockpile should be undertaken to act as a noise barrier between the Limestone Mine and the sensitive receptor at Aldeia Osso-ua and Caisidu.
- Community resettlement and relocation should be considered for the most sensitive receptors at Aldeia Osso-ua and Caisidu; and the small coastal community living adjacent to the Limestone Mine supporting infrastructure at the jetty site.
- Haulage of goods and movement of vehicles/people and equipment can be scheduled and sequenced to reduce the number of noisy operations.
- Where required, noise barriers should be constructed to abate the noise impacts.
- Alternative construction methods may also be available which may be more practicable and cost effective in dealing with potential noise impacts. For example:
  - An alternative to pile driving may be the use of vibration or hydraulic insertion techniques; or
  - Use of electric compressors, which are significantly quieter than diesel or gasoline engine powered compressors (BBS, 2015b).
- Vehicles should be selected in accordance with Vehicle Standard (Australian Design Rule 83/00 – External Noise) 2005 (Motor Vehicles Standard Act, 1989).
- Specifying the use of adequate muffler systems can control engine noise.
- Employing shields that are physically attached to the particular piece of equipment is effective, particularly for stationary equipment.
- Equipment modifications, such as dampening of metal surfaces, are effective in reducing noise due to vibration.
- Sound aprons generally take the form of sound absorptive mats hung from the equipment or on frames attached to the equipment.
- Enclosures for stationary work may be constructed of wood or any other suitable material and typically surround the specific operation area and equipment.
- Blasting Mats which are used as blankets for blasting operations to control and confine debris. These mats also provide a degree of noise attenuation from the blast.
- Selection of Equipment to ensure that the quietest equipment is selected.
- Maintenance Programs to ensure that all equipment is operating optimally.
- PPE (e.g. ear plugs) will be provided to all employees (Holtec, 2015a).

### 9.9.5 Monitoring and Reporting

The residual impact of noise at the sensitive receptors is expected to be low; however, qualitative monitoring of ambient noise levels is recommended to confirm the assessment.

**Figure 9-3: Noise monitoring at the Jetty location**

In the event that the qualitative monitoring identifies a potentially unacceptable level of noise at a sensitive receptor, quantitative monitoring will be required to validate the observation. This includes:

- Daily noise logging for a fixed duration of 2-4 weeks at all sensitive receptors during all phases. At least one event of noise logging at each of pre-construction, construction and decommissioning.
- One event of noise logging every 6 months during operations, until the effects on the community fall below the acceptable level for two monitoring events.

The noise logging event is to be undertaken in order to:

1. Confirm the predicted noise emissions at the sensitive receptors during each of the project phases;
2. Identify the primary sources of peak noise emissions and develop real-time management responses to the impacts; and
3. Make adjustments to the mitigation and monitoring measures where necessary.
Figure 9-4: Location of Noise Baseline Measurement Stations
9.10 Surface Water

9.10.1 Management Objectives
The key objectives for the management of surface water for the Project are to:

- Maintain the integrity, ecological functions and environmental values of surface water;
- Minimise long term damage to catchment function; and
- Minimise potential impact to infrastructure from stormwater and surface water drainage.

9.10.2 Applicable standards and legislation
The following international standards may be applicable in relation to surface water:

- Timor-Leste [Draft] National Water Resources;
- DoW Water Quality Protection Guidelines (2000);
- Western Australian Water in Mining Guideline (2013); and

9.10.3 Impact Assessment

Pre-construction and construction
The results of the surface water impact assessment (Appendix 3) suggest the proposed infrastructure associated with the Project are not expected to have a significant impact on the quantity and quality of streamflow or on the associated environmental receptors in the study area, subject to the recommended surface water mitigation measures being put in place.

The impacts from the pre-construction and construction phases are expected to be “Low”.

Operation
The results of the surface water assessment suggest the proposed infrastructure associated with the Project are not expected to have a significant impact on the quantity and quality of streamflow or on the associated environmental receptors in the study area, subject to the recommended surface water mitigation measures being put in place.

Areas of social and ecological value that are dependent on runoff, such as local springs used for public water supply, Closed Tropical Forest vegetation identified along watercourses and drainage lines, and associated fauna species, will be protected by implementing the recommended surface water mitigation measures. These measures are intended to reduce the risk of changes to the flow regimes and water quality in the local watercourses as a result of the proposed development.
SWMM hydrological modelling of the proposed development area was conducted using 5 years of daily rainfall data. The model was used to generate total daily flow frequency plots for existing, operational and closure scenarios. The results show the proposed mine development has a negligible effect on the frequency and magnitude of streamflow events for all scenarios. This is due to the mitigating effects of the runoff management measures proposed and the relatively small proportion of the total catchment area that is impacted by the proposed development.

The model of the proposed diversion routes around mine infrastructure shows that they do not impact on the watercourses flowing into the Uaimatabai and Uaisa Springs.

Surface water quality management measures will minimise the risk of potential contamination of spring water from surface water flows from the Project site.

The impacts on surface water quality and quantity from the operation of the Project are ‘Low’ as the pre-development and post-development shows similar run-off values with negligible differences in frequency and magnitude of streamflow events.

The residual impacts of the development are ‘Low’ as a result of the modelled effectiveness of the mitigation measures proposed.

**Decommissioning**

The results of the surface water assessment suggest the proposed developments associated with the Project are not expected to have a significant impact on the quantity and quality of streamflow or on the associated environmental receptors in the study area subject to the recommended surface water mitigation measures being put in place.

The impacts from the decommissioning phases are expected to be ‘Low’.

### 9.10.4 Mitigation Measures

**Pre-Construction**

In order to quantify and qualify the risk from inundation, flooding and surface water run off a 3D rainfall runoff hydrological model of the Cement Plant and Jetty site should be completed. Mitigation measures around minimising flood and inundation risk include:

- Diversion trenches and soakwells;
- Paving and bitumen ground cover to control infiltration;
- Drains down-gradient from the plant site to capture potentially contaminated surface water run-off;
- Waste water treatment plant set up to accept Cement Plant site run off water via drains and pumps; and
- Establish weir and surface water stream flow gauges up- and down-gradient from the Cement Plant site to determine the baseline condition and monitor subsequent changes.

In order to qualify the risk from water quality contamination, the following mitigation measures are recommended:

- Monitoring of surface water features for water quality impacts; and
- Establish weir and surface water stream flow gauges up- and down-gradient from the Cement Plant site to determine the baseline condition and monitor subsequent changes.

**Construction**

In order to quantify and qualify the risk from inundation, flooding (including cyclone events) and surface water run off a 3D rainfall runoff hydrological model of the Cement Plant site should be completed. Mitigation measures around minimising flood and inundation risk during construction include:

- Plant site construction plan to incorporate drainage information to inform placement of construction material and construction camp infrastructure;
- Establish weir and surface water stream flow gauges up- and down-gradient from the Cement Plant site to determine the baseline condition and monitor subsequent changes; and
- Cement Plant site layout incorporate flooding and surface water drainage information to protect strategic infrastructure.

In order to qualify the risk from water quality contamination, the following mitigation measures are recommended:

- Monitoring of surface water features for water quality impacts; and
- Establish weir and surface water stream flow gauges up- and down-gradient from the Cement Plant site to determine the baseline condition and monitor subsequent changes.

**Operation**

In order to quantify and qualify the risk from inundation, flooding and surface water run off a 3D rainfall runoff hydrological model of the Cement Plant and Jetty site should be completed. Mitigation measures around minimising flood and inundation risk include:

- Diversion trenches and soakwells;
- Paving and bitumen ground cover to control infiltration;
- Drains down-gradient from the Cement Plant site to capture potentially contaminated surface water run-off;
- Waste water treatment plant set up to accept Cement Plant site run off water via drains and pumps; and
TL CEMENT, LDA
BAUCAU CEMENT PROJECT
ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE

- Establish weir and surface water stream flow gauges up- and down-gradient from the Cement Plant site to determine the baseline condition and monitor subsequent changes.

In order to qualify the risk from water quality contamination, the following mitigation measures are recommended:

- Monitoring of surface water features for water quality impacts; and
- Establish weir and surface water stream flow gauges up- and down-gradient from the Cement Plant site to determine the baseline condition and monitor subsequent changes.

Decommissioning

In order to quantify and qualify the risk from inundation, flooding and surface water run off a 3D rainfall runoff hydrological model of the Cement Plant and Jetty site should be completed. Mitigation measures around minimising flood and inundation risk include:

- Diversion trenches and soakwells;
- Paving and bitumen ground cover to control infiltration;
- Drains down-gradient from the Cement Plant site to capture potentially contaminated surface water run-off
- Waste water treatment plant set up to accept Cement Plant site run off water via drains and pumps; and
- Establish weir and surface water stream flow gauges up- and down-gradient from the Cement Plant site to determine the baseline condition and monitor subsequent changes.

In order to qualify the risk from water quality contamination, the following mitigation measures are recommended:

- Monitoring of surface water features for water quality impacts; and
- Establish weir and surface water stream flow gauges up- and down-gradient from the Cement Plant site to determine the baseline condition and monitor subsequent changes.

9.10.5 Monitoring and Reporting

Monitoring of surface water flows and water quality in watercourses and drainage lines will be undertaken to establish baseline conditions and for compliance monitoring.

A rain gauge will be installed as part of the Automated Weather Station in the catchment.

The water level and rainfall data will also be compared with water level logger data in groundwater monitoring bores and at springs to improve the understanding of surface-groundwater recharge to the springs.
Monthly data downloads of the stream flow runoff data will occur, during the wet season, with interpretation of data at a 6-monthly interval for the duration of the Project. This frequency will be adjusted during the operations phase when the baseline conditions have been adequately understood and the impacts to surface water flows have been confirmed through monitoring.

Figure 9-5 Typical streamflow gauge (source: Wikipedia)

All chemical and/or oil / fuel spills will be recorded and investigated in accordance with the Emergency Response plan as implemented by the EMS.

9.11 Groundwater

9.11.1 Management Objectives

The key objectives for the management of groundwater impacts are to:

- Maintain the integrity, ecological functions and environmental values of groundwater;
- Minimise the impact on the flow and quality of springs; and
- Ensure that mine dewatering impacts (drawdown) are limited in geographic extent and are quantified.

9.11.2 Applicable standards and legislation

The following standards and legislation is applicable to groundwater:

- Timor Water Supply Guidelines (undated, Ministerio das Infra-Estruturas);
9.11.3 Impact Assessment

The full Preliminary Groundwater Environmental Impact Assessment Report is provided in Appendix 4.

Pre-construction

Potential impacts on groundwater associated with the pre-construction activities may include:

- Pre-construction activities of Cement Plant, equipment and chemical use, as well as land clearing, may cause groundwater quality impacts via contamination. The nearest spring to the Cement Plant is 650 m east of the Cement Plant site boundary (Uaisa Spring). This spring is located on the 120 m ASL contour, which indicates that the water table intersects the geology at this location. The groundwater drainage is expected to mimic the topography and flow in a westerly direction. The Cement Plant site is located on the 100 m ASL contour, so it is expected that the spring is located above-gradient from the Cement Plant, Conveyor Belt and Jetty. Because of this, it is expected that the water quality impacts on the spring will be ‘Low’.

- Clearing of vegetation may impact aquifer recharge by changing the rate of groundwater infiltration by surface water. The streams are ephemeral over the Cement Plant area and the Cement Plant is located on the boundary between two catchments totalling 455 ha in area. The clearing area for the Cement Plant and Conveyor Belt is 20 ha and as a proportion of the whole, the impact on recharge is expected to be ‘Low’.

- Groundwater has been identified as the primary water source for the Cement Plant and the water requirements for the Project during pre-construction is 350 m$^3$/day. The water supply borehole location is expected to be near the Project site in alluvial unconfined sediments. There are not expected to be any impacts on nearby water users or ecosystems as a result of this abstraction.

The overall potential impacts on the groundwater during the pre-construction phase are expected to be localised and short term. Therefore, the potential impacts are deemed to be ‘Low’.

Construction

Potential impacts on groundwater associated with the construction activities may include:

- The construction activities of the Cement Plant, equipment and chemical use as well as land clearing, may cause groundwater quality impacts via contamination. The nearest spring to the Cement Plant is 650 m east of the Cement Plant site boundary (Ossu-ua Spring). This spring is located on the 120 m ASL contour, which indicates that the water table intersects the geology at this location. The groundwater drainage is expected to mimic the topography and flow in a westerly direction. The Cement Plant site is located on the 100 m ASL contour, so it is
expected that the spring is located above-gradient from the Cement Plant, Conveyor Belt and Marine Jetty. Because of this, it is expected that the water quality impacts on the spring will be low.

- Clearing of vegetation may impact aquifer recharge by changing the rate of infiltration by surface water. No further clearing of vegetation will occur during construction so there will be no impact on recharge.

- Groundwater has been identified as the primary water source for the Cement Plant. During construction this is expected to be in the order of 350 m$^3$/day (4 L/s). The water supply borehole location is expected to be near the Cement Plant, in alluvial unconfined sediments. There are not expected to be any impacts on nearby water users or ecosystems as a result of this abstraction.

The construction phase impacts on the groundwater are expected to be localised and short term. Therefore, the potential impacts are deemed to be ‘Low’.
Operation

Potential impacts on groundwater associated with the operational activities may include:

- The Cement Plant, equipment and chemical use during Project operation may cause groundwater quality impacts via contamination. The nearest spring to the Cement Plant is 650 m east of the Cement Plant site boundary (Ossu-ua Spring). This spring is located on the 120 m ASL contour, which indicates that the water table intersects the geology at this location. The groundwater drainage is expected to mimic the topography and flow in a westerly direction. The Cement Plant site is located on the 100 m ASL contour, so it is expected that the spring is located above-gradient from the Cement Plant, Conveyor Belt and Marine Jetty. Because of this, it is expected that the water quality impacts on the spring will be low.

- Clearing of vegetation may impact aquifer recharge by changing the rate of infiltration by surface water. No additional land clearing is expected during Cement Plant operation so there will be no further impact on recharge during operation.

- Groundwater has been identified as the primary water source for the Cement Plant. During operation this is expected to be in the order of 3,150 m$^3$/day (36 L/s). The water supply borehole location is expected to be near the Cement Plant, in alluvial unconfined sediments. Impacts to the local ecosystems and other groundwater users will be quantified on completion of the groundwater test programme. The impacts are expected to be moderate.

The operation phase impacts on the groundwater are expected to be localised but long term. Therefore, the potential impacts are deemed to be ‘Medium’.

Decommissioning

Potential impacts on groundwater associated with the decommissioning activities may include:

- The decommissioning activities of the Cement Plant, equipment and chemical use as well as land contouring and revegetation may cause groundwater quality impacts via contamination. The effects are expected to be low as no equipment or building material will be used as part of the rehabilitation.

- Revegetation, contouring and backfill activities will likely have a positive impact on groundwater recharge due to an increase in permeability, duration of water retention time allowing infiltration and an increase in the amount of water flowing over the Project site compared to the operations phase.

- Groundwater has been identified as the primary water source, however during decommissioning any impacts are expected to be negligible.

The decommissioning phase impacts on the groundwater are expected to be localised and short term. The impacts are ‘Low’.
9.11.4 Mitigation Measures

Pre-construction, Construction, Operation and Decommissioning

Mitigation of impacts on groundwater quality and levels on groundwater quality from the Project will be managed through the implementation of an Emergency Response Plan. Monitoring boreholes will be drilled at strategic locations around the infrastructure to monitor the background water quality as well as provide an indication of the presence of contaminants in the surrounding aquifer.

Groundwater modelling for the water supply will be undertaken to determine the radius of influence of the drawdown in the local aquifers. This will enable the Project to manage abstraction and dewatering to minimise impacts to vegetation, river base flow and local water supply.

Contamination of the aquifer from the Project will be mitigated through an Emergency Response Plan and all spills will be immediately cleaned up and disposed of appropriately.

Figure 9-6 Sampling of water for water quality impact
All chemicals used on site will be stored, handled and disposed of in a responsible manner and in accordance with the EMP.

9.11.5 Monitoring and Reporting
Pre-Construction, Construction, Operation and Decommissioning

Implementation of the Emergency Response Plan will include at least a quarterly analysis and technical review of water quality parameters and levels in monitoring boreholes, springs and drainages features within and surrounding the Project. Flow rates in the springs and drainages will be recorded and monitored at least monthly.

The Project’s Environmental Management Plan will contain appropriate emergency response processes to observed decreases in spring and drainage flows and deterioration in water quality compared to the baseline and the water quality standards.

Contamination of the aquifer from the Project activities will be reported to the regulator within an appropriate timeframe and the process and procedure for identifying and managing the contamination detailed in the Spill Management Plan.

All chemicals used on site will be stored, handled and disposed of in a responsible manner and in accordance with the EMP.

9.12 Coastal and Marine Waters

Construction and operation of the MOF, material loading and unloading and movement of vehicles and machinery at the MOF and Jetty may potentially impact the beaches, bathymetry and sediment transport. The MOF and Jetty are likely to be impacted by the natural events associated with tides, sea level change, storm surge, coastal wind and waves and ocean currents.

The MOF design as incorporated in this impact assessment is preliminary and alternative construction methods are being considered e.g. piling.

9.12.1 Management Objectives

The key objectives for the management of potential impacts to coastal and marine water are to:

- Maintain the integrity, ecological functions and environmental values of the marine environment;
- Minimise the impact on bathymetry and sediment transport from the jetty and MOF; and
- Minimise the impact on coastal zone including beaches.
9.12.2 Applicable Standards and Legislation

The following Timor-Leste legislation and international standards may be applicable in relation to coastal and marine waters:

- Law No. 5, 1990 on Conservation of Biological Resources and their Ecosystems.
- Law No. 5, 1994 Concerning Biodiversity.
- UNTAET Regulation No. 2000/19 on protected places (30 June 2000) was established for the purpose of protecting designated areas, endangered species, wetlands, mangrove areas, historic, cultural and artistic sites, conservation of biodiversity and protection of the biological resources of East Timor. Fifteen natural areas were protected under this regulation and have been designated as Protected Natural Areas (PNAs). The majority comprise primary forest areas, coral reefs, mangroves, wetland habitat and mountain summits above 2,000 m.

9.12.3 Impact Assessment

Pre-construction

Potential impacts on coastal and marine waters associated with the pre-construction activities for the MOF and Jetty may include:

- The MOF is expected to have significant impacts to coastal processes. The largest impact will be to sediment transport, and this may manifest itself as marked erosion and shoreline recession with localized change in the water quality in the long term.

- The seasonally fluctuating erosion will most likely be significant. Erosion of the adjacent coastline will possibly result in landward shoreline migration of up to 50 m. Impacts due to the MOF may be experienced for hundreds of meters to the Northeast and Southwest of the structure depending upon the season. It is likely that this potential erosion would impact the Jetty abutment structure to the Northeast.

- Additionally, shore-perpendicular structures such as the MOF will interrupt longshore currents. The interruption of currents will be localized to the vicinity of the structure and will most likely result in the generation of offshore currents along the sides of the MOF known as "rip currents". If the project site is publicly accessible, these rip currents may pose a drowning hazard for swimmers and fisherman (WorleyParsons, 2015).
Potential impacts on coastal and marine waters associated with the construction activities for the MOF and Jetty may include:

- The MOF is expected to have significant impacts to coastal processes. The largest impact will be to sediment transport, and this may manifest itself as marked erosion and shoreline recession with localized change in the water quality in the long term.

- The seasonally fluctuating erosion will most likely be significant. Erosion of the adjacent coastline will possibly result in landward shoreline migration of up to 50 m. Impacts due to the MOF may be experienced for hundreds of meters to the northeast and southwest of the structure depending upon the season. It is likely that this potential erosion would impact the Jetty abutment structure to the northeast.

- Additionally, shore-perpendicular structures such as the MOF will interrupt longshore currents. The interruption of currents will be localized to the vicinity of the structure and will most likely result in the generation of offshore currents along the sides of the MOF known as "rip currents". If the Project site is publicly accessible, these rip currents may pose a drowning hazard for swimmers and fisherman (WorleyParsons, 2015).

- The construction activities (incl. vessel; vehicle; machinery; and material laydown) have the potential to impact the beach and marine waters adjacent to the Jetty. The impacts are likely to be short term and highly localised.

- The pile supported Jetty will have little effect on coastal processes as the piles will allow currents and sediment to flow naturally. Any impacts will most likely be limited to localized scour in the immediate vicinity of individual piles.

- The abutment will hinder the naturally fluctuating longshore flow of sediment. For example, during the southeast monsoon, the abutment will impede the associated expected southwesterly flow of sediment. Sediment will become trapped on the northeasterly side of the abutment.

- This impediment is only expected to occur for a short time however because the abutment is relatively short and does not have significant capacity for sediment storage. Once the sediment storage capacity is exceeded, the sediment will be transported around the head of the abutment at normal rates.

- This process will reverse upon occurrence of the subsequent monsoon season. The net result may be isolated erosion of the downstream shoreline until the abutment sediment storage capacity is exceeded. It is likely that at the onset of the northwest monsoon, some temporary erosion will occur on the northeast side of the abutment. At the onset of the southeast monsoon, the temporary erosion will most likely switch to the southwest side of the abutment (WorleyParsons, 2015).
The construction activities (incl. vessel; vehicle, machinery; and material laydown) for the MOF and Jetty have the potential to impact the beach and marine waters. The potential impacts have been assessed as 'Medium' because of the highly localised area of impact.

**Operation**

Potential impacts on coastal and marine waters associated with the operational activities for the MOF and Jetty may include:

- The MOF is expected to have significant impacts to coastal processes. The largest impact will be to sediment transport, and this may manifest itself as marked erosion and shoreline recession with localized change in the water quality in the long term.

- The seasonally fluctuating erosion will most likely be significant. Erosion of the adjacent coastline will possibly result in landward shoreline migration of up to 50 m. Impacts due to the MOF may be experienced for hundreds of meters to the northeast and southwest of the structure depending upon the season. It is likely that this potential erosion would impact the Jetty abutment structure to the northeast.

- Additionally, shore-perpendicular structures such as the MOF will interrupt longshore currents. The interruption of currents will be localized to the vicinity of the structure and will most likely result in the generation of offshore currents along the sides of the MOF known as "rip currents". If the project site is publicly accessible, these rip currents may pose a drowning hazard for swimmers and fisherman (WorleyParsons, 2015).

- The pile supported Jetty will have little effect on coastal processes as the piles will allow currents and sediment to flow naturally. Any impacts will most likely be limited to localized scour in the immediate vicinity of individual piles.

- The abutment will hinder the naturally fluctuating longshore flow of sediment. For example, during the southeast monsoon, the abutment will impede the associated expected southwesterly flow of sediment. Sediment will become trapped on the northeasterly side of the abutment.

- This impediment is only expected to occur for a short time however because the abutment is relatively short and does not have significant capacity for sediment storage. Once the sediment storage capacity is exceeded, the sediment will be transported around the head of the abutment at normal rates.

- This process will reverse upon occurrence of the subsequent monsoon season. The net result may be isolated erosion of the downstream shoreline until the abutment sediment storage capacity is exceeded. It is likely that at the onset of the northwest monsoon, some temporary erosion will occur on the Northeast side of the abutment. At the onset of the southeast monsoon, the temporary erosion will most likely switch to the southwest side of the abutment (WorleyParsons, 2015).
The impact of the MOF and Jetty on the coastal and marine waters during operations is therefore ‘Medium’, because of the short term (life of the Project) and highly localised area of impact.

Decommissioning

Potential impacts on coastal and marine waters associated with the decommissioning activities for the MOF and Jetty may include:

- The potential impact during decommissioning is from construction material recovery and disposal.

- The MOF is expected to have significant impacts to coastal processes, however during decommissioning this impact is expected to change and eventually decrease to negligible levels.

- All materials used in the construction and operation of the MOF shall be disposed of in a controlled manner to a waste facility to reduce the potential impact on the coastal and marine environment.

- The decommissioning activities (incl. vessel; vehicle; machinery; and material laydown) have the potential to impact the beach and marine waters adjacent to the Jetty.

- All materials used in the construction and operation of the jetty shall be disposed of in a controlled manner to a waste facility to reduce the potential impact on the coastal and marine environment.

The decommissioning activities (incl. vessel; vehicle; machinery; and material laydown) have the potential to impact the beach and marine waters adjacent to the MOF and Jetty. This impact has been assessed as ‘Low’ because the impact is short term and highly localised.
9.12.4 Mitigation Measures

Pre-construction

Construction of the MOF and Jetty will be undertaken in accordance with the Environmental Management Plan which addresses:

- Spills and discharge of material or fuels to the beach or marine environment;
- Contouring and movement of vehicles on the beach to minimize scour and erosion;
- Vessel approach to the MOF to minimize discharge of ballast and spread of marine pests; and
- Storage of construction materials adjacent to the MOF location to minimize disturbance of beach processes.

Construction

If the MOF and Jetty is to remain indefinitely, a maintenance program including sand bypassing may be required. Sand bypassing can be accomplished by physical plant such as excavators, front end loaders, and dump trucks, or it can be accomplished by fluidization of the sediment and subsequent pumping.

Construction of the Jetty will be undertaken in accordance with the Environmental Management Plan which addresses:

- Spills and discharge of material or fuels to the beach or marine environment;
- Contouring and movement of vehicles on the beach to minimize scour and erosion;
- Vessel approach to the Jetty to minimize discharge of ballast and spread of marine pests;
- Storage of construction materials adjacent to the Jetty location to minimize disturbance of beach processes; and
- An Emergency Response Plan will be required in the case of severe storm surge or tidal events which threaten the integrity of the MOF and Jetty, potentially affecting any personnel, vessels or vehicles.

Operation

During the operations phase, the Jetty and MOF environmental impacts will be managed in accordance with the Environmental Management Plan which addresses:

- Spills and discharge of material or fuels to the beach or marine environment;
- Vessel approach to the Jetty to minimize discharge of ballast and spread of marine pests; and
• An Emergency Response Plan in the case of severe storm surge or tidal events which threaten the integrity of the MOF and Jetty.

Decommissioning

During the decommissioning phase, the Jetty and MOF environmental impacts will be managed in accordance with the Environmental Management Plan which addresses:

• Spills and discharge of material or fuels to the beach or marine environment;
• Vessel approach to the Jetty to minimize discharge of ballast and spread of marine pests; and
• An Emergency Response Plan in the case of severe storm surge or tidal events which threaten the integrity of the MOF and Jetty.

9.12.5 Monitoring and Reporting

Pre-construction

Monitoring of sedimentation effects will be undertaken at minimum twice a year detailed in-situ surveys of the beach and infrastructure.

A detailed survey and image record will be undertaken immediately after construction of the MOF to determine the new baseline condition.
Figure 9-7 Monitoring impact on coral using reference site photography

Monthly monitoring of key erosion and sedimentation locations will be undertaken through the use of permanent time lapse cameras, installed at strategic locations.

Images will be compared monthly and where the sedimentation or scour exceeds the determined trigger values, the appropriate response will be implemented.

Construction

Monitoring of sedimentation effects will be undertaken at minimum twice a year detailed in-situ surveys of the beach and infrastructure.

A detailed survey and image record will be undertaken immediately after construction of the Jetty to determine the new baseline condition.

Monthly monitoring of key erosion and sedimentation locations will be undertaken through the use of permanent time lapse cameras, installed at strategic locations.
Images will be compared monthly and where the sedimentation or scour exceeds the determined trigger values, the appropriate response will be implemented.

**Operation**

Monitoring of sedimentation effects will be undertaken at minimum twice a year detailed in-situ surveys of the beach and infrastructure.

Monthly monitoring of key erosion and sedimentation locations will be undertaken through the use of permanent time lapse cameras, installed at strategic locations.

Images will be compared monthly and where the sedimentation or scour exceeds the determined trigger values, the appropriate response will be implemented.

**Decommissioning**

Monitoring during the decommissioning period will be limited to surveying and reporting on the final post-decommissioning beach and coastal processes. Decommissioning shall be undertaken to restore the pre-construction landform and coastal environment.

Where any structure or deviation from the pre-construction landform is proposed as the final footprint post-decommissioning, this will be modelled in a Sediment Transport model to determine the permanent effects on the coast and marine waters and approved by the regulator.

**9.13 Flora (Terrestrial)**

**9.13.1 Management Objective**

The key objectives for the management of terrestrial flora are to:

- Maintain the abundance, diversity, geographic distribution and productivity of flora at the species and ecosystem levels through the avoidance or management of adverse impacts.

**9.13.2 Applicable Standards and Legislation**

There has been no national mapping of vegetation communities in Timor-Leste and relatively few published botanical surveys making it difficult to place survey results into a regional or national context. Therefore, the International Union for Conservation of Nature (IUCN) has been used as the local standard for assessing the impact on flora.

The IUCN Red List of Threatened Species™ provides taxonomic, conservation status and distribution information on plants, fungi and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction.
The following legislation and regulations are applicable to the environmental protection and biodiversity conservation in Timor-Leste:

- Law No. 5, 1990 on Conservation of Biological Resources and their Ecosystems;
- Law No. 5, 1994 Concerning Biodiversity;
- Government Regulation No. 28, 1985 on Forest Protection;
- Government Regulation No. 51, 1993 on Environmental Impact Analysis;
- United Nations Transitional Administration in East Timor Regulation No. 2000/17; and

9.13.3 Impact Assessment

The full Baucau Cement Clinker Plant Vegetation and Fauna Survey Report (Trainor & Easton, 2015) is provided in Appendix 5.

Pre-construction and Construction

The activities which will lead to impacts on terrestrial flora during the pre-construction and construction phases of the Project include site clearing, levelling and excavation. Potential impacts to terrestrial flora may include direct loss of:

- native vegetation;
- individual IUCN listed species;
- agricultural land and subsidence gardens;
- food crops and estates e.g. coconuts and bananas;
- timber for fuel source; and
- cash crops e.g. sandalwood.

Overall, the Jetty site is a heavily modified plantation environment with a severe infestation of *Lantana camara* throughout. The biological diversity at the site is considered very low and overall the site was not representative of a pristine coastal/beach forest. No plant species listed by the IUCN were recorded within the Conveyor Belt and Jetty footprint (Trainor & Easton, 2015).

The Cement Plant site consists predominately of very open savannah woodland (dominated by *Eucalyptus alba* and Ceylon Oak (*Schleichera oleosa*)) which has been extensively modified for agriculture and grazing. The remaining areas consisted of isolated patches of Closed Tropical Forest system occurring in depressions and drainage floors. The Closed Tropical Forest patch was relatively weed free at its centre. The area of Closed Tropical Forest is dominated by *Ficus* Species (unidentified). *Intsia bijuga* (Borneo Teak), was recorded at the survey site P002 (see Figure 9 in Appendix 5), which is listed as ‘Vulnerable’ by the IUCN Red List (Trainor & Easton, 2015).
The total area of vegetation to be cleared for the construction of the Cement Plant, Conveyor and Jetty is calculated to be 75.41 ha. Table 34 below provides a breakdown of this total based on each vegetation association recorded at the Cement Plant and Jetty sites.

### Table 34: Vegetation Associations to be cleared for the Construction of the Cement Plant, Conveyor Belt and Jetty

<table>
<thead>
<tr>
<th>Vegetation</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degraded Open Woodland (<em>Eucalyptus, Ziziphus, Corypha</em>)</td>
<td>66.92</td>
</tr>
<tr>
<td>Degraded Palm forest</td>
<td>2.11</td>
</tr>
<tr>
<td>Degraded Beach forest</td>
<td>1.47</td>
</tr>
<tr>
<td>Degraded Open Woodland (<em>Ziziphus, Corypha</em>)</td>
<td>3.15</td>
</tr>
<tr>
<td>Degraded Tropical forest</td>
<td>1.76</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>75.41</strong></td>
</tr>
</tbody>
</table>

Therefore, based on the impact risk assessment the potential impacts to terrestrial flora at the Project during pre-construction and construction are considered ‘Low’ given localised area of clearing, the presence of one IUCN listed flora species recorded within the Cement Plant footprint; and degraded condition of the existing vegetation to be cleared.

### Operation

Given the majority of the impacts to terrestrial flora will be associated with clearing of vegetation during the pre-construction and construction phase, it is not anticipated that the operation of the Project will have any significant impacts on terrestrial flora. Potential impacts associated with operational phase are likely to be indirect loss of native vegetation through:

- Dust deposition;
- Depletion of water sources (surface and/or groundwater);
- Contamination of water sources (surface and/or groundwater), and soil;
- Soil erosion; and
- Weed invasion e.g. *Lantana camara*.

Therefore, the potential impacts to terrestrial flora during operation of the Project are considered to be ‘Low’.

### Decommissioning

Given the majority of the impacts to terrestrial flora will be associated with clearing of vegetation during the pre-construction and construction phase, it is not anticipated that the decommissioning of
the Project will have any significant negative impacts on terrestrial flora. The main potential impacts associated with decommissioning are indirect loss of native vegetation through:

- Dust deposition;
- Depletion of water sources (surface and/or groundwater);
- Contamination of water sources (surface and/or groundwater), and soil;
- Soil erosion; and
- Weed invasion e.g. *Lantana camara*.

The decommissioning phase of the Project will likely see positive impacts for terrestrial flora as the areas cleared for the construction and operation will be rehabilitated and restored to their pre-construction condition.

Therefore, the potential impacts to terrestrial flora decommissioning of the Project are considered to be ‘Low’.

**9.13.4 Mitigation Measures**

**Pre-construction and Construction**

The following mitigation measures will be implemented for the pre-construction and construction phase of the Project:

- Minimise the disturbance footprint as far as practicable.
- Undertake stripping and stockpiling of vegetation and topsoil for reuse in the decommissioning and rehabilitation phase.
- Preserve topsoil for rehabilitation by stripping soil during construction.
- Site clearing to be conducted sequentially.
- Topsoil to be stock piled separately from overburden / interburden for rehabilitation purposes and protected against loss of run-off.
- All employees and contractors will be required to complete an environmental education training program, including refresher sessions.
- Prior to site entry all vehicles, plant and equipment will be cleaned down and inspected to reduce the likelihood of spreading weeds.
- Development and implementation of site controls for alien invasive plants.
- Dust suppression measures (e.g. water sprinkling) at all dust generating sites (e.g. haul roads, access roads, and waste dumps) (Holtec, 2015a).
The following mitigation measures will be implemented during the operational phase of the Project:

- Implementation of the site controls for alien invasive plants.
- Environmental education training program, including refresher sessions, for all employees, contractors and families surrounding the Project site.
- Dust suppression measures (e.g. water sprinkling) at all dust generating sites (e.g. haul roads, access roads, and waste dumps) (Holtec, 2015a).

**Decommissioning**

The following mitigation measures will be implemented during the decommissioning phase of the Project:

- Implement the Closure Plan.
- Sequential rehabilitation to be conducted as soon as possible at the completion of operation.
- The areas degraded during the pre-construction and construction phases shall be restored to their natural, pre-construction condition.
- Dust suppression measures (e.g. water sprinkling) at all dust generating sites (e.g. haul roads, access roads, and waste dumps).
- Afforestation and plantation of local species in areas degraded during the pre-construction, construction and operation phases of the Project (Holtec, 2015a).

**9.13.5 Monitoring and Reporting**

The following monitoring and reporting requirements will be implemented for the Project.

**Pre-construction and Construction**

The total area of vegetation cleared during the pre-construction and construction phase will be recorded.

**Operation**

Weed hygiene practices will be adopted to reduce spread of weed seeds, and weed control. New areas of weed colonization will be recorded and monitored following implementation of the appropriate management/control measures.

**Decommissioning**

Weed hygiene practices will be adopted to reduce spread of weed seeds, and weed control. New areas of weed colonization will be recorded and monitored following implementation of the appropriate management/control measures.
Figure 9-8 Dust control truck

The total area of re-vegetation and the species used for rehabilitation will be recorded and monitored for a period of 5 years following decommissioning.

**9.14 Wetlands**
There are no wetlands within or adjacent to the Project site.

**9.15 Mangroves**
There are no mangroves within or adjacent to the Project site.

**9.16 Fauna (Terrestrial)**

**9.16.1 Management Objectives**
The key objectives for the management of terrestrial fauna are to:
maintain the abundance, diversity, geographic distribution and productivity of native fauna at
the species and ecosystem levels through the avoidance or management of adverse impacts.

9.16.2 Applicable Standards and Legislation

There has been no national mapping of fauna habitats in Timor-Leste and relatively few published
fauna surveys making it difficult to place survey results into a regional or national context.

Therefore, the IUCN and the Convention on International Trade in Endangered Species (CITES) has
been used as the local standard for assessing the impact on terrestrial fauna.

The IUCN Red List of Threatened Species™ provides taxonomic, conservation status and distribution
information on plants, fungi and animals that have been globally evaluated using the IUCN Red List
Categories and Criteria. This system is designed to determine the relative risk of extinction, and the
main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are
facing a higher risk of global extinction.

The following legislation and regulations are applicable to the environmental protection and
biodiversity conservation in Timor-Leste:

- Law No. 5, 1990 on Conservation of Biological Resources and their Ecosystems;
- Law No. 5, 1994 Concerning Biodiversity;
- Government Regulation No. 28, 1985 on Forest Protection;
- Government Regulation No. 51, 1993 on Environmental Impact Analysis;
- United Nations Transitional Administration in East Timor Regulation No. 2000/17; and

9.16.3 Impact Assessment

The full Baucau Cement Clinker Plant Vegetation and Fauna Survey Report (Trainor & Easton, 2015)
is provided in Appendix 5.

Pre-construction and Construction

The activities which will likely lead to impacts on terrestrial fauna during the pre-construction and
construction phases of the Project include site clearing, levelling, blasting and excavation. Potential
impacts to terrestrial fauna may include:

- Direct loss of habitat through vegetation clearing;
- Harm/death/displacement of individual IUCN listed species;
- Increased susceptibility of native fauna to predation;
- Soil disturbance and potential refuge destruction for ground dwelling, or cryptic fauna species;
Changes to natural drainage adversely affecting fauna and their habitat;

Changes to understorey and floristic composition may alter the habitat used by particular fauna species;

Potential increase in weed species within and adjacent to the Project site could lead to a change in the fire regime and food resources (i.e. flowers and plants), potentially impacting on resident terrestrial fauna species and habitat; and

Disturbance to landscape movement and fauna activities due to noise, vibration and lightning impacts.

The fauna habitat recorded at the Jetty site consisted of degraded Beach Forest dominated by "Corypha" palm, Coconut Palm ("Cocos nucifera") and Breadfruit ("Artocarpus" sp.) with weedy or bare understorey and is considered to have low to moderate fauna habitat quality due to extensive disturbance (Trainor & Easton, 2015).

Approximately 30 Indonesian Short-nosed Fruit Bat ("Cynopterus titthaecheilus") were recorded roosting under "Corypha" palm fronds and nine of the 10 insectivorous microbat species were recorded at the Jetty site. The Timor Inornate Bronzeback snake ("Dendrelaphis inornatus") was observed in the leaf litter at the Jetty site (Trainor & Easton, 2015).

The fauna habitat at the Cement Plant site consisted predominantly of open woodland, mainly dominated by "Eucalyptus alba" or mixed woodland with "Schleichera oleosa" with a grassy or weedy ground cover. Overall it is considered to have relatively low to moderate fauna habitat quality because it lacked Closed Tropical Forest and exhibited extensive disturbance from grazing (Trainor & Easton, 2015).

The only globally ‘Near Threatened’ species recorded in the Cement Plant site was Cinnamon-banded Kingfisher ("Halcyon australasia") which is generally considered a Closed Tropical Forest specialist, but can also use "Eucalyptus alba" savanna woodland. Otherwise highly generalized fauna were recorded including open country-woodland birds such as Barred Dove ("Geopelia maugueus"), Streak-breasted Honeyeater ("Meliphaga reticulata"), the two widespread introduced geckos (Tokay Gecko and House Gecko), flocks of about 35 sheep and several horses (Trainor & Easton, 2015).

Therefore, based on the impact risk assessment the potential impacts to fauna during pre-construction and construction are considered ‘Low’ given presence of one recorded IUCN listed fauna species within the Cement Plant footprint; the fauna habitat is considered to be of low to moderate quality and most fauna species recorded are not sessile and able to move off to undisturbed areas.

**Operation**

Given the majority of the impacts to terrestrial fauna will be associated with clearing of vegetation during the pre-construction and construction phases, it is not anticipated that the operation of the Project will have any significant impacts on terrestrial fauna.
The activities which will likely lead to impacts on terrestrial fauna during the operational phase of the Project include:

- Harm / death / displacement of individual IUCN listed species;
- Increased susceptibility of native fauna to predation;
- Soil disturbance and potential refuge destruction for ground dwelling, or cryptic fauna species;
- Changes to natural drainage adversely affecting fauna and their habitat;
- Potential increase in weed species within and adjacent to the Project site could lead to a change in the fire regime, potentially impacting on resident terrestrial fauna species and habitat;
- Disturbance to landscape and movement of fauna activities due to noise, vibration and light spill impacts.

Therefore, the potential impacts to terrestrial flora during operations of the Project are considered ‘Low’.

Decommissioning

Given the majority of the impacts to terrestrial fauna will be associated with clearing of vegetation during the pre-construction and construction phase, it is not anticipated that the decommissioning of the Project will have any significant negative impacts on terrestrial fauna. The main potential impacts associated with decommissioning are indirect loss of native vegetation through:

- Dust deposition;
- Depletion of water sources (surface and/or groundwater);
- Contamination of water sources (surface and/or groundwater), and soil;
- Soil erosion; and
- Weed invasion e.g. Lantana camara.

The decommissioning phase of the Project will likely see some positive impacts for terrestrial fauna as the areas cleared for the construction and operation are rehabilitated and restored to current land use. Refer to Section 9.16.4 [Mitigation Measures] and the Mine Closure Plan (Holtec, 2015a) for further details on the rehabilitation and closure plan strategy.

Therefore, the potential impacts to terrestrial fauna during decommissioning of the Project are considered ‘Low’.

9.16.4 Mitigation Measures

Pre-construction and Construction
The following mitigation measures will be implemented for the pre-construction and construction phase of the Project:

- Minimise the disturbance footprint as far as practicable.
- Undertake stripping and stockpiling of vegetation and topsoil for reuse in the decommissioning and rehabilitation phase.
- Preserve topsoil for rehabilitation by stripping soil during construction, so native seed stock can be maintained.
- Site clearing will be conducted sequentially.
- Develop and implement the Mine Closure Plan.
- Topsoil to be stock piled separately from overburden/interburden for rehabilitation purposes and protected against loss of run-off.
- All employees and contractors will be required to complete an environmental education training program, including refresher sessions.
- Prior to site entry all vehicles, plant and equipment will be cleaned down and inspected to reduce the likelihood of spreading weeds.
- Development and implementation of site controls for alien invasive plants.
- Dust suppression measures (e.g. water sprinkling) at all dust generating sites (e.g. haul roads, access roads, and waste dumps).
- Sessile fauna, if present, at construction sites to be relocated by ecological experts prior to commencement of site clearing and construction.
- Site clearing to be conducted sequentially and from one corner of the site to the other, enabling highly mobile fauna species to leave the construction area (Holtec, 2015a).

Operation

The following mitigation measures will be implemented during the operational phase of the Project:

- Implementation of the BAP.
- Implementation of the site controls for alien invasive plants.
- Environmental education training program, including inductions and refresher sessions, for all employees, contractors and families surrounding the Project site.
- Dust suppression measures (e.g. water sprinkling) at all dust generating sites (e.g. haul roads, access roads, and waste dumps) (Holtec, 2015a).

Decommissioning
The following mitigation measures should be implemented during the decommissioning phase of the Project:

- Implement the Mine Closure Plan.
- Sequential rehabilitation to be conducted as soon as possible at the completion of operation.
- The areas degraded during the pre-construction and construction phases shall be restored to their existing land use condition.
- Dust suppression measures (e.g. water sprinkling) at all dust generating sites (e.g. haul roads, access roads, and waste dumps).
- Afforestation and planation of local species in areas degraded during the pre-construction, construction and operation phases of the Project (Holtec, 2015a).

**9.16.5 Monitoring and Reporting**

The following monitoring and reporting requirements will be implemented for the Project:

**Pre-construction and Construction**

The total area of vegetation cleared during the pre-construction and construction phase should be recorded.

Any incidents of fauna injury and death should be recorded.

**Operation**

Weed hygiene practices should be adopted to reduce spread of weed seeds, and weed control. New areas of weed colonization should be recorded and monitored following implementation of the appropriate management/control measures.

**Decommissioning**

Weed hygiene practices should be adopted to reduce spread of weed seeds, and weed control. New areas of weed colonization should be recorded and monitored following implementation of the appropriate management/control measures.

The total area of re-vegetation and the species used for rehabilitation should be recorded and monitored for a period of 5 years following decommissioning.

**9.17 Marine Fauna including Fisheries**

**9.17.1 Management Objectives**

The key objectives for the management of marine fauna (including fisheries) are to:
9.17.2 Applicable Standards and Legislation

The following Timor-Leste legislation and international standards may be applicable in relation to marine fauna:

- Law No. 5, 1990 on Conservation of Biological Resources and their Ecosystems.
- Law No. 5, 1994 Concerning Biodiversity.
- Government Regulation No. 28, 1985 on Forest Protection.
- UNTAET Regulation No. 2000/19 on protected places (30 June 2000) was established for the purpose of protecting designated areas, endangered species, wetlands, mangrove areas, historic, cultural and artistic sites, conservation of biodiversity and protection of the biological resources of East Timor. Fifteen natural areas were protected under this regulation and have been designated as Protected Natural Areas (PNAs). The majority comprise primary forest areas, coral reefs, mangroves, wetland habitat and mountain summits above 2000 m.
- The International Convention for the Control and Management of Ships’ Ballast Water and Sediments (IMO 2004) provides standards and requirements for the control of marine pest translocation in ships ballast.
- At present there is no international convention for the management of biofouling, however the Australian government has developed a National System for the Prevention and Management of Marine Pest Incursions (NSPM MPI, 2009).

9.17.3 Impact Assessment

Pre-construction

Potential impacts on marine fauna associated with the pre-construction activities for the MOF and Jetty may include:

- Construction and operation of the MOF is likely to have an impact on local fish populations and invertebrates. The MOF is located in an area of hard substrate which contains a high
percentage of hard and soft corals. These corals provide habitat and food sources for fish and invertebrates. The total footprint of the MOF is 0.23 ha.

- The fish caught in the Project site are typical of reef associated species either living within the coral matrix or swimming in the water column above. There may be local short-term disturbance of the fish community that inhabit the coral reef areas directly impacted by the Project.

- The pre-construction phase incorporating the construction of the MOF will have a moderate impact on marine fauna and fisheries, with a permanent destruction of hard and soft coral habitat within the MOF footprint.

- The pre-construction phase impact on marine mega fauna is expected to be localized and short term and therefore ‘Low’, with mitigation measures required to address the potential impact of pre-construction activities on migration pathways and foraging or feeding areas for megafauna.

### Construction

Potential impacts on coastal and marine waters associated with the construction activities for the MOF and Jetty may include:

- The Jetty and shipping operations has the potential to affect marine life and marine habitats, including fish and marine fauna.

- There is also the potential for noise impacts during construction related to the operation of heavy equipment and vehicles. There may be vibration impacts as well during construction resulting from pile-driving and earth compaction. Marine fauna will be driven out of the local area by the noise and vibration associated with construction. The marine fauna impact from noise is ‘Low’ and readily mitigated.

- Construction of the Jetty is likely to have an impact on local fish and invertebrates. The Jetty is located in an area consisting of mostly sand, rock and rubble. The majority of the hard and soft coral communities growing in the broader survey area are located on rocky outcrops to the north and south of the proposed Jetty footprints. The location of the proposed Jetty footprint is ideally positioned to have minimal direct impact upon the hard and soft coral communities in the survey area.

- Loss of a small area of coral reef habitat in the Jetty footprint is considered minor and of little ecological impact. Large areas of similar fringing coral reef will be unaffected at the local and regional scale outside of the Project footprint. The construction of the Jetty in the long term is likely to create a fish and coral habitat (e.g. pylons) which will add to the current fish abundance and diversity (WorleyParsons, 2015).

- The construction impact on marine megafauna is ‘Low’, because the record of a turtle identified near the coast adjacent to Laga has not been specified as a nesting beach or rookery (Dethmers, K., et al., 2012). The impacts on marine megafauna can be mitigated through
implementing best practices with respect to the timing and methods for construction, blasting, piling and sediment-disturbance activities.

**Operation**

Potential impacts on coastal and marine waters associated with the operational activities for the MOF and Jetty may include:

- It is expected that the vessel movements during the Project operation will have a ‘**Low**’ impact on marine megafauna, however this can be mitigated through the implementation of mitigation, monitoring and management measures for all activities that occur in the ocean and near-shore environment.

- Loading and unloading of vessels at the Jetty is expected to have a ‘**Low**’ impact on marine fauna. Any impacts from spills or accidental discharge will be managed in accordance with the Environmental Management Plan and the associated Emergency Response Plan.

- Potential impacts from working at night on the feeding and nesting behaviour of turtles is expected to be ‘**Low**’ unless the beach where the Jetty is being constructed is confirmed to be a turtle nesting beach. At present, the data indicates that the record was an opportunistic observation not indicating significant nesting activities.

It is expected that there will be some displacement of traditional fishing areas in the vicinity of the Project, specifically where shipping movements increase. However, exclusion areas will be limited and activities are expected to co-exist as they do at Dili Port.

**Decommissioning**

Potential impacts on coastal and marine waters associated with the decommissioning activities for the MOF and Jetty may include:

- It is expected that vessel and heavy machinery movements during the decommissioning will have a ‘**Low**’ impact on marine megafauna, however this can be mitigated through the implementation of mitigation, monitoring and management measures for all activities that occur in the ocean and near-shore environment.

- Decommissioning works associated with the MOF and Jetty are expected to have a ‘**Low**’ impact on marine fauna. Any impacts from spills or accidental discharge will be managed in accordance with the Environmental Management Plan and the associated Emergency Response Plan.

**9.17.4 Mitigation and Measures**

**Pre-Construction**

Construction of the MOF will be undertaken in accordance with a Environmental Management Plan which addresses:
Impact on marine megafauna movement from shipping and vehicles in the Project site and waters adjacent to the Project site;

- Impacts from light during night time works in the Project site;
- Vibration and noise impacts from piling, excavating and drilling works;
- Impacts from accidental discharge and spills to the ocean and beach environment; and
- Ballast water management and discharge protocols.

Collection of additional baseline environmental data to confirm the habitat distribution in the Project site along the beach at the Jetty including turtle nesting, seagrass habitat (i.e. dugong feeding areas) and crocodile habitat.

Collection of baseline environmental data pertaining to sea water quality to provide background data for comparison purposes. Water quality is potentially impacted by spills, ballast discharge and sedimentation. Water quality changes have the potential to impact coral health and have indirect impacts on fisheries health, reproduction and numbers.

Identification of water quality reference and impact sites to be sited within and adjacent to the Project impact area.

Water quality background data should include at minimum measurements for: pH, salinity, turbidity, chlorophyll-a, total phosphorous, filterable reactive phosphate, total nitrogen, oxides of nitrogen, ammonium and dissolved oxygen (Table 3.3.4 Tropical Australia, ANZECC 2000).

**Construction**

Construction of the Jetty and operations of the MOF will be undertaken in accordance with a Environmental Management Plan which addresses:

- Impact on marine megafauna movement from shipping and vehicles in the Project site and waters adjacent to the Project site;
- Impacts from light during night time works in the Project site;
- Vibration and noise impacts from piling, excavating and drilling works;
- Impacts from accidental discharge and spills to the ocean and beach environment; and
- Ballast water management and discharge protocols.

Project scheduling to limit shipping movements during the key mammal migration period typically June, August and November annually, particularly in November of each year. This is to minimize the potential direct impact of vessels on mammals in the Wetar Strait.

**Operation**
Operations of the Jetty and MOF will be undertaken in accordance with an Environmental Management Plan which addresses:

- Impact on marine megafauna movement from shipping and vehicles in the Project site and waters adjacent to the Project site;
- Impacts from light during night time works in the Project site;
- Vibration and noise impacts from piling, excavating and drilling works;
- Impacts from accidental discharge and spills to the ocean and beach environment; and
- Ballast water management and discharge protocols.
- Project scheduling to limit shipping movements during the key mammal migration period typically June, August and November annually, particularly in November of each year. This is to minimize the potential direct impact of vessels on mammals in the Wetar Strait.

Decommissioning

Decommissioning of the Jetty and MOF will be undertaken in accordance with an Environmental Management Plan which addresses:

- Impact on marine megafauna movement from shipping and vehicles in the Project site and waters adjacent to the Project site;
- Impacts from light during night time works in the Project site;
- Vibration and noise impacts from piling, excavating and drilling works;
- Impacts from accidental discharge and spills to the ocean and beach environment; and
- Ballast water management and discharge protocols.

9.17.5 Monitoring and Reporting

Pre-construction and Construction

Deploying and training Marine Mammal Observers (MMOs) to work in the Project site during the key migration period for large mammals. This period is typically June, August and November annually (Dethmers, K., et al, 2012). Data to be recorded includes type, number and distribution of marine mammals and other fauna.

Monthly collation of marine fauna records to summarise trends in distribution of large marine fauna in the Project site.

Regular community engagement surveys of subsistence fishers to determine if there have been any changes in their behavior and location of fishing areas as a result of the Project.
Annual review and reporting of coral habitats around the Jetty and MOF with a survey of coral health, sedimentation and fisheries.

Collection of water quality measurements at reference and impact sites to be sited within and adjacent to the Project impact area. Measurements are to be taken at least twice per calendar year, outside of and during the monsoon season.

**Operation**

Deploying and training Marine Mammal Observers (MMOs) to work in the Project site during the key migration period for large mammals. This period is typically June, August and November annually (Dethmers, K., et al, 2012). Data to be recorded includes type, number and distribution of marine mammals and other fauna.

Monthly collation of marine fauna records to summarise trends in distribution of large marine fauna in the Project site.

Regular community engagement surveys of subsistence fishers to determine if there have been any changes in their behavior and location of fishing areas as a result of the Project.

Annual review and reporting of coral habitats around the Jetty and MOF with a survey of coral health, sedimentation and fisheries.

Collection of water quality measurements at reference and impact sites to be sited within and adjacent to the project impact area. Measurements are to be taken at least twice per calendar year, outside of and during the monsoon season.

**Decommissioning**

Post-decommissioning survey of marine fauna to summarise trends in distribution of large marine fauna in the Project site post-closure.

Post-decommissioning survey of coral habitats around the former site of the Jetty and MOF with a survey of coral health, sedimentation and fisheries.

### 9.18 Marine Habitats including Corals

#### 9.18.1 Management Objectives

The key objectives for the management of marine habitats (including corals) are to:

- Maintain the integrity, ecological functions and environmental values of the marine environment
- Minimise the impact on marine habitats including corals from the jetty and MOF.
9.18.2 Applicable Standards and Legislation

The following Timor-Leste legislation and international standards may be applicable in relation to climate and greenhouse gas emissions:

- Law No. 5, 1990 on Conservation of Biological Resources and their Ecosystems.
- Law No. 5, 1994 Concerning Biodiversity.
- Government Regulation No. 28, 1985 on Forest Protection.
- UNTAET Regulation No. 2000/19 on protected places (30 June 2000) was established for the purpose of protecting designated areas, endangered species, wetlands, mangrove areas, historic, cultural and artistic sites, conservation of biodiversity and protection of the biological resources of East Timor. Fifteen natural areas were protected under this regulation and have been designated as Protected Natural Areas (PNAs). The majority comprise primary forest areas, coral reefs, mangroves, wetland habitat and mountain summits above 2000 m.
- The International Convention for the Control and Management of Ships’ Ballast Water and Sediments (IMO 2004) provides standards and requirements for the control of marine pest translocation in ships ballast.
- At present there is no international convention for the management of biofouling, however the Australian government has developed a National System for the Prevention and Management of Marine Pest Incursions (NSPMMP, 2009).
9.18.3 Impact Assessment

Pre-construction

A Material Offloading Facility (MOF) is required for the Project in order to bring in materials, equipment and plant parts. The location of the MOF footprint overlaps with an area of hard substrate which will contain a high percentage cover of hard and soft corals. The area to be impacted by the MOF is 0.23 ha. The impact is permanent and local and therefore is ‘Medium’.

The movement of ships and machinery within the project footprint has the potential to introduce marine pests and disease which impacts coral health. The impact is deemed to be low and readily mitigated through implementation of the Environmental Management Plan.

Construction

A Jetty is proposed at a distance of 2 km from the Cement Plant site. The Jetty will unload inbound material including coal, gypsum, and iron ore from 8000 deadweight ton (DWT) barges. The hard coral community in the Jetty footprint can be described as sparse and is primarily located in the northern section. The coral cover at the two other sites directly in the Jetty footprint was estimated at >10 – 20 % cover. Only a small area of the footprint has areas of soft coral. [WorleyParsons, 2015]

The total area impacted by the Jetty footprint is 1.5 ha.

The movement of ships and machinery within the Project footprint has the potential to introduce marine pests and disease which impacts coral health. The impact is deemed to be low and readily mitigated through implementation of the Environmental Management Plan.

Loading and unloading of vessels at the Jetty is expected to have a ‘Low’ impact on corals and marine habitats. Any impacts from spills or accidental discharge will be managed in accordance with the Environmental Management Plan and the associated Emergency Response Plan.

Operation

The movement of ships and machinery within the Project footprint has the potential to introduce marine pests and disease which impacts coral health. The impact is deemed to be ‘Low’ and readily mitigated through implementation of the Environmental Management Plan.

Loading and unloading of vessels at the Jetty is expected to have a low impact on corals and marine habitats. Any impacts from spills or accidental discharge will be managed in accordance with the Environmental Management Plan and the associated Emergency Response Plan.

Decommissioning

The removal of existing infrastructure has the potential to impact the corals which have established during the operations phase. The impact on corals and marine habitat from decommissioning compared to the pre-construction condition is expected to be ‘Low’.

It will not be possible to restore the hard and soft corals in the MOF footprint to the previous condition, however the closure plan should consider retaining hard substrate e.g. foundations and retaining...
walls in situ to encourage colonization post-decommissioning. The feasibility should be assessed during the planned reviews of the closure plan. The impacts from MOF decommissioning on marine habitat is expected to be ‘Low’.

9.18.4 Mitigation Measures

Pre-construction
Develop and implement a Environmental Management Plan and the associated Emergency Response Plan which incorporates:

- Ballast water management and Introduced Marine Pests monitoring and controls;
- Identification of coral locations on engineering drawings and construction plans; and
- Identification of impact zone sites, nearby sites and reference (background) sites for the coral health monitoring program.

Construction
Develop and implement a Environmental Management Plan and the associated Emergency Response Plan which incorporates:

- Ballast water management and Introduced Marine Pests monitoring and controls;
- Identification of coral locations on engineering drawings and construction plans; and
- A schedule for monitoring, recording and reporting on coral health.

Operation
Develop and implement an Environmental Management Plan and the associated Emergency Response Plan which incorporates:

- Ballast water management and Introduced Marine Pests monitoring and controls;
- Identification of coral locations on engineering drawings and construction plans; and
- A schedule for monitoring, recording and reporting on coral health.

Decommissioning
Implement the Environmental Management Plan and the associated Emergency Response Plan which incorporates:

- Ballast water management and Introduced Marine Pests monitoring and controls;
- Identification of coral locations on engineering drawings and construction plans; and
- Management of waste materials during decommissioning.
9.18.5 Monitoring and Reporting

Pre-construction

Identify and tag (e.g. set up quadrats or transect locations) for impact zone sites, nearby sites and reference (background) sites for the monitoring network around the MOF and the Jetty. Key hard and soft coral sites are located between the Jetty and the beach, to the south-east.

Undertake a pre-construction survey of the identified sites to develop the reference imagery and GPS database.

Reporting and recording of baseline coral health monitoring data.

Construction

Undertake a post-construction survey of the identified sites to compare the coral health to the reference imagery and GPS database.

Reporting and recording of post-construction coral health monitoring data.

Make recommendations on the frequency of operations coral health surveys.

Develop the Environmental Management Plan to incorporate any recommendations from the post-construction survey.

Operation

Undertake regular, scheduled surveys of the identified sites to compare the coral health to the reference imagery and GPS database. The frequency should be confirmed during the construction phase.

Reporting and recording of post-construction coral health monitoring data.

Updating the Environmental Management Plan to incorporate any recommendations from the post-construction survey.

Decommissioning

Undertake post-decommissioning survey of the identified sites to compare the coral health to the reference imagery and GPS database.

Reporting and recording of post-decommissioning coral health monitoring data.

9.19 Traffic and Transport

9.19.1 Management Objectives

The key objectives for the management of traffic and transport impacts are to:
To protect the amenity and safety of nearby residents from potential impacts resulting from increased traffic and transport activities associated with the development of the Project; and

Minimise disturbance to local traffic and ensure road safety is not compromised by the development of the Project.

9.19.2 Applicable Standards and Legislation

There are no relevant standards or legislation currently in Timor-Leste applicable for traffic and transport.

9.19.3 Impact Assessment

A Traffic Impact Assessment (BBS, 2015c) for the Project was undertaken. The assessment included:

- Review of the existing transport network;
- Traffic counts at six locations (Figure 3 in Appendix 6);
- Spot speed calculations at four locations (Figure 3 in Appendix 6); and
- Traffic modelling to determine potential impacts associated with the construction and operation of the Project.

The full Traffic Impact Assessment Study of Clinker Cement Project Report (BBS, 2015c) is provided in Appendix 6.

It should be noted that the Traffic Impact Assessment Report (BBS, 2015c) excludes impacts associated with ship movements and aviation.

The Traffic Impact Assessment Study Report (BBS, 2015c) noted that the existing condition of roads in the network:

- lack road furniture (i.e. lighting, road markings, signage and barriers);
- are narrow with an average width of 5 meters, with unpaved shoulders and some shoulders are covered by plantation and no side ditch;
- all intersections are uncontrolled i.e. no road marking, or signage;
- the geometric substandard design indicated by:
  - small radii curvatures;
  - short lateral clearances; and
  - high gradient (steep-upgrade and downgrade).
Pre-construction

Based on the risk assessment the potential impacts to transport and traffic during the pre-construction phase are deemed to be 'Low' owing to the short-term, and localised nature of the impacts.

Construction

The construction of the Project will see an increase in the number of vehicles (particularly heavy vehicles) movements within the Project site and beyond. The potential impacts during construction phase mainly relate to the following activities:

- Daily mobilization of heavy vehicles transporting construction material; and
- Occasional daily mobilization of workers not housed on site from Baucau to the Cement Plant.

The increase in heavy vehicle numbers and movements is likely to cause damage to the condition of the local road network and also poses a safety risk for the local population.

It is predicted that construction activities will result in additional traffic flow from Dili to the Project site and between Baucau and the Project site. During construction of the Cement Plant it was assumed that transportation for 1,000 persons per day will be required from Baucau to the Plant. Additional traffic flows are associated with the mobilization of heavy vehicles transporting construction materials. Table 35 below outlines the predicted additional traffic flows during the construction of the Project (BBS, 2015c).

Table 35: Construction Phase - Additional Traffic Flow (BBS, 2015c)

<table>
<thead>
<tr>
<th>Origin – Destination</th>
<th>Vehicle Type</th>
<th>pcu1 value</th>
<th>Additional Traffic Flow (pcuph2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baucau city – Clinker Plant</td>
<td>MB3</td>
<td>2.4</td>
<td>102</td>
</tr>
</tbody>
</table>

Notes:

1. pcu = passenger car unit
2. pcuph = passenger car unit per hour
3. MB = medium bus with capacity of 20-26 seats

The volume capacity ratio indicates that the road network has capacity to accommodate the additional vehicles required during the construction phase (BBS, 2015c)

Based on the risk assessment the potential impacts to transport and traffic during the construction phase are deemed to be 'Low' owing to the short-term, and localised nature of the impact.

Operation

The operation of the Project will see an increase in the number of vehicles (particularly heavy vehicles) and vehicle movements within the Project site and beyond. The potential impacts during operation phase mainly relate to the following activities:
Transportation of the finished product (cement) from the plant to the local market in Baucau; and

Daily mobilization of workers not housed on site from Baucau to the Cement Plant and Limestone Mine.

The increase in heavy vehicle numbers and movements is likely to cause damage to the condition of the local road network and also poses a safety risk for the local population.

Up to 0.5 Mtpa of the finished product (cement) will be transported from the plant to Baucau. If using 10 tonne trucks, it could generate approximately 10 truck trips per day (330 day, 12 hours per day), which translates to an additional traffic flow of 12 pcuph.

It was assumed during the model development, that the 700 people employed for the operation of the Project will be living in Baucau. If they are transported by a medium sized bus (with a capacity of 20 passengers), it is anticipated that the increase in traffic between the Cement Plant and Baucau city will be 71 pcuph (BBS, 2015c).

Although further design information indicates that the majority will be housed on site and no travel from Baucau will be required, the results from the model indicate the worst case scenario for traffic increase.

Table 36 below outlines the predicted additional traffic flows for the operational phase of the Project.

Table 36: Operational Phase - Additional Traffic Flow (BBS, 2015c)

<table>
<thead>
<tr>
<th>Origin – Destination</th>
<th>Vehicle Type</th>
<th>pcu1 value</th>
<th>Additional Traffic Flow (pcuph2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baucau city – Clinker Plant</td>
<td>MB3</td>
<td>2.4</td>
<td>71</td>
</tr>
<tr>
<td>Baucau – Dili (finished product)</td>
<td>MHV4</td>
<td>2.4</td>
<td>12</td>
</tr>
</tbody>
</table>

Notes:
1. pcu = passenger car unit
2. pcuph = passenger car unit per hour
3. MB = medium bus with capacity of 20-26 seats
4. MHV = medium heavy vehicle such truck with 4 or 6 wheels

Based on the risk assessment the potential impacts associated with the increase of transport and traffic during the operation of the Project is deemed to be 'Medium', owing to the longer-term regional impact.

Decommissioning

Based on the risk assessment the potential impacts to transport and traffic during the decommissioning phase are deemed to be 'Low' owing to the short-term, and localised nature of the impact.
9.19.4 Mitigation Measures

Traffic impacts associated with the construction and operation of the Project can be adequately managed if the following mitigation measures are adopted and implemented:

- Minimising vehicle movement – good planning and scheduling can limit the number of vehicle movements required which will reduce the likely impacts to the condition of the roads and public safety.
- Limit vehicle reversing, as it is major cause of fatal accidents. Implementation of one-way systems, ensuring reversing sensor/alarms are installed on all vehicles and mobile equipment and signage in reversing areas can reduce the risk of reversing accidents.
- Traffic signage – all traffic signage will be clearly and prominently displayed in well-lit areas. Signage will be posted to indicate speed limits, restricted access, visitor parking, headroom, and other route hazards.
- Speed limits will be implemented and enforced.
- Road widening may be required as a minimum road width of 6.5 meters is recommended for heavy vehicles (BBS, 2015c).

9.20 Employment

The following section provides a brief overview of the potential impacts and mitigation measures associated with employment. Section 10 [Social Impact and Economic Assessment] provides greater detail on the potential impacts relating social and economic impacts.

9.20.1 Management Objectives

The key objectives for the management of employment are to ensure:

- To maximise local employment opportunities throughout all phases of the Project
- Prospective employees are provided with the necessary and appropriate skills training for employment opportunities during all phases of the Project;
- The expectation of employment is not over inflated and clearly outlined to the locals, thereby minimising any potential conflicts/discourse amongst the local populace; and
- Existing employment sectors/source of livelihood are not adversely impacted.

9.20.2 Applicable Standards and Legislation

The following standards and legislation are applicable to employment:

9.20.3 Impact Assessment

Pre-construction

The plan for the development of the Project has raised great expectations amongst the local residents. The greatest expectation being the creation of new employment opportunities and the recruitment of a large number of workers for a relatively long-term period (BBS, 2015d).

It is likely the employment opportunities for the pre-construction activities will be significantly less than those for the construction and operational phases. The period of employment is also expected to be for a short-term period. It is likely that any potential impacts will be positive for the community and their livelihoods, as the Project will provide the opportunity for skill development and training. Therefore, the risk assessment determines the potential impacts associated with employment during the pre-construction phase is considered to be ‘Low’.

Construction

The primary positive impact of the Project is the opportunity of employment and training / skill development. As discussed in Section 4 [Project Description], the employment opportunities associated with the construction of the Project are expected to be in the order of 3,000 persons. Local business are also likely to benefit during the construction phase, as a result of increased trade.

While the development of the Project will predominately result in positive impacts for the employment sector, there is also the potential for some negative impacts, namely:

- Potential conflicts associated with allocation / distribution of employment opportunities amongst local villages and administrative sub-units.
- Potential conflicts associated with expectations and reality of pay scales and employment terms.
- Loss of monetary income with termination of employment at the end of the construction, stage and subsequent adjustment of lifestyle with the loss of income (BBS, 2015d).

The risk assessment classifies the potential impacts associated with employment during the construction phase to be ‘Low’, as the primary impact will be positive with the employees being offered the opportunity for skill development and training.

Operation

As discussed in Section 4 [Project Description], the employment opportunities associated with the operation of the Project are expected to be in the order of 1,000 persons.

Given the relatively high pay and long-term period (17 years) it is likely that employee recruitment for the operational phase is probably going to be more sensitive than for any other phase of the Project. The recruitment of employees in the formal sector ten to raise suspicions about nepotism (BBS, 2015d).
As with the conclusion of the construction activities, termination of the operational employment at the end of the life of the Project (approximately 50+ years) will see a stop to cash income. If not adequately planned for this could lead to difficulties for the local population as they struggle to adjust to the low productivity of the traditional sector (BBS, 2015d).

The risk assessment classifies the potential impacts associated with employment during the operation phase to be ‘Low’, as the primary impact will be positive with the employees being offered the opportunity for skill development and training.

Decommissioning

It is likely the employment opportunities during the decommissioning phase will be significantly less than those for the construction and operational phases. The period of employment is also expected to be for a short-term period. It is likely that any potential impacts will be positive impacts for the community and their livelihoods as the project will provide the opportunity for skill development and training. Therefore, the risk assessment determines the potential impacts associated with employment during the decommissioning phase is considered to be ‘Low’.

9.20.4 Mitigation Measures

Pre-Construction, Construction, Operation and Decommissioning

TL Cement should continue to engage with community and other stakeholders as identified in the EIS public consultation throughout the life of the project.

It is recommended that the selection and management of employee applications should be handled by a specialist employee management institution formed through a consultative process with sub-district and suco leadership, thereby removing the need for an external business partner (BBS, 2015d).

The formation of the institution should ideally involve youth groups representing their sucos. The institution should handle relations with formal leaderships, managements, coordinators and supervisors and receive complaints from the community about unfair treatment (i.e. a Grievance Mechanism). The institute should also play the role of coordinator, opportunity distributor and negotiator over pay scales and employment terms. Setting up this institute will be a crucial element in building a synergistic relationship with local stakeholders (BBS, 2015d).

To mitigate the possible negative impacts associated the loss of cash income with the termination of employment, the locals should be encouraged to utilise the cash income, during employment, for investments that will assist with increasing productivity of the local agricultural sector (BBS, 2015d).
9.21 Infrastructure

9.21.1 Management Objectives

The key objectives for infrastructure are to ensure:

- Upgrades to existing or construction of new infrastructure for the Project are designed and built fit for purpose; and
- Existing infrastructure are not adversely impacted by the development and operation of the Project.

9.21.2 Applicable Standards and Legislation

There are currently no relevant standards or legislation application to infrastructure in Timor-Leste.

9.21.3 Impact Assessment

It is considered that the development of the Project will have a long term beneficial impact on the local communities and economy in terms of social infrastructure development. Infrastructure such as roads, seaport, water and electricity are expected to enhance socio-economic development in the area, through job creation and increase in commercial activities.

Pre-construction and Construction

During the pre-construction and construction phase it is likely there will be an increased pressure on existing infrastructure due to Project related influx. However, the development of the Project will also result an improvement to the local infrastructure with the upgrading of existing and development of new infrastructure to cater for the operation of the Project.

Therefore, the risk assessment classifies the potential impacts to infrastructure during the pre-construction and construction phase to be ‘Low’, as the primary impact will be positive with the development of new and improvement of existing infrastructure.

Operation

During the operational phase of the Project there will be a requirement for ongoing monitoring and maintenance for all associated infrastructure. The potential impacts to infrastructure during the operational phase will associated with deterioration and depreciation through usage.

Therefore, the risk assessment classifies the potential impacts to infrastructure during the operation phase to be ‘Low’.
Decommissioning

The risk assessment classifies the potential impacts to infrastructure during the decommissioning phase to be ‘Low’, as certain infrastructure assets are retired and decommissioned or ownership is transferred to local administrative entities.

9.21.4 Mitigation Measures

Pre-construction and Construction

The Project Proponent will identify and prioritise the upgrades and construction of new infrastructure required for the construction and operation of the Project (e.g. water treatment and wastewater facilities; roads and accommodation facilities).

Operation

Ongoing inspection, monitoring and maintenance programmes will be developed and implemented for the relevant infrastructure during the operational phase of the Project to ensure optimal operation.

Decommissioning

The following measures will be implemented for the decommissioning of infrastructure, which is not transferred to a third party or granted permission from statutory bodies to remain for the socio-economic development of the region:

- Refurbish existing infrastructure like mine office, workshop, stores and other buildings for use by local community;
- Mining equipment and other machinery with potential resale or scrap value will be removed;
- Remaining equipment will be drained of all lubricants, hydraulic oils, fuels and other process reagents and disposed of as hazardous waste;
- Buildings to be demolished and rubble to be placed into the base of the mine. Specific demolition requirements include:
  - All power and water services to be disconnected and certified as safe prior to commencement of any demolition works;
  - All fittings, fixtures and equipment within buildings will be dismantled and removed to designated temporary disposal yards;
  - All above ground electrical, water and other service infrastructure and equipment to be removed and replaced and placed in disposal pits or the designated temporary salvage yards;
  - All pipes and structures deeper than 400 mm need to be sealed to prevent possible ingress and ponding of water;
o All concrete below 400 mm depth will remain underground with the invert of all structures broken/sealed to prevent possible ingress and ponding of water;

o All subsurface cavities such as reinforced concrete tunnels under septic tanks will be backfilled;

o All water tanks not required for closure activity will be demolished and rubble placed at the base of the quarry. Once water is no longer required on site, the remaining tanks will also be demolished

• Prior to decommissioning and closure, consultation with all stakeholders (relevant authorities, government and local community) regarding the roads to be retained and demolished. Any roads no longer required will be rehabilitated by:

  o Culverts and ducts will be removed;

  o The natural water flow will be restored and any disturbed section of the watercourse will be stabilised and revegetated;

  o Road surfaces, shoulders and embankments will be graded to a slope suitable to prevent erosion;

  o Cuttings will be assessed and where necessary measure to improve safety and erosion stability will be implemented; and

  o Rehabilitated surfaces will be vegetated with a mixture of indigenous species;

• Prior to removal and disposal septic tanks will be emptied and the sludge used as soil ameliorants where needed (Holtec, 2015a).

9.21.5 Monitoring and Reporting

Pre-construction, Construction, Operation and Decommissioning

The following monitoring and reporting of infrastructure will be undertaken during the various phases of the Project:

• Condition of the roads, including the location of and frequency of reparis required.

• Condition of drainage structures, including the location of and frequency of reparis required.

• The Complaints and Grievance records will be regularly reviewed; and

• Prior to decommissioning and closure, consultation with all stakeholders (relevant authorities, government and local community) will be undertaken regarding any infrastructure associated with the Project to be retained and/or demolished.
9.22 Economic Uses of Forest and Other Natural Resources

The following section provides a brief overview of the potential impacts and mitigation measures associated with economic uses of forest and other natural resources. Section 10 [Social Impact and Economic Assessment] provides greater detail on the potential impacts relating social and economic impacts.

9.22.1 Management Objectives

The key objectives for the management of economic uses of forest and other natural resources impacts are to:

- ensure the local communities access to forest and other natural resources for economic usage are not adversely affected with the development of the Project; and
- Maintain the abundance, diversity, geographic distribution and productivity of flora and fauna at the species and ecosystem levels through the avoidance or management of adverse impacts.

9.22.2 Applicable Standards and Legislation

The following standards and legislation may be applicable in relation to the management of economic uses of forest and other natural resources:

- UNTAET Regulation 2000/17 on the Prohibition of Logging Operations and the Export of Wood from East Timor;
- Draft Decree Law on Forest Management, draft 7, received August 2013;
- Draft Decree Law on Biodiversity, dated March 2012;
- United Nations Convention for Biodiversity (1992);
- United Nations Convention to Combat Desertification

9.22.3 Impact Assessment

Pre-construction and Construction

The development of the Project will result in the loss of land for the communities currently utilising the land and coastline. This loss of land and coastline and the resources on it, will place greater pressure and demand on other areas and natural resources. The development of the Cement Plant and Jetty will result in clearing a total of 75.41 ha of vegetation (refer to Section 9.13 [Terrestrial Flora] above), some of which may be utilised by the local communities as a source of commercial firewood. However, as detailed in Section 10 [Social Impact and Economic Assessment] there is no clear
information about the average income of firewood collectors, but each collector can probably earn $10 - $15 per harvesting trip at a price of $0.5 per firewood bundle.

The risk assessment classifies the potential impacts to the economic use of forests and other natural resources during the pre-construction and construction phase to be ‘Medium’, as the potential impacts are short-term (i.e. for the life of the Project) and the Project will provide a positive benefit to the local area with economic diversification.

Operation

The bulk of the impacts to the economic uses of forest and other natural resources will be associated with the pre-construction and construction phase as vegetation is cleared and access to these resources are restricted. Therefore, the risk assessment classifies the potential impacts to infrastructure during the operation phase to be ‘Low’.

Decommissioning

The bulk of the impacts to the economic uses of forest and other natural resources will be associated with the pre-construction and construction phase as vegetation is cleared and access to these resources are restricted.

The decommissioning phase will see the implementation of the Mine Closure Plan, rehabilitation of cleared and degraded area with indigenous species to a pre-constructions state and the possibly of access restrictions being lifted, all of which may be seen as positive impacts for economic uses of forests and other resources.

Therefore, the risk assessment classifies the potential impacts during the decommissioning phase to be ‘Low’.

9.22.4 Mitigation Measures

Pre-construction and Construction

The following mitigation measures should be implemented for the pre-construction and construction phase of the Project:

- Minimise the disturbance footprint as far as practicable.
- Undertake stripping and stockpiling of vegetation and topsoil for reuse in the decommissioning and rehabilitation phase.
- Preserve topsoil for rehabilitation by stripping soil during construction.
- Site clearing to be conducted sequentially.
- Topsoil to be stock piled separately from overburden/interburden for rehabilitation purposes and protected against loss of run-off.
Operation

The following mitigation measures should be implemented during the operational phase of the Project:

- Implementation of the site controls for alien invasive plants (Holtec, 2015a).

Decommissioning

The following mitigation measures should be implemented during the decommissioning phase of the Project:

- Implement the Mine Closure Plan.
- Sequential rehabilitation to be conducted as soon as possible at the completion of operation.
- The areas degraded during the pre-construction and construction phases shall be restored to their natural, pre-construction condition.
- Afforestation and plantation of local species in areas degraded during the pre-construction, construction and operation phases of the Project (Holtec, 2015a).

9.22.5 Monitoring and Reporting

The following monitoring and reporting requirements should be implemented for the Project:

Pre-construction and Construction

The total area of vegetation cleared during the pre-construction and construction phase should be recorded. Operation

Weed hygiene practices should be adopted to reduce spread of weed seeds, and weed control. New areas of weed colonization should be recorded and monitored following implementation of the appropriate management/control measures.

Decommissioning

Weed hygiene practices should be adopted to reduce spread of weed seeds, and weed control. New areas of weed colonization should be recorded and monitored following implementation of the appropriate management/control measures.

The total area of re-vegetation and the species used for rehabilitation should be recorded and monitored for a period of 5 years following decommissioning.

9.23 Fishing

9.23.1 Management Objectives

The key objectives for the management of socio-economic impacts to fisheries are to ensure:
• Local communities’ access to fishing grounds for economic and subsistence use are not adversely affected by the development of the Project;

• Communities near the Project are able to contribute to the protection and maintenance of fishing resources; and

• Project activities will not adversely impact fisheries in the local area in the long term.

9.23.2 Applicable Standards and Legislation

The following standards and legislation may be applicable in relation to the management of fishing resources:

• Draft Decree Law on Biodiversity, dated March 2012;

• United Nations Convention for Biodiversity (1992);


9.23.3 Impact Assessment

Pre-construction

The pre-construction phase includes development of the MOF and site preparations including fencing and establishing access controls. The fisheries survey results indicate that the catch recorded in the vicinity of the MOF and Jetty comprises small fish mainly from the coral reef. Subsistence fishing takes place at between 50 m – 75 m from the beach using rods and nets. There are about 4 - 5 huts located at the beach adjacent to the jetty. The exclusion of community access to the beach at the Jetty is expected to have a ‘Low’ impact on fishing because the restricted access zone on the beach will be no more than 450 m.

Construction

The construction phase includes development of the Jetty with ongoing access controls. The fisheries survey results indicate that the catch recorded in the vicinity of the Jetty comprises small fish mainly from the coral reef. Subsistence fishing takes place at between 50 m – 75 m from the beach using rods and nets. There are about 4 - 5 huts located at the beach next to the jetty. The exclusion of community access to the beach at the Jetty is expected to have a ‘Low’ impact on fishing because the restricted access zone on the beach will be no more than 450 m.

Operation

The operation phase includes operations of the Jetty with ongoing access controls. The exclusion of community access to the beach at the Jetty is expected to have a ‘Low’ impact on fishing during the project operation.
Decommissioning

The decommissioning phase includes removal of the MOF and Jetty with most likely relaxing of access controls. The exclusion of community access to the beach at the MOF Jetty is expected to have a positive impact on fishing during the project decommissioning, with access returning in a controlled manner to minimize risk to health and safety. Therefore, decommissioning activities will have a ‘Low’ impact on fishing.

9.23.4 Mitigation Measures

Pre-construction

The impact on community access to the beach will be mitigated by proposed measures which include:

- Providing alternative access locations,
- Providing safe passage zones across the conveyor corridor crossing the beach between the Jetty and the Cement Plant sites; and
- Ensuring that the timeline for implementation of access controls is communicated to the families who are directly impacted by the access restrictions.

Construction

The impact on community access to the beach during the Project will be mitigated by proposed measures which include:

- Providing alternative access locations,
- Providing safe passage zones across the conveyor corridor crossing the beach between the Jetty and the Cement Plant sites; and
- Ensuring that the timeline for implementation of access controls is communicated to the families who are directly impacted by the access restrictions.

Operation

The impact on community access to the beach during the Project will be mitigated by proposed measures which include:

- Providing alternative access locations,
- Providing safe passage zones across the conveyor corridor crossing the beach between the Jetty and the Cement Plant sites; and
- Ensuring that the timeline for implementation of access controls is communicated to the families who are directly impacted by the access restrictions.
Decommissioning

The impact on community access to the beach during the Project decommissioning will be mitigated by proposed measures which include:

- Providing alternative access locations,
- Providing safe passage zones across the conveyor corridor crossing the beach between the Jetty and the Cement Plant sites; and
- Ensuring that the timeline for removal or modifications to the access controls is communicated to the families who are directly impacted.

9.23.5 Monitoring and Reporting

The impact on fishing is ‘Low’ so monitoring is not recommended as a mitigation measure.

9.24 Socio-Economic Agriculture

The following section provides a brief overview of the potential impacts and mitigation measures associated with socio-economic agriculture. Section 10 [Social Impact and Economic Assessment] provides greater detail on the potential impacts relating social and economic impacts.

9.24.1 Management Objectives

The key objectives for the management of socio-economic agriculture are to:

- Ensure the local communities who have access to the forest and other natural resources for economic usage, are not adversely affected by the development of the Project; and
- Maintain the abundance, diversity, geographic distribution and productivity of flora and fauna at the species and ecosystem levels through the avoidance or management of adverse impacts.

9.24.2 Applicable Standards and Legislation

The following standards and legislation may be applicable in relation to the management of socio-economic uses of forest and other natural resources:

- UNTAET Regulation 2000/17 on the Prohibition of Logging Operations and the Export of Wood from East Timor;
- Draft Decree Law on Forest Management, draft 7, received August 2013;
- Draft Decree Law on Biodiversity, dated March 2012;
- United Nations Convention for Biodiversity (1992);
- United Nations Convention to Combat Desertification;
9.24.3 Impact Assessment

Pre-construction, Construction and Operation

As detailed in Section 5.8 [Description of the Environment] agriculture is the chief occupation of the people in the Project site. The crops being cultivated include peanuts, coconut, corn and vegetables like beans, tomatoes, cassava, potatoes, etc. The important fruit trees are banana and papaya.

The development of the Project will result in clearing a total of 75.41 ha of land (refer to Section 9.13 [Terrestrial Flora] above), and access restriction to certain areas, some of which may be utilised by the local communities for agricultural purposes.

Whilst, the land clearing and access restriction may impact the local socio-economic agricultural system, through land clearing and access restriction; the Project will also provide a positive impact through economic diversification and job creation, which will provide an alternative source of income for the local community.

The risk assessment classifies the potential impacts to socio-economic agriculture during the pre-construction, construction and operation phase to be ‘Low’.

Decommissioning

The bulk of the impacts will be associated with the pre-construction, construction and operational phases as land is cleared and access is restricted.

The decommissioning phase will see, rehabilitation of cleared and degraded area with indigenous species to a pre-constructions state and the possibly of access restrictions being lifted, all of which may be seen as positive impacts for economic uses of the land and other resources.

Therefore, the risk assessment classifies the potential impacts during the decommissioning phase to be ‘Low’.

9.24.4 Mitigation Measures

Pre-construction and Construction

The following mitigation measures will be implemented for the pre-construction and construction phase of the Project to ensure the future viability of the local’s socio-economic agriculture opportunities:

- Minimise the disturbance footprint as far as practicable.
- Undertake stripping and stockpiling of vegetation and topsoil for reuse in the decommissioning and rehabilitation phase.
Preserve topsoil for rehabilitation by stripping soil during construction.
Site clearing to be conducted sequentially.
Topsoil to be stock piled separately from overburden/interburden for rehabilitation purposes and protected against loss of run-off.

**Operation**

**Decommissioning**

The following mitigation measures will be implemented for the decommissioning phase of the Project to ensure the future viability of the local’s socio-economic agriculture opportunities:

- To mitigate the possible negative impacts associated the loss of cash income with the termination of employment, the locals will be encouraged to utilise the cash income, during employment, for investments that will assist with increasing productivity of the local agricultural sector (BBS, 2015d).
- Implement the Mine Closure Plan.
- Sequential rehabilitation to be conducted as soon as possible at the completion of operation.
- The areas degraded during the pre-construction and construction phases will be restored to their natural, pre-construction condition.
- Afforestation and plantation of local species in areas degraded during the pre-construction, construction and operation phases of the Project (Holtec, 2015a).

**9.24.5 Monitoring and Reporting**

The following monitoring and reporting requirements will be implemented for the project:

**Pre-construction and Construction**

The total area of vegetation cleared during the pre-construction and construction phase will be recorded.

**Operation**

Weed hygiene practices will be adopted to reduce spread of weed seeds, and weed control. New areas of weed colonization will be recorded and monitored following implementation of the appropriate management/control measures.

**Decommissioning**

Weed hygiene practices will be adopted to reduce spread of weed seeds, and weed control. New areas of weed colonization will be recorded and monitored following implementation of the appropriate management/control measures.
The total area of re-vegetation and the species used for rehabilitation will be recorded and monitored for a period of 5 years following decommissioning.

9.25 Tourism

While Baucau itself is an important tourism centre in Timor-Leste, the Project location is not considered to be a popular destination for tourism. Therefore, it is not considered that the Project will contribute to Baucau’s role as a tourism centre.

It is unlikely that the development and operation of the Project will adversely or positively impact on tourism to the local area or to Timor-Leste as a whole. Therefore, no impact assessment has been undertaken for this factor as there are likely to be no potential impacts.

9.26 Population and Community

The following section provides a brief overview of the potential impacts and mitigation measures associated with population and community. Section 10 [Social Impact and Economic Assessment] provides greater detail on the potential impacts relating social and economic impacts.

9.26.1 Management Objectives

The key objectives for population and community management are to:

- Ensure a smooth transitioning during relocation as well as during influx of people into Administrative Post of Vemasse and Baucau.
- Minimize potential conflict among locals and between locals and newcomers.

9.26.2 Applicable Standards and Legislation

The following standards and legislation may be applicable in relation to the management of population and community:

- Parliamentary Law 3/2009, Community Leaderships and Their Election; and

9.26.3 Impact Assessment

Pre-construction and Construction

Below are the potential impacts of the pre-construction and construction activities associated with the plant and jetty on population and community:

- There are approximately 3 households near the jetty area that will be directly impacted or may need to be relocated in the plant area near the jetty (BBS, 2015d). The GoTL is responsible for
undertaking resettlement for those families whose homes and farmland are directly affected by the Project construction and operation. TL Cement are working with the GoTL to address resettlement by a separate process to the EIS.

- The local area may experience an influx of people, as they seek employment opportunities associated with the pre-construction and construction phase of the Project.
- There will be potential conflict of interest between sucos within and/or those near the Project area in Baucau Administrative Post.
- Loss of sense of place (visual impact) affecting local communities due to site clearing and construction activities (Holtec, 2015a).

Operation

Below are the potential impacts of the operational activities associated with the plant and jetty on population and community:

- The local area may experience an influx of people, as they seek employment opportunities associated with the operational phase of the Project.
- Increased chances of the spread of communicable diseases such as HIV/AIDS and STDs linked to influx of predominantly male job-seekers and workers.
- Potential conflict of interest between sucos within and/or those near the Project area in both Vemasse and Baucau Post Administrative.
- Potential damage to household subsistence condition due to the rise of a labor-market (industrial) economy that will initially create developmental paradox that is expected to empower the regional economy but may end up causing economic dependence (BBS, 2015d).

Decommissioning

Below are the potential impacts of the decommissioning activities associated with the plant and jetty on population and community:

- Increased hunting/ poaching of wildlife and loss of habitats for crop production.
- Direct impacts on Project employees and their families including loss of employment and income due to termination of contract and/or cessation of operations, decommissioning and closure.
- Dust generation and site disturbance due to earth moving and removal of infrastructure, affecting the visual character for communities.

9.26.4 Mitigation Measures

Pre-construction, Construction and Operation
Below are the mitigation measures proposed on the above mentioned impacts during pre-construction, construction and operation:

- Upon receiving the Environmental License and other Project approvals, The government of Timor Leste will proceed with a comprehensive resettlement plan (BBS, 2015d). This plan is outside the scope of the EIS but should include the following expectations of the affected households:
  - The households wish that their new settlement would remain within the territory of the same hamlet or the same baptismal name group (such as the Belo);
  - The site and house construction costs should not be borne by those families whose homes and farmland are directly affected;
  - If the new settlement is located close to another populated settlement, there must be proper consultation to ensure the existing residents’ willingness to accept the resettled households, since this issue is related to the availability of livelihood resources in the future;
  - The resettled households need some form of certainty about their future livelihood (especially for their descendants), particularly if all their traditional resources have been taken over by the Project;

- It is predicted that the majority of skilled and semi-skilled workers will be recruited from within Administrative Post of Vemasse and Baucau. Though, there will be some employment opportunities in the cement plant for people outside of Tirilolo, the number would not be large enough to overwhelm local workers and/or people (BBS, 2015d).

- Early discussion involving local and regional leaders (i.e. chefe sucos and municipal / administrative post administrators) including the PNTL on influx of employers from outside of the Project area in particular and Baucau in general.

- Develop and communicate a clear and concise employment and recruitment policy to prevent opportunistic job seekers from settling in the area.

- The selection management of employee applications will be handled by a special institution formed through consultative processes with administrative post and suco leaderships to remove the need for a third party hiring agency (BBS, 2015d) and hence avoiding conflict over employment opportunities and recruitment practices.


- Develop a comprehensive HIV/AIDS program for employees through employee wellness program which should include the following:
  - Awareness campaigns targeting Project workers, senior management, contractors, sub-contractors.
o Prevention, voluntary counseling for HIV testing, as well as anti-retroviral treatment for employees.

• For visual impact, clearing of vegetation can be done in phases so that only those areas required for immediate development are cleared. In addition, simultaneous plantation will be conducted in the area as per the Mine Plan.

• Potential damage to household subsistence condition can be mitigated by actively promoting the development of different economic sectors from an early stage e.g. through incentivizing other industries to locate in the area, contributing to adequate infrastructure and promoting an increase and diversity of skills in the local population.

Decommissioning

Below are the mitigation measures proposed on the above mentioned impacts during decommissioning:

• An environmental education programme will be developed and implemented for all TLC employees (Holtec, 2015a).

• Mitigations of direct impacts on employees and their families on loss of employment and income are as follow (Holtec, 2015a):
  o Communication with employees to discuss the implications of closure.
  o Phased programme of retrenchments and retirements to ensure that the full impact of reduction in employment is spread over several years to ensure that the impact is absorbed as far as possible.
  o Early development of alternative livelihood strategies for employees.
  o Development of a skill register and dissemination of the register to alternative employers, government, etc…
  o Develop the TL Cement grievance procedure to capture and address grievances arising due to retrenchments and downscaling.
  o Actively promoting the development of different economic sectors from an early stage e.g. through incentivizing other industries to locate in the area, contributing to adequate infrastructure and promoting an increase and diversity of skills in the local population.

9.26.5 Monitoring and Reporting

Pre-construction

Monitoring parameters on site clearing will be determined in the Mine Closure Plan (e.g. % vegetative cover, vertical structure of vegetation, plant health, richness etc.) (Holtec, 2015a).
The ambient air monitoring for PM$_{10}$, PM$_{2.5}$ and dust fall rate will be carried out in the quarry and nearby locations with the start of construction activity. The monitoring shall be in line with the guidelines of in country requirements and World Bank / IFC guidelines.

**Construction**

Monitoring parameters on site clearing will be determined in the Mine Closure Plan (e.g. % vegetative cover, vertical structure of vegetation, plant health, richness etc.) (Holtec, 2015a).

The ambient air monitoring for PM$_{10}$, PM$_{2.5}$ and dust fall rate will be carried out in the quarry and nearby locations with the start of construction activity. The monitoring shall be in line with the guidelines of in country requirements and World Bank / IFC guidelines.

**Operation**

The ambient air monitoring for PM$_{10}$, PM$_{2.5}$ and dust fall rate will be carried out in the quarry and nearby locations with the start of construction activity. The monitoring will be in line with the guidelines of in country requirements and World Bank/IFC guidelines.

**Decommissioning**

The ambient air monitoring for PM$_{10}$, PM$_{2.5}$ and dust fall rate will be carried out in the quarry and nearby locations with the start of construction activity. The monitoring will be in line with the guidelines of in country requirements and World Bank/IFC guidelines.

**9.27 Community Health**

The following section provides a brief overview of the potential impacts and mitigation measures associated with community health. Section 10 [Social Impact and Economic Assessment] provides greater detail on the potential impacts relating to social and economic impacts.

**9.27.1 Management Objectives**

The key objectives for community health are to ensure:

- There are no adverse impacts to community health associated with the development and operation of the Project.

**9.27.2 Applicable Standards and Legislation**

There is no formal Timor legislation addressing community health. However, in 2008, the Ministry of Health (MoH) introduced Servisu Integrado du Saude Comunidade - Integrated Community Health Services (SISCa) in its bid to improve access to basic health services and preventative services at the village level. SISCa has six components, including: family registration; nutrition assistance and child health promotion; maternal health and family spacing; hygiene, sanitation and malaria.
The Ministry of Health then launched the Comprehensive Primary Health Care Package in 2015. One of the components of this package is household registration conducted by a doctor at the suco and aldeia level.

9.27.3 Impact Assessment

Pre-construction, Construction and Operation

The following adverse health impacts, without management or mitigation measures, could arise during the pre-construction, construction and operational phase of the Project:

- Increase in the number of respiratory ailments due to an influx of people into the area, overcrowding in settlements and poorly ventilated accommodation;
- Increase in the level of respiratory ailments due to increased dust caused by construction activities and to a lesser extent operation phase activities;
- Increase in vector-related ailments such as malaria due to increase in population density;
- Increase in sexually transmitted infections such as the human immunodeficiency virus due to population influx;
- Increase in lifestyle risk such as alcoholism, drugs, gender and domestic violence due to increased disposable incomes;
- Increase in communicable disease such as cholera due to the rapid change in the social and physical environment; and
- Increased pressure on health services infrastructure.

The development of the Project may also see a positive impact to community health as the Project Proponent will commit to a number of health care initiatives and programmes, as outline in the Mitigation section below.

Therefore, the risk assessment classifies the potential impacts to community health, without management and mitigation, during the pre-construction, construction and operational phase to be ‘Low’.

Decommissioning

It is unlikely that the decommissioning of the Project will result in any adverse impacts on community health. Therefore, the risk assessment classifies the potential impacts to community health to be ‘Low’.
9.27.4 Mitigation Measures

Pre-construction, Construction and Operation

Proposed mitigation measures to reduce the impact on community health and safety, and potentially improve the health standard of the communities include:

- Facilitate education and awareness programs throughout the lifespan of the Project;
- Design roads and implement driver training for employees to improve traffic safety. More specifically, the roads around the Project;
- Upgrading and providing the Project roads with all-weather, 24 hr capability.
- TL Cement will help the Government of Timor Leste identify, wherever possible, main trunk roads where volumes of traffic are expected to grow should bypass urban centres and be controlled by appropriate signage and traffic control structures such as traffic lights or roundabouts. Alternatively, any habitation should be setback from the road and adequate traffic management measures put in place by GoTL; and
- Establish a secure buffer zone from activities posing safety risks to villages or scattered dwellings.
- Develop a comprehensive HIV/AIDS program for employees through employee wellness programme which should include the following:
  - Awareness campaigns targeting project workers, senior management, contractors, sub-contractors and their spouses
  - Prevention, voluntary counselling for HIV testing, as well as anti-retroviral treatment for employees
- Development and implementation of a Health and Safety Policy (Holtec, 2015a);
- Develop a MOU with the Local Healthcare Centre in Baucau for service provision to the local workforce and their dependents (Holtec, 2015a);
- Consulting with NGOs in the area that may support operations at the nearby health centres, with special focus on refurbishment of key areas, equipment and building maintenance, as well as, improved health care management information systems as part of its CSR program (Holtec, 2015a);
- Possible participation via CSR programs for community development/sustainability plans to support infrastructure development in the area (Holtec, 2015a);
- Collaboration with local health authorities and other relevant stakeholders to develop an integrated mosquito control strategy, which should also include:
9.27.5 Monitoring and Reporting

Pre-construction, Construction and Operation

In collaboration with local health authorities and other relevant stakeholders, the following health care issues should be monitored and recorded, while maintaining patient confidentiality:

- The number of new HIV/AIDS diagnosis and anti-retroviral treatment for employees;
- The number of:
  - Respiratory ailments such as tuberculosis;
  - Vector-related ailments such as malaria; and
  - Increases in lifestyle risk such as alcoholism, drugs, gender and domestic violence; and
  - Increase in communicable disease such as cholera;
  - Vehicle related injuries, and deaths; and
  - Work place related injuries and deaths.

Decommissioning

Prior to decommissioning and closure, consultation with all stakeholders (relevant authorities, government and local community) regarding any health facilities associated with the Project to be retained and/or demolished.

9.28 Institutions, Schools and Health Facilities

The following section provides a brief overview of the potential impacts and mitigation measures associated with institutions, schools and health facilities. Section 10 [Social Impact and Economic Assessment] provides greater detail on the potential impacts relating social and economic impacts.
9.28.1 Management Objectives

The key objectives for the management of institutions, schools and health facilities are to:

- Minimise potential impact and disturbances to facilities especially during their scheduled operation hours.

9.28.2 Applicable Standards and Legislation

The following legislation and international standards may be applicable in relation to institutions, schools and health facilities:

- Decree Law 9/2011, National Institute of Health;
- Decree Law 7/2010, Legal Regime for Administration and Management of the Basic Education System; and

9.28.3 Impact Assessment

Pre-construction

The potential impacts of the pre-construction activities associated with the plant and jetty on institutions, school and health facilities are:

- Constant movement of vehicle from Baucau along the Caisido road will potentially increase dust (PM10 and PM2.5) and noise level thus impacting the learning process at St. Francis of Assisi Primary School as well as other activities taken place at the Village Hall and the Church in Caisido.
- Increased pressure on healthcare and education infrastructure due to Project related influx.

Construction

The potential impacts of the construction activities associated with the plant and jetty on institutions, school and health facilities are:

- Constant movement of vehicle from Baucau along the Caisido road will increase dust (PM10 and PM2.5) and noise level thus affecting activities taking place at St. Francis of Assisi Primary School, the Village Hall and the Church in Caisido as they are located adjacent to the road.
- Increased of noise level due to movement of manpower, earth moving and vegetation clearing activities, use of construction equipment, blasting and civil and mechanical construction will affect activities at St. Francis of Assisi Primary School, the Village Hall, the Church and the health clinic in Caisido.
- Increased pressure on healthcare and education infrastructure due to Project related influx.
Operation

The potential impacts of the operational activities associated with the plant and jetty on institutions, school and health facilities are:

• Increased noise level from the machineries operated in the Cement Plant will affect learning process at St. Francis of Assisi Primary School as well as other activities taking place at the Village Hall, the Church and the health clinic during normal working hours.

• Increased pressure on healthcare and education infrastructure due to Project related influx.

Decommissioning

The potential impacts of the decommissioning activities associated with the plant and jetty on institutions, school and health facilities are:

• Decommissioning of the infrastructure will involve dismantling and removal of certain equipment which may produce noise.

9.28.4 Mitigation Measures

Pre-construction, Construction, Operation and Decommissioning

The following mitigation measures will be implemented for the duration of the Project (i.e. pre-construction through to decommissioning):

• Regular water sprinkling on the roads and application of dust suppressants to sections of roads used routinely by vehicles that pass through and close to habitation and facilities including conducting routine air quality monitoring (Holtec 2015).

• Haulage of goods and movement of vehicles / people and equipment can be scheduled and sequenced to reduce the number of noisy operations.

• Where required, noise barriers can be constructed to abate the noise impacts.

• Alternative construction methods may also be available which may be more practicable and cost effective in dealing with potential noise impacts.

• Consulting with NGOs in the area that may support operations at the nearby health centres, with special focus on refurbishment of key areas, equipment and building maintenance, as well as, improved health care management information systems as part of its CSR program (Holtec, 2015a);

• Possible participation via CSR programs in community development/sustainability plans to support infrastructure development in the area (Holtec, 2015a); and

• Impacts from influx of workers on health facilities can be mitigated by developing a MOU with the Local Healthcare Centers in Baucau for service provision to the local workforce and their dependents (Holtec, 2015a).
9.28.5 Monitoring and Reporting

Pre-construction, Construction, Operation and Decommissioning

The impacts on institutions, schools and health care facilities are to be monitored and managed through the Complaints and Grievance Mechanism.

9.29 Community and Family Structures

The following section provides a brief overview of the potential impacts and mitigation measures associated with community and family structures. Section 10 [Social Impact and Economic Assessment] provides greater detail on the potential impacts from social and economic impacts.

9.29.1 Management Objectives

The key objectives for the management of community and family structures are to:

- Maintain and protect the community and family structures near the Project site and/or within new site; and
- Minimize potential conflict and/or tension within community and family members and ensure their kinship is not jeopardized by the development of the Project.

9.29.2 Applicable Standards and Legislation

The following standards and legislation may be applicable in relation to the community and family structure:

- Decree Law No. 5/2004 on Community Authority;
- Decree Law No. 29/2011, Fair Price;
- Parliamentary Law 3/2009, Community Leadership and Their Election; and

9.29.3 Impact Assessment

Pre-construction, Construction, Operation and Decommissioning

The acquisition of land for the Cement Plant and Jetty and the construction of roads may potentially cause impacts on the community and family structure in the form of:

- Conflicts over the status of land (i.e. private owned or state owned);
- Conflicts over land acquisition systems and process/values;
Impacts to household subsistence and ability to generate income;
- Conflicts over the dismantling of graves and customary/traditional ritual houses; and
- Community resettlement.

The consultation to date has collated the input and concerns from the community and these have been addressed in the Social Impact Assessment. The number of households that will be directly impacted or may need to be relocated is approximately 3 households at the plant and jetty site.

According to the impact significance framework, this impact is 'High'.

### 9.29.4 Mitigation Measures

**Pre-construction, construction, operation and decommissioning**

Mitigation measures which will minimise the impact of the project on community and family structure include:

- Development and implementation of the Resettlement Plan by the GOTL;
- Continuous and ongoing consultation with stakeholders throughout the project life;
- Consultation with land owners, suco Lia-Nain, chefe aldeia and chefe suco; and
- Encourage and create strategies for sustainable economic empowerment.

The GoTL is responsible for undertaking resettlement for those families whose homes and farmland are directly affected by Plant and Jetty construction and operation. TL Cement is working with the GoTL to address resettlement by a separate process to the EIS.

### 9.29.5 Monitoring and Reporting

The impacts on the community are to be monitored and managed through the Complaints and Grievance Mechanism.

### 9.30 Land Ownership and Land Rights

The following section provides a brief overview of the potential impacts and mitigation measures associated with land ownership and land rights. Section 10 [Social Impact and Economic Assessment] provides greater detail on the potential impacts relating social and economic impacts.

It should be noted that this EIA does not address the issue of resettlement. The Government of Timor Leste will develop and implement a separate Resettlement Plan.

### 9.30.1 Management Objectives

The key objectives for land ownership and land rights are to:
Monitor the GoTL’s implementation of resettlement to encourage accordance with international best practice, including an approach based on IFC Performance Standard 5;

Monitor the implementation of the IFC’s preference for “in-kind” payments versus the Government’s previous use of cash compensation;

Ensure entitlement for compensation where people do not have proof of landownership; and

Ensure security of tenure at resettlement sites.

### 9.30.2 Applicable Standards and Legislation

According to the IFC Dili airport Preliminary Legal Due Diligence Review (2013), “The current land ownership legal regime in Timor-Leste is complex and uncertain”. The Constitution only allows expropriation where the following conditions are met: 1) expropriation is in the public interest; 2) fair compensation is paid; and 3) resort to expropriation is allowed by law. There is no existing expropriation or compulsory land acquisition law in Timor-Leste. It is not clear whether Condition No. 3 requires an expropriation law to be passed by Parliament or whether a Government Decree Law would be sufficient.

The Preliminary Legal Review (2013) notes that, although not legally required to allowed, it is common practice for Government to pay compensation when evicting illegal occupants from State land. Compensation is negotiated between the Government and community on a case-by-case basis. However, ‘best practice’ indicates that IFC Performance Standard 5 should be considered to produce a mutually-agreeable resettlement policy framework.

### 9.30.3 Impact Assessment

The GoTL is responsible for undertaking resettlement for those families whose homes and farmland are directly affected by Plant and Jetty construction and operation. TL Cement is working with the GoTL to address resettlement by a separate process to the EIS.

### Pre-Construction

As detailed in Section 5.8 [Existing Environment], land is generally divided into two categories, namely: Private or Government. According to the Director of Land and Property, the legal status of a plot of land is largely based upon the absence or presence of human cultivation (BBS, 2015d). This classification may lead to conflict with owners of land that have been or are being left fallow for several years, whether due to:

- the need to restore soil fertility,

- labour shortages and the underdeveloped market economy, which makes it impractical or undesirable to work more land than the farmer needs to meet his family’s subsistence needs; or
• damage or neglect of traditional irrigation networks leading to the abandonment of arable land (BBS, 2015d).

Land ownership status is generally not supported by official documentation and claims to ownership are corroborated by the statement of neighbouring landowners. The Suco does not administer land ownership, nor are there any land registers that record the type, extent and ownership of land. Owners seldom know the exact area of land they have in numerical terms as field boundaries take the form of piled stone fences and local residents usually quote how many fenced plots they have. This lack of formal land ownership certificates/documentation places traditional small holders in a weak bargaining position (BBS, 2015d).

As there is currently no taxation system for privately owned land, the value of land and appropriate compensation is not easily determined (BBS, 2015d).

Compensation through cash payments could also lead to potential flow-on impacts such as:

• proliferation of impoverished households;
• reduced environmental quality;
• perpetuation of substandard housing;
• poorer health care (especially among the vulnerable groups); and
• deprivation of opportunities for finding industrial jobs (BBS, 2015d).

In addition to conflicts over individual land ownership status, there may be potential conflict over land rights between neighbouring sucos. This issue becomes particularly important in light of cooperative suco empowerment plans promise by TL Cement in prior consultative meetings (BBS, 2015d).

The risk assessment determines the potential impacts associated with land ownership and land rights during the pre-construction phase is considered to be ‘Extreme’.

Construction and Operation

The main impacts on landownership and land rights will be experienced in the pre-construction phase, as access and ownership of the land will need to be resolved prior to commencement of any works. Therefore, the risk assessment determines the potential impacts on land ownership and land rights during construction and operation to be ‘High’.

Decommissioning

TL Cement will relinquish the land back to the government and/or local people only once they have met all the closure requirements and the land is deemed safe and suitable for use and/or occupation.

Therefore, the risk assessment determines the potential impacts on land ownership and land rights during construction and operation to be ‘Medium’.
9.30.4 Mitigation Measures

TL Cement is currently working with the Directorate of Land, Property and Cadastral Services (DLPCS) to map affected households, farmland, and other property. Once TL Cement has secured the mining license and environmental licenses required for the project, the Government of Timor Leste will enter into discussions with those affected households and property owners. Based on the mapping and negotiations, the Government of Timor Leste will prepare a Resettlement Plan.

Any recommended measures to mitigate the impact to Land Ownership and Land Rights are the responsibility of GoTL to consider in the context of the project.

9.30.5 Monitoring and Reporting

Pre-construction, Construction, Operation and Decommissioning

The impacts on land ownership are to be monitored and managed through the Complaints and Grievance Mechanism.

9.31 Natural Resource Rights

The following section provides a brief overview of the applicable Standards and Legislations, potential impacts and mitigation measures associated with natural resource rights.

9.31.1 Management Objectives

The key objectives for the management of natural resource rights are to:

- Maintain and protect the natural resource rights near the Project site and/or within new site
- Minimize potential impacts on the surrounding environment

9.31.2 Applicable Standards and Legislation

The following standards and legislation may be applicable in relation to natural resource rights:

- Decree Law 26/2012 Environment Basic Law (EBL);
- Decree Law 5/2011 Environmental Licensing Law (ELL);
- UNTAET Regulation 2000/19 on Protected Places;
- UNTAET Regulation 2000/17 on the Prohibition of Logging Operations and the Export of Wood from East Timor;
- Draft Decree Law on Forest Management, draft 7, received August 2013;
- Draft Decree Law on Biodiversity, dated March 2012;
- United Nations Convention for Biodiversity (1992)
9.31.3 Impact Assessment

Section 10 [Social Impact and Economic Assessment] provides greater detail on the potential impacts relating to potential social and economic impacts.

Pre-construction, Construction, Operation and Decommissioning

As detailed in Section 6.13.5 [Existing Environment], the use of the area of the Jetty and Cement Plant is limited to harvesting wood and building material, grazing for livestock and providing future cropping areas. The impact of clearing and restricting community access will impact natural resources rights of at least 10 families adjacent to the mine site.

The impact on natural resources rights is “Low” due to its localised nature.

9.31.4 Mitigation Measures

Pre-construction and Construction

The following mitigation measures will be implemented during the pre-construction and construction phase:

- Site clearing to be conducted sequentially;
- Sequential rehabilitation to be conducted;
- Clearing of vegetation can be done in phases so that only those areas required for immediate development are cleared; and
- Implement mitigation measures recommended in the GoTL’s Resettlement Plan to maximize community resilience and ensure fair compensation where resources are directly affected.

Operation

The following mitigation measures will be implemented during the operation phase:

- An environmental education programme to be develops and implemented for all employees, their families and habitation within and surrounding concession area.

Decommissioning

The following mitigation measures will be implemented during the decommissioning phase:
• Develop strategies to address the provision of sustainable, alternative livelihoods upon cessation of operations, decommissioning and closure;
• Communication with internal stakeholders i.e. employees to discuss the implications of closure;
• An environmental education programme to be developed and implemented for all employees, their families and villages within concession area.

9.31.5 Monitoring and Reporting
Pre-construction, Construction, Operation and Decommissioning

The impacts on natural resources rights are to be monitored and managed through the Complaints and Grievance Mechanism.

9.32 Cultural Heritage, Archaeological and Sacred Sites

9.32.1 Management Objectives

The key objectives for cultural heritage, archaeological and sacred sites are to:

• Minimise the number of recorded heritage sites which are directly impacted by the Project;
• Ensure that the management of the relocation of known sites is undertaken in accordance with best practice standards; and
• Ensure transparency and consultation occurs in relation to the required impacts on known heritage sites in the Project site.

9.32.2 Applicable Legislation

There is no local standard for the identification, management, relocation and protection of cultural heritage sites, places, artefacts or expressions in Timor-Leste. The following standards are relevant globally:

• International Council on Monuments and Sites – Charter;
• UNESCO Conventions and recommendations relating to Cultural Heritage; and
• World Bank Operational Policy 4.11 Physical Cultural Resources.

9.32.3 Impact Assessment

The religious architectural and sacred heritage sites located near to or adjacent to the Jetty, Conveyor belt and Cement Plant site (as described in Section 6.15) [Description of the Environment – Cultural heritage] are unlikely to be directly impacted by the development of the Project. For safety purposes,
access to the heritage sites nearby to the Project may be restricted during the Project life. However, this can be readily mitigated through access control measures.

Based on the risk assessment the potential impacts to the heritage sites is classed as ‘Low’.

9.32.4 Mitigation Measures

Pre-construction and Construction

The Environmental Management Plan will document the process and procedures to be followed during the Project, including the management of new sites encountered during the Project life.

Access to the sites during the life of the Project will be considered in the context of the importance of the sites to the local community. Where safe access cannot be guaranteed, those sites which are located adjacent to the Project will be fenced off, access restricted for the Project life or relocated.

All archaeological excavations within or adjacent to the study area will be authorised by the State Secretariat of Tourism, Art and Culture and undertaken by a team of professional archaeologists (Oliveira, 2015).

Operation

Access to sites located within the project boundary during the life of the Project will be considered in the context of the importance of the sites to the local community. Where safe access cannot be guaranteed, those sites which are located adjacent to the Project will be fenced off, access restricted for the Project life or relocated.

Decommissioning

For sites that were not directly impacted during the construction and operation of the Project, but were fenced off for safety reasons will have their access re-instated once decommissioning activities are completed and it is deemed safe for the public.

9.32.5 Monitoring and Reporting

The Environmental Management Plan will document the process for recording all incidences of impact on heritage sites.

Following all incidents of non-compliance, a review will be undertaken and, where appropriate, the EMP will be revised and updated to reflect the appropriate additional management measures identified from the review process.

9.33 Unique Landscapes

The development of the Project will introduce a new style of industrial activity to the largely rural landscape that is currently characterised by low-intensity agricultural land use and fishing activities. While the Project will result in a permanent change to the immediate landscape and existing land
uses, there are no unique landscapes within or immediately adjacent to the Project site what will be impacted. Therefore, no impact assessment has been undertaken for this factor, as there are no potential impacts.
10 SOCIAL IMPACT ASSESSMENT

10.1 Social components existing within and adjacent to the project site.

10.1.1 Ecological Condition
The ecological and geographical situation of Timor is marked by environmental destruction and degradation, which creates serious problems for Timor Leste. Another description of the situation in Timor is: ‘An island-wide ecological crisis, caused by swidden agriculture systems and population pressure.’ Pannel also states the ‘characterisation of subsistence systems as a voracious slash and burn agricultural regime’, with ‘low agrarian production’ (Pannell, 2011:217).

Pannel’s opinion is meant to describe Timor as a whole, but some of these characteristics are also visible in the Caisido (inland) region of Tirilolo. Informer’s statements on the migration of the Da Costa and Flores groups to the Baucau region and the use of Osso-Ua as a leper colony around 1945 indicates a substantial history of settlement in the area. The signs of environmental degradation and destruction can be seen in the form of empty uncultivated fields overrun with bushes and shrubs. Osso-Ua still has some secondary forests area that experiences constant deforestation under the pressure of logging for building materials and firewood. The agricultural land is cultivated under a slash-and-burn cultivation system that rotates from one farming plot to the next on a 3-year cycle (fallow system). The soil is riddled with limestone boulders which limits local subsistence patterns to low-productivity agrarian production. This situation leads to considerable population pressure. This population pressure is attributable not to a large population but to the low productivity of arable land (especially dry orchards) in fulfilling subsistence needs.

Agricultural water sources are relatively rare, except in Osso-Ua where water is largely limited to domestic uses. The exploitation of natural resources depends heavily on the availability of rain, so the types of crops that can be cultivated are relatively limited and cannot respond to market demands. Even when the locals sell their produce on the market, it is merely to obtain cash for the fulfillment of other needs. This pattern is theoretically categorized as subsistence farming.

10.1.2 Land Status
Land in Caisido is divided into two categories according to status, namely private land/property and government property. Government property generally covers all land not cultivated by local residents. This category has unclear boundaries since there are many fields that have been left fallow and become scrublands but are still claimed as private property. Some land around Osso-Ua is full of perennial plants and not cultivated but claimed as private property. The key difference is supposed to be about whether the land is cultivated or not but the difference between the two remains ill-defined except when private owners have a clear idea of the boundaries of their property. Land ownership...
status is generally not supported by official documentation. Claims to possession of land are corroborated only by the statement of neighboring landowners. The Suco administration does not make much fuss about formal land ownership in any case since there is currently no taxation system for privately owned land. The village doesn't have detailed land registers that record the type, extent, and ownership of private land for tax collection purposes.

Field boundaries take the form of piled stone fences. The owners seldom know the exact area of land they have in numerical terms. Land is commonly measured by means of the stone fence boundaries, and the local residents usually quote how many fenced plots they have. 24 years of Indonesian occupation in Timor Leste had not successfully introduced the concept of quantitative land measurement. This can be explained by the local system of slash-and-burn cultivation, where land clearance mostly depends on the availability of labor to process and estimate the amount of produce needed to fulfill subsistence requirements.

10.1.3 Land Use

In terms of land use, the local population distinguishes between four categories, namely paddies/rice fields, forests, gardens/orchards, and bushes/scrubland.

10.1.3.1 PADDY FIELDS

Information from the Chefe Suco in Tirilolo and Vemasse; state the existence of rice fields in the local area but not the areal extent in each suco and the fields’ geographic location. In the Caisido area near the planned project site, there is an approximately 0.5 ha rice plot in the Aldeia Osso-Ua. This field draws water from a local water source so that the owner can plant upland rice. Due to the cultivation of paddies on the land, the owner categorizes the plot as a rice field.

Statements from the chefe suco and our own field observations indicate that the rice fields in the area depend heavily on rain. Once the land has been used to grow rice, it cannot be reused for other crops due to the lack of water for further cultivation. Some sucos have ricefield plots watered from springs in Bucoli (Palmer, 2011:145) but the lack of farm labor means that the field only produces one crop per year or is left completely fallow.

Land cultivation is done in a very simple manner; once the land has been watered, a water buffalo is used to churn up the soil until it is suitable for planting. The government has provided aid in the form of tractors for rice cultivation, but the local population seems unable to use the machines effectively so their use remains very limited. Ricefield owners who do not own buffaloes may cooperate with the owner of a buffalo in cultivating his land. In this arrangement, the owner of the buffalo gets the same share as the owner of the field. The owner of the buffalo becomes responsible for the cultivation of the land all the way to the harvest. This system has not seen much development since landowners are often reluctant to share their produce.
Calculations during the field study indicate that a 0.5 ha field planted with three sacks’ worth of rice seeds would produce 60 sacks of rice of the same quality. After the rice has been dried, the end result is 30 sacks weighing 25 kg each.

This low production rate and scarcity of labor has prevented rice cultivation from becoming a major factor in economic development.

10.1.3.2 Forest

Forests around the cement plant site are mostly located in the Osso-Ua Aldeia of suco Tirilolo. They see the forest as a place to hunt and to harvest wood for building materials (whether for their own use or for sale) or for firewood. There is no definite information about how many trees have been cut down for their wood, but he said that most locals pick firewood from already fallen trees. There is no clear information about the average income of firewood collectors either, but each collector can probably earn $10-$15 per harvesting trip at a price of $0.5 per firewood bundle.

Some Ostico residents engage in similar activities, but they only fell trees to find building materials for their own houses. One of the things that may cause some ambiguity over land ownership in this suco is the presence of candlenut plants growing in local settlements and nearby forests. Lands where these trees grow may be claimed as private property even though the land would otherwise be seen as public forests when judged by the variety of other plants growing in the vicinity. This Ostico forest is located outside the clay mining site. Almost all the land in the projected clay mining site are rice fields, both those presently cultivated by their owners and those that have been abandoned by owners who moved to a different area, namely the Wailacama aldeia as we have described in a previous section.

10.1.3.3 Gardens and Orchards

Horticultural lands (gardens and orchards) are the main source of subsistence for the Caisido people (Parlemento, Caisido, Lialailaiso, and Osso-Ua). This land is mostly dry lands planted during the rainy season. Gardens are orchards are normally located close to the owners' houses or settlements. Cultivated orchards are usually protected with stone fences to prevent interference by livestock. Most residents own more than one fenced orchard located close to each other, or alternatively a single large orchard (about 1 ha) divided into smaller plots with stone fences. The division into multiple sub-plots usually correlates with the planting and cultivation strategy. Most gardens/orchards are worked for 2-3 years and then moved to a different location for the same interval. This rotation is meant to restore soil fertility since the orchards are given no fertilizers whatsoever. The only measure for increasing soil fertility is burning the brush growing on the land. There is no effort to use livestock manure as fertilizers either since most livestock are not kept in pens but rather left to roam free in the scrublands around the village.

The cultivation of the orchards begins in August-October or November. Planting should be accomplished by December or January at the latest. In the event that the rains begin in December, the planting process is likely to fail. The work from August to November mostly consists of land
clearance and the burning of the cut-down vegetation. The clearance can be done with the aid of unpaid labor from close relatives in return for help in clearing these relatives’ land in turn. Despite this extra labor, the amount of land opened is still limited according to how much land the owner can realistically manage by himself. The tending of the orchards is generally performed only by members of the nuclear family since each family is fully occupied with tending its own land and there’s not much opportunity to enlist help from others. After the land has been burned, it is tilled with hoes. Garden/orchard lands usually have stones strewn randomly across them, so plants are normally placed in an irregular manner to make use of the available non-rocky patches of soil. The most important crops are maize and groundnuts. The maize is normally consumed by the family and livestock, while the groundnuts are primarily used as a cash crop. Other crops commonly planted in the area tubers like cassava and sweet potatoes and vegetables such as green tomatoes and chili peppers. The tubers are primarily meant for subsistence while the vegetables are usually intended for both subsistence and cash.

10.1.3.4 Bushes and Scrubland

The bush and scrublands are usually regarded as reserve lands for the 3-year plot rotation system. These lands are covered in long grasses and bushy growths (especially Imperata cylindrical, Cromolaena adorata, and Lantana camara L). These sites are also used as pastures for buffaloes, oxen, and goats. The parts where the grasses and shrubs grow densely are ecologically regarded as a normal part in the succession towards secondary forest. The bushes and scrub do not cover the land in a fully continuous manner, so external parties are prone to categorize the land as uncultivated wastes or government property. However, further exploration will reveal linear piles of stones that mark out field boundaries. Each farmer knows the boundaries of their plots. Most of the bushes and scrubland in Caisido are located outside the projected mine and plant sites.

Tenure System

The land as the main resource for the fulfillment of the local population’s subsistence needs is usually obtained through ancestors from the people’s forebears. There is no clear indication of when the ancestral settlers began to reside in the Caisido region. Theoretically speaking, given the lineage-based social structures, it is likely that the ancestors only go two generations back (current residents' fathers and grandfathers). As such, the Caisido region was probably settled around 75-100 years ago.

Those estimations aside, the local residents’ assertions that their land ownership proceeds from ancestral rights shows that they feel that they have the rights of possession. This possession usually comes without any form of written or formal proof. The local population generally does not feel any pressing need to obtain formal acknowledgement of their land ownership since the legal status of their claim to the land has never been seriously disputed before. Only with the plans for the construction of a cement factory does the issue of ownership come to the fore. This is particularly relevant to the bushes and scrublands since there is some concern that the lands being left fallow might be claimed as government property despite the existence of ownership markers in the form of stone fences or boundaries.
10.1.3.5 Animal Husbandry

Animal husbandry is one of the traditional sectors in the livelihood of the Caisido population (in Parlemento, Caicido, Lialaileso, and Osso-Ua). However, not all families own livestock. Livestock are mostly treated as a way to invest the surplus obtained from agriculture, especially gardening/orchard farming. The most common types of livestock are horses, water buffaloes, oxen, goats, pigs, and chicken. It is not easy to find out the exact number of livestock and the number of households that keep them since the Suco administration has never performed any census on livestock ownership. The following Table 3.10 is based upon estimations offered by the Village Secretary and Chefe Aldeia, though neither of them could give precise estimates of the combination of livestock types and how many of each type are owned by individual families. Even so, this data may prove useful since it still contributes towards the main research objective of observing the forms and functions of traditional investment in communities that still struggle with subsistence needs. The functions of livestock will be explained in the following sections, while surplus strategies will be described elsewhere.

Table 3.1 Livestock table and ownership

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Caicido Total Family: 184</th>
<th>Lialaileso Total Family: 127</th>
<th>Parlemento Total Family: 99</th>
<th>Osso-Ua Total Family: 184</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Owner</td>
<td>Total Animal</td>
<td>Total Owner</td>
<td>Total Animal</td>
<td>Total Owner</td>
</tr>
<tr>
<td>Goat</td>
<td>120 200</td>
<td>110 250</td>
<td>90 100</td>
<td>127 200</td>
</tr>
<tr>
<td>Sheep</td>
<td>100 250</td>
<td>115 230</td>
<td>90 120</td>
<td>130 150</td>
</tr>
<tr>
<td>Horse</td>
<td>15 25</td>
<td>11 36</td>
<td>15 30</td>
<td>16 30</td>
</tr>
<tr>
<td>Cow/Buffa</td>
<td>8 40</td>
<td>17 60</td>
<td>18 30</td>
<td>15 30</td>
</tr>
<tr>
<td>Pig</td>
<td>180 250</td>
<td>129 160</td>
<td>118 230</td>
<td>127 260</td>
</tr>
<tr>
<td>Chicken</td>
<td>182 400</td>
<td>180 360</td>
<td>118 230</td>
<td>238 260</td>
</tr>
</tbody>
</table>

Source: Tabulation From Suco Tirilolo 2015

**Chicken.** Buffaloes, pigs, and chicken are symbols of wealth that carry not only economic value but also considerable social and ritual significance. Chicken are regarded as livestock with the lowest value. Despite this low economic value, chicken provide a way to fulfill emergency demands at very short notice. These demands include offering food to important guests, providing aid to neighbors in distress, making contributions to celebrations of life-cycle events, and obtaining cash to cover unexpected needs.

**Goat and Sheep.** Sheep and goats are important livestock for *belis* contributions. They also provide a source of quick cash, being the next most easily sold type of livestock after chicken. Sheep and goats are usually not bought for household consumption but rather become the first choice for surplus investment. Their relatively affordable price compared to pigs makes them some of the most intensely traded livestock in the market.

**Pigs.** Pigs have a substantially higher economic value relative to chicken and goats; they also play an important part in various individual and group rituals, in addition to being acceptable gifts or dowry given by the wife’s family to the husband’s or vice versa on ceremonial occasions. A gift deemed...
inappropriate or inadequate may be taken to signify a lack of respect that may lead to friction in the relationship between the two parties. Pigs are also an important component in sealing deals or agreements to resolve past disputes.

**Buffalo.** Are the most valuable type of livestock and also very important in traditional religious rituals as well as *belis* contributions. Buffaloes are used in death rituals, rituals in the customary house (*rumah adat*), and bonding activities when the entire lineage gathers at the end of the year (for Christmas and New Year).

### 10.1.3.6 Traditional Fisheries

The planned jetty site on the Osso-Ua coast is currently used by some Osso-Ua villagers for fishing activities. They go out to fish when the waves are not too high. Their fishing activities are conducted with very simple equipment such as fishing poles with lines and bait as well as rowboats.

The fishing methods are also quite simple; one of the boat's crew takes the fishing tackle a short distance out to sea, about 50-75 m from the coast. After the line is released, the boat does not return straight away to the beach but waits for some time while moving the fishing tackle around in several directions to attract attention to the bait. Once a fish has taken the bait, somebody on the beach would alternately draw and play out the line until the fish tires out. When the fish's resistance has subsided, the line would be fastened to a bamboo pole sunk into the beach. This procedure is repeated until some or all of the fishing lines have caught enough fish.

This activity may provide up to $10 - $20 per fishing trip. Larger fishes are usually sold to buyers in Baucau, who can be contacted over a cellular phone. Fish that are not (or cannot be) sold are not preserved in the form of salted fish but used for housed consumption.

### 10.1.3.7 Non Farming Activities

Caisido's isolation and the difficult circumstances for agriculture haven't prompted the development of non-farming activities. There is only 1 small shop/kiosk owned by the chief *Lia nain* in the Suco, 2 canned drink sellers, and 1 greengrocer. The *lia nain*'s shop sells several types of canned and packaged drinks, children's snacks, light dry snacks, and rice. Due to the shop's location right across a school, it receives a great deal of patronage from the children during the school's break times. The owner stated that he opened the shop to help the local people obtain basic necessities, especially during long dry seasons and drought periods when there's not much chance to farm productively and the local people have to come and buy rice on credit. The payment is deferred until the next harvest. The shop only provides credit for the purchase of rice, while other commodities have to be paid for in cash. The owner believes that credits for non-essential items (other than rice and baby supplies) would saddle the borrowers with an unbearable burden; indeed, even the rice credits are only given on a limited basis.

A *Parlemento* resident can be categorized as a greengrocer. His inventory comes from a combination of purchases from his neighbor, produce from his own garden, and purchases in the old market of Baucau. He then ties together the vegetables in certain amounts to be sold in retail. He actively pursues his commerce activities since he needs a great deal of cash to provide food and milk for an
infant child. He also feeds nieces and nephews playing at his house during mealtimes, so he needs some money to buy extra rice. At the same time, he also works as a lottery brokers, but neglected to mention it for unknown reasons.

Apart from these mercantile activities, there are also 10 two-wheeled vehicles operated by Caisido residents to serve trips to and from far-flung local settlements. These motorcycle taxis usually gather beside the main road at the junction with the road towards Caisido. The fares vary between $1 and $3 depending on the distance. There are not many passengers for these motorcycles aside from outsiders who wish to travel into the area, such as the research team. One of the motorcyclists explained that he usually earns no more than $5/day.

Handicraft and food industries remain underdeveloped. For the most part, it is limited to old women weaving baskets for their own use from the leaves of *lontar* palms growing around the *aldeia*.

Informers state that there have been no empowerment initiatives for the development of household industries. Such empowerment remains a difficult proposition due to the absence of a substantial market.

### 10.2 Social Laws and regulations

**DECREE LAW NO. 5/2011 “ENVIRONMENTAL LICENSING”**

The socio-economic component of the EIA was undertaken (to the extent possible) in accordance with the Democratic Republic of Timor Leste Decree Law No. 5/2011. Within Decree Law 5/2011 (the Decree), potential social impacts are defined as “a set of positive and negative changes produced in social … parameters which include, among other things, people and their economic and social structures."

**Asian Development Bank (ADB) Safeguards Policies**

ADB’s [Safeguard Policy Statement](https://www.adb.org/publications/adbs-safeguard-policy-statement) (2009) provides a comprehensive guidance on complying with requirement for environmental and social safeguards (Involuntary resettlement of and indigenous people) in projects. It aims to avoid or minimize the impacts on people affected by a project, and to provide support and assistance to those who lose their land and property, as well as for others whose livelihoods are affected by the acquisition of land or restrictions on land use. Resettlement planning is designed to provide to provide affected community members with a standard of living equal to, if not better than, that which they had before the project. The resettlement Action Plan is being developed by TL Cement in conjunction with the Government of Timor Leste. Therefore it has not been included in this EIA.

#### 10.2.1 Recommendations for Project design, Implementation arrangements and Monitoring plans

Involving the public in preparation of the EIS is fundamental to increasing the public’s understanding and acceptance of the Project (e.g., how the Project may affect or improve their living conditions). Public involvement also enables members of the public to identify and bring forward impacts and
issues that are not immediately obvious to the EIS team. The earlier in the Project preparation process the public can be involved, the more likely that a trusting relationship can be built and useful recommendations made.

Some recommendations from the community include the following:

- The stakeholders appeal to the government to decide upon a new neighbourhood for our resettlement and to make sure that the development of the cement factory will generate benefit for our present and future generations.
- They hope the company to provide a clear plan for protecting their future livelihood and for ensuring good coordination the government.
- They appeal to the company to establish an agreement with the Government of Timor-Leste.

Some of their concerns include:

- Whether there are any traditional houses that the development may impinge upon.
- How the government and other stakeholders would pay due respect to our cultural inheritance.
- Clear identification of boundaries for the development site(s).
- The Government should clarify land ownership and possession status with the Caisido community.
- The Government and stakeholders should continue information dissemination and consultation efforts with the community.

Responses to the community’s concerns from the authorities and TL-Cement Agency:

**The Director of Land and Property**

The Director of Land and Property responded about status of the land; first he explained that there are several types of land, *i.e.*

- Abandoned land/state property.
- Heritage/customary land passed down from the ancestors to become communal property, such as a suco’s common lands.
- Private property land, registered with land ownership certificates.

Furthermore, he explained that before the project begins, his team will work together with local authorities to identify the proprietor(s) of each type and plot of land, and then affected plots will be measured to calculate the appropriate compensation value.

**Baucau district Administrator**

“Affirmed that the company has every intention to improve the community's livelihood and that they (the community) should not pay any attention to rumours that the company will destroy Suco Caisido’s natural environment. He added that he will keep fighting for the community’s wishes and that his team will frequently visit the communities so that they can hear the local communities’ concerns and reports them to the government for consideration.”

**Police District Commander of Baucau**
“Stated that they are ready to provide full security in the designated area and assure that since many young people will be employed, there will be no youth confrontations. He also appealed to the community to ignore rumours’ spread by those who clearly do not want to develop the nation. He emphasized that his team will work together to support the government by supporting the project. He appealed to the community that this is their ‘battle’ and that everyone should take the chance to win it as this will reduce the unemployment rate in the country and improve our economic condition.”

The Youth Group

“Their full support for this project and agreed that it will generate profits for their community by reducing the unemployment rate in Baucau District.”

Responses from the BGC/TL Cement to the community’s concern, spoken by the Director

“He explained that in order to manage the HR, they will use following method:

- Training
- Assign the right person to the right position

They will also employ local people in the following capacities:

- Labour
- Janitors/Cleaning Service
- Security
- Administration
- Construction worker
- Carpenter

He also affirmed that the government and its counterparts will be working together to reduce the unemployment rate in the country and that they will keep fighting for the community’s well-being. This will increase the local HR capacity so that they will not rely on other nations’ HR.”

10.3 Complaints and Grievances Mechanism

The Project Proponent will establish a Complaints and Grievances Mechanism (CGM) related to environmental and social issues arising during the pre-construction, construction, operation and decommissioning, and post-closure phases of the Project.

The Complaints and Grievance Mechanism shall be developed to ensure that concerns and potential conflicts arising during the various phases of the Project can be satisfactorily addressed. WorleyParsons has developed this grievance mechanism framework for discussion with stakeholders (including government) to refine the procedure to meet stakeholder needs through consultation.

Once refined, project staff (comprising a representative who will receive grievances at each Project site’s grievance office, and a Dili office representative) should be provided with training. These staff
will accept and log incoming grievances and, if the grievance is directly related to the Project’s actions, follow a prioritisation process to identify the required remedial action.

illustrates a suggested procedure for managing and resolving complaints during the feasibility stage. The procedure is equally relevant during the development stage of the Project with responsibility for resolution defined between the Project Proponent and the construction contractor. It is important to ensure the following values are upheld throughout the grievance process:

- Awareness;
- Accessibility;
- Transparency; and
- Expediency.

Stakeholder awareness of the existence of the CGM will mean that when an issue arises, community members will know where to go to address and resolve the issue. This will encourage the issue to be dealt with through the appropriate mechanism and will improve expediency of resolution and good will with the community. Therefore, when engaging with the villages and other stakeholders they should be made aware of the grievance mechanism and where or whom they should contact to access the mechanism.

Accessibility to the CGM will also enable stakeholders to air their complaints directly thereby avoiding other forums such as the media. Typically, the earlier the Proponent becomes aware of potential issues, the more efficiently these can be mitigated and contained. Furthermore early detection of potential issues can prevent problems arising later in the Project lifecycle. It will be essential to break down barriers to accessibility which, based on baseline investigations, include, geographic location, literacy levels, language and cultural appropriateness, and distrust in government or corporate structures. Recommended strategies to overcome these barriers include:

- Establishing a grievance office at Dili, surrounding sucos and the Cement Plant site where grievances might be heard, namely Caisido and Baucau.
- Upon request, remote locations and vulnerable individuals (e.g. elderly and disabled) should be visited by a representative of the project on a regular basis who will disseminate information regarding the Project and receive complaints from stakeholders at their village or residence. This will promote accessibility of the grievance procedure and help build a relationship with communities and encourage dialogue.
- Complaints should be able to be registered via a toll-free mobile telephone number to be established by the Proponent in cooperation with local telecom provider to allow direct access to each individual to the grievance mechanism. Another option is to provide a pre-paid mobile phone to each village chief to be exclusively used for lodging grievances. The mobile phone would allow the chief to send a message to the nearest grievance office requesting the grievance officer to visit the village and record the grievance. The pre-paid mobile option needs to be further investigated in consultation with village chiefs.
- Representatives should be instructed to note down complaints where the individual is unable or unwilling to write the complaint themselves.
- Local people fluent in the relevant languages should be engaged as representatives.
Locals should be consulted regarding the cultural appropriateness of the complaints process.
Complainants should be given the option of maintaining anonymity throughout the complaints process.

Transparency of process cultivates trust and ensures expectations among the stakeholders are set at an appropriate level. Elements of the grievance procedure which will encourage transparency include explaining the process and timescales associated with processing a complaint, providing the complainant with a copy of the complaint when it has been submitted and ensuring the complainant is kept informed of developments in processing their complaint. Written complaints should be held at the respective grievance offices where the complainant (or a designated advocate) should be allowed access.

Expediency will enable efficient processing of complaints. In order to encourage expediency the project should set deadlines for processing complaints and a case management approach should be established among the relevant staff, with oversight from a senior individual who should be assigned responsibility for management of the grievance mechanism.

As well as committing to the values mentioned here, the project will work to International Finance Corporation (IFC) guidelines (IFC, 2011) regarding grievance mechanisms.
Figure 10-1 Grievance resolution framework

1. Complaint received via one of the designated community contact points
2. Receipt of complaint acknowledged and registered
3. Complaint handling personnel notified
4. Complaint assessed and categorised
   - Low Risk
   - Medium Risk
   - High Risk
5. Resolution decision at local office level
6. Complainant satisfied?
   - Yes: Project procedures, actions or communications amended to enable resolution and prevent further complaints
   - No: Mediation (neutral mediators)
7. Complainant satisfied?
   - Yes: Relevant action taken to enable resolution and prevent further complaints
   - No: Escalate complaint: Local judicial or administrative solutions
10.4 Purpose and Objectives

The Social Impact Assessment (SIA) (Appendix 7) was performed through an ethnographic survey using observation, in-depth interviews, and secondary data collection at the village level, especially in areas likely to be directly impacted from the Project. This is based on the assumption that the people in such areas are the most likely to suffer significant impact (in terms of changes to their subsistence livelihoods). The people elsewhere are expected to be less significantly affected since the potential benefits provided by the Project in the form of employment opportunities are not likely to dramatically change their resource exploitation habits, except under intense empowerment to increase the productivity of existing resources.

The study was based on the following activities:

- Preliminary observation on 5\textsuperscript{th} – 9\textsuperscript{th} May 2015; and
- Ethnographic study 20\textsuperscript{th} May – 2\textsuperscript{nd} June 2015 (This ethnographic study was conducted by two anthropologist).

Observations were performed to understand land use patterns and the resource situation; crop types and planting schemes; cooperation in the exploitation of subsistence resources; the location of residential areas relative to the Project site; the location of cultural identity sites (such as cemeteries and traditional/customary houses) relative to the Project site, and resource exploitation activities (agriculture and fisheries) in order to understand subsistence patterns.

In-depth interviews were intended to understand the production systems and patterns needed for the survival of the nuclear family and the lineage group; distribution arrangements between woman-giving and woman-receiving lineage groups in the context of group reproduction and the development of intergroup networks, and customary norms in the exchange between woman-givers and woman-receivers as social capital in the social security context; accumulation strategies in accord with customary norms to manipulate the demands of obligations as a member of the lineage group; types of crops and planting (production) strategies to fulfill subsistence needs; and modes and processes for acquiring cash income from produce in order to fulfill consumption needs and accumulate surplus.

Apart from these three livelihood factors, the in-depth interview also sought to develop an understanding of customary and religious rituals with regards to the affirmation of lineage membership after the introduction of new identity paradigms by the church. The focus lies upon the importance of these two identities to the individual as a member of the village community, as well as to land and the attached rights for the community member.

Secondary data was extracted from two different sources. The first is the data from the 2010 population census. This data was compared to the latest demographic data from 2015, which was available in the local village. The main intention of this comparison, was to determinethe population growth rate in the villages around the Project site, namely the villages (Suco) of the Baucau Subdistricts. Not all villages around the Project site had a complete suite of demographic data that included levels of education, occupations of family members, vulnerable groups, and age groups.
Data Analysis and Impact Assessment

Secondary / quantitative data was analysed to find out tendencies and patterns. This data is particularly useful for finding out the reasons and considerations behind the villagers' behaviour, especially those within the indirect impact area. Meanwhile, quantitative data for villages in the direct-impact area is used to forecast the spread, magnitude, and accumulation of reversible and irreversible impacts.

Quantitative data from medical reports were analyzed for patterns in the diseases commonly found among the local population and their relationship to sanitation conditions, the scarcity of clean water, and the local population's socioeconomic well-being.

Impact assessment is based upon the following guidelines:

1. IFC's Performance Standard on Environment and Social Sustainability 2012.

The main subjects of analysis are:

a) Direct and indirect impacts;
b) Extent and magnitude;
c) Cumulative Impact;
d) Reversible or irreversible;
e) Manageable or unmanageable; and
f) Impact consequences with and without the Project.

10.6 Description of the Socio-Cultural, Institutional, Historical and Political Context

10.6.1 Study Area

The area is traditionally known as the Caisido region, consisting of the Parlemento, Caisido, Lialailes, and Osso-ua Aldeia in the Suco Tirilolo. Beyond these five aldeia, observation was also made upon several sucos in the Baucau subdistrict, which exhibit certain similarities and peculiarities in terms of ecology, ricefield cultivation, perennial gardens, etc. Apart from this direct observation, secondary data collection was conducted in suco administrative centers, and also interviews with chefe suco to find out their knowledge, response, and hopes about the planned Project.

Administrative boundaries

The planned site for the Baucau Cement Project is administratively located in Suco Tirilolo, Baucau Subdistrict. The Limestone Mine site and Cement Plant sites are located within the Osso-ua aldeia. Access roads to the Osso-ua aldeia pass through the Parlemento, Caisido, and Lialailes aldeia. All four aldeia comprise a region within Suco Tirilolo historically known as Caisido. The Limestone Mine and Cement Plant sites are located approximately 7 km away from the Baucau – Dili main road. The four aldeia are still relatively isolated, particularly in the case of Osso-Ua. Roads that allow access to four-wheeled vehicles were built approximately 3 years ago. With the establishment of the road, public transportation cars now make 2 trips per day from Baucau City to the Parlemento aldeia, but the route does not extend into Osso-ua. Passengers going to Osso-ua must stop at the Caisido T-junction and walk the remaining 4 km. Most Osso-ua residents who wish to travel to or from Baucau City prefer to walk approximately 7 km to an intersection on the Baucau-Dili road, where they then take a ride on local transport to the city. About 10 motorcycles for hire park at the end of this road to serve trips to the four abovementioned aldeia. However, most local residents prefer to walk the distance since the cost of a motorcycle trip ($2 - $3) is deemed too steep.

The construction of the Baucau Cement Project is expected to potentially cause direct impacts to five aldeia in two sucos as well as indirect impacts to other villages around the Project site. This is shown in Table 37.
10.6.2 The History of Adat Identity and Territory

One of the informers explained that Baucau was settled by people from the western region of Waiweko / waihaloi who initially migrated to the east (Manatuke) to the area between Dili and Baucau, followed by a further migration to Waikéke (west) and finally to Baucau. Immigrants from Waihaloi are dominated by the Da Costa group. The first destination at Waikéke was already occupied by the Amaral, Soares, Ximenes and Sausagroups, which prompted them to remigrate westwards or ‘upwards’ to what is now Baucau. These clan names were based upon the baptismal names of leaders among the territorial elite at the time. These names were then adopted by community members born and residing within the territory of particular sucos.

At the moment, certain baptismal names signify a person’s origins or residence in a suco. The Baucau Subdistrict is traditionally dominated by three surnames, namely Da Costa, Belo, and Flores. Local legend holds that these three surnames originated from three brothers who owned / controlled resource in their respective territories (sucos). Each lineage owns an adat / customary house used for communal rituals with their ancestors. This adat building is located in Suco Bahu. Ceremonies are held on an irregular schedule, depending on whether the house requires repairs or not. Ceremonies are led by the oldest male member of the groups. This leadership is not passed down to a late leader’s son but is transferred according to seniority.

All the sucos, are dominated by particular baptismal surnames. All residents of the village / suco identify with or are identified with the historical baptismal name of their traditional elites. Although the village / suco residents use the same baptismal name throughout the entire suco, they usually do not

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Table 37: Impact of Project on Sucos

<table>
<thead>
<tr>
<th>Subdistrict</th>
<th>Direct Impact Sucos</th>
<th>Indirect Impact Sucos</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Limestone Mine and Cement Plant site.</td>
</tr>
<tr>
<td></td>
<td>Tirilolo</td>
<td>Bahu</td>
</tr>
<tr>
<td>Baucau</td>
<td>-</td>
<td>Bucoli</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Baruma</td>
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<td>Wailili</td>
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<td>Samalari</td>
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<td></td>
<td>-</td>
<td>Triloca</td>
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<tr>
<td></td>
<td>-</td>
<td>Seical</td>
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<tr>
<td></td>
<td>-</td>
<td>Caibada</td>
</tr>
</tbody>
</table>

Source: Survey Inventarisation, May 2015.
share the close blood ties that such a shared surname would normally imply. Theoretically, all communities have elite and follower components. To affirm the power of the traditional elites, the power is institutionalized in certain rituals. The ritual site and mechanism are chosen to reinforce the power of the traditional elite over their territory. This traditional power is performed through rituals, along with the organizational apparatus needed to arrange and conduct the rituals.

No such ritual activities have been found in the Project site apart from that performed by lineage groups in their customary houses. In this respect, the baptismal surname cannot be accurately seen as clan names, but rather as territorial groupings.

10.6.3 The History of Osso-Ua’s Leper Colony

Suco Tirilolo is the oldest suco along with Bahu and Caiboda. These three Suco were the origin of a social group based upon a baptismal surname, namely Belo. This Suco was historically divided into two regions: the inland Caisido region (now the Aldeia Caisido) and the upper region (Old Market, Baucau Subdistrict). The inland (Caisido) region is made up of 4 Aldeia: Caisido, Parlemento, Lialaileso, and Osso-Ua. All these four Caisido had been settled prior to 1945 except for Osso-Ua. Osso-Ua is located approximately 4 km away from the other three aldeia towards the north, an isolated site that can only be reached over a footpath.

Informers state that, around the year 1945, the Portuguese government (Portu) designated Osso-Ua as a quarantine area for lepers from all over East Timor. The lepers were left to fend for themselves with no amenities provided by the government – no housing, arable land, nor healthcare. The lepers were managed solely through restrictions on the use of the clean water sources passing through the village. The lepers were directed to use the smaller water source (Uai Mata Anna) while the larger water source (Uai Mata Uli) was reserved for the general public. This separation was intended to prevent contagion. Attempts to approach and treat the lepers began under Indonesian rule (1988). Medical care was provided by church sisters. Intensive care only began in 2008 and has continued to this day. Reports from village family cards and church records indicate that only 2 lepers remain in the area. Recent information hints that the leper colony will eventually be moved to Bondura, a coastal site to the west of Osso-Ua.

10.6.4 A chance of Community Empowerment

1. Over 400 years of Portuguese colonization, 29 years of Indonesian occupation, and 16 years of independence, the people of Caisido (four aldeia around the Limestone Mine and Cement Plant sites) have received scarcely any attention from the outside. External attention only began to manifest itself during the Indonesian occupation in the form of:

2. The construction of clean water conduits from the army base at the Baucau-Tirilolo road junction, utilizing a water source originally tapped to serve the military base. The clean water supply went all the way to Caisido with a flow rate of 1000 L/s in the 1980s.
3. 2011 saw the electrification of four villages (including Tirilolo) with the construction of 18 km of power lines from Caibada Village to Caisido by the State Secretariat on Electricity (Secretario Du Estado Elektrisidade).

4. The isolation of the area and the lack of medical care has motivated the Australian Red Cross foundation to widen the 3 km access road from the Baucau main street (in front of the military /Falintil Forcas de Defesa de Timor-Leste/FFDTL base) to Caisido - Caibada and a 4-km stretch on the Caisido - Osso-ua route, and to build clean water reservoirs in Caisido. This was done three years ago on the initiative of Baucau community figures who contacted the Australian nonprofit.

5. 2013 saw an expansion of the electrical network from Carabela (Vemasse) to Osso-Ua;

6. Food aid and improvement of the road from the T-junction on the main street to the four aldeia by the US NGO CARE International (Cooperative for Assistance and Relief Everywhere).

7. In 2002-2003 the WHO (World Health Organization) brought in food aid for pregnant and lactating mothers and children under five years old, as well as treatment for malaria; this was done in cooperation with the ministry of integrated community healthcare (SISCA / Servico, Integrado, Saude Comunitario).

8. In 2004, existing clean water conduits underwent maintenance in the form of the replacement of old pipes with new pipes of the same diameter (2 inches);

9. In 2014, the clean water distribution network was expanded to Osso-Ua from the existing pipeline (Caisido);

10. 2015 saw the construction of new clean water pipes parallel to the old pipes. The new pipes will fill 10,000 L water storage reservoirs in several locations with water taken from Garuwai.

11. In 2013, the World Vision foundation provided aid for the construction of an elementary school in Parlemento and healthcare clinics. The new clinics began to operate in June 2014. This aid was directed towards the fulfillment of education and healthcare needs, while the local population's hopes for agricultural empowerment have not yet been addressed.

10.6.5 Institutes of Authority

The Baucau Municipality is subject to two main spheres of authority, one being the government's (Formal) and the other being the church's (informal). Although their authorities differ, they both have the ability to mobilize the masses and the need to support each other.

10.6.5.1 Formal Authority

Regent/District Administrator in Baucau

The formal government hierarchy in Baucau proceeds from the Regent (district administrator) to the subdistrict, then to the suco, the aldeia, and finally to the bairo (citizen). The Regent and the Subdistrict Administrator are appointed by the central government in Dili while the head of the Suco is
generally elected by the local population. Although the Regent and the Subdistrict Administrator are not elected, their power and authority to lead the bairro are widely acknowledged. They act on behalf of the government through the suco administration. In case of any deadlock related to the Project (such as with land issues), they have the final say within their respective spheres of authority and can compel obedience from the bairro. The present emergency in Baucau has given the Police Department wide-ranging powers in the interest of maintaining law and order, especially in the suppression of the MM (Maut Muru) ‘rebellion.’ Any activities by external parties must obtain the approval of both the civil government and police authorities. This approval must be obtained through the proper bureaucratic procedures. The procedures are largely vertical to signify the respect / acknowledgement given by the leader(s) of the requesting institution to the local government authorities. According to these procedures, all the bureaucratic staff at the central (district), subdistrict, and suco level will obey their orders and carry out their duty in serving the interests of the external party (investor, researcher, community empowerment initiative, or the like).

Subdistrict Office and the Roles of the Camat/Baucau Sub-District Administrator

The subdistrict is the level of government immediately below the district/municipality and is further divided into several suco. As the intermediate institution between the district and the suco, the subdistrict is responsible for implementing decisions and policies from the district level down to its subordinate sucos. Conversely, it forwards inputs, performance reports, and complaints from the sucos up to the district level. The subdistrict office contains a number of services/specialties that handle specific aspects of government, the economy, economic and social development, security, the youth, women, and traditional/customary (adat) issues. These services’ activities depend heavily on the Subdistrict Administrator’s performance. The agencies may implement top-down programs from the central government or bottom-up programs initiated at the suco level. The program to gather inputs and initiatives from the suco level has been in the works at the suco level but has not proceeded to the final implementation stage. Empowerment initiatives are usually made by third parties cooperating with the appropriate agency under the central government. The District, Subdistrict, and Suco administration merely get notified of the program. Some numbers are adjusted to be more in line with the programs already planned by the Subdistrict.

However, there are programs initiated at the suggestion of local NGOs to foreign donor institutions outside the Subdistrict’s lineup of programs. The unilateral implementation of empowerment actions by external parties has become a major issue for Subdistrict and Suco administrators since such initiatives may invite dissatisfaction from other sucos or groups. However, Subdistrict or Suco administrators can only refuse such programs (initiated by foreign donors through local NGOs) with great difficulty since the programs are intended to benefit the region’s people in the first place.

Subdistrict institutions and the administrator are meant to play a central role in planning and implementing various citizen empowerment programs, but this role has not been satisfactorily implemented. Still, the success or failure of local development is closely tied with the Subdistrict Administrator’s performance in the eyes of the aldeia citizens. According to the informer (Chefe Aldeia), the average citizen has virtually no power to change the prevailing conditions no matter what.
For this reason, the arrival of a major project in the form of a cement plan is hoped to change life in Baucau for the better.

**Role and Authority of the Suco**

The Chefe Suco is the lowest representative of the central government’s authority at the local level. The Suco’s role is to serve the citizens’ interests and implement the central government’s programs to the citizens at the suco level. For this purpose, the chefe suco is aided by an administrative staff that includes the suco secretary, aides / representatives for specific issues (youth, women, healthcare, religion, education, economy), and the customary chief at the suco level (lia nain) (see Figure 10-2). All of these suco staff members are appointed by the Chefe Suco, except for the lia nain in Tirilolo who is chosen through a popular election process. This particular office is usually given to a person deemed to have the most extensive knowledge of traditional laws and customs. This person does not have to be of advanced age or a descendant of the previous Lia nain. The Chefe Suco is directly elected by the people. In some of the villages we visited, the Chefe Suco were common people who had managed to prevail over rivals coming from the local elite (the rich). According to these Chefe Suco, they were elected since the people wanted an accessible leader hailing from among the common people so that the Chefe Suco can be more easily met or contacted without having to navigate too much bureaucracy.

**Figure 10-2: Suco Staff Organisation Chart**

The Chefe Suco’s role and authority are respected due to his position as a government representative. The Chefe has the power to make decisions in dealing with outsiders. In matters that solely involve local citizens, the Chefe Suco frequently delegates authority to the Chefe Aldeia at the hamlet/aldeia level or to the specialist staff. The principal staff member who has the greatest effect upon the strengths and weaknesses of the suco administration as the whole is the suco secretary. Although the secretary is appointed by the chefe, he/she wields considerable influence upon the
leader. The Suco Secretary in Tirilolo seems to have an even more important role in the suco’s administration than in the other villages we visited.

Although the organization chart of the village names many of the staff members we have previously mentioned, in none of the villages (Tirilolo, Triloca, Ostio, and Vemasse). Most of them usually handle their duties from their homes and occasionally visit the village center to obtain information related to their duties. If the Chefe Suco needs them, they can be summoned through telecommunication apparatus such as cellular phones.

An important village-level institution that handles conflicts between village people or among the youth is the KPK (Konsellu Polisia Komunitaria / Community Police Councils). This agency has two co-leaders, one appointed by the police (community police) and one community representative. This institution also includes representatives from youth, women’s, religious, aldeia, and business interest groups. In practice the KPK leadership and the Chefe Suco act to handle local issues and disputes so that they don’t have to be taken to the police.

The Aldeia

The Aldeia is the furthermost extension of the Suco organization. This lowest level of village administration is led by a Chefe Aldeia elected by the hamlet’s residents. The Chefe’s role and responsibility as a local leader is to serve the needs of the people. As a normal citizen in the hamlet, he should be quite familiar with all aspects of the hamlet’s life, from whether certain villagers are native to the village to their employment status, the education of their children, and their places of residence. Despite the status of the Chefe Aldeia, his power or authority in certain matters (such as the acknowledgement of land boundaries and the making of deals with external parties) can only be exercised in consultation with the local citizens, as otherwise the decision is likely to face considerable resistance. Such important decisions are normally made through a citizen’s meeting to obtain a local consensus.

At the projected mine and plant site, the aldeia official is elected by the villagers, but he is not fully interested in becoming the Chefe Aldeia. He was elected at the behest of the local population, but he sometimes objects to the burden of the office since it does not provide him with any stipends or allowances for travel to the village’s administrative center. The obligation to attend village meetings twice a week is straining his resources. At the same time, his activities in accompanying outsiders have raised suspicions among the local people; these suspicions are mostly along the lines that he might try to arrange things for his own private profit. In the case of the Cement Plant, the Chefe Aldeia’s busy schedule in accompanying the researchers caused some resentment since some villagers believe that the Chefe is hiding information from them. Arguably, the Chefe Aldeia should hold more frequent community meetings to explain the ongoing activities.

Informal Authority: The Political Power of Religion

A non-governmental entity with the power to affect people’s lives in Baucau is the Catholic Church. The people of the Baucau district and subdistrict are devout Catholic. The tough environmental conditions (dry due to the lack of water sources suitable for intensive farming), underdeveloped
market economy, longstanding isolation, and dearth of economic or human resource empowerment initiatives are all factors that have influenced group solidarity models.

As mentioned in a previous section, the basic social structure in the area is based upon kinship or lineage bonds. This model of social organization means that the structure of the hamlet community is made up of related kinship groups that stand independently of each other as social, economic, and political units that compete for survival resources. Whether consciously or not, territorial division along the lines of baptismal surnames is intended to control potential conflict over available resources. The ecological conditions that do not support intensive food-crop agriculture have prompted kin groups to lay claim over large expanses of land. Thus there is the need for a customary division of lands in order to allow coexistence between different groups.

In the past, the colonial government never raised substantial objections to the control of land by traditional elites. The distribution of ownership and possession over survival resources is made on the basis of closeness to elite groups, such as to followers, allies, and slaves. The distribution of rights over the resources could potentially lead to social stratification against the interests of lower-class groups, followers, and slaves. These facts on the ground, in contrast to egalitarian Christian teachings, may have prompted the Church to perform social engineering though the granting of baptismal names to traditional elites to delineate the boundaries of their traditional authority.

The division of territory according to baptismal identity has important implications to the Church’s mission of placing all worshippers on an equal footing. Traditional elites do not view the identification of territorial control with baptismal names as a threat to their traditional authority. However, in the long term this surname uniformity may eventually undermine traditional power structure. As a consequence, the territorial groups based on baptismal names no longer know who among them are truly descended from traditional elites. All members of a hamlet community sharing the same baptismal surname have equal rights to exploit the local resources.

The identification between baptismal surnames and individual customary lands remains in force to this day. The baptismal surname serves to identify the person’s place of origin along with the concomitant rights. This issue should be considered if it becomes necessary to relocate the people closest to the Project site as we will explain later.

10.6.6 Basic Social Structure of the Community

The use of baptismal surnames as the signifier of social territorial units gives the impression that the inhabitants of a single hamlet or suco form a single kinship group descended from the same ancestor. This is obviously mistaken since, despite their social and territorial unity, they are not always closely related by blood or by marriage.

Within the uniform surname shared by all members in a hamlet, there are smaller kin-based social units made up of individuals descended from a common ancestor. The members of such groups are aware of their closer bonds as kinsfolk to each other. In anthropological terms, this kind of social unit is known as lineages. The lineage unit is led by the oldest male member of the kin group. In Caisido,
membership in the same kin group is signified by affiliation to a particular customary house (rumah adat).

The customary house serves not only to remember and maintain a spiritual relationship with ancestors and deceased lineage members; it also acts as a nexus of identification for the living members of the kin group (see Table 38). Within a customary house, a lineage member is known and identified by his / her original traditional name and the ancestor’s original name. This identity is an important fixture for validating each person’s rights and obligation as a hamlet resident and a group member. When the lineage group gathers in the customary house, the traditional chieftain / elder (lia nain) – the oldest male member of the lineage – recites the traditional name of every member. For convenience’s sake, all lineage members must know their ancestor’s traditional name. Customary houses are normally situated together with other customary houses, as in the case of the houses owned by the people of the aldeia closest to the Limestone Mine and Cement Plant site, However, in some cases the customary house may be built outside the consolidated site. This variation does not seem to be viewed as a transgression against customs and traditions.

Table 38: Some Lineage Ancestor Adat House Name of Osso-Ua

<table>
<thead>
<tr>
<th>Betulale</th>
<th>Cai-Ono</th>
<th>Loledeso</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lole Utohamo</td>
<td>Gei-Uono</td>
<td>Loladeso-Anamesa</td>
</tr>
<tr>
<td>Caiada Maucul</td>
<td>Caiwada Cakrano Uake</td>
<td>Caiwada Au Bala</td>
</tr>
<tr>
<td>Rubiace</td>
<td>Sinielaki</td>
<td>Wonolila</td>
</tr>
</tbody>
</table>

Source: Interview with key informant, Osso-Ua 2015

This difference has not attracted complaints from other villagers. Neither the chefe aldeia nor the customary head of the relevant lineage considers the owner aloof or asocial. They seem to be able to accept the reason offered, which is to make it easier to care for the customary house.

Nevertheless, the customary house (rumah adat) continues to play an important role as a symbol of identity and the people’s reaffirmation as native residents of a hamlet. As a member in a hamlet / suco, the control and possession over the limited resources available in the hamlet / suco is a critical factor in ensuring survival. The customary house can be theoretically viewed as a response to the Church’s attempts to impose a new identity by compressing social strata into a single egalitarian layer without any distinction in power between one class and the next. The aims and relevance of this institution has already been discussed above.

10.6.7 Marriage System and the Debt of Exchange

It has been explained above that the basic social structure of the Caisido communities (the aldeias Parlemento, Caisido, Lialaileso, and Osso-Ua) is the patrilineal and patrilocal lineage. This group consists of a set of nuclear families led by related males. If a daughter/sister and her husband continues to live with the group, her household does not count towards the reproduction of the lineage
group, or in other words the children of female descendants are not regarded as members of the parent lineage.

The reproduction of the lineage is conducted through the marriage of a male member with a woman from another lineage. There are no rules or restrictions about which lineage’s women are deemed suitable for marriage. Neither is there any prohibition against marrying people from the same hamlet, or in other words with the same group. For instance, a Belo may marry with another Belo as long as the two do not come from the same lineage (the same customary house/rumah adat). However, the sons of a certain lineage (such as Belo) are generally encouraged to find a mate from a surname group (such as Soares). This is meant to build wider-ranging social networks, which at the same time expands the web of socio-economic exchange and mutual political protection. Still, this does not guarantee the possibility of resource exploitation within the territory owned by the parents of the fetosaun (daughter-in-law). The establishment of social networks through marriage bonds will provide greater social security through a perpetual exchange arrangement.

Marriage not only allows reproduction for the members of lineage groups but also forms a perpetual exchange relationship between the two lineages (ummane-fetosaun). There are few or no customs that dictate whom one might marry or how the lineage might arrange marriages. Young men are generally free to choose their prospective mates. The marriage procedure is quite long and involved. First, when a man wishes to propose marriage with a woman, the man’s family must make an initial approach or state a preliminary wish to propose to the woman’s family (‘ketok pintu’ or ‘knocking the door’). After the proposal has been accepted, the male side must offer livestock – usually buffalo or oxen – as ‘pembuka jalan’ (‘opening the way.’). The livestock will then be used in a ceremony in the customary house to inform the ancestors of the woman’s family about the plan; once this has been accomplished, the two parties will then discuss the size of the bridewealth (belis). When they have reached an agreement the male side will pay the bridewealth (belis). The demanded belis is always rather costly, but the male side does not always have to pay it immediately. In fact, even if the male side is capable of paying the entire sum at once, such a one-time payment would be rejected as being inappropriate and a customary transgression. The male side usually makes an initial payment of the belis in the form of a buffalo, ox, horse, or goat depending on their financial capabilities. The rest of the belis would be paid later after the marriage as some sort of debt repayment. The belis debt is called and paid when the female side needs it, whether to provide belis for a male member of their own lineage, to conduct ceremonies in the customary house, to defray funeral expenses, or to fulfill some similar need. The payment should ideally be in the form of livestock as in the initial belis payment. Neither side is allowed to make an exact reckoning of whether the debt has been paid in full or not. Any discussion about calculating the debt, especially when initiated by the male side, is regarded as a breach of taboo and a transgression against longstanding customs. If it happens anyway, a customary fine is levied upon the male side in the form of livestock similar to the original belis payment.

After receiving the belis, the female side reciprocates by giving a modo (or sayur) in the form of a pig, a chicken, a piece of cloth, etc. The relative position between the two lineages remains the same; that
is, if one side wishes to throw a feast for the other, then it must remember its original role as either the
woman-giving or the woman-receiving side. Any mistake in the kind or amount of payment made at
any point is seen as a customary violation and the transgressor must pay a fine.

Even when the belis has not been completely paid out, any children from the union is regarded as a
descendant of the male lineage. The children of a female member of the lineage does not count as a
member of the mother’s lineage, but may request baptism by one of the mother’s male relatives if
he/she wishes to use both the paternal and the maternal baptismal surname. Similarly, when a
woman marries into a different baptismal surname, she would continue to use her original baptismal
surname by appending it before her husband’s surname, e.g. Maria Belo Suares. In this case Belo
would be the baptismal surname of Maria’s parents, while Soares is her husband’s baptismal
surname appended at the end of her own. This naming signifies identification and respect for both
surnames.

The use of baptismal surnames as personal identity is closely intertwined to rights to partake of the
resources in a traditional/customary territory. Today the demand for this is largely economic in nature,
especially in terms of membership in the parents’ customary house (rumah adat) and lineage
grouping. The political side of these rights (such as eligibility to become a chefe suco) is no longer
influenced by particular traditional identities, and tends to depend more on the ability to connect with
ordinary people.

Although female members of the lineage have been ‘released’ to their husbands' respective lineages,
they still maintain some degree of connection with their parental families through brother-sister
relationships. For instance, if a married woman dies, some of the first people the husband would
inform are the wife’s parents or lia nain. In the process the husband or the male side of the exchange
is supposed to send livestock in a similar manner to the payment of the belis. Similarly, if the husband
dies and the wife would like to remarry, the new husband-to-be should ask for permission from the
widow’s parents or lineage elders, not from the oldest male member of the late husband’s lineage. In
either case, the bonds of exchange between the lineages are not severed upon the death of either
party in the marriage. The presence of the woman-giving side (regarded as the life-giving side) and
the woman-receiving side are required for joint funeral arrangements. This involvement by both sides
is deemed important not only for the sake of the soul of the departed, but also for those left behind to
gain some closure. Hicsk (1976) states “that the passing of information to the woman-giving lineage is
related to beliefs about how to take care of the soul of the departed so that it can rest in peace in the
afterlife and so that the living members of the lineage can come to terms with the loss.”

This explanation can be summarized in that the role of female members of the lineage is not limited to
being reproductive agents but also as the means for the establishment of a web of exchange
relationships that can have beneficial effects to her lineage of origin. In the religious-magic sense, she
plays a major role in death-related rituals as a representative of the life-giving lineage. Her rights in
her own lineage may seem quite weak since she does not have inheritance rights, but she is an
important asset to her lineage in the establishment of extensive social security networks through a
system of her perpetual exchange and her role in taking care of death- and funeral-related
arrangements. The customary exchange system through marriage can be seen as a socioeconomic burden to the male side, while at the same time providing the customary lineage group with the social capital to accumulate surplus in the face of resource scarcity.

Under all this customary pressure, the traditional system allows the opportunity to answer economic challenges (subsistence needs) with the aid of a complex exchange network. In this context, it would appear that the apportioning of customary lands through baptismal surname groups and the harsh ecological conditions have influenced the modes of social organization. From the spatial perspective, the territory of the baptismal surname group is a ‘place produced through the interaction of social relation, expression of identity and the practice of culture.’ (Appadurai, cite from Panneli, 2011: 220)

10.6.8 Women's Position and Gender

Women's position and role in the Suco Tirilolo community in general and the Caisido region in particular (the Aldeias Parlemento, Caisido, Lialailes, and Osso-ua) – and even among the Baucau population as a whole – appear to be rather contradictory. As a member of the lineage group, her presence is an important asset for the rest of the kin group in establishing social relationships, especially for economic purposes. On the other hand, she lacks the right to inherit subsistence resources (particularly land) from her lineage group.

The patrilineal and patrilocal system in Tirilolo (and Baucau in general) is rather unique. In a normal patrilineal system, the woman’s bridewealth (belis) must be paid in full, and afterwards neither she nor her husband retains any obligation to aid in the provision of dowries or bridewealth for her male relatives who would like to marry. If the husband dies, the woman (and her children) fully becomes the ward of the husband’s family.

In Baucau, although the woman has to be ‘purchased’ by her husband, custom dictates that the man should not pay the requested bridewealth (belis) in full even if he is capable of doing so. The outstanding sum becomes a perpetual debt that the husband must stand ready to repay throughout the marriage, and also creates a bond of mutual indebtedness between the lineage groups that will last for generations. Neither side is supposed to raise the point of whether the price has been paid in full or not. Any discussion of the matter is seen as a taboo.

Once a bond has been formed between woman-giving and woman-receiving lineages (ummane – fetosaun), the relationship is perpetuated in the form of occasional exchanges. Each side must keep its original role in mind in performing later exchanges or offering aid. The woman-givers (ummane) would give something commensurate to the original “sayur”, such as pigs, chicken or something similar. On the other hand, the male side must offer contributions or aid of similar form and value as the belis, such as buffaloes, oxen, goats, or horses. These customary obligations also apply in offering meals (or throwing a feast) for either the woman-giving or woman-receiving side. Mistakes in offering gifts or serving food would require the party at fault to pay customary fines.

Although a woman has been given by her lineage to her husband’s lineage, she is required to maintain elder-younger sibling (maun – alin) or brother-sister bonds. If the woman dies, the husband
must promptly break the news to the wife’s family, especially her elder siblings. This communication is
accompanied with a gift of livestock similar to the original bells. The notification is mostly about the
process of taking care of the deceased spouse’s body. Similarly, if a woman gets widowed and
another man wishes to marry her afterwards, the new husband-to-be should put forth his proposal to
the oldest male member of the woaman’s lineage. The agreement does not have to wait for consent
from the woman or her late husband’s family. Afterwards the remarried woman will reside according
to the terms of the agreement, sometimes with her new husband’s lineage and sometimes back with
her original lineage on land managed by the oldest male member in her lineage group (lia nain).

Women do not have equal status with their male relatives, but their role is very important in building
social security networks for her lineage’s descendants and in achieving closure in matters that touch
the world of the afterlife. Amidst these ambiguities, women/wives need to develop strategies to
guarantee their futures.

Local natural and ecological circumstances that do not support market-oriented intensive farming,
stagnant subsistence patterns, the lack of local investment opportunities outside traditional sectors,
the burden of mutual indebtedness between ummane and fetosaun and elder and younger siblings –
all of these are challenges that must be overcome by lineage groups and especially the women in
order to be able to accumulate surplus and invest them for the future.

10.6.9 Decision-Making among Kin Group and the Neighborhood

It has been explained in previous sections that the patrilineal lineage constitutes the basic social
structure in the Caisido community. This kind of structure places decision-making power in the hands
of the oldest male member of the lineage. Although the oldest male holds the power, he must consult
with his male relatives. Husbands of female relatives living with her lineage group are not counted in
the consensus, and even if present they do not have the right to express their opinions.

In relation to the Project, any major decisions related to land purchases and or resettlement /
relocation will require several consultative meetings, since it is possible that the solutions/suggestions
chosen in the local meetings may fail to garner official government approval. By the same token, any
decisions or suggestions made by governmental authorities must be discussed and mooted with male
relatives in the lineage group; the process goes back and forth until an agreement is reached.

At the hamlet level, the Chefe Aldeia’s office as the head of the hamlet does not give him the authority
to make unilateral decisions, especially when it may affect fellow villagers’ assets. Any decisions must
be made together by the lineage as a whole. It may take multiple meetings to reach a final decision
since, as mentioned above, the decisions made by the lineage’s lia nain cannot be implemented
unilaterally without consulting with male relatives within the lineage.

Hamlet-level consultative meetings involve all lia nain according to the number of customary houses
(rumah adat). Since every lineage group has decision-making authority, there is probably going to be
some differences in opinion between the lineages. However, in dealing with the Project, the decisions
of the most directly-affected lineages should be prioritized, while the remaining lineages should not
have the authority to speak for the affected lineages or for the hamlet as a whole. The chief of the Aldeia does not have the authority to interfere with any villager’s interests. His role as the leader of the aldeia or suco is merely to facilitate the meeting and pass suggestions from the other parties that he represents. The chefe of the aldeia and/or suco cannot impose his will and can only offer recommendations. Should the matter fall into a deadlock, the decision would be referred to the Regent/District Administrator. The Regent’s decision is binding and final, and the villagers treat the District Administrator (Bupati) as the symbol of the government’s ultimate power, but the decision must inevitably take account of the interests of all parties without unfairly benefiting any single party over the others. Still, the lack of any written and legal proof of possession over the land resources managed by the villagers places these villagers in a relatively weak bargaining position.

10.7 Stakeholder Identification and participation

Efforts to disseminate information about the Project by TL Cement took the form of several public consultation meetings:

On 9 May 2014, a meeting in Suco Tirilolo, attended by the Chefe Suco of Tirilolo, Bahu, Triloca, Caibada, Bucoli, Garuwai, and Wailili. The institutions involved include:

- District Administrator of Baucau;
- Chief Police Commander in Baucau;
- Baucau Subdistrict Administrator;
- Local NGO Hamahun;
- Director of IPG (Institute of Petroleum and Geology);
- Director of BGC/TL Cement;
- Director of Land and Property of Baucau District;
- Director of Environment of Baucau District;
- Representative of Veterans in Baucau District;
- Local Authorities;
- Tirilolo community; an estimated 90% of community members from the 4 Aldeia closest to the project site were present at the meeting; and
- Tirilolo youth.

The response from the Caisido community can be summarized by the following points:

a) The Caisido community is 100% willing to welcome the investment and the Baucau Cement Project in the area.
b) The community and youth in Caisido (38 traditional houses), will not impede the progress towards the development of aucau Cement Plant and will be working with the Government of Timor-Leste to improve the economic condition of the population.

c) We appeal to the government to decide upon a new neighbourhood for our resettlement and to make sure that the development of the aucau Cement Plant will generate benefit for our present and future generations.

d) We appeal to the company to provide a clear plan for protecting our future livelihood and for ensuring good coordination the government.

e) We appeal to the company to establish an agreement with the Government of Timor-Leste.

They raised the following concerns

a) Whether there are any traditional houses that the development may impinge upon.

b) How the government and other stakeholders would pay due respect to our cultural inheritance.

c) Clear identification of boundaries for the development site(s).

d) The Government should clarify land ownership and possession status with the Caisido community.

e) The Government and stakeholders should continue information dissemination and consultation efforts with the community.

Responses to the community's concerns from the authorities and TL-Cement Agency:

The Director of Land and Property

The Director of Land and Property responded about status of the land; first he explained that there are several types of land, i.e.

a) Abandoned land / state property.

b) Heritage / customary land passed down from the ancestors to become communal property, such as suco's common lands.

c) Private property land, registered with land ownership certificates.

d) Dowry property exchange.

Furthermore, he explained that before the project begins, his team will work together with local authorities to identify the proprietor(s) of each type and plot of land, and then affected plots will be measured to calculate the appropriate compensation value.

Baucau district Administrator

"Affirmed that the company has every intention to improve the community's livelihood and that they (the community) should not pay any attention to rumors that the company will destroy Suco Caisido's
natural environment. He added that he will keep fighting for the community's wishes and that his team will frequently visit the communities so that they can hear the local communities' concerns and report them to the government for consideration.

**Police District Commander of Baucau**

"Stated that they are ready to provide full security in the designated area and assure that since many young people will be employed, there will be no youth confrontations. He also appealed to the community to ignore rumors spread by those who clearly do not want to develop the nation. He emphasized that his team will work together to support the government by supporting the project. He appealed to the community that this is their 'battle' and that everyone should take the chance to win it as this will reduce the unemployment rate in the country and improve our economic condition."

**The Youth Group**

"Their full support for this project and agreed that it will generate profits for their community by reducing the unemployment rate in Baucau District."

**Responses from the BGC/TL Cement to the community’s concern, spoken by the Director**

"He explained that in order to manage the HR, they will use following method:

- Training; and
- Assign the right person to the right position.

They will also employ local people in the following capacities:

- Labour;
- Janitors / Cleaning Service;
- Security;
- Administration;
- Construction worker; and
- Carpenter.

He also affirmed that the government and its counterparts will be working together to reduce the unemployment rate in the country and that they will keep fighting for the community's well-being. This will increase the local HR capacity so that they will not rely on other nations' HR."

1. After General meeting on May 9 2015. The TL-Cement representative held intensive meeting with local people at several suco, i.e.
2. On 24 June 2014, another public consultation was held in Suco Tirilolo. The meeting was attended by the Chefe Suco and the Youth Groups of Suco Tirilolo. It raised the issue of the status of the land. The community expressed their hopes:
o The Community recommended that the government and the company should prioritize the interest of the local population in the Caisido region, especially the four Aldeia: Caisido, Lialaileso, Parlemento, and Osso-Ua. This is the recommendation and information from the Tirilolo Community.

3. On 16 July 2014 there was a public consultation to discuss cultural ceremonies at the planned Project site. For this purpose, TL Cement was requested to clearly delineate the Project site's boundaries, since the community would like to perform an animal (buffalo) sacrifice ceremony at the site.

4. On 10 November 2014, a meeting was held with the community and landowners in the Macadai aldeia, Suco Bucoli. The results stated that:

   o The planned Limestone Mine sites AD-1, AD-7, and MI-3 were formerly arable lands but they are currently abandoned. There are other plots of fallow or abandoned land, and around 5% are owned by community members. This calls for compensation to prevent conflict;

   o The community is glad to hear that an industry will be established in the Baucau municipality for the first time. It will be advantageous for the community and will benefit the livelihood of the community and future generations.

5. Meeting with the Bucoli community and landowners. The topic was an explanation by TL Cement over the public's concerns, especially about the recruitment of workers for the Project. The recruitment will be ‘based on their capacity and skill and they will be given training for the relevant positions ranging from technical ones to non-technical ones such as administration’.

All statements quoted in this section are based on the minutes of public consultation as documented by TL Cement (Project No. 301012-02135).

6. In addition, on 1 March - 7 April 2014, the stakeholders from Baucau and Vemasse Subdistricts were taken on an inspection to the central plant of TL-Cement in Australia.

10.7.1 Analysis of key social issues

The survey was performed randomly upon the Chefe Suco and a number of local residents; we did not manage to meet up with all the Chefe Suco who were involved in the public consultation since some of them were away when we visited the locations. We met in person with the Chefe Suco of Tirilolo and Triloca, and the Suco Secretaries of Vemasse. These village secretaries appear to have a more forward-thinking view in the collection and expression of community opinions. Our associates indirectly collected community wishes and opinions from the Sucos Bahu, Bucoli, and Garuwai.

The overall results of the survey are: the general response from the Sucos is relatively consistent with the opinions expressed in the existing minutes of public consultations, so most of them do not bear repeating. Most of the concerns relate to the Project’s commitment to employ local workers, transparency in labor recruitment, and an equitable distribution of employment opportunities for the
youth from all Sucos in the Sub-district, and finally the degree of TL Cement’s commitment to local development.

• Although the Chefe Suco had already attended the public meetings, they still expressed some doubts,

• Would the plant cause dust and noise pollution in the local area?

• Would TL Cement really implement the same standard and type of manufacturing equipment as in the Australian plant? There are concerns that TL Cement might use lesser-grade equipment that could cause environmental problems in Timor-Leste.

• Would TL-Cement apply the same remuneration scale and system as in TL-Cement Australia?

• Will the project truly employ as many locals as asserted in the public meetings?

10.8 Social Risk Analysis

This chapter on impact assessment describes both the potential positive and the potential negative impacts (primary and secondary) that may result from the implementation of the TL Cement Project. The potential positive and negative impacts upon the environment are divided into three categories, namely:

• Pre-construction;

• Construction; and

• Operation.

The most common social impact prediction methods may not be perfectly applicable to the local region and / or communities, so these methods require some degree of modification and improvisation to suit the local situation. Some programs may cause both intended and unintended results. It should be kept in mind that the impact of monetization in a subsistence community would have long-term effects and the consequences of the impact might diverge into several different directions due to regional diversity. In Baucau's case, ecology is a significant factor that influences the nature of impacts. The adverse ecological situation in the Caisido area requires special attention or treatment. It should also be noted that mitigation efforts would directly impact the Caisido area as the center of social impacts.

In Caisido, the aspects of life that would be affected by the Project are not restricted to employment opportunities, but also include the loss of land as a source of livelihood; the uprooting of cemeteries and traditional / customary ritual houses; noise, dust and ash pollution; intense traffic in heavy vehicles and other means of Project-related transportation; and the day-to-day behavior of the labor force. Therefore, the Project's effects to daily life would be quite significant. In contrast, the impacts to other communities would be mostly a matter of emerging employment opportunities even though these opportunities would not become available in particularly large numbers.
10.8.1.1 Pre Construction Phase

The major activities in the pre-construction phase are the acquisition of land for the Limestone Mine and Cement Plant sites and the construction of roads to the Clay site as well as the Jetty and various supporting facilities. These activities are expected to cause a number of significant positive and negative impacts in the form of:

- Potential Positive impact;
- High expectations among the local people Primary potential negative impacts;
- Conflict over the status of land;
- Conflict over compensation values and systems;
- Conflict over the dismantling of graves and customary ritual houses/rumah adat;
- Resettlement;
- Secondary potential negative impacts;
- Potential conflict of interest inter-suco; and
- Potential damage to household subsistence condition.

10.8.1.1.1 Potential Positive Impacts

1. High Expectations among the Local People

The plans for the construction of a Baucau Cement Plant in the Baucau Subdistrict have raised great expectations among the local residents for the social and economic development of their home region. These hopes were further strengthened when the Project invited local representatives to visit and review the site and activities of a cement plant in the cement industry's central location in Australia.

Other activities that have contributed to the local residents’ high hopes are studies held on behalf of the Project and meetings to disseminate information about the potential risks and benefits of the proposed Project. The principal expectation among formal government authorities from the district level all the way down to the sucos and among youth representatives are the creation of new employment opportunities; the improvement of public and social infrastructure and facilities such as roads, medical clinics, and schools; and the revitalization of local and sub-regional economic activities. The recruitment of a large number of workers for relatively long-term employment is seen as a factor that would inject a measure of vitality into the social and economic life of the region, which has previously remained stagnant due to dependence upon the traditional agricultural sector where the limited availability of labor and the harsh environmental conditions have stood in the way of economic expansion. This difficult situation places the local residents in an uncertain and precarious subsistence situation. Change is deemed unlikely in the absence of an external stimulus (in this case, the arrival of the cement industry).
10.8.1.1.2  PRIMARY POTENTIAL NEGATIVE IMPACTS

1. Conflict over the Status of Land

The required amount of land for Cement Plant, Jetty, Conveyor and MOF is approximately 82 ha. The limestone extraction area is categorized by the Director of Land and Property in Baucau District as uncultivated secondary forest. The land needed for the rest of the Project infrastructure and facilities lies on a variegated landscape of gardens / orchards, rice fields, and residential properties.

According to the Director of Land and Property, the legal status of a plot of land is largely based upon the absence or presence of human cultivation. Cultivated land is treated as private property, while uncultivated or abandoned land is regarded as public or government property. This categorization according to cultivation status may lead to conflict with the owners of land that have been or are being left fallow for several years, whether due to the need to restore the fertility of the land or due to labor shortages and the underdeveloped market economy, which makes it impractical or undesirable to work more land than what the farmer needs to fulfill his family's subsistence needs; damage or neglect to traditional irrigation networks has also caused the abandonment of arable land.

Unlike rice fields that are worked in every planting season, garden and orchard plots are usually exploited for a specific period between 3 and 5 years long and then left fallow for roughly the same amount of time before the site is cleared and taken back into cultivation. As such, horticultural land may appear to be abandoned when in fact it is being deliberately left fallow to restore soil fertility.

Another point of difference is that rice fields that have been abandoned or left fallow tend to remain identifiable as former rice fields, unlike abandoned gardens and orchards that quickly become indistinguishable from the surrounding bush apart from traditional markers like the low stone fences used to mark field boundaries. These fences are easily damaged or brought down by livestock grazing or browsing on the land. Nevertheless, these traditional fences are acknowledged by the village community as markers of land ownership. The fences are mended and rebuilt whenever the fallow plot is cleared and reopened for cultivation.

The lack of formal land ownership certificates places traditional smallholders in a weak bargaining position. At the same time, local community structures are based upon kinship / lineage groups and socioeconomic bonds between woman-giving and woman-receiving groups, and this tends to facilitate the spread of any potential conflict. The involvement of the woman-giving side would eventually influence the morality of exchange between the woman-giving and the woman-receiving side; it may also weaken women's bargaining position as we shall explain in a later section.

2. Conflict over Compensation Value and System

The determination of compensation prices / values and the type or model of compensation payment is a follow-on impact of land acquisition. Another major issue is the appropriate value and system of compensatory payments for communities that still live at a subsistence level.

These secondary negative impacts may become primary impacts under the influence of two factors that may lead to the accumulation of impacts. The first stems from the unilateral determination of
land ownership status according to the government’s criterion of whether the land is being worked or not; the proportion of land being actively cultivated is relatively small, so the landowners’ bargaining position in negotiating compensation values tends to be rather weak. The attribution of inadequate amounts of land to the local residents is the likely result of unilateral decision-making through the District Administrator’s fiat. Even if the owner is capable of driving a hard bargain, the eventual amount of the compensation agreed upon by both sides would probably still be too low to allow the purchase of enough land elsewhere.

An issue to be considered is the choice of compensation system. The land acquisition system usually involves the outright sale of land, which suits the preference of most project investors.

Compensation through cash payments could lead to potential follow-on impacts such as the proliferation of impoverished households, reduced environmental quality and the perpetuation of substandard housing.

3. Conflict over the Dismantling of Graves and Traditional Ritual Houses

The construction of the cement industry would affect a number of gravesites and approximately three customary/ traditional ritual houses (rumah adat) in the vicinity of the Cement Plant and Jetty sites. The number of affected religious-cultural sites would be quite small, but it would be unwise to underestimate their significance to the traditional belief system and their importance in symbolizing the integrity of lineage identity. Any disturbance to gravesites would interfere with the spiritual connection between living family members and the souls of the dearly departed. In conjunction with the impacts of land acquisition, this may lead to an accumulation of impacts that adversely affect the psychological condition of living family members. The concomitant psychological and physiological stress would be attributed to the disturbance to ancestral graves. This stress cannot be easily reversed.

Another kind of cultural site that requires great care in its handling is the customary ritual house (rumah adat). Based on our informant who owned the customary house, there are 3 customary houses that will have to be relocated. These houses are located away from the hamlet’s main cluster of customary houses, ostensibly so that the lineage groups that own them would have an easier time conducting their rituals. We suspect that the actual reason was that these lineages were descended from the lepers exiled to Osso-Ua. The traditional rituals are performed on an irregular schedule and the local population seems to have largely forgotten those families’ identity as the descendants of lepers, so it’s unlikely that there would be any major objections to their relocation.

The relocation of a customary house is expected to go much more easily than the exhumation and relocation of a gravesite. The customary house essentially symbolizes a lineage group’s identity. This symbol of group identity plays an important part in allowing members of the same territorial community to distinguish themselves from each other. As the basic social structure in the area, the lineage group provides a venue for group reproduction and the establishment of social security networks through bonding rituals between woman-giving and woman-receiving groups. There is no indication that customary houses are regarded as the abode of the souls of departed ancestors.
However, communication with the souls of departed ancestors is performed in the customary house, such as when the lineage would like to accept a marriage proposal from another lineage. The customary house also serves as an institution to socially bond the lineage members together. Rumah adat or Ummanenum is symbolic rule of the patrilineal lineage groups of members. Therefore, the relocation of a customary house and the attendant ceremonies would require a great deal of intensive consultation beforehand.

The degree and extent of impacts from the relocation of these cultural sites would be relatively limited, but there is the risk of accumulated impacts against the local population’s traditional beliefs. The impacts would also be basically irreversible, so the mitigation efforts should involve consultation with all relevant parties to protect the interests of the living family members. This would allow the effective management of the impacts.

These issues aside, the project is still likely to end up being economically and socially beneficial, not only to the families affiliated with the relocated graves and customary houses but also to the Caisido population as a whole. This should be put into perspective against the situation in the absence of the project, in which case there would be fewer opportunities to open the region to the outside world.

4. Resettlement

The construction of a cement factory would require the resettlement of at least 12 households in the vicinity of the mine and plant sites and 3 households near the jetty. This number is relatively small, but any population resettlement presents complicated issues. The implementation of the Resettlement Plan should take account of the residents’ wishes, the state of the resettlement site, and assistance for the social and economic reestablishment of the relocated households.

Consultative meetings have shown that Caisido communities offer a great deal of support but also expect much in return from the cement factory. They are willing to help in overcoming potential hurdles in the interest of local economic development. Community leaders do not always seem to be aware that the construction of the cement industry would require the relocation of graves, customary houses, and households. These three issues are the prerogative of the affected lineages, whose decision-making powers cannot be assumed by a different party. Of course these affected households would probably not go openly against the majority opinion, but any decision over the appropriation or relocation of private property should involve direct consultation with the affected parties. This expectation was expressed by the households whose gravesites, customary houses, or homes would be directly affected by the Project.

Resettlement action cannot be treated separately from the relocation of graves and customary houses as disparate issues that require consultation. Each issue has a unique battery of impacts in terms of extent, magnitude, and accumulation, but the mitigation demands an integrated approach. For this reason, the consultative approach would treat the discussion of these three principal issues as a single package. The consultation should discuss the management of the issues in a thorough and transparent manner with regards to the risks and benefits to the hamlet residents so that the household leaders (lineage lina nain) would be able to take decisions without duress or pressure. The
complexity of the issues faced by the owners of the houses, graves, and customary houses due for relocation means multiple and repeated consultation sessions are likely to be necessary.

The analysis above shows that resettlement action is associated with significant primary impacts not only with regards to the restoration of livelihood for the resettled population but also in the relocation of graves and customary houses, so there is considerable risk of impact accumulation. However, the impact is largely reversible and manageable. The management of the affected groups should be relatively achievable due to their small numbers.

Neglect and lack of attention towards the resettled population’s attempt to reorganize their lives may cause significant economic decline and (at least in theory) might even trap them in long-lasting poverty. As such, it would be wise to engage in the comprehensive treatment of resettlement issues and to allocate employment opportunities for at least one member of each resettled family.

Despite the complexity of the issues described above, the presence of the Project is still expected to enhance the dynamism of the local socio-economic conditions. Local resources and capabilities for the fulfillment of subsistence needs have largely been constrained by various uncertainties and harsh natural conditions. The Project would allow the population to overcome these constraints by taking advantage of new employment opportunities and the opening-up of their region to the outside world.

10.8.1.1.2.1 SECONDARY POTENTIAL NEGATIVE IMPACTS

1. Potential Conflict of Interest between Sucos

In addition to conflicts over individual land ownership status, there is also the potential for conflict over land rights between neighboring sucos.

From our analysis land acquisition will cause different potential impacts in the two affected sucos. Around the activity centers of the cement factory, the potential direct impacts take the form of potential conflicts over land stewardship rights if the criterion of ownership is decided unilaterally according to the government’s standards. The probable consequence is that the local population will receive less compensation than they actually deserve since the extent of land deemed eligible for compensation would be limited to the garden/orchard plots being presently cultivated. The impact may also exacerbate the situation when the affected household is affiliated with the customary houses (rumah adat) or gravesites that would be directly affected by the Project; this further weakens their bargaining position and places them under greater psychological stress. These impacts can and should be managed to reduce or even eliminate the potential direct and follow-on consequences, such as by taking appropriate decisions about land ownership status, compensation value, and the relocation of graves, residences, and/or customary houses through intensive consultation with the aid of a third-party facilitator.

Seen as a whole, the Project is probably still going to have a net positive impact, especially with the opening up of the Ostico region to the outside world and the opportunities to develop currently neglected agricultural lands. These two opportunities should promote and accelerate the development
of the Vemasse area. Meanwhile, the absence of the Project would leave Vemasse in its current isolation with a substantially different pace of change.

2. Potential Damage to Household Subsistence Situation

In Caisido, no matter how much land is acquired by the Project, the results will inevitably affect local households' subsistence situation. This is particularly related to the change in the status of the reserve/fallow fields, which are traditionally regarded as private property but might end up being treated as government property with no attached rights for individual compensation. In that situation, even if the owner receives compensation, the sum might be insufficient to offset the loss of the land. The money/capital thus obtained would not be enough for the development of businesses outside the traditional sector that the owners are already familiar with.

The case study on household economies has revealed that households with alternative sources of income (apart from horticulture) are more likely to be able to secure their subsistence situation and accumulate surplus. The employment opportunities provided by the Project may also help replace the loss of traditional subsistence resources. However, this opportunity may be beyond the practical reach of some households. The average size of a household in Osso-Ua and other hamlets is no more than 4 - 5 people, and as such there would normally be only one family member who could work at the Project, and even then they would likely end up in a non-skilled position with correspondingly low wages. The family will have an even harder time trying to accumulate surplus if the employment is intermediated by a third party. This situation would persist throughout the existence of the cement industry unless there are adequate efforts to empower the traditional sector with the aim of increasing field productivity.

Records indicate that 3 households near the Cement Plant and Jetty will be directly affected by land acquisition activities. The number of landowners who would be affected by the road-building project is currently unknown, but the geographical extent of the impact would be limited to the Osso-Ua aldeia.

The direct impacts may be transitory but their consequences may extend far into the future, especially in the absence of initiatives to empower the traditional sector and create employment opportunities. The impacts may accumulate if the subsistence condition persists, which will lower the value of local human resources in terms of health and fitness and thus impair the local population's chances for involvement in the Project. However, the impact is essentially manageable and reversible. Also, if the Project is properly planned and managed, it should be able to improve the social and economic situation of local communities as a whole. The absence of the Project in the Caisido region would thus leave the region in its present stagnation since there would be no external empowerment initiatives that address the core issues in local economic activities.
10.8.1.2 Construction Phase

Main Activities:

- Land clearance and site preparation;
- Jetty construction;
- Employment opportunities;
- Mobilization of heavy equipment;

Primary Potential Positive Impact:

- Employment opportunities Secondary Potential Positive Impacts;
- Improvement in local households’ social and economic condition;

Primary Potential Negative Impacts:

- Conflict Over Recruitment Job Opportunity;
- Termination of employment at the end of construction Secondary Potential Negative Impacts;
- Influx of workers from outside the local region;
- Women’s bargaining power;
- Dependence upon Cash Income/Money in Household Subsistence Arrangements; and
- Public health.

10.8.1.2.1 Primary Potential Positive Impact

1. Employment Opportunities

Employment opportunities are one of the main issues that the Project relies upon for attracting the support of the local population. Construction activities for the Project are estimated to require a peak number of around 1,000 workers, or about 9% of the working-age population in the two local subdistricts.

Our estimation based on analogical with similar Project the employment will be 12% of the employment opportunities created would be for management staff, 28% for technical workers, and 60% for unskilled laborers. The Sub-district Baucau population, should ideally be able to fill all the required positions, except for management staff and technical skill. Surveys reveal that around 19% - 22% of young men and 22% of young women have senior high school education while 9% - 12% of young men and 8% - 10% of young women have college or university education. In the rural (Caisido) region about 10% - 20% of boys and 12% - 21% of girls have achieved junior high school education, 5% - 17% of young men and 12% - 25% of young women have senior highschool education, and 13% - 31% of young men and 13% - 24% of young women have bachelor’s degrees.
There is a secondary technical school in Suco Uailili of the Baucau sub-district that accepts student from the entire Baucau region. The graduates from this school should be able to fill some of the technical worker positions required by the Project.

10.8.1.2.2 **SECONDARY POTENTIAL POSITIVE IMPACT**

1. **Improvement of Household Economic Condition**

The possible availability of employment opportunities in the local area is an important follow-on impact that helps provide more certainty for household subsistence. Case studies show that households with additional sources of income in non-traditional sectors are more likely to be able to fulfill their subsistence needs. The availability of $15 daily (based on our experience during site visit) pay over a fairly long period would help guarantee the fulfillment of subsistence needs for young men’s parental households while the parents would still be able to work their traditional gardens and orchards. Although not all jobs will be available for the entire duration of the construction phase, several days of work per month would still help greatly towards the fulfillment of subsistence requirement. A $15 daily wage is equivalent to 1 sack or 25 kg of rice. This much rice would fulfill 2 weeks of subsistence needs for 4-5 family members in a household. There is relatively little concern that the availability of cash will attract potential borrowers since all households in the immediate area would stand to benefit from the Project.

Problems may arise since, in theory, communities with a long tradition of subsistence living may have difficulties in turning their cash (capital) surplus into productive spending. From the same theoretical standpoint, it would be difficult to make productive investments since there are few or no local opportunities. The harsh natural and soil conditions and the fragmented ownership of small, widely dispersed plots of land tend to make it difficult to improve the efficiency and productivity of the land. However, a spin off benefit could be secondary services local business owners could provide to future project employees.

Field productivity can be increased in two ways, namely with the more extensive planting of marketable crops and improved irrigation and the introduction of fertilizers. These treatments would open more opportunities of work in the traditional sector, especially for women and the elderly. These activities would also help the promotion of a market economy since the growth of the traditonal sector can be expected to aid the growth of the commerce and transportation sectors. All of these would depend on the availability of outside help, such as agricultural inspectors who can motivate and teach the farmers about ways to increase the productivity of their plots. The project may get involved in these activities by supporting the distribution of fertilizers and high-quality seeds in cooperation with the relevant government authorities.

These steps should be begun during construction to ease further assistance efforts during the operational phase. Such efforts would be very important in getting women to be more involved in the economy of their village.
The improvement of local households’ social and economic conditions is the follow-on impact from the availability of employment opportunities and secondary downstream service and commerce industries. TL Cement has plans to develop a training program for local community members. This training may include technical training in plant maintenance, equipment hire and scaffolding services, to name a few examples. The training program TL Cement hopes to implement includes training local community members in biomass supply and waste management. They are also hoping to develop a biomass supply industry. As the plant will be designed to use alternative fuels, including rice husks.

Proper empowerment measures would result in more widespread positive impacts that would have cumulative effects in other sectors, such as the improvement of human resource quality, better certainty for the fulfillment of subsistence needs, and the greater involvement of women in the local and regional economy. Conversely, the absence of empowerment efforts can nullify the positive impacts by accustoming local households to consumptive economic behaviour. This last concern can be managed as long as the mitigation efforts are begun as early as possible (during the construction phase). In the long term, the project can help traditional subsistence agriculture patterns become more efficient in the operational phase, by facilitating the sale of vegetable produces in the open market for the fulfillment of subsistence needs (or in the production-market-consumption model). This subsistence model can be quite risky, but fortunately the types of crops planted for local consumption needs do not appear to be highly vulnerable to market price fluctuations. Local farmers have developed adequate knowledge about natural patterns for the purpose of anticipating the vagaries of the weather and natural conditions, so the risk of failure should be quite limited.

10.8.1.2.3 PRIMARY POTENTIAL NEGATIVE IMPACTS

1. Conflict Over Employment Opportunities and Recruitment Practices

The opportunity to exploit traditional resources has hitherto been restricted to local residents or the dominant territorial grouping in a suco.

It is not unlikely that a new resource (such as employment opportunities) would be treated under the same paradigm of control.

According to Cernea (1988), we suggest that the selection and management of employee applications should be handled by a special institution formed through consultative processes with sub-district and suco leadership to remove the need for an external business partner.

The formation of the institution should ideally involve youth groups representing their sucos. In Baucau, it should also involve the KPK (Konsellu Polisia Komunitaria) as a protector. The Project should form an institution to handle relations with formal leaderships, managements, coordinators, and supervisors and to receive complaints from the community about unfair treatment (a Grievance Mechanism). Such a measure would be necessary since there are not many employment opportunities outside the traditional sector in the Baucau district, so the appearance of a large number of employment opportunities would attract widespread interest and the concomitant conflict potential.
The employee management institution should play the role of a coordinator, opportunity distributor, and negotiator over pay scales and employment terms, in addition to organizing training programs as planned by the Project by TL-Cement during socialization. With regards to this plan, there is the question of whether it will be possible to hold training for all the workers required in the construction process. The first step would usually require induction (explanation about workplace safety) whereas the public perception is that the training would largely be about how to perform skilled and semi-skilled work. This matter should be clarified beforehand so as not to cause message dissonance with the formal institutions hitherto tasked with disseminating information to the public.

The analysis above indicates that the employment opportunities available during the construction stage would have both positive and negative primary impacts. The positive side lies in the follow-on impacts to other aspects of life, such as increased certainty of subsistence, especially in the Caisido region; increased work experience outside traditional sectors on a massive scale; and indirect training for youth groups who handle of this big recruitment workers in the orderly management of large numbers of workers over a long period of time. These follow-on impacts would be very difficult to replicate without the presence of a major Project like TL-Cement.

The primary and follow-on impacts listed above are essentially nonrepreatable since similar opportunities would not always be available. The potential negative impacts from improper management can be put under control to prevent their perpetuation.

The advent of the Project in the Baucau District would open far more possibilities for regional development than in its absence. The traditional agricultural sector faces numerous natural and ecological difficulties that make it hard to promote social and economic development without the aid of non-traditional sectors that can absorb labor on a far larger scale.

2. Termination of Employment at the End of Construction

The recruitment and involvement of local labor during construction does not only result in positive impacts; it would also create a major problem at the end of construction activities. Local workers can have positive impacts upon the economic state of their own households and of the village as a whole as long as they remain actively employed. However, as construction activities reach their conclusion, the flow of income would stop. The cash income from project activities cannot be easily obtained from other locally-based activities. While the operational phase would bring about its own employment opportunities, the numbers are no more than a third of the opportunities available at the peak of the construction phase. This means that at least a quarter (± 25%) of the locally recruited construction workers would lose an important source of cash income. This possibility would present a major problem if not properly anticipated and planned for in advance.

There are a number of measures that can be taken as explained in the impact mitigation section. Two such measures are to encourage the utilization of the cash income for investments that increase the productivity of the local agricultural sector. As well as investing in training programmes for community members. This training may include technical training in plant maintenance, equipment hire and scaffolding services. This could lead to spin off business opportunities for community members.
Fortunately, these impacts can be mitigated with proper anticipative measures, as we shall explain later in the section about the empowerment of the local economy. Compared to the situation in the absence of the Project, the impacts of the termination of employment at the end of construction are still relatively manageable, especially once the beneficial impacts of the project are taken into account.

10.8.1.2.4 SECONDARY POTENTIAL NEGATIVE IMPACTS

1. Potential Impact of the Influx of New Workers upon Local Social and Cultural Aspects

Although the construction phase would involve the recruitment of many workers, there is relatively little likelihood for an influx of job-seeking outsiders into the Baucau Subdistrict. This can be largely attributed to customs that hinder the entrance of outsiders into a suco’s territory. As such, that the majority of skilled and semi-skilled workers will be recruited from within the local subdistricts. Although different sucos have different dominant baptismal names, relationships between the residents of different sucos are relatively amicable except in the matter of resource control, where prohibitions exist against the entrance of a suco’s residents into the territory of a different suco. There will be some employment opportunities in the cement factory for people from outside Tirilolo, but the number would not be large enough to overwhelm local workers from Suco Tirilolo.

The workers’ dispersed / distributed activities and the demands of daily commute for workers from outside Suco Tirilolo means that the outsiders are not likely to have intense contact with local residents, especially local women. The devout Catholic faith of most local residents also contribute to the strength of faith-based social bonds and norms so there is little cause for worry about undesirable forms of social contact between men and women. Despite the presence of several different territorial groups, the tendency is to place more of an emphasis upon the common features of local belief systems as represented by the customary houses (rumah adat) along with the norms of exchange in marriage arrangements and the stewardship of graves and customary houses. Thanks to these factors, the presence of a large number of project-affiliated workers is not likely to significantly affect or change the local culture. Instead, the most likely cause of social transformation is the widespread introduction of a cash wage system, as explained in other sub-chapters.

2. Women’s Bargaining Power

The Project provides attractive employment opportunities for male job-seekers. On the other hand, the industry does not offer many opportunities specifically intended for women. Indeed, women were not even involved in the preliminary consultative meetings, except for the heads of the Baucau Subdistrict

Traditionally, women have an important role in the lineage for the establishment of exchange networks. However, their decision-making position is relatively weak. The exception is in the management of the household economy, where the wife normally has the authority to determine the household’s consumption pattern. The wife’s role in garden / orchard cultivation is largely that of
supporting the husband in his cultivation activities. Similarly, women hold a secondary position in deciding how the produce should be marketed.

The Project’s recruitment of a predominantly male workforce may facilitate opportunities for women to take a more significant role in horticulture or trade. Since trading activities tend to be hindered by a shortage of capital, the only major opportunity available would be to fill labor requirements in the traditional garden / orchard farming sector. Even so, such activities still provide no guarantees for the woman’s future; for instance, if her husband dies, the horticultural lands will tend to fall into the hands of the husband’s oldest male relative.

3. Dependence Upon Cash Income/Money in Household Subsistence Arrangements

The widespread availability of a large number of employment opportunities for all sucos in the two local subdistrict – and the subsequent payment of regular wages to recruited workers – could create a dependence upon cash in the household economy. The likelihood of gaining cash income from the traditional sector has been quite limited thus far, and the harsh ecological conditions of the local area have also limited the growth of market-oriented endeavors in the traditional agricultural / horticultural sector. Of course, the small amount of cash income obtained from the traditional sector has been very important, but it does not play a central role in the local economy, so the introduction of money has not caused a dramatic cultural change that eventually results in social change. An important indicator of this is the relatively weak social stratification among community members. Indeed, the adverse ecological conditions and the limited availability of land and labor have combined to promote the development of a relatively unstratified society characterized by a reluctance to display excess personal fortune for fears of being seen as a prideful person with a lack of social consciousness.

The introduction of a cash wage system on such an extensive and long-term basis can trigger a shift to a subsistence model that prioritizes market-oriented production over household consumption. The traditional farming sector would then be demoted to secondary priority or even neglected entirely, as in the case of Wailacama households that have abandoned farming to become merchants or salarymen. For Caisido households, the convenience of having regular pay as a principal source of subsistence resources would only last until the end of the construction phase.

10.8.1.3 Operation Phase

- Main Activities;
- Employment Opportunities; and
- Development of Regional Socio-Economic Activity.

10.8.1.3.1 Primary Potential Positive Impact

1. Direct employment Opportunities

The employment opportunities in the operational phase would be for top managers, senior experts, junior experts, computer science undergraduates, and non-specific workers with various levels of
educational requirements (from high school to junior high school or even elementary school). The estimated number of employee requirements is around 700; this number is based on our estimation that the Project will absorb approximately 700 opportunities mostly for skilled, semi-skilled, and unskilled labors. TL Cement would continue to prioritize applicants from the local area. All workers would receive prior training to bring their skills up to the standards demanded by TL Cement.

The number of workers required would be around three-quarter (75%) the number at the peak of the construction phase. However, the operational workers have the advantage that they would become permanent employees for the term of the industry’s operation, with the attendant social security facilities, health insurance, and other social security measures according to the prevailing rules and regulations in TL Cement. Similarly, the system and amount of remuneration would not differ much from the standards that apply to TL Cement plants elsewhere.

10.8.1.3.2 SECONDARY POTENTIAL POSITIVE IMPACT

1. The Development of Regional Socio-Economic Activity

Major companies have an inherent responsibility to promote the empowerment of local communities through Corporate Social Responsibility (CSR) programs. The impact mitigation and management measures suggested for the individual impact categories above can be made into an integral part of CSR. However, this requires consultation and cooperation with the suco administration and related government agencies at the district level.

Community representatives and survey results both indicate that the local residents would like to see repairs to irrigation infrastructures in order to restore rice field productivity in certain areas where rice cultivation has recently become impracticable. They would also like the introduction of more productive garden/orchard farming practices, especially for environmentally-friendly organic vegetable crops. These efforts would empower the local economy through increased transportation activity, the emergence of vegetable commodity middlemen, and increased trade in agricultural supplies such as tools and fertilizers. These developments would open employment opportunities for women who are largely unable to apply for industrial jobs.

Another issue that may arise from the workings of the agricultural/horticultural sector is the demand for labor. Both rice and garden/orchard cultivation in the area is predominantly handled by men. Traditional farming practices have not maximized the use of women's labor, partly because women remain less effective and efficient in working the land. This problem may be addressed through intensive education and training programs to encourage women's involvement not only as farm workers but also as agricultural/horticultural entrepreneurs. TL Cement proposes a micro finance scheme that would target women to assist them to overcoming the barriers to finance. The demand for farm labor may be filled by inviting or involving workers from women-giving groups outside the local territory. Alternatively, the demand may attract people from other areas to work as paid farm laborers in the Baucau Subdistrict. This possibility is facilitated by the availability of facilities for daily or weekly horizontal mobility.
The explanation above shows that CSR efforts constitute the unforeseen or indirect impact of the Project. This impact would have considerable geographical extent due to not only the growth of the commercial farming sector but also the incentive for inter-regional labor mobility (a cumulative impact). The potential negative follow-on impacts from the introduction of a money economy are probably going to remain within controllable bounds. The Church and customary institutions have hitherto played their respective parts in preserving group identity and the traditional exchange system, thus maintaining the integrity of local cultural values. However, there is a case for strengthening the Church’s involvement in maintaining the consistent implementation of religious norms. Theoretically speaking, cultural change is unlikely as long as the main elements of the culture remain functional. In this case, the most important cultural elements for the Baucau community are the customary (ritual) house and the exchange morality.

10.8.1.3.3 PRIMARY POTENTIAL NEGATIVE IMPACTS

1. Potential Conflict over Employee Recruitment and the Distribution of Opportunities

During the consultative meetings, the sucos outside the Project site expressed their desire to get a share of the employment opportunities.

The relatively high pay and attractive social and health security facilities during the operational period would obviously be very attractive to job-seekers, and this may lead to struggles over the employment opportunities – not only among the job-seekers themselves, but also among chefe sucos who would like as many of their people as possible to be admitted as workers. The outcome of this competition over a limited number of jobs would depend on how the distribution of employment opportunities is managed during the construction phase. The successful management of this issue would help greatly in defusing potential conflicts over employment opportunities in the subsequent operational phase. On the other hand, if the local labor recruitment institution (run by the local youth) fails to manage it properly, tensions will persist and may grow into open conflict.

Employee recruitment for the operational stage is probably going to be a more sensitive subject than in the construction phase. The recruitment of employees in the formal sector tends to raise suspicions about nepotism, whether to the benefit of lineage groups, territorial surname groups, or individual loyalties to former freedom fighters. One of the factors that contribute towards the intense competition is the scarcity of employment opportunities outside the traditional sectors, especially jobs with attractive employment benefits similar to those offered by TL Cement. Fortunately, it is possible to manage this potential conflict.

The explanation above marks employment opportunities in the operational phase as a significant direct impact. Although the number of jobs available would not be as large as during the construction phase, the impact is more sustainable and irreversible due to the scarcity of similar jobs in the Baucau region; the impact has considerable extent and causes accumulated impacts in the form of guaranteed and comfortable livelihoods for a reasonably long period, increased trust due to the fulfillment of the Project’s promises, and improved human resource quality thanks to the training programs. The follow-on impacts include the increase of public transportation activity, more income
for shopkeepers and small traders, and increased quality of housing in the Caisido region. However, if the employee recruitment process is not properly managed, the employment opportunities may produce the opposite primary impact in the form of potential conflicts between sucos.

2. Potential Development of Enclave Communities

One of the undesirable potential impacts from employment opportunities associated with the Project is the segregation of a relatively well-off community of factory laborers and employees from the majority of subsistence / traditional farmers who remain incapable of overcoming the barriers to the growth of the agricultural and horticultural sector. Therefore, it would be wrong to neglect the social and economic empowerment of the traditional farming sector. The empowerment of the traditional sector should pay appropriate attention to the difficulties and potentials presented by the local ecological landscape, so as to minimize the likelihood for the development of local and regional disparities.

10.8.1.3.4 **SECONDARY POTENTIAL NEGATIVE IMPACT**

1. Potential Dissatisfaction Over Actual Results Compared to the Project’s Promises

As the operational phase begins, local stakeholders will begin to closely scrutinize TL Cement over its promises to provide employment opportunities and improve the local socio-economic situation. The issues that would stand out in the eyes of local communities include worker recruitment and the distribution of employment opportunities, wage levels and remuneration systems, the handling of land acquisitions, and the relocation of gravesites, customary houses, and local residences. Efforts to empower the local population through CSR programs initiated by the Project in the interest of transforming the local / village and sub-regional economy (as promised in information dissemination meetings with formal leaders from the District Administrator all the way down to the heads of individual villages, and with local youth groups) is another matter that would determine how the local population sees the Project’s intent to contribute towards the local economy.

The Proponent’s willingness to turn these promises into reality – such as by setting up a special institution within the Project to listen to and address the local people’s complaints against the Project – would be a crucial element in building a synergistic relationship with local stakeholders. If the project does not devote sufficient attention to the development of such a harmonious relationship, all the effort put into impact mitigation and management would not be able to stop the growth of dissatisfaction among the local communities. This would in turn tarnish the Project’s image in the eyes of external donors and investors. In this kind of situation, while the Project would be able to continue its operation, it would lose the trust needed to expand into new raw material extraction sites. Even if such plans manage to obtain the support of local authorities, resistance by the local population would become a cause for worry. The ultimate impact would be to discourage investors from contributing to the industry’s financial sustainment.
Since the opportunity for social and economic empowerment through the Project would develop in a gradual manner, the full benefits from the Project would not be immediately felt. However, once these benefits take root, their impact would be irreversible.

2. Potential Local Community Health Condition

Operation phase activities in Limestone Mine and Cement Plant will be generated particulate matter and gases. Based on air quality modelling, the dispersed pollutants are predicted to be able to reach the sensitive areas, but the concentration level reaching these areas are all below the standard for each averaging time. From the modelling, it is known that only NO₂ parameter is exceed the standard, however the dispersed only around the Cement Plant or Limstone Mine site where the operation phase is undertaken to the North West Direction.

Higher concentration of these pollutants may occur during the dry season which last from July to November, because during these months wet deposition rarely happens.

From the above description, the activities in operation phase would potentially affect to the community health in the long term (as long as the operation phase of the Project). Therefore, to mitigate all unexpected possibility from the dispersed, it is suggested to provide buffer zone or green belt around Cement Plant site and/or Limestone Mine site. Moreover, for safety reason, it is necessary to re-develop the settlement near the Project site. This activity could be included as corporate social responsibility programme / fund and can be categorized as corporate compensation without using money toward the community.

10.8.2 Strategy to Achieve Social Development Outcomes

The table below presents summaries of the mitigation efforts for significant impacts. The detailed description will be presented in following section.

This report does not account for the cost of the mitigation measures from TL Cement’s viewpoint and for the Project’s economic viability from the costs-and-benefits standpoint. Such feasibility evaluations are beyond the scope of this study.

Table 39: Summary of Proposed Impact Mitigation Measures

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Proposed Mitigation Measures</th>
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<tbody>
<tr>
<td>Land acquisition:</td>
<td>Intense negotiation with landowner, chefe aldeia, chefe suco, and lia nain</td>
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<tr>
<td>- Loss of subsistence resources</td>
<td></td>
</tr>
<tr>
<td>- Loss of bargaining power over land status, value, and compensation system</td>
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<tr>
<td>Population displacement / resettlement</td>
<td>Comprehensive resettlement program</td>
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<tr>
<td>Relocation of ancestral cultural sites: graves and customary ritual houses (rumah adat)</td>
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<tr>
<td>Recruitment of workers and distribution of employment</td>
<td>Establishment of a labor recruitment institution</td>
</tr>
<tr>
<td>Potential Impact</td>
<td>Proposed Mitigation Measures</td>
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<td>---------------------------------------------------------------------------------</td>
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<tr>
<td>Loss of women's bargaining power</td>
<td>Establishment of a regional development board</td>
</tr>
<tr>
<td>Dependence upon cash income in household economic subsistence systems</td>
<td>Empowerment of women's role in agricultural and horticultural production</td>
</tr>
<tr>
<td>Transformation of traditional agriculture and the promotion of regional development</td>
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### 10.8.2.1 Agricultural Development and Market Integration

If the Project only devotes its management activities to the people directly affected by the Project, the management effort should not be particularly difficult. The most direct and immediate impacts would only fall upon a small number of residents within a relatively small and isolated area. The larger issues would arise from the Project's introduction of a cash income system on a large scale, both in the number of workers and the geographical area from which these workers would be recruited. Aside from this substantial cash income, the Project would provide additional benefits in the form of health insurance, housing, and several other facilities normally unavailable to the local residents. The opportunity to gain these benefits would only be available to a limited number of mostly male workers, especially in the construction phase. The operational phase would open more employment opportunities for women but the number would be quite small. On the other hand, the traditional sector also provides employment opportunities for women, but it remains rather underdeveloped. The majority of ricefield and garden / orchard cultivators still struggle with the limitations of primitive technology as well as the low productivity of traditional farming systems and methods. Although this sector already produces a limited amount of cash crops for the market, the market reach and penetration of traditional farm produce remains quite limited, and as a result most local farmers have to take out a subsistence living with painstaking effort. These factors hinder the transformation of the rural economy in the absence of external intervention.

In this kind of situation, a paradoxical change could result from the introduction of a cash wage system with a high value relative to the kind of cash income normally available from the traditional sector. On one hand, the Project can provide enormous benefits to the people affiliated with it, while the majority (especially women and productive workers who are not recruited into the Project) would still have to contend with the stagnation of the subsistence economy. This could lead to a hitherto unprecedented degree of social stratification.

For this reason, the Project's direct or indirect involvement would become necessary for the transformation of local traditional agriculture into a more market-oriented form. This can be implemented through:

- The development of agricultural programs and market integration measures;
• Empowerment of women's role in agricultural production (ricefields and gardens / orchards); and

• Empowerment of agricultural merchants to enhance their capability to bring new agricultural technologies into the local region and market agricultural products out of it.

These efforts would help in:

• Preventing the local residents from becoming dependent upon the Project as their principal source of cash income;

• Enhancing the dynamic growth of the traditional sector according to its own cultivation cycles so that any disturbances to the industrial sector would not cripple the local and regional economy, and so that social and economic class segregation would not become too pronounced; and

• Encouraging the involvement of women in the regulation of the household economy so that their position vis-a-vis the men would not be weakened.
11 ECONOMIC ASSESSMENT

11.1 Ecological Condition

The ecological and geographical situation of Timor is marked by environmental destruction and degradation, which creates serious problems for Timor-Leste. Another description of the situation in Timor is: ‘An island-wide ecological crisis, caused by swidden agriculture systems and population pressure.’ Pannel also states the ‘characterisation of subsistence systems as a voracious slash and burn agricultural regime’, with ‘low agrarian production’ (Pannell, 2011:217).

Pannel’s opinion is meant to describe Timor as a whole, but some of these characteristics are also visible in the Caisido (inland) region of Tirilolo. Informer’s statements on the migration of the Da Costa and Flores groups to the Baucau region and the use of Osso-Ua as a leper colony around 1945 indicates a substantial history of settlement in the area. The signs of environmental degradation and destruction can be seen in the form of empty uncultivated fields overrun with bushes and shrubs. Osso-Ua still has some secondary forests area that experiences constant deforestation under the pressure of logging for building materials and firewood. The agricultural land is cultivated under a slash-and-burn cultivation system that rotates from one farming plot to the next on a 3-year cycle (fallow system). The soil is riddled with limestone boulders which limits local subsistence patterns to low-productivity agrarian production. This situation leads to considerable population pressure. This population pressure is attributable not to a large population but to the low productivity of arable land (especially dry orchards) in fulfilling subsistence needs.

Agricultural water sources are relatively rare, except in Osso-Ua where water is largely limited to domestic uses. The exploitation of natural resources depends heavily on the availability of rain, so the types of crops that can be cultivated are relatively limited and cannot respond to market demands. Even when the locals sell their produce on the market, it is merely to obtain cash for the fulfillment of other needs. This pattern is theoretically categorized as subsistence farming. The longstanding isolation and lack of attention from the outside has led the Caisido (inland) peoples in Tirilolo to develop their social and cultural organizations in a ‘rural’ or ‘parochial’ manner, as described by Appdurai: “… place is produce through the interaction of social relation, expression of identity and the practice of culture.” (cited from Pannel, 2011:220).

11.1.1 Land Use and Land Status

The Caisido people in Tirilolo (Aldeia Parlemento, Caisido, Lialaileso and Osso-Ua) distinguish various types of land according to their status and usage.

11.1.2 Land Status

Land in Caisido is divided into two categories according to status, namely private land / property and government property. Government property generally covers all land not cultivated by local residents.
This category has unclear boundaries since there are many fields that have been left fallow and become scrublands but are still claimed as private property. Some land around Osso-Ua is full of perennial plants and not cultivated but claimed as private property. One exception is the Limestone Mine site, where the secondary forest is categorized as government property. This land is not claimed or cultivated but the local residents harvest the trees for building materials. The key difference is supposed to be about whether the land is cultivated or not but the difference between the two remains ill-defined except when private owners have a clear idea of the boundaries of their property. Some issues have surfaced with regards to the scrublands on either side of the access road from the Baucau –Parlemento aldeia main road. The land is generally uncultivated but claimed as private property. This claim is understandable since the local cultivation pattern follows a 3 - year cycle of land clearance and crop rotation. The rocky soil and lack of knowledge about fertilizers means that landowners have to restore their lands’ fertility by leaving the fallow for a certain interval prior to recultivation. Humus for the land is obtained from the ashes of the burned bushes and scrubs.

Land ownership status is generally not supported by official documentation. Claims to possession of land are corroborated only by the statement of neighboring landowners. The suco administration does not make much fuss about formal land ownership in any case since there is currently no taxation system for privately owned land. The village doesn’t have detailed land registers that record the type, extent, and ownership of private land for tax collection purposes.

Field boundaries take the form of piled stone fences. The owners seldom know the exact area of land they have in numerical terms. Land is commonly measured by means of the stone fence boundaries, and the local residents usually quote how many fenced plots they have. 24 years of Indonesian occupation in Timor-Leste had not successfully introduced the concept of quantitative land measurement. This can be explained by the local system of slash-and-burn cultivation, where land clearance mostly depends on the availability of labor to process and estimate the amount of produce needed to fulfill subsistence requirements.

### 11.1.3 Land use

In terms of land use, the local population distinguishes between four categories, namely paddies / rice fields, forests, gardens/orchards, and bushes / scrubland.

#### 11.1.3.1 Paddy Fields

Information from the Chefe Suco in Tirilolo and Vemasse, stated the existence of rice fields in the local area but not the areal extent in each suco and the fields’ geographic location. In the Caisido area near the planned Project site, there is an approximately 0.5 ha rice plot in the Aldeia Osso-Ua. This field draws water from a local water source so that the owner can plant upland rice. Due to the cultivation of paddies on the land, the owner categorizes the plot as a rice field.

Statements from the chefe suco and our own field observations indicate that the rice fields in the area depend heavily on rain. Once the land has been used to grow rice, it cannot be reused for other crops due to the lack of water for further cultivation. Some sucos have ricefield plots watered from springs in
Bucoli (Palmer, 2011:145) but the lack of farm labor means that the field only produces one crop per year or is left completely fallow.

Land cultivation is done in a very simple manner; once the land has been watered, a water buffalo is used to churn up the soil until it is suitable for planting. The government has provided aid in the form of tractors for rice cultivation, but the local population seems unable to use the machines effectively so their use remains very limited. Ricefield owners who do not own buffaloes may cooperate with the owner of a buffalo in cultivating his land. In this arrangement, the owner of the buffalo gets the same share as the owner of the field. The owner of the buffalo becomes responsible for the cultivation of the land all the way to the harvest. This system has not seen much development since landowners are often reluctant to share their produce.

For the most part, ricefield owners also own a buffalo (or more), so their land cultivation work is done with the use of their own buffalo by the head of the family (male). The next phase is to plant cultivated rice seedlings with the aid of several workers. Most of the workers in this phase are women, and are generally relatives or neighbors of the owners. Non-related workers are paid about $5 / day while relatives only receive food during the planting work and a discretionary amount of the produce later on based on their contribution during planting and their economic condition. Once the rice has been planted, it is generally left without any further care or fertilizers until it is ready for harvest. This simple rice cultivation regime results in very low productivity. Calculations during the field study indicate that a 0.5 ha field planted with three sacks’ worth of rice seeds would produce 60 sacks of rice of the same quality. After the rice has been dried, the end result is 30 sacks weighing 25 kg each.

This low production rate and scarcity of labor has prevented rice cultivation from becoming a major factor in economic development. Garden / orchard cultivation has a better potential for surplus accumulation than rice cultivation. One of the problems is that rice fields (especially in the Vemassee subdistrict) cannot be used to cultivate other crops. The land gets waterlogged during the rainy season, making rice the only option available. The rice produce is generally not sold but kept for the farmer’s own consumption.

The lands claimed as rice fields in the Osso-Ua aldeia are planted with dry (upland) rice. These lands do not generally receive much excess water so the owner retains the choice of planting them with other crops.

Ricefield owners, especially in the sucos of the Baucau and Vemassee districts, are likely to be the oldest settlers in each suco in a similar fashion to the villages in West Timor (NTT, Indonesia). Rice fields are owned by traditional elites since rice represents a more certain means of subsistence compared to other traditional sources like coffee (Achmad, 2002). In Timor-Leste, especially in Baucau and Vemassee, the merging of lineage groups into baptismal name groups (as explained earlier) makes it difficult to decide (for example) which Belo or which Freitas is directly descended from the founder group in the tribe. However, land clearance and cultivation for rice fields tends to demand considerable amounts of labor, so only local elites are capable of mobilizing the necessary workforce.
11.1.3.2 Forests

Forests around the Cement Plant site are mostly located in the Osso-Ua Aldeia of suco Tirilolo, as we have mentioned before. The secondary forests in these two areas are fairly thick. They see the forest as a place to hunt and to harvest wood for building materials (whether for their own use or for sale) or for firewood. There is no definite information about how many trees have been cut down for their wood, but he said that most locals pick firewood from already fallen trees. There is no clear information about the average income of firewood collectors either, but each collector can probably earn $10 - $15 per harvesting trip at a price of $0.5 per firewood bundle. One of the things that may cause some ambiguity over land ownership in this suco is the presence of candlenut plants growing in local settlements and nearby forests. Lands where these trees grow may be claimed as private property even though the land would otherwise be seen as public forests when judged by the variety of other plants growing in the vicinity.

Local residents in the two aldeia closest to the forest have not mentioned the existence of any forbidden or sacred ground inside. Neither do they view the forest as the location of dead ancestral spirits that must not be disturbed. Their belief system holds that their ancestral spirits reside in the customary house (rumah adat) and tomb.

11.1.3.3 Gardens and Orchards

Horticultural lands (gardens and orchards) are the main source of subsistence for the Caisido people (Parlemento, Caisido, Lialaileso, and Osso-Ua). This land is mostly dry lands planted during the rainy season. Gardens are orchards are normally located close to the owners' houses or settlements. Cultivated orchards are usually protected with stone fences to prevent interference by livestock. Most residents own more than one fenced orchard located close to each other, or alternatively a single large orchard (about 1 ha) divided into smaller plots with stone fences. The division into multiple sub-plots usually correlates with the planting and cultivation strategy. Most gardens / orchards are worked for 2 - 3 years and then moved to a different location for the same interval. This rotation is meant to restore soil fertility since the orchards are given no fertilizers whatsoever. The only measure for increasing soil fertility is burning the brush growing on the land. There is no effort to use livestock manure as fertilizers either since most livestock are not kept in pens but rather left to roam free in the scrublands around the village.

The cultivation of the orchards begins in August - October or November. Planting should be accomplished by December or January at the latest. In the event that the rains begin in December, the planting process is likely to fail. The work from August to November mostly consists of land clearance and the burning of the cut-down vegetation. The clearance can be done with the aid of unpaid labor from close relatives in return for help in clearing these relatives' land in turn. Despite this extra labor, the amount of land opened is still limited according to how much land the owner can realistically manage by himself. The tending of the orchards is generally performed only by members of the nuclear family since each family is fully occupied with tending its own land and there's not much opportunity to enlist help from others. Every person / household has an associated garden or orchard...
so there are no landless laborers to hire either. Neither are there any rent or sharecropping arrangements apart from the lending of some land to the husband of a sister who lives with his wife’s kin group. Despite this lease of land, the lender does not incur any obligation to help in the management of the oldest male relative’s orchards from the wife’s side (a form of corvee labor). This is due to the fact that every single farmer must devote full attention to tending his/her land in the face of their dependence upon the whims of the weather. Climate change or early rains inevitably influence the choice of crops to plant and how much land should be cultivated.

After the land has been burned, it is tilled with hoes. Garden/orchard lands usually have stones strewn randomly across them, so plants are normally placed in an irregular manner to make use of the available non-rocky patches of soil. The most important crops are maize and groundnuts. The maize is normally consumed by the family and livestock, while the groundnuts are primarily used as a cash crop. Other crops commonly planted in the area tubers like cassava and sweet potatoes and vegetables such as green tomatoes and chili peppers. The tubers are primarily meant for subsistence while the vegetables are usually intended for both subsistence and cash.

There are two main planting strategies used by garden/orchard owners. Those who own large numbers of plots may plant a single type of crop in every fenced plot to maximize production, especially for cash crops such as chili or shallots. People who use this strategy usually intend to sell all their produce.

Although each plot is designated for only one specific kind of crop, usually the larger plots are still reserved for subsistence staple crops. The amount of land planted depends on estimations of subsistence requirements. More focused monoculture of cash crops is likely to be more profitable for the fulfillment of subsistence needs, but this strategy is very uncommon except among people who have enough land to be worth dividing into a number of monoculture plots. This strategy is usually adopted when there is considerable need for a cash income, for example by a respondent with four children who are undergoing higher education in Indonesian universities (in Surabaya, Malang, and Jakarta).

The second strategy is most prevalent among farmers who have a relatively large amount of land concentrated in a single contiguous expanse. This expanse is then fenced up into several smaller plots and each plot is used for a single type of crop. In this case the largest plots also tend to be reserved for staple crops like maize and groundnuts. In this case the owner errs on the side of safety by prioritizing self-subsistence needs over cash income.

These first two strategies depend on the farmer’s diligence and the availability of labor. One example is a case respondent who chose the first strategy. The respondent is a Muslim man, and despite his advanced age he continues to put a great deal of work into his orchards for his children’s sake. Any surpluses are stored in the form of livestock or sent directly to one of his children. Thus, these surpluses do not go into improving his wood-and-bamboo house as in the case of most other villagers. His reluctance to renovate his house is based upon his reluctance to show off his material wealth. This relates to the local standards of morality, which will be discussed in a later section. Despite his Islamic beliefs, he uses a baptismal surname (Belo) to affirm his status as a native
resident of Parlemento, and as a member of the lineage he continues to contribute livestock for ceremonies in his lineage's customary house (rumah adat).

The second case respondent is a horticultural farmer who also owns a simple mom-and-pop store. He has the motivation to maximize the productivity of his orchards, but the demands of running the store prevent him from devoting his entire attention to farming. He divides his land into a dedicated plot for staple crops such as maize and groundnuts, while secondary crops such as green tomatoes, cassava, and sweet potatoes are planted haphazardly in the spaces between the main crops.

The first respondent tends to sell his produce immediately at harvest-time, but the second respondent prefers to hold on to his groundnut harvest until the price rises. For the vegetable crops, the second respondents harvests them in stages according to their differing harvest times and then sells them directly in the old market. The proceeds from the sale are used to buy goods to resell in his shop. This allows him to fulfill his subsistence needs at the same time he replenishes the stock in his shop. His profits and/or surpluses are saved up by buying livestock such as pigs, chicken, and goats.

The planting and sale strategies utilized by those two farmers are not common among other gardeners/orchard-owners. Most of them have rather small plots (topping out around 50 m x 50 m or 50 m x 75 m), so they lack the capability to adopt the strategies used by larger landowners. They mostly plant a variety of crops such as maize, groundnuts, shallots, and chili peppers with some sort of intercropping or random planting pattern. The main consideration in choosing which crops to concentrate on is the demands of subsistence (maize) and for cash (groundnuts, shallots, and chilis). However, the small amount planted for each type of crops means that the yield (especially for cash crop) tends to fluctuate. Sales are made in stages as each crop ripens for harvest. The lack of traders who visit the farmers to collect produce means that the farmers must go to the market to sell their produce by themselves. There are merchants in the market who would buy up the entire groundnut crop for resale, but none for the vegetable products so the farmers have to sell them directly to individual shopkeepers in the market or even to customers in the street.

The horticultural situation in Osso-ua is relatively better than in Parlemento, Caisido, dan Lialaileso. The gardens and orchards in Osso-Ua are quite suitable for vegetable crops such as shallots, upland rice, and chili peppers. All of these are regarded as cash crops. The relative remoteness of the area from the closest public transportation facility (around 4 km from the closest point served by public transportation cars going to Caisido) means that the farmers tend to be reluctant to sell their produce directly in the market. The produce is normally sold to buyers who travel from the city (the old market) to pick up the commodities at Osso-Ua.

It is not easy to calculate the productivity of local gardens / orchards since the harvest is normally performed in several stages, except by the owners of particularly large plots. Most owners do not know how much horticultural land they have and use, and for the most part they only count how many fenced plots they have. Therefore, the calculation of horticultural income is done by fenced plots.

The Lia nain of the suco describe a set of ritual strictures for the management of gardens and orchards from the land clearance phase, to the burn, the tilling, the planting, the harvest, and all the
way to the storage of the harvested produce. The main objective in understanding the local population’s economic activities is to figure out whether they are already capable of fulfilling their subsistence needs with their main sources of livelihood, how they regulate their production and consumption, distribution systems (especially within kin groups), how they accumulate surplus, and how they invest surplus to guarantee the household’s future economic sustainability (especially in the context of women’s needs) as we will explain in a later section.

11.1.3.4 BUSHES AND SCRUBLAND

The bush and scrublands are usually regarded as reserve lands for the 3-year plot rotation system. These lands are covered in long grasses and bushy growths (especially *Imperata cylindrical*, *Cromolaena adorata*, and *Lantana camara*). These sites are also used as pastures for buffaloes, oxen, and goats. The parts where the grasses and shrubs grow densely are ecologically regarded as a normal part in the succession towards secondary forest. The bushes and scrub do not cover the land in a fully continuous manner, so external parties are prone to categorize the land as uncultivated wastes or government property. However, further exploration will reveal linear piles of stones that mark out field boundaries. Each farmer knows the boundaries of their plots. Most of the bushes and scrubland in Caisido are located outside the projected Limestone Mine and Cement Plant sites.

11.1.4 Tenure System

The land as the main resource for the fulfillment of the local population’s subsistence needs is usually obtained through ancestors from the people’s forebears. There is no clear indication of when the ancestral settlers began to reside in the Caisido region. Theoretically speaking, given the lineage-based social structures, it is likely that the ancestors only go two generations back (current residents’ fathers and grandfathers). As such, the Caisido region was probably settled around 75-100 years ago.

Those estimations aside, the local residents’ assertions that their land ownership proceeds from ancestral rights shows that they feel that they have the rights of possession. This possession usually comes without any form of written or formal proof. The local population generally does not feel any pressing need to obtain formal acknowledgement of their land ownership since the legal status of their claim to the land has never been seriously disputed before. Only with the plans for the construction of the Project does the issue of ownership come to the fore. This is particularly relevant to the bushes and scrublands since there is some concern that the lands being left fallow might be claimed as government property despite the existence of ownership markers in the form of stone fences or boundaries.

Apart from these individual ownership claims, the local population would also like to stake out their communal rights as members of the Belo group. The Belo group is a territorial control identity for all the people acknowledged as members of the Belo group. Other baptismal surnames will find difficulties or may even be barred from claiming possession of lands within Belo territories even if they...
choose to marry a woman from the Belo territory. The only kind of opportunity that may be made available is as a temporary borrower in lands owned by the wife’s family.

Ownership and possession of land is passed down through inheritance. Only sons receive inheritance rights while daughters do not, although the latter remain the ward of the oldest son in the family (lia nain). All sons have a claim to the inheritance but the control of the land is given to the oldest son, who will then arrange for the distribution of workable land; if any son is a minor or is uninterested in faming (such as if they have already a job in the city), the right to manage the land is handled by the lia nain who also takes responsibility for the distribution of subsistence needs. In this case the wife usually regulates the management and fulfillment of common subsistence needs.

When a son relinquishes possession rights to the land, such as by selling off his share, his economic and political status as a lineage member is no longer under the lia nain’s responsibility and he loses the right to participate in decision-making at the kinship and hamlet/aldeia level. Therefore, the relinquishment of land possession rights is a decision that cannot be taken unilaterally and must involve both the lia nain in the kinship group and the lia nain for the village as a whole.

Daughters do not get inheritance rights since they will eventually fall under their husbands’ custody. If the husband dies without descendant, the husband’s property will fall under the management of the oldest male in the husband’s kin group. However, if the property comes in the form of land, the widow may still have rights to make use of the land. In this regard, interview results indicate that most wives and mothers would invest the property of a deceased husband towards their children’s education. These children represent the mother’s principal hope for future livelihood.

If the widow wishes to return to her parents’ kin group, she becomes a ward of her group’s lia nain. If she wishes to remarry and the new husband would like to move in with the wife’s kin group / family, he must seek the approval of the woman’s lia nain (the oldest male in the lineage elder).

In any case, no matter who dies in the relationship, customary exchanges between woman-giving and woman-receiving parties remain in force. Indeed, if the widow chooses the remarry, it merely creates a larger network of exchange relationships. Local informers state that it is very difficult to avoid the customary burden brought about by these obligations.

11.1.5 Animal Husbandary

Animal husbandry is one of the traditional sectors in the livelihood of the Caicido population (in Parlemento, Caicido, Lialailesos, and Osso-Ua). However, not all families own livestock. Livestock are mostly treated as a way to invest the surplus obtained from agriculture, especially gardening / orchard farming. The most common types of livestock are horses, water buffaloes, oxen, goats, pigs and chicken. It is not easy to find out the exact number of livestock and the number of households that keep them since the Suco administration has never performed any census on livestock ownership. The following Table 40 is based upon estimations offered by the Village Secretary and Chefe Aldeia, though neither of them could give precise estimates of the combination of livestock types and how many of each type are owned by individual families. Even so, this data may prove useful since it still
contributes towards the main research objective of observing the forms and functions of traditional investment in communities that still struggle with subsistence needs. The functions of livestock will be explained in the following sections, while surplus strategies will be described elsewhere.

**Table 40: Livestock table and ownership**

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Caicido</th>
<th>Lialaileso</th>
<th>Parlemento</th>
<th>Osso-Ua</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Family: 184</td>
<td>Total Family: 127</td>
<td>Total Family: 99</td>
<td>Total Family: 184</td>
</tr>
<tr>
<td></td>
<td>Total Owner</td>
<td>Total Animal</td>
<td>Total Owner</td>
<td>Total Animal</td>
</tr>
<tr>
<td>Goat</td>
<td>120</td>
<td>200</td>
<td>110</td>
<td>250</td>
</tr>
<tr>
<td>Sheep</td>
<td>100</td>
<td>250</td>
<td>115</td>
<td>230</td>
</tr>
<tr>
<td>Horse</td>
<td>15</td>
<td>25</td>
<td>11</td>
<td>36</td>
</tr>
<tr>
<td>Cow/Buffa</td>
<td>8</td>
<td>40</td>
<td>17</td>
<td>60</td>
</tr>
<tr>
<td>Pig</td>
<td>180</td>
<td>250</td>
<td>129</td>
<td>160</td>
</tr>
<tr>
<td>Chicken</td>
<td>182</td>
<td>400</td>
<td>180</td>
<td>360</td>
</tr>
</tbody>
</table>

*Source: Tabulation Form Suco Tirilolo 2015*

### 11.1.5.1 Chicken

Buffaloes, pigs, and chicken are symbols of wealth that carry not only economic value but also considerable social and ritual significance. Chicken are regarded as livestock with the lowest value. Despite this low economic value, chicken provide a way to fulfill emergency demands at very short notice. These demands include offering food to important guests, providing aid to neighbors in distress, making contributions to celebrations of life-cycle events, and obtaining cash to cover unexpected needs.

### 11.1.5.2 Goat and Sheep

Sheep and goats are important livestock for belis contributions. They also provide a source of quick cash, being the next most easily sold type of livestock after chicken. Sheep and goats are usually not bought for household consumption but rather become the first choice for surplus investment. Their relatively affordable price compared to pigs makes them some of the most intensely traded livestock in the market.
11.1.5.3 Pigs

Pigs have a substantially higher economic value relative to chicken and goats; they also play an important part in various individual and group rituals, in addition to being acceptable gifts or dowery given by the wife's family to the husband's or vice versa on ceremonial occasions. A gift deemed inappropriate or inadequate may be taken to signify a lack of respect that may lead to friction in the relationship between the two parties. Pigs are also an important component in sealing deals or agreements to resolve past disputes.

11.1.5.4 Buffalo

Are the most valuable type of livestock and also very important in traditional religious rituals as well as belis contributions. Buffaloes are used in death rituals, rituals in the customary house (rumah adat), and bonding activities when the entire lineage gathers at the end of the year (for Christmas and New Year).

11.1.6 Traditional Fisheries

The planned Jetty site on the Osso-Ua coast is currently used by some Osso-Ua villagers for fishing activities. They go out to fish when the waves are not too high. Their fishing activities are conducted with very simple equipment such as fishing poles with lines and bait as well as rowboats.

The fishing methods are also quite simple; one of the boat's crewman takes the fishing tackle a short distance out to sea, about 50 m - 75 m from the coast. After the line is released, the boat does not return straight away to the beach but waits for some time while moving the fishing tackle around in several directions to attract attention to the bait. Once a fish has taken the bait, somebody on the beach would alternately draw and play out the line until the fish tires out. When the fish's resistance has subsided, the line would be fastened to a bamboo pole sunk into the beach. This procedure is repeated until some or all of the fishing lines have caught enough fish.

This activity may provide up to $10 - $20 per fishing trip. Larger fishes are usually sold to buyers in Baucau, who can be contacted over a cellular phone. Fish that are not (or cannot be) sold are not preserved in the form of salted fish but used for housed consumption.

Everyone can engage in fishing but a boat provides the owner with an important productive asset in this regard. Relatives may borrow the boat; so can non-relatives, but seldom more than once before they acquire their own boats.

11.1.7 Non Farming Activities

Caisido's isolation and the difficult circumstances for agriculture has not prompted the development of non-farming activities. There is only 1 small shop / kiosk owned by the chief Lia nain in the Suco, 2 canned drink sellers, and 1 greengrocer. The lia nain's shop sells several types of canned and packaged drinks, children's snacks, light dry snacks, and rice. Due to the shop's location right across
a school, it receives a great deal of patronage from the children during the school’s break times. The owner stated that he opened the shop to help the local people obtain basic necessities, especially during long dry seasons and drought periods when there’s not much chance to farm productively and the local people have to come and buy rice on credit. The payment is deferred until the next harvest. The shop only provides credit for the purchase of rice, while other commodities have to be paid for in cash. The owner believes that credits for non-essential items (other than rice and baby supplies) would saddle the borrowers with an unbearable burden; indeed, even the rice credits are only given on a limited basis.

Shop inventory is acquired from the old market in Baucau and transported with the use of public transportation cars passing by the shop. The shop owner does not buy produce from the locals or accept loan payments in kind. Such transactions may in fact be profitable, but the owner believes that groundnuts are the only produce with considerable market value and its price tends to be quite low at harvest time. Farmers may hold on to their nuts until the price rises, and indeed the shop-owner does so for his own produce, but he does not feel comfortable doing so with his customers’ produce since he fears that he may be accused of being selfish and lose his respectability as the lianin. By encouraging fellow villagers to sell their produce on their own, he tries to avoid becoming a subject of gossip and resentment.

Capital for the store was obtained from his own savings. The original capital was acquired by buying livestock like goats, pigs, and chicken, or by strategically timing the sale of his groundnut harvest. The groundnuts are not sold immediately at harvest time but kept until the price has risen by a reasonable extent; for example, the price of groundnuts at harvest may go as low as $10 for every 25 kg rice sack, but during scarcer times it may rise as high as $20 - $30 / sack. The significance and mechanism of this surplus accumulation system will be explained later.

The two sellers of drinks and children’s snacks in Parlemento and Osso-Ua cannot be properly called food/beverage merchants since their stock of merchandise is very limited, consisting of a few cans of drinks, several instant noodle packages, and some snacks.

A Parlemento resident can be categorized as a greengrocer. His inventory comes from a combination of purchases from his neighbor, produce from his own garden, and purchases in the old market of Baucau. He then ties together the vegetables in certain amounts to be sold in retail. He actively pursues his commerce activities since he needs a great deal of cash to provide food and milk for an infant child. He also feeds nieces and nephews playing at his house during mealtimes, so he needs some money to buy extra rice. At the same time, he also works as a lottery brokers, but neglected to mention it for unknown reasons.

Apart from these mercantile activities, there are also 10 two-wheeled vehicles operated by Caisido residents to serve trips to and from far-flung local settlements. These motorcycle taxis usually gather beside the main road at the junction with the road towards Caisido. The fares vary between $1 and $3 depending on the distance. There are not many passengers for these motorcycles aside from outsiders who wish to travel into the area, such as the research team. One of the motorcyclists explained that he usually earns no more than $5 / day.
Handicraft and food industries remain underdeveloped. For the most part, it is limited to old women weaving baskets for their own use from the leaves of lontar palms growing around the aldeia.

Informers state that there have been no empowerment initiatives for the development of household industries. Such empowerment remains a difficult proposition due to the absence of a substantial market.

11.2 Economic Morality among Kin Groups and Neighborhoods

Economic activities in Caisido cannot be equated with rural economic activity in Java, where money economy and the accumulation of surplus by individual households have become long-established fundamental features. In most parts of Caisido, the village community is made up of members of the same lineage. The lineage’s social unity is affirmed through kinship and marriage relationships that involve special reunification / reaffirmation ceremonies involving all lineage members in the customary house (rumah adat). These ways mark the local population’s identity as native residents.

Land as a livelihood resource is only possessed for the fulfillment of life’s necessities. Private possession rights are transferred through an inheritance system. The nuclear family as the smallest unit in the local community’s economy is given some latitude in choosing how to fulfill its subsistence needs. However, as part of a larger kinship or lineage group, these families have the obligation to share their subsistence resources with members of the same kin / lineage groups before they share with the rest of the village. These differences underlie a mutual aid system based upon a morality of exchange within the community. This is particularly visible in the marriage system, which regulates the types of goods to be exchanged and the moral values of the exchange. These institutional arrangements provide direct and indirect social guarantees for mutual subsistence while at the same time presenting obstacles to the development or improvement of an individual household’s socioeconomic condition. In this context, limited resources, the ecology of the land, and the lack of empowerment initiatives have limited the village economy to the fulfillment of subsistence needs under mutual uncertainty.

11.2.1 Morality of Exchange

There are several important details that must be observed to understand the economic system of the Caisido community. Firstly, most of the local population manages to survive in social and physical terms amidst resource limitations on land that can only support the cultivation of a few types of food crops. Access to the market economy is also rather limited, except for livestock. Similarly, there are relatively few opportunities to acquire cash. These circumstances prompted the development of mutual sustenance patterns, especially with regards to how social and moral systems can guarantee the formation of social institutions. The social structures and organizations thus formed, although united by kinship ties, still leave room for a considerable degree of inter-lineage social competition where the groups openly profess their kinship to each other but privately prefer to attend to their own interests.
Amidst these resource limitations, the society needs an institution that can guarantee the mutual fulfillment of subsistence needs, namely an exchange institution. The exchange institution is also developed to provide social security and fulfill individual sustenance needs as well as group reproduction needs. The exchanges in Caisido partake of both reciprocity and redistribution. Reciprocal exchanges play an important part in forming livelihoods and maintaining social institutions.

The social norms contained in reciprocal giving imply that the gift is made to bind the recipient with an obligation to reciprocate, especially when the gift takes the form of a marriageable woman. This obligation perpetuates itself indefinitely as long as the parties are bound in a well-maintained social bond. No calculations are made on the basis of economics (money) or the types of goods exchanged. Valuation stresses the idea of ‘need’ and the social relationship between the two actors, such as between a woman-giving lineage and a woman-receiving lineage; this exchange pervades all livelihood, social, economic, and ritual aspects. Reciprocity with members of the same village is based upon religious norms, common congregations, or baptismal brotherhoods. This reciprocity happens on a much more limited level.

The variety of choices in terms of exchanged goods remains bound to the exchange morality or rules that provide a common ground for the actors in the exchange. Generally speaking, the reciprocal exchange system has an important role in establishing and maintaining social relationships between woman-giving and woman-receiving groups.

Owing a belis debt is not seen as a shameful or disgraceful thing. Indeed, the pervasiveness of the reciprocal indebtedness indicates the extent of a person’s social network and the degree of trust in his ability to reciprocate. This reciprocal indebtedness pays no heed to the value of the exchanged goods or any fixed timeframe for the reciprocation expected from relatives by marriage.

The rules that regulate requests for loans are determined by the group’s status as either the woman-giver or the woman-receiver. The gift of a dowry in the form of ceremonial items by the groom’s side to the bride’s family places the woman-receiving group as the first group who will be approached for a loan or aid by relatives from the woman-giving side. The borrower is not required to repay the loan with the exact same quantity and kind of goods; for example, the loan of a buffalo may be repaid with women’s ceremonial items of unequal value with the item originally borrowed. Repayment with the exact same type and value of goods is seen as a breach of tradition. Such a violation would affect the relationships that have been so painstakingly established.

11.2.2 The Accumulation of Wealth

Amidst the complexity of the reciprocal indebtedness morality, the poor ecological resource situation, and the underdeveloped market economy, it is quite difficult to accumulate considerable amounts of wealth. However, this does not mean that the exchange institution does not provide any opportunities to accumulate surplus, only that not all individuals are capable of doing it.

The traditional morality allows group members the chance to acquire livestock as a way to accommodate surplus. Livestock is commonly kept as a form of savings to finance the future
education of the owner’s children. These savings are seldom used to buy more land or to increase the added value of the owner’s house since there is hardly any purchaseable land to begin with. In the last few years, farmers with large orchards have begun to invest their surplus by buying motorcycles that are then hired out to help fulfill local transportation demands. This initial investment outside traditional sectors may signify a change of paradigm in material investment. The notion of ‘helping’ serves as a convenient excuse for the investment. Theoretically, a change in the preferred type of investment asset may be the initial signs of the more widespread introduction of money economy that will create opportunities for socioeconomic stratification that have been absent thus far.

11.2.3 Money

In a society that still depends on a subsistence cycle where transaction systems provide the main principle for the exchange and redistribution of goods and labor, the definition of money is that of a device that serves as a medium of payment, a way to measure the value of goods, a calculation apparatus, and the means to accumulate savings.

In Caisido, certain kinds of livestock such as buffaloes, pigs, and chicken can be seen as money from the perspective of local value standards, with buffaloes having the greatest nominal value. People in Caisido are already familiar with money but have not yet begun to use it extensively except to obtain education and healthcare services and to transact with outsiders in purchasing everyday necessities that are not produced within the village.

Giving transactions usually involve the transfer of goods according to need. Ritual goods are deemed unsuitable for monetary reimbursement or even valuation. This does not mean that people do not keep money at home, but rather that keeping significant amounts of money at home is unprofitable since it would invite others to request loans and thus prevent the owner from effectively saving the money.

As with more traditional means of exchange, the use of money is also categorized into several levels from the highest to the lowest priority. The payment of education / tuition fees take first priority, and the higher the level of education the more important it becomes. Other high-priority items include the conduct of important rituals and healthcare expenses. Home improvements occupy the lowest priority.

In a community that relies upon a traditional exchange economy, the introduction of money does not always result in the immediate spread of market economy as long as the use of the ‘new’ means of exchange (i.e. money) does not nullify or interfere with existing priorities among actors and categories of goods. In Caisido, the use of money occupies its own distinct scale of priorities, while more traditional means of exchange such as buffaloes and pigs are used to fulfill needs on an altogether different scale of priorities. The institutions of exchange transaction remain relatively unchanged. With regards to the unique properties of money as it is commonly understood, traditional commodities such as buffaloes remain irreplaceable since they are regarded as more than mere ‘assets’ but also as living creatures with a symbolic value that figures into the transaction process. In the context of traditional customs and values, the functions of these alternative means of exchange are integrated with other socio-cultural elements into an inseparable whole.
New material symbols of wealth (motorcycles) have not displaced more traditional symbols. This can be seen in how exchanges to repay belis debts do not utilize money as the unit of value. The fulfillment of material needs has not caused the emergence of social stratification based on conditional hierarchies since everyone is regarded as members of the same group. The only available opportunities rely on the cultivation and maintenance of relationships that establish social networks with woman-giving and woman-receiving families and brother-sister relations as a way to guarantee livelihood through a number of mechanisms, especially in times of crisis. Examples include the customary demand to always provide food for people in need and social institutions that require people to accumulate wealth in the form of ritually significant goods (such as livestock).

11.2.4 Social Stratification

The Caisido community does not exhibit significant disparities in wealth. Although certain persons and families may own more land or livestock, they generally do not flaunt this wealth in everyday life, as exemplified by the Muslim informer mentioned in a previous section. There are no rules against displays of surplus, but most people apparently do not wish to openly display excess wealth. Many of the respondents in our in-depth interviews expressed a preference to invest their surplus in the education of their children and the purchase of livestock as savings assets. These kinds of surplus investments are deemed traditionally respectable since the improvement of children’s human resource value can help counteract the image of the home village as an underdeveloped area.

These differences may be attributed to the ecologically critical resource situation and the limited opportunities for expansion, which leads to the notion that ostentatious displays of superior wealth should be regarded as ‘deviations’ against traditional norms and as cause for suspicion, especially when the ostentatious party is prone to ignoring local norms of the communal economy.

11.3 Income and Expenditure

With the extreme ecological conditions, the rarity of water, and the poorly developed market economy (lacking traders to collect the local population’s produce); it is difficult to see why the Caisido residents persist with their subsistence patterns and strategies. The main exceptions are people who have enough land to develop market-oriented cultivation strategies, such as by devoting each particular plot of fenced land to a single type of market or subsistence crop. This makes it easier to quantify the collected harvest. On the other hand, in the more usual paradigm where horticultural farmers only own and open as much land as they think they need and the available labor, the harvest is more difficult to measure quantitatively except for main staples like maize and groundnuts. Other crops are planted in an intercropped / interspersed manner, haphazardly maintained, and harvested as they ripen. These methods make it very difficult to count or estimate the total size and value of the harvest.

Some case respondents have willingly provided information on their produce, categorized by the type of main staple crop:
Table 41: Garden and Orchard Production for Subsistence Needs in Caisido

<table>
<thead>
<tr>
<th>Total Garden (pagar)</th>
<th>Case Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Estimated Area (m²/pagar)</td>
<td>100 x 100</td>
</tr>
<tr>
<td>Crops</td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>5 sacks</td>
</tr>
<tr>
<td>Peanut</td>
<td>10 sacks</td>
</tr>
<tr>
<td>Tomato</td>
<td>1 sack/ @ 10 kg</td>
</tr>
<tr>
<td>Kale/Kangkung</td>
<td>-</td>
</tr>
<tr>
<td>Red Chili</td>
<td>1 sack/@ 10 kg</td>
</tr>
<tr>
<td>Cayenne Pepper/Cabe rawit</td>
<td>-</td>
</tr>
<tr>
<td>Red Onion</td>
<td>-</td>
</tr>
<tr>
<td>Cassava</td>
<td>-</td>
</tr>
<tr>
<td>Tuber/Ubi jalar</td>
<td>-</td>
</tr>
<tr>
<td>Rice Needs</td>
<td></td>
</tr>
<tr>
<td>Total Family Member</td>
<td>4</td>
</tr>
<tr>
<td>Rice needs/week</td>
<td>1 sack @ 25 kg/week</td>
</tr>
</tbody>
</table>

*Source: Case Study of household income*

*Note: (-) cannot be calculated*

The case studies show that case respondents 1, 2, and 4 are capable of fulfilling their subsistence needs. This is correlated not only to how much horticultural land they own and farm, but also two other supporting factors. One is lower subsistence needs, where a 25 kg sack of rice can be made to last for a week and 2 sacks for a month. Another is that respondents 1 or 2 successfully engineered the sale of their produce, not selling them immediately after the harvest but holding on to them for several months to get better prices.
Both respondents could utilize this measure since they have built subsistence fulfillment reserves from their shop profits and personal savings. On the other hand, respondent 4 managed to fulfill his subsistence needs because his family could obtain additional income from fishing. The remaining case respondents – 3 and 5 – could not resort to these measures since they lacked alternative sources to help fulfill their needs and to adopt a more sophisticated produce-selling strategy, so they were forced to sell when prices were still low. The price of groundnuts can fall as low as $10 – $15 per 10 kg can depend whether the nuts have been peeled or not, meanwhile, in scarcer times groundnuts can sell for as much as $30 - $40 per 10 kg can in peeled condition. The difference in these sale prices is not as dramatic as it seems since freshly harvested groundnuts are volumetrically larger and thus fewer of them will fit the can than when the nuts have been peeled and dried for several months. The discrepancy between freshly harvested volume and the dried volume after 2 - 3 months of storage can be quite dramatic; the freshly harvested nuts may be half again as large as the dried ones. This results in a price difference of only around $5 – $10 / can. The problem is how would a subsistence farmer fulfill his family’s needs and his own for the 2 - 3 month it would take to wait for favorable prices? It is only possible when the farmer has substantial surplus or an alternative source of income that can help fulfill his household’s needs. It is quite difficult to find out how many households in Caisido fall into this category.

These case studies lead to the conclusion that a household’s ability to fulfill its subsistence needs cannot be judged according to the amount of land it cultivates, but rather by how many alternative livelihoods are available to fulfill subsistence needs so that the household would have the freedom to develop more optimal subsistence strategies. In many cases the gardens / orchards are the only sources available for the fulfillment of all family members’ sustenance demands.

The results of in-depth interviews provide a general picture of the daily consumption patterns commonly found among Caisido households. All case respondents state that they always eat breakfast made out of whatever produce they have at hand, such as nuts, corn, and tubers. Lunch should ideally include rice, especially for children. Adults may eat other carbohydrate sources instead (such as tubers) and defer their consumption of rice to dinnertime. Dinner (usually in the evening) serves rice as the principal carbohydrate source for all family members. Issues may arise when there are infants or toddlers that still require milk. For example, respondent 3’s wife gave birth to twins but could not produce breast milk, so he had to buy canned milk for the twins. Infant malnutrition and survival rates should ideally be deduced from fertility and mortality data. Unfortunately, the data is not available in the local clinic so it is very difficult to figure out the infant survival rate. Still, the low population growth rate of around 1% per year can be taken as an indication of the local population’s lack of subsistence capacity.

The largest expenditure for all households in Caisido is the purchase of rice. Rice is generally not produced locally but rather purchased in the market. Although the price of rice has remained within reasonable bounds at $10 - $15 per 25 kg sack, the subsistence pattern carries considerable risks if the market fails to meet the demand (such as if production or distribution was disturbed by a natural disaster) or if the price of agricultural produce experiences dramatic fluctuations. All of these circumstances can affect the local population’s subsistence/survival capabilities.
Table 42: Livestock and Crop Prices

<table>
<thead>
<tr>
<th>Unit Name</th>
<th>Price</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick</td>
<td>$0.45 - $0.65 cent</td>
<td>1 Piece</td>
<td></td>
</tr>
<tr>
<td>Brick</td>
<td>45 cent</td>
<td>1 Piece</td>
<td></td>
</tr>
<tr>
<td>Chicken</td>
<td>$5 - $20</td>
<td>1 Chicken</td>
<td>Depends on size</td>
</tr>
<tr>
<td>Chili</td>
<td>$25</td>
<td>1 Sack 25 kg</td>
<td></td>
</tr>
<tr>
<td>Cow/Buffalo</td>
<td>$600</td>
<td>1 Big Cow</td>
<td></td>
</tr>
<tr>
<td>Firewood</td>
<td>50 cent</td>
<td>1 bundle</td>
<td></td>
</tr>
<tr>
<td>Firewood</td>
<td>$0.5</td>
<td>1 bundle</td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td>$15</td>
<td>12 Fishes/ kg</td>
<td></td>
</tr>
<tr>
<td>Goat</td>
<td>$60-$200</td>
<td>1 goat</td>
<td>Depends on size</td>
</tr>
<tr>
<td>Guava</td>
<td>50 cent</td>
<td>4 fruits</td>
<td></td>
</tr>
<tr>
<td>Jati Wood</td>
<td>$600- 4700</td>
<td>1 m³ or 40 pieces firewood with 2 cm x 30 cm size</td>
<td>It is a condition that you have to share the profit with the person who cut the wood. In addition you have to obtain a permit from the Authority. It is estimated to take 3 days to retrieve.</td>
</tr>
<tr>
<td>Kale (Kangkung)</td>
<td>25-50 cent</td>
<td>1 bundle</td>
<td></td>
</tr>
<tr>
<td>Peanut</td>
<td>$15 – $45</td>
<td>1 Sack 25 kg</td>
<td>Depends on size and if peeled or not peeled</td>
</tr>
<tr>
<td>Pig</td>
<td>$30 - $50</td>
<td>1 pig</td>
<td>Depends on size</td>
</tr>
<tr>
<td>Tomato</td>
<td>$3</td>
<td>1 kuncimas/large bucket 10 kg</td>
<td>Depends on size</td>
</tr>
<tr>
<td>White Jati /Philiphina’s Jati</td>
<td>$100</td>
<td>1 m³</td>
<td></td>
</tr>
</tbody>
</table>


Note: Rice’s price for 1 sack (25kg) equal $12-$15.

11.4 Social risk analysis

There are around 15 households with a household size of 5 - 12 persons whose lands are located on the proposed Project footprint of the Limestone Mine, Plant and Jetty. These households will need to
be relocated. It is recommended that a Relocation Plan is prepared by the Timor-Leste Government prior to the relocation being undertaken. The Resettlement Plan should provide a resettlement site preferable with the same territory of the hamlet, such as Belo, and be undertaken with detailed community consultation in order to prevent conflicts over land use and possession. It is not recommended that people be resettled in a different suco inhabited by a different baptismal name, as this will cause significant difficulty in allowing these people to rebuild their livelihoods. The social risk analysis is deemed to be medium if the above recommendations are implemented.

In addition some gravesites will need to be relocated or fenced off. These are of varying cultural importance, therefore the risk of social impact, as long as the above recommendations in the Impact and Mitigation Assessment Section 9.32 are implemented the risk to deemed to be medium.

### 11.5 Economic analysis of impacts

The Economic assessment of the key environmental impacts is qualitatively described below. This approach is described further in the World Bank guidelines on the assessment of the economic value of environmental impacts and benefits.

The information available does not permit a detailed Cost Benefit Analysis, the costs and benefits are qualified by identifying which environmental impact has a corresponding mitigation measure and the cost to implement this mitigation measure over the life of the Project.
Table 43: Qualitative assessment of the cost of environmental impacts (World Bank, 2003)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Impact</th>
<th>Positive Cost benefit</th>
<th>Cost benefit</th>
<th>USD</th>
<th>Negative Cost impact</th>
<th>Cost impact</th>
<th>USD</th>
<th>Cost of Mitigation Measure</th>
</tr>
</thead>
</table>
| Pre Construction | Clearing of vegetation | None                  | None         | $0  | Cement Plant area used for livestock grazing  
10 families (maximum) directly impacted by loss of native vegetation | Compensation per the Resettlement Plan: $15,000 estimate  
Monitoring and weed eradication costs: $5.6M  
Fauna relocation and monitoring, re-introduction and elimination of pests: $670k  
Rehabilitation costs (Labour and materials): $? | |
| Air quality and dust | None                  | None                  | None         | $0  | Dust suppression techniques include water spraying and enclosing equipment  
Monitoring costs  
Potential increase in illness and health impacts to the local population  
Resettlement costs | Compensation per the Resettlement Plan: $15,000 estimate  
Dust suppression sprayer and labour: $?  
2000/month  
Cost of illness and loss of productivity: $? | |
| Noise          | None                  | None                  | None         | $0  | Noise limitation techniques include water spraying and enclosing equipment  
Monitoring costs  
Potential increase in illness and health impacts to the local population | Compensation per the Resettlement Plan: $15,000 estimate  
Monitoring costs: $580k  
Cost of illness and loss of productivity: $? | |
<table>
<thead>
<tr>
<th>Stage</th>
<th>Impact</th>
<th>Positive Cost benefit</th>
<th>USD</th>
<th>Negative Cost impact</th>
<th>USD</th>
<th>Cost of Mitigation Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cost benefit</td>
<td></td>
<td>Cost impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water quality and quantity</td>
<td>Development of a water supply borehole has the potential to supply potable water to the local community</td>
<td>Cost of illness from lack of access to clean water: $?</td>
<td></td>
<td>Monitoring costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost of transporting water from other sources: $?</td>
<td></td>
<td>Rehabilitation costs in the event of a spill or contamination event</td>
<td>$1.4M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monitoring costs</td>
<td></td>
<td>Spill and contamination mitigation measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic</td>
<td>Employment and training of local peoples (Training Centre)</td>
<td>$22 million USD (20 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Economic

- Employment and training of local peoples (Training Centre)
- 400 people per year
- 200 people employed as trainers
- Training programs 6-12 months long

Construction

- Air quality and dust
- 30MW Renewable energy source will provide all electricity for the Project, reducing the Greenhouse Gas emissions to zero.
- $? Equivalent cost of a 30MW fossil fuel power station
- Greenhouse Gas Emissions

Dust suppression techniques include water spraying and enclosing equipment
- Monitoring costs
- Potential increase in illness and health impacts to the local population
- Resettlement costs

Noise

- None
- $0

Noise limitation techniques include water spraying and enclosing equipment
- Monitoring costs
- Cost of illness and loss of productivity: $?
## Positive Cost benefit

<table>
<thead>
<tr>
<th>Stage</th>
<th>Impact</th>
<th>Cost benefit</th>
<th>USD</th>
<th>Cost impact</th>
<th>USD</th>
<th>Cost of Mitigation Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality and quantity</td>
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<td>Cost of illness from lack of access to clean water: $?</td>
<td></td>
<td>Monitoring costs Rehabilitation costs in the event of a spill or contamination event</td>
<td></td>
<td>Water Quality Monitoring costs: $1.4M Water Quantity Monitoring costs : $970k</td>
</tr>
<tr>
<td>Economic</td>
<td>Employment and training of local peoples (Training Centre) 400 people per year 200 people employed as trainers Training programs 6-12 months long</td>
<td>$22 million USD (20 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>30MW Renewable energy source will provide all electricity for the Project, reducing the Greenhouse Gas emissions to zero.</td>
<td>$? Equivalent cost of a 30MW fossil fuel power station Greenhouse Gas Emissions</td>
<td></td>
<td>Dust suppression techniques include water spraying and enclosing equipment Monitoring costs</td>
<td></td>
<td>Dust suppression sprayer and labour: $? 2000/month Cost of illness and loss of productivity: $?</td>
</tr>
<tr>
<td>Noise</td>
<td>None</td>
<td>$0</td>
<td></td>
<td>Noise limitation techniques</td>
<td></td>
<td>Monitoring costs:</td>
</tr>
<tr>
<td>Stage</td>
<td>Impact</td>
<td>Positive Cost benefit</td>
<td>Negative Cost impact</td>
<td>Cost of Mitigation Measure</td>
<td></td>
<td></td>
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<td>--------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Cost benefit USD</td>
<td>Cost impact USD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>include water spraying and enclosing equipment</td>
<td>$580k</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Monitoring costs</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Potential increase in illness and health impacts to the local population</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Resettlement costs</td>
<td></td>
<td></td>
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</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>400 people per year</td>
<td></td>
<td>Rehabilitation costs in the event of a spill or contamination event</td>
<td></td>
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</tr>
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<td></td>
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<td></td>
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<td>Water Quantity Monitoring costs: $970k</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Training programs 6-12 months long</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Clearing of vegetation</td>
<td>$5/bundle firewood/pers/day (Section 11.1.2)</td>
<td>Cement Plant area used for livestock grazing</td>
<td>Monitoring and weed eradication costs: $5.6M</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Revegetation at the end of the Project life will aim to improve the</td>
<td></td>
<td>10 families (maximum) directly impacted by loss of native vegetation</td>
<td>Fauna relocation and monitoring, reintroduction and elimination of pests: $670k</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage Impact</td>
<td>Positive Cost benefit</td>
<td>Negative Cost impact</td>
<td>Cost of Mitigation Measure</td>
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<td></td>
<td>value of forest /</td>
<td>Dust suppression</td>
<td>Rehabilitation costs</td>
<td></td>
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<td></td>
<td>agriculture</td>
<td>techniques include</td>
<td>(Labour and materials): $?</td>
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<td></td>
<td>Reduction in weed</td>
<td>water spraying and</td>
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<td></td>
<td>infestation in the</td>
<td>enclosing equipment</td>
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<td></td>
<td>Project area</td>
<td>Monitoring costs</td>
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<tr>
<td>Air quality and dust</td>
<td>Reduction in illness</td>
<td>Dust suppression</td>
<td>Dust suppression</td>
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<td></td>
<td>from dust</td>
<td>techniques include</td>
<td>sprayer and labour: $?</td>
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<td></td>
<td></td>
<td>water spraying and</td>
<td>2000/month</td>
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<td>enclosing equipment</td>
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<tr>
<td>Noise</td>
<td>None</td>
<td>Noise limitation</td>
<td>Compensation per the</td>
<td></td>
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<td></td>
<td></td>
<td>techniques include</td>
<td>Resettlement Plan:</td>
<td></td>
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<td></td>
<td></td>
<td>water spraying and</td>
<td>$15,000 estimate</td>
<td></td>
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<td></td>
<td></td>
<td>enclosing equipment</td>
<td>Monitoring costs:</td>
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<td></td>
<td>Monitoring costs</td>
<td>$580k</td>
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<td>Cost of illness and</td>
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<td>loss of productivity: $?</td>
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<td>Water quality and quantity</td>
<td>Development of a</td>
<td>Cost of illness</td>
<td>Water Quality</td>
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<td></td>
<td>water supply borehole</td>
<td>from lack of</td>
<td>Monitoring costs:</td>
<td></td>
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<tr>
<td></td>
<td>has the potential to</td>
<td>access to clean</td>
<td>$1.4M</td>
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<td></td>
<td>supply potable water</td>
<td>water: $?</td>
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<tr>
<td></td>
<td>to the local community</td>
<td></td>
<td>Water Quantity</td>
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<td></td>
<td></td>
<td>Cost of transporting</td>
<td>Monitoring costs:</td>
<td></td>
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<td></td>
<td></td>
<td>water from other</td>
<td>$970k</td>
<td></td>
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<td></td>
<td></td>
<td>sources: $?</td>
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</tbody>
</table>

The economic values of environmental impacts of the Project are mitigated through the following best practice approaches:

1. Selection of plant and equipment which meets emissions standards;
2. Engineering and project design to limit the footprint area and thus impacts to vegetation from clearing and on heritage sites;
3. Identification of key vegetated areas to be retained to reduce the potential impact on forest specialist birds;
4. Site selection to limit the impacts of dust and noise on the communities and reduce the costs associated with noise attenuation and dust suppression measures;
5. Selection of the Project implementation approach to ensure access to employment opportunities for the local people; and
6. Selection and development of Best Available Technology (BAT) through the use of CFB Technology, which in addition to coal can burn biomass and other waste materials to reduce the carbon footprint. CFB has a greater direct project cost than other similar technologies. TL Cement is committed to using the BAT for power generation for the Project.

The Project’s environmental and social monitoring measures have been quantified in the Environmental Management Plan (EMP).
12 SUMMARY OF THE ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Framework (EMF) sets the structure for managing environmental risks and impacts during the Project life cycle. The EMF for the TL Cement Project includes the following key approaches:

a. Select the Project option which has the lowest possible environmental footprint;
b. Reduce the environmental impact, as far as possible, through engineering and design approaches;
c. Mitigate environmental impact, as far as possible, through engineering and design approaches;
d. Manage the direct impacts and the risk of ongoing impact through management measures and monitoring; and
e. Continuously improve the environmental management and monitoring measures through the Project life cycle.

As required by the Environmental Licensing Law the Environmental Management Plan (EMP) is a separate document from the Environmental Impact Statement (EIS).

The EMP is an essential tool for ensuring that mitigation of the negative impacts and enhancement of the positive impacts is carried out effectively throughout the life of the Project. An EMP should be systematically improved on a regular basis to ensure that best available technologies (BAT) and best environmental management practices are implemented in a manner that is pragmatic, efficient and cost-effective.

The EMP for the TL Cement Project addresses:

1. Environmental impacts which are identified as ‘Medium’ or greater in EIS document;
2. Mitigation measures for all aspects which are required in accordance with industry best practice;
3. Monitoring measures and standards to be followed;
4. Trigger values or target values of measurement criteria;
5. Reporting requirements; and
6. Continuous improvement process.

The EMP will be reviewed at the following key Project milestones:

- Completion of the pre-construction phase and additional specialist studies;
- Completion of the construction phase;
- Award of the Operations contract to incorporate operator-specific information;
- Every 5 years at minimum during Operations phase; and
- On finalization of the Mine Closure Plan.

The EMP will be reviewed following the events where:
• Equipment or procedural changes result in a positive or negative change to the Project environmental and social risks;
• Monitoring results indicate that a change to the mitigation and monitoring regime is required to manage the Project impacts;
• Legislative changes in country require update to the EMP; and
• There is a change to the responsibility matrix for EMP implementation.
13  PUBLIC CONSULTATION

Involving the public in preparation of the EIS is fundamental to increasing the public's understanding and acceptance of the Project (e.g., how the Project may affect or improve their living conditions). Public involvement also enables members of the public to identify and bring forward impacts and issues that are not immediately obvious to the EIS team. The earlier in the Project preparation process the public can be involved, the more likely that a trusting relationship can be built and useful recommendations made.

WorleyParsons and TL Cement have undertaken a process of consultation with the people who may be affected by the Project and the Project stakeholders. WorleyParsons and TL Cement have made efforts to ensure that the public, including affected people, women and vulnerable groups, have the opportunity to participate fully in the consultation process. Consultations have taken place on a continuous basis, starting as early as possible in the EIA process. This section describes the public consultation conducted to date.

13.1  Purpose of Public Consultation

The public consultation process for the environmental assessment is carried out in accordance with the Draft Ministerial Diploma for the “Regulation on the Public Consultation Procedures and Requirements during the Environmental Assessment Process” dated 22 April 2014.

13.2  Methodology and Approach

13.2.1  Identification of Stakeholders

For the proposed development of the Project in Baucau, WorleyParsons mapped the project stakeholders. The list of identified stakeholder is summarized in the table below.

Table 44: List of identified stakeholders for the Project

<table>
<thead>
<tr>
<th>Governments</th>
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</thead>
<tbody>
<tr>
<td>President of Republic Democratic of Timor-Leste</td>
</tr>
<tr>
<td>President of RDTL</td>
</tr>
<tr>
<td>Prime Minister of Republic Democratic of Timor-Leste</td>
</tr>
<tr>
<td>Prime Minister of RDTL</td>
</tr>
<tr>
<td>Ministry of Commerce, Industry, and Environment</td>
</tr>
<tr>
<td>Minister of CIE</td>
</tr>
<tr>
<td>National Directorate for Pollution Control and Environmental Impact</td>
</tr>
</tbody>
</table>
**TL CEMENT, LDA**  
**BAUCAU CEMENT PROJECT**  
**ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE**

| General Director for Environment  
| Nacional Director for Industries and Manufacturing  

| Ministry of Petroleum and Mineral Resources  
| Minister of PMR  
| National Directorate of Minerals  
| Institute of Petroleum and Geology (IPG)  

| Ministry of Justice  
| Secretary of State for Land and Property  

| Ministry of Finance  
| Minister of Finance  

| Ministry of Planning and Strategic Investment  
| Minister of PSI  

| Ministry of Public Works, Transport and Communications  
| Minister of PWTC  
| Directorate of Ports/APORTIL  
| National Directorate for Water Quality and Control  

| Ministry of Tourism, Arts and Culture  
| Secretary of State for Arts and Culture  

| Secretary of State for Employment Policy and Vocational Training  
| Secretary of State for EPVT  

**Municipality (District) Government**

| Baucau Municipality (formerly Baucau District Administration)  

| Baucau Administrative Post (formerly Baucau Sub-District Administration)  

| PNTL Baucau Municipality  

| PNTL Baucau Administrative Post  

| BOP Baucau Municipality  

| F-FDTL Baucau Municipality  

| Baucau Municipality Directorate of Land, Property and Cadastral Services  

| Baucau Municipality Directorate of Pollution Control and Environmental Impact  

| Baucau Municipality Health Directorate  

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<table>
<thead>
<tr>
<th>Local Government</th>
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<tbody>
<tr>
<td>Baucau Municipality SEPFOPE</td>
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<tr>
<td>Baucau Municipality Public Works</td>
</tr>
<tr>
<td>Baucau Municipality Social Directorate</td>
</tr>
<tr>
<td>Baucau Municipality Agriculture Directorate</td>
</tr>
<tr>
<td>Baucau Municipality Water and Sanitation Directorate</td>
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<tr>
<td>Baucau Municipality Electricity Directorate</td>
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<table>
<thead>
<tr>
<th>Local Community</th>
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<tbody>
<tr>
<td>Suco Council Tirilolo</td>
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<tr>
<td>Suco Council Triloca</td>
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<tr>
<td>Suco Council Caibada</td>
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<td>Suco Council Bahu,</td>
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<tr>
<td>Suco Council Bucoli</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Local Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chefes de Aldeia</td>
</tr>
<tr>
<td>Lia'nain</td>
</tr>
<tr>
<td>Local Youth Organizations</td>
</tr>
<tr>
<td>Local Women's Organizations</td>
</tr>
<tr>
<td>Local Fishermen's Organization</td>
</tr>
<tr>
<td>Baucau Parish – Old Town</td>
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<tr>
<td>Baucau Parish – New Town</td>
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<tr>
<td>Baucau Bishop</td>
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</tbody>
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<tr>
<th>Civil Society/Local NGOs</th>
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<tbody>
<tr>
<td>La'o Hamutuk</td>
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<tr>
<td>Luta Hamutuk</td>
</tr>
<tr>
<td>Haburas</td>
</tr>
<tr>
<td>Rede ba Rai</td>
</tr>
<tr>
<td>Belun</td>
</tr>
</tbody>
</table>
13.2.2 Mechanism for Public Consultation

The EIS public consultation engaged affected communities, general public, non-governmental organizations, government agencies, and others.

Newspaper readership is low in Baucau and thus other advertising methods are better suited to encourage broad public consultation. Therefore, all notices associated with the EIS public consultation were advertised on national television (TVTL) in Dili on the 4th to 10th of December 2015. Notices were also advertised though local radio stations such Radio Popular Coulelemai Bucoli and Radio Komunidade Lian Matebian in Baucau commencing on the 27th November 2015 to 4th December 2015. A copy of the public notice was also posted on TL Cement’s website. Additionally, the notices were displayed at local government offices including Baucau Municipality, Baucau Administrative Post, Chief of Village, and PNTL Baucau Municipality. Lastly, a copy of all notices was provided to the NDPCEI.

A non-technical summary was prepared and translated into Tetun and was made available at the following locations:

- TL Cement Office;
- Baucau Municipality Office;
- The NDPCEI Dili Office;
- The NDPCEI Baucau municipality office;
- Baucau church;
- PNTL Vemasse HQ;
- Vemasse Administrative Post;
- Baucau Municipality SEPOPE Directorate; and
- Tirilolo Suco Hall.

The document was made available for viewing during normal business hours and made available free of charge.
13.3 Summary of Consultation Activities

The table below provides a summary of the type of public consultation and key issues addressed during the consultation undertaken to date for the Project.

Table 45: Summary of consultation activities

<table>
<thead>
<tr>
<th>Date</th>
<th>Type of Consultation</th>
<th>Key components</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2014</td>
<td>TL Cement conducted consultation with the Tirilolo community and Youth group</td>
<td>The meeting was used to discuss the land use and crop types in the area, in relation to the location of the proposed project.</td>
</tr>
<tr>
<td>July 2014</td>
<td>TL Cement met with members of the Casido Traditional Council, Suco Council and Government of Timor Leste to coordinate activities for a cultural ceremony.</td>
<td>Prior to TL Cement construction and production activities it is important to hold a cultural ceremony.</td>
</tr>
<tr>
<td>October 2014</td>
<td>TL Cement met with the Lia-Nain of Suco Ostico</td>
<td>The meeting was used to discuss the proposed project and the land use in the area.</td>
</tr>
<tr>
<td>November 2014</td>
<td>TL Cement met the communities from Suco’s Bucoli Adeia Macadai, Lulihen and Land owners Mr Virgilio G Antonio, Mr Oscar Da Silva and Mr Jose’ Da Silva</td>
<td>The meeting was used to discuss the proposed project and the land use in the area. The community was supportive of industry being established in Bacau.</td>
</tr>
<tr>
<td>February 2015</td>
<td>TL Cement and WorleyParsons conducted consultation in the local community during a site visit with the Lian Nian (Traditional Leaders)</td>
<td>The locals in general were enthusiastic about the project and had queries about the development activities for the locals that TL Cement would initiate</td>
</tr>
</tbody>
</table>
## TL CEMENT, LDA

**BAUCAU CEMENT PROJECT**

**ENVIRONMENTAL IMPACT STATEMENT - CEMENT PLANT, JETTY, CONVEYOR BELT AND ASSOCIATED INFRASTRUCTURE**

<table>
<thead>
<tr>
<th>Date</th>
<th>Type of Consultation</th>
<th>Key components</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2015</td>
<td>TL cement and WorleyParsons with the community representatives:</td>
<td>as well as the employment opportunities the project would generate for the locals.</td>
</tr>
<tr>
<td></td>
<td>• Chefe Suco Trololo: Ricardo Ernesto Belo (RB)</td>
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</tr>
<tr>
<td></td>
<td>• Chief of Community Police in Suco Trilolo: Norberta Belo (NB)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Chefe Aldeia Lia Lailesu: Cipriano Belo (CB)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Chefe Aldeia Parlamentu: Manuel Belo (MB)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Chief of Traditional Practice (Lia Nain): Duarte Belo (DUB)</td>
<td>These meetings were set up to discuss the field work surveys that would be undertaken for the EIS</td>
</tr>
<tr>
<td></td>
<td>• Secretary of Suco Trilolo: Zeca Belo (ZB)</td>
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<tr>
<td>August 2015</td>
<td>Community Questionnaire</td>
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<td></td>
<td>WP Timor Leste office staff visited four (4) most affected aldeias in Suco Trilolo;</td>
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<td></td>
<td>aldeia lia lailesu, Parlamentu, Caisido-Kotalali and Osso-wa.</td>
<td>The objective was to meet the community who are unable to attend the previous meeting and hear their opinions and suggestions as well as improve their awareness of the project.</td>
</tr>
<tr>
<td>3 September 2015</td>
<td>Public Consultation on the draft TOR</td>
<td>Most of them were well aware of the project and showed their enthusiasm for the project; however, they are worried about the impact of the project on their cultural heritage, land and lifestyle.</td>
</tr>
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</table>

WorleyParsons presented
<table>
<thead>
<tr>
<th>Date</th>
<th>Type of Consultation</th>
<th>Key components</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 December 2015</td>
<td>TL Cement and WPTL organized a public meeting in Caisido, Baucau Municipality, to discuss the proposed project and the draft EIS and EMP. The date, venue, and time of this public meeting were coordinated with the relevant Administrator, Chefes do Suco and Chefes da Aldeia.</td>
<td>WorleyParsons presented a description of the project, explained the EIS process, and provided a brief summary of the study findings to date. Following the presentation, two information tables were set up with maps, diagrams and pictures of a similar cement plant in Indonesia. The tables were staffed by representatives of WorleyParsons and TL Cement who provided more detailed explanations of project details and answer questions. The community members were invited to observe, ask questions and/or provide recommendations to the Project team.</td>
</tr>
<tr>
<td>07 January 2016</td>
<td>TL Cement and Worley Parsons met with the NGO group Lao Hamutuk to update them on preliminary EIS findings</td>
<td>WorleyParsons described the project, explained the EIS process, and provided a brief summary of the study findings to date. Lao Hamutuk stated that resettlement and compensation need to be carefully addressed. Lessons learnt from the</td>
</tr>
<tr>
<td>Date</td>
<td>Type of Consultation</td>
<td>Key components</td>
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</tr>
<tr>
<td>07 January 2016</td>
<td>TL Cement and Worley Parsons met with Foundação Haburas to update them on preliminary EIS findings</td>
<td>WorleyParsons description of the project, explained the EIS process, and provided a brief summary of the study findings to date. Foundação Haburas stated that a Resettlement/relocation and Groundwater Management Plans should be developed.</td>
</tr>
<tr>
<td>13 January 2016</td>
<td>TL Cement and Worley Parsons met with Direcção Nacional Controla Qualidade Agua (DNCQA) to update them on preliminary EIS findings</td>
<td>WorleyParsons description of the project, explained the EIS process, and provided a brief summary of the study findings to date. DNCQA stated that that resettlement and compensation need to be carefully addressed. Groundwater, Dust and Noise management plans should be developed.</td>
</tr>
<tr>
<td>13 January 2016</td>
<td>TL Cement and Worley Parsons met with NGO group Luta Hamutuk (LH) to update them on preliminary EIS findings</td>
<td>WorleyParsons description of the project, explained the EIS process, and provided a brief summary of the study findings to date. LH stated that that resettlement and compensation need to be carefully addressed. Government strategies to maintain and enhance subsistence farming</td>
</tr>
<tr>
<td>Date</td>
<td>Type of Consultation</td>
<td>Key components</td>
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<td>strategies need to be implemented. They recommended contributions towards the health and education sectors.</td>
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</tbody>
</table>

13.3.1 Meeting the Traditional Leaders (Lia Nain)

TL Cement and WorleyParsons conducted follow up consultation in the local community during a site visit in February 2015. Figure 13-1 shows WorleyParsons team members met with local Lian Nian (Traditional Leaders).

The locals in general were enthusiastic about the Project and had queries about the development activities for the locals that TL Cement would initiate as well as the employment opportunities the Project would generate for the locals.
Further meetings were then held by TL cement and WorleyParsons with the community in May 2015. These meetings were set up to discuss the field work surveys that would be undertaken for the EIS as shown in Figure 13-2.

These meetings were attended by the following community members:

- Chefe Suco Trololo: Ricardo Ernesto Belo (RB);
- Chief of Community Police in Suco Trilolo: Norberta Belo (NB);
- Chefe Aldeia Lia Lailesu: Cipriano Belo (CB);
- Chefe Aldeia Parlamentu: Manuel Belo (MB);
- Chief of Traditional Practice (Lia Nain): Duarte Belo (DUB); and
- Secretary of Suco Trilolo: Zeca Belo (ZB).

Representative of youth of Suco Trilolo: Damião Belo (DB) Minutes from these meetings can be found in Appendix 8.
13.3.3 Community Questionnaire

In August 2015, WPTL staff visited four (4) most affected aldeias in Suco Tirilolo; aldeia lia lailesu, Parlamentu, Caisido-Kotalali and Osso-wa. A questionnaire (see Appendix 9) was distributed and completed by community residents. The objective was to meet the community who are unable to attend the previous meeting and hear their opinions and suggestions as well as improve their awareness of the Project. Most of the residents were well aware of the Project and showed their enthusiasm for the Project; however, they were worried about the impact of the Project on their cultural heritage, land and lifestyle.
13.3.4 Consultation of draft TOR

On the 3rd September 2015, a public consultation meeting on the draft TOR was conducted in Caisido, Baucau Municipality. WPTL advertised a Public Notice providing details on how to review and submit comments on the TOR after the submittal of the proposed TOR for the EIS study to the Environmental Authority. WorleyParsons presented a video prepared by TL Cement describing the Project and presented a PowerPoint describing the EIA process and the Terms of Reference for carrying out the EIS. WorleyParsons also presented some preliminary findings as described in the TOR and Project Documents. Details of the Draft TOR consultation are included in the Final TOR approved by the NDPCEI.

Pictures of the consultation are shown in Figure 13-4 below.
13.3.5 Consultation of draft EIS

TL Cement and WPTL organized a public meeting on 11 December 2015 in Caisido, Baucau Municipality, to discuss the proposed Project and the draft EIS and EMP. The date, venue, and time of this public meeting were coordinated with the relevant Administrator, Chefes do Suco and Chefes da Aldeia. The public meeting was advertised as described in Section 13.2.2 above. The public meeting was advertised on public radio and television. The public meeting respected all local traditions and customs. In particular, the traditional leaders appointed by the community led the traditional ceremony before the opening of the public meeting. A translator was available to translate presentations and consultation sessions.

WorleyParsons presented a description of the Project, explained the EIS process, and provided a summary of the study findings to date. Following the presentation, two information tables were set up with maps, diagrams and pictures of a similar cement plant in Indonesia. The tables were staffed by representatives from WorleyParsons and TL Cement who provided more detailed explanations of
Project details and fielded questions, when required. The community members were invited to observe, ask questions and/or provide recommendations to the Project team. All questions and comments were recorded.

Following the small group sessions, attendees were given the opportunity to speak and express their opinions in front of the entire assembly. All questions were responded to by TL Cement and/or WorleyParsons representatives. All questions and responses were recorded.

A record of the meeting has been included in the Appendix 8, including attendance registers and all comments and opinions given by members of the public.

13.4 Summary of Comments and Actions Taken

Overall, the community members welcome the Project. The local leaders – i.e. Chief of village, F-FDTL (National Army), and Representative of the Baucau Administrator – who attended were very supportive of the Project as well. They encouraged the attendees to listen and engage so they could have a better understanding of the Project and the draft EIS presented.

In summary, most of the communities’ concerns revolve around their properties (including sacred sites) that may be taken or affected by the Project, job opportunities and environmental issues including air, noise and water pollution.

TL Cement is currently working with the Directorate of Land, Property and Cadastral Services (DLPCS) to map affected households, farmland, and other property. Once the mining and environmental licenses have been secured, TL Cement will then initiate discussions with those affected households and property owners.

TL Cement has a list of positions and how many local workers required. The company will aim to hire these people internally and directly.

WorleyParsons explained that the EIS study has evaluated these issues and determined that with the recommended mitigation measures, they pose a less than significant impact.

Table 46 presents the comments received from the public, community leaders, local officials and other stakeholders during the Q&A session of the Draft EIS Public Consultation held in Caisidu, Baucau on the 11th December 2015. All questions were answered by either the Managing Director of TL Cement, James Rhee or WorleyParsons’ representatives.

Table 46: Q&A and Recommendations received during Public Consultation in Caisidu, Baucau

<table>
<thead>
<tr>
<th>#</th>
<th>Questions from Public Consultation</th>
<th>Proponent’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Francisco Hero (PNTL)</td>
<td>James Rhee (TL Cement)</td>
</tr>
<tr>
<td></td>
<td>What is the difference between the produced clinker for exporting to Australia and the remaining to be sold as cement in Timor-Leste?</td>
<td>There is no difference. Exporting clinker is best since it can travel long distance and resists changes due to change in temperature.</td>
</tr>
<tr>
<td>#</td>
<td>Questions from Public Consultation</td>
<td>Proponent’s Response</td>
</tr>
<tr>
<td>----</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>Jaime (school teacher), Suco Parlamento; Deonisio Belo, Suco Tiriolo; Tomas Freitas, Administrative Post of Vemasse</td>
<td>Why a large amount of clinker is to be sent to Australia? Won’t it be practical to produce and export the final product (cement) instead? Cement cannot be stored longer and may compact during shipping due to change in temperature whereas clinker can be stored longer (including travel long distance) without changing its composition.</td>
</tr>
<tr>
<td>3</td>
<td>Jaime (school teacher), Suco Parlamento; Claudio (student); Agustinho da Costa Belo, Aldeia Osso-ua; Joao Freitas, Suco Caisido</td>
<td>What are the impacts from the cement plant and limestone mine to the surrounding environment? What are the measures taken to mitigate these impacts? Air pollution mainly will come from power generation and dust. Dust will mainly be released during transportation of material from mine to plant and from/to jetty using conveyor belt. The amount of air pollution can be mitigated by using solar and wind power to generate electricity whereas dust from the conveyor belt will be well contained using a closed system. In addition, company will build new road from mine to plant as a mitigation measure to reduce dust. Regarding noise pollution, since it is low risk, hence no mitigation measure required.</td>
</tr>
<tr>
<td>4</td>
<td>Jaime (school teacher), Suco Parlamento; Joao Freitas, Suco Caisido; Tomas Freitas, Administrative Post of Vemasse</td>
<td>What is the position of TL Cement regarding any sacred site and/or cemetery found within the project site? TL Cement respects all cultural heritages including evidence of ancient human habitation found within the project site. During a field study on the project site and its vicinity, some antique materials from ancient civilization (spanning the last ca 30,000 years) were found and documented.</td>
</tr>
<tr>
<td>5</td>
<td>Francisco Hero (PNTL)</td>
<td>Where is the location to drill borewells for water supply? Will the amount withdraw from the well affect the spring located in Osso-ua? Water requirement for mining and plant operation is to be abstracted from groundwater through the drilling of borewells at the Uaidei River.</td>
</tr>
<tr>
<td>#</td>
<td>Questions from Public Consultation</td>
<td>Proponent’s Response</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6</td>
<td>Manuel Azevedo</td>
<td>A feasibility study will be conducted prior to finalize the decision on drilling. The location of the proposed drilling site and the Osso-Ua Spring are quite far separated and thus there will be no impact to Ossu-Ua Spring.</td>
</tr>
<tr>
<td>7</td>
<td>Agustinho da Costa Belo, Aldeia Osso-ua</td>
<td>TL Cement is currently working with the Directorate of Land, Property and Cadastral Services (DLPCS) to map affected households, farmland, and other property. Once TL Cement has secured the mining and environmental licenses required for the project, we will enter into discussions with those affected households and property owners. Based on the mapping and negotiations, The Government of Timor Leste will prepare a Resettlement Plan. This Resettlement Plan will provide greater detail on the monitoring and reporting requirements in relation to the potential social and economic impacts associated with the development of the project.</td>
</tr>
<tr>
<td>8</td>
<td>Jeca de Assis Belo, Secretary of the Suco Council, Tirilolo</td>
<td>Clinker is sent to Australia for later production. All cement cannot be produced here in Baucau for it will compact during shipping.</td>
</tr>
<tr>
<td>9</td>
<td>Antonio Soares Belo; Herminio Belo</td>
<td>TL Cement is competing with Indonesia and Vietnam is terms of cost production. But since the minimum wage is very low in Timor-Leste, the locals can expect a better salary range from TL Cement.</td>
</tr>
<tr>
<td>10</td>
<td>Duarte Xavier</td>
<td>Noted</td>
</tr>
<tr>
<td>#</td>
<td>Questions from Public Consultation</td>
<td>Proponent's Response</td>
</tr>
<tr>
<td>----</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>11</td>
<td>Duarte Xavier</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>It is mentioned that traffic will increase from 3 to 71 passenger cars in a day during construction and operation. What will be the mitigation measure towards dust caused by this high traffic?</td>
<td>Dust suppression using water.</td>
</tr>
<tr>
<td>12</td>
<td>Ricardo Belo, Chief of Village (Chefe Suco)</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>Will the plan to build new road be limited within project site?</td>
<td>Yes.</td>
</tr>
<tr>
<td>13</td>
<td>Herminio Belo</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>Where will the waste water from the plant be discharged? Is there any treatment plan for waste water?</td>
<td>The volume of waste water from plant to be discharged is very low and thus will have negligible detrimental impact to the environment. In addition, all chemicals used on site are to be stored, handled and disposed of in a responsible manner and in accordance with the EMP.</td>
</tr>
<tr>
<td>14</td>
<td>Felipe Belmiro Belo</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>Recommendation: There should be compensation for community whose properties are directly affected by the project.</td>
<td>Yes.</td>
</tr>
<tr>
<td>15</td>
<td>Jose Filipe</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>How many people will the company employ during construction and operation? Are 1000 permanent worker to keep throughout the lifetime of the project or will there be a 10-year rotation cycle?</td>
<td>The priority to work will be given to one member of families that are directly affected. There will be no educational and necessary skills background needed for these people. Most of the community from 4 Sucos will be employed by the project either in the project site or to work within their respective community doing various community maintenance and development program.</td>
</tr>
<tr>
<td></td>
<td>Is there any benefit to local people who are not directly involved in the project (i.e. elderly and people with disabilities)?</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Jose Filipe</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>When limestone is extracted fully from the identified mine site, will the company move to a new mine site?</td>
<td>We have around 400 years' worth of limestone reserve in the area. The Block I-1 area has sufficient reserves for approximately 17 years of production assuming full capacity operation (2.2 million tonnes of limestone/year).</td>
</tr>
</tbody>
</table>
### Questions from Public Consultation

<table>
<thead>
<tr>
<th>#</th>
<th>Questions from Public Consultation</th>
<th>Proponent’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Thomas Freitas, Administrative Post of Vemasse&lt;br&gt;How will the export of clinker be controlled? Who will be in-charge of and control the jetty? If there is an agreement between the government and the company, who are to involve in the export process?</td>
<td>Jetty will be controlled by TL Cement whereas the Customs will control the administrative side of the export. Recommendation: A local should be employed to work in the jetty with the customs and/or the project team so to maintain transparency in the export of material from the jetty.</td>
</tr>
<tr>
<td>18</td>
<td>Thomas Freitas, Administrative Post of Vemasse&lt;br&gt;How will the company select the local workers to work?</td>
<td>TL Cement has a list of positions and how many workers required. The company will hire these people internally and directly.</td>
</tr>
<tr>
<td>19</td>
<td>Eusebio Assis (Youth Representative), Suco Tirilolo&lt;br&gt;What is the status of the study conducted?</td>
<td>Limestone study is done. Jetty is to be conducted and clay is to be finalized.</td>
</tr>
<tr>
<td>20</td>
<td>Eusebio Assis (Youth Representative), Suco Tirilolo&lt;br&gt;When is the construction taking place?</td>
<td>TL Cement plans to begin construction by July 2016, pending project approvals.</td>
</tr>
<tr>
<td>21</td>
<td>Eusebio Assis (Youth Representative), Suco Tirilolo&lt;br&gt;When will the affected community be gathered to discuss property lost and cultural heritage-related issues before proceeding with construction of the plant and/or limestone extraction?</td>
<td>TL Cement will proceed with compensation negotiations following receipt of project approvals.</td>
</tr>
<tr>
<td>22</td>
<td>Eusebio Assis (Youth Representative), Suco Tirilolo&lt;br&gt;When will the training for local workers begin?</td>
<td>Once the company has obtained the Environmental License and other project approvals.</td>
</tr>
</tbody>
</table>

In addition to the public consultation for Draft EIS held in Caisido, WPTL also conducted consultation visit on draft EIS with stakeholders who were unable to attend the mentioned public consultation. Based on the consultation meeting held with various stakeholders such as La’o Hamutuk, Fundação Haburas, Luta Hamutuk, BESIK, National Directorate for water Quality Control (NDWQC) and IFC, below are the summary of the concerns noted:
1. There is a need for good mitigation measures especially compensation for affected /displaced persons, e.g. documenting impact of cash compensation on Suai population especially for woman. Proponent should not compensate displaced persons with cash as cash compensation is not adequate, suitable or sustainable.

2. Benefit need to be accrued locally and not offshored to foreign investors, e.g. Suai Airport Project used imported Indonesia labor.

3. Increased activity from traffic and operations, thus require best approach to dust and noise management.

4. Land right is a complicated issue in Timor-Leste. Unsolved land conflicts in Timor-Leste caused by the lack of land law has resulted in conflict especially relocation process eg. Suia communities that have been relocated by the Tasi Mane Project so far are unable to settle.

5. Water chemical concentration.

6. Waste management.

7. Environmental impact assessment for coal generated power and if substantial, “polluters pay” approach can be applied.

8. Only small subset of population is represented on public consultation e.g., most of people attended the first consultation has the same surname (in Timor same surname means related to each other).

9. Ground water will be affected by mining activities therefore, the ground water management plan need to be conducted as well as the chance that mining could hit/intersect with water conduit in karst limestone formation (impact on the local hydrology).

10. Concern the water supply will be insufficient as 36.4 litter required per second.

11. TL cement to help improve the livelihood of locals through vivid contribution towards health and education sector. E.g. improve health center, bring instructor from Australia or Indonesia to teach on how to raise cattle for meat production, etc.

12. Water Resources Law is in draft version and will be approved by the council of ministries. In the future, Project will require water resources and spring water extraction entitlement.
13.4.1 Photos from Public Consultation (11 December 2015) on Draft EIS

Figure 13-5: Preparation activity for Draft EIS consultation by WPTL and TL Cement teams
Figure 13-6: Traditional welcome ceremony at Draft EIS Public Consultation Meeting
Figure 13-7: Community Leader attendees at Draft EIS Public Consultation Meeting

Figure 13-8: Presentation by WPTL and TL Cement at Draft EIS Public Consultation Meeting
13.5 Summary of Public Opinion on Proposed Project

Key comments from community members are extracted below:

Lian Nian (Traditional Leaders) said “The locals in general were enthusiastic about the project and had queries about the development activities for the locals that TL Cement would initiate as well as the employment opportunities the project would generate for the locals”

Casido Community leaders “are 100% willing to accept the cement plant project in their area”

Chief of Suco “Time of development has come. Community to ignore any rumours [that project will destroy livelihood]”.

Director of Environmental Department, GoTL said that many community concerns around air quality will be addressed by “technology used in Australia which does not produce smog to a level harmful to the nearby community”.

Overall the response to the project is positive and the majority (more than 90%) of the local community supports the project.
13.6 Recommendations for Future Consultations

TL Cement is committed to ensuring continued, open and transparent consultation with all Project stakeholders and interested and affected parties. Consultation will continue through the life cycle of the Project. The key measures for ensuring that this occurs include development of the following key documents and processes:

• Resettlement Plan;
• Compensation Procedure;
• Employment Strategy;
• Complaints and Grievance mechanism;
• Environmental Management Plan; and
• Stakeholder consultation process.
14 DIFFICULTIES ENCOUNTERED IN PREPARATION OF THE EIS

This EIS has been prepared in accordance with the template provided in Annex 4 of the Draft General Regulations (Draft 5 dated 22 April 2014). The preparation of the EIS encountered the following challenges which were managed by the Environmental Consultant:

1. The specialist studies were commissioned to study an area greater than the area of the Cement Plant, Conveyor, and Jetty and the results required careful analysis and interpretation to determine the impacts from the Project;
2. The stakeholder consultation was undertaken over an extended period of time and it was important to ensure that accurate records were kept so that the results of the consultation could be presented in the EIS; and
3. Determination of the Project impacts was undertaken using a risk assessment process which rated the potential impacts. This process is generally acceptable in Australia and elsewhere, however is not specified as a recommended methodology in the Draft General Regulations. All impacts have corresponding mitigation and management measures to illustrate TL Cement’s commitment to minimizing the negative impacts of the Project on the environment and community.
15 CONCLUSIONS AND RECOMMENDATIONS

The key recommendations from the EIS pertain to ensuring that the impacts on community livelihood and amenity are mitigated and managed throughout the Project life. The EIS identifies environmental impacts from noise, dust and traffic as a result of the movement of trucks and equipment on the site. The mitigation measures for these include selection of equipment to minimize noise, dust management measures using suppression methods and project scheduling planning to limit vehicle movements on and around the Project area.

Water management and waste management Strategies are required to mitigate the risk to commination of surface and groundwater resources near the Porject area. This includes strategies for oil spill management and disposal.

TL Cement is committed to ensuring continued, open and transparent consultation with all Project stakeholders and interested and affected parties. Consultation will continue through the life cycle of the Project.

The environmental and social risks from the development of the Project are readily mitigated and can be managed through the implementation of a robust Environmental Management Plan (EMP) and ongoing stakeholder consultation and management.
16 NON-TECHNICAL SUMMARY

16.1 Introduction

TL Cement LDA, a privately-owned company, proposes to construct a new cement manufacturing plant in Baucau Municipality, Timor-Leste. In accordance with Decree Law 05/2011, Environmental Licensing Law (ELL), the TL Cement LDA has submitted an Application for Environmental License for this project to the National Directorate of the Environment (NDE). The Baucau Cement Project will consist of:

1. Cement Plant, Marine Jetty, Belt Conveyor, and associated infrastructure
2. Limestone Mine

The NDE has classified the project as a “Category A” project, and must go through the environmental assessment process, including preparation of an Environmental Impact Statement (EIS).

16.2 Purpose of this document

This document is a Non-Technical Summary (NTS) of the EIS for the Cement Plant, Marine Jetty, Belt Conveyor and associated infrastructure. This NTS presents the assessment of the potential environmental and social impacts, proposed control measures to mitigate and manage the impacts, and remaining impacts of the project.

16.3 Benefits of the project

The benefits of the project include direct employment with 1000 permanent jobs expected during operations. The project aims to develop local capacity and will develop a training centre. Other benefits include indirect employment to local community members, through the multiplier effect due to downstream socio-economic benefits and consequent improvement in the living conditions of local population in the project area. It is estimated that at least 2000 more jobs can be created through indirect activities during operations with local business opportunity creation in supplying goods and services to TL Cement and its employees.

The location of the Baucau Cement Project and its components can be seen in Figure 16-1.
Figure 16-1: Location of Baucau Cement Project components
### 16.4 Key project characteristics

The key project characteristics are listed in Table 47.

**Table 47: Summary of Baucau Cement Project Characteristics**

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project life</strong></td>
<td>50 years at full production capacity</td>
</tr>
<tr>
<td><strong>Investment</strong></td>
<td>$400 million USD</td>
</tr>
<tr>
<td></td>
<td>Largest industrial project undertaken in Timor-Leste to date</td>
</tr>
<tr>
<td><strong>Annual production</strong></td>
<td>1.65 million tons per annum (mtpa) of Portland cement clinker (main component of cement (Figure 16-2)):</td>
</tr>
<tr>
<td></td>
<td>• 0.5 mtpa will be combined with the other required components to make Ordinary Portland Cement (a complete cement mixture (Figure 16-3)) to be sold locally in Timor Leste and Australia (~70% in Timor-Leste and ~30% to Australia)</td>
</tr>
<tr>
<td></td>
<td>• 1.15 mtpa will be packaged as Portland cement clinker and exported by ships to Australia</td>
</tr>
<tr>
<td><strong>Cement types produced</strong></td>
<td><img src="image1.png" alt="Portland cement clinker" /> 10 cm <img src="image2.png" alt="Ordinary Portland cement" /></td>
</tr>
<tr>
<td><strong>List of major project components</strong></td>
<td>Cement processing plant (650 m x 400 m)</td>
</tr>
<tr>
<td></td>
<td>• Including a construction camp and worker residential area (35 containers of 40 feet in length. 1 office unit, one cafeteria unit, 5 accommodation units each with 24 rooms (120 rooms in total).</td>
</tr>
<tr>
<td></td>
<td>Fully Enclosed Pipe Conveyor Belt (1.5 km long)</td>
</tr>
</tbody>
</table>
16.5 Operations

When in operation, limestone will be taken to the Cement Plant for processing. Some other cement components will be shipped to the Marine Jetty and put on a fully enclosed Pipe Conveyor Belt and taken to the Cement Plant to be processed along with the limestone and turned into Portland cement clinker.

Portland cement clinker is small lumps that are the basic ingredient of cement (Figure 16-2). The Portland cement clinker will then be taken by the same full enclosed Pipe Conveyor Belt from the cement plant to the Port where it will be loaded onto ships from a Marine Jetty.

A similar example of a conveyor and marine jetty can be seen in Figure 16-4: The Baucau Cement Plant Project once in operation.
Figure 16-4: The Baucau Cement Plant Project once in operation
16.6 Project Phases

The project will have four phases: Pre-construction (18 months), Construction (2 years), Operations (over 35 - 50 years) and Decommissioning (5 years). A summary of the activities to be undertaken during each phase and potential impacts are presented in Table 48. In addition, the potential impacts that could occur as a result of the activities during each phase have been outlined below. Of these, key impacts have been identified as either a ‘Medium’ or ‘High’ risk, and have been discussed further in Section 16.7, along with identified mitigation measures to manage and reduce the impacts.
Table 48: Summary of Baucau Cement Project phase characteristics and potential impacts

<table>
<thead>
<tr>
<th>Phase</th>
<th>Activities</th>
<th>Potential Impacts (risk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-construction</td>
<td>• Clearing of fence lines &amp; Installing fences</td>
<td>• Clearing of natural vegetation (Low)</td>
</tr>
<tr>
<td>(Duration of approximately 18 months)</td>
<td>• Clearing of access roads internal to the project area</td>
<td>• Displacement of people (Medium to High)</td>
</tr>
<tr>
<td></td>
<td>• Establishment of Laydown areas and preliminary office infrastructure such as portable toilets and shipping containers for storage</td>
<td>• Exclusion of people from fishing grounds, boreholes and springs (Low)</td>
</tr>
<tr>
<td></td>
<td>• Relocation of people and animals within the project area</td>
<td>• Increased traffic and transport (Low)</td>
</tr>
<tr>
<td></td>
<td>• Exploratory water source drilling and installation of water supply wells.</td>
<td>• Increased noise and increase in air pollution (Low)</td>
</tr>
<tr>
<td></td>
<td>• Installation of power supply infrastructure corridors via clearing, excavation and pegging</td>
<td>• Disturbance of heritage sites (Low)</td>
</tr>
<tr>
<td></td>
<td>• Geological studies including bore drilling and pit surveys</td>
<td>• Increased groundwater usage (Low)</td>
</tr>
<tr>
<td></td>
<td>• Weir installation in streams</td>
<td>• Clearing of coral (Low)</td>
</tr>
<tr>
<td></td>
<td>• Establishment of exclusion zones around fishing areas, boreholes and springs (known impact, appropriation of natural asset)</td>
<td>• Disturbance of cultural heritage at the mine site (Medium to High)</td>
</tr>
<tr>
<td></td>
<td>• Construction of material offloading facility (construction jetty)</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>• Clearing of the Cement site/area - Excavation, Piling, Pouring of concrete foundations and permanent establishment of accommodation, offices and workshops</td>
<td>• Clearing of natural vegetation (Low)</td>
</tr>
<tr>
<td>(Duration of approximately 2 years)</td>
<td></td>
<td>• Displacement of people (High)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Visual impact (High)</td>
</tr>
<tr>
<td>Building structures in concrete and steel for cement equipment</td>
<td>Increased noise, increased air pollution (Low)</td>
<td></td>
</tr>
<tr>
<td>Developing internal cement plant roads and drainage</td>
<td>Increased traffic and transport (Low)</td>
<td></td>
</tr>
<tr>
<td>Establishment of bunds, hauling roads, drainage areas and mine stope markers ahead of mining commencing</td>
<td>Increased light and heavy vehicle interaction with pedestrians and motorbikes (Medium)</td>
<td></td>
</tr>
<tr>
<td>Installation of cement plant equipment</td>
<td>Increased groundwater usage (Low)</td>
<td></td>
</tr>
<tr>
<td>Construction of power plant</td>
<td>Increase in waste (Low)</td>
<td></td>
</tr>
<tr>
<td>Installation of conveyor system</td>
<td>Clearing of coral (Low)</td>
<td></td>
</tr>
<tr>
<td>Piling and construction of jetty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction of internal access roads and haul roads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge into landfill – solid and liquid waste</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Operation**

**Duration of approximately 35-50 years**

| Operating conveyor transporting material to/from Jetty | Increased traffic and transport (Medium) |
| Operational cement plant | Increased noise, increased air pollution (Low) |
| Operational power plant operational | Disturbance to community from blasting (Medium) |
| Operational jetty and MOF | Increased light and heavy vehicle interaction with pedestrians and motorbikes (Medium) |
| Maintenance clearing within the plant site boundary (e.g. tree lopping for power lines) |  |
| Discharge to landfill – solid waste |  |
### De-Commissioning

(Duration of approximately 5 year)

- Rehabilitation

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>De-Commissioning</td>
<td></td>
</tr>
</tbody>
</table>

- Increased groundwater usage (Medium)
- Increased pollution (waste water outfall) (Low)
- Reduction in employment levels
- Continued employment during rehabilitation and closure of the mine
- Negative impact on local economy
- Rehabilitated landscape-It is possible to create tourism venue during rehabilitation based on local community needs
16.7 Key Potential Impacts and Mitigation Measures

There are a number of aspects to the project that have the potential to cause 'environmental and social impacts during different phases of the project. Of these, key aspects and their impacts have been identified to be a 'Medium' or 'High' risk. These key aspects, along with mitigation measures identified to manage and reduce the impacts, and monitoring and reporting to ensure compliance, have been outlined in Table 49 below.
### Table 49: Key Potential Impacts, Mitigation Measures and Monitoring and Reporting

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Mitigation Measures</th>
</tr>
</thead>
</table>
| **Displacement / Resettlement** | Local people will be displaced and will require relocation in order for this project land to be acquired.  
During pre-construction the people who live on the land zone for the project will need to be relocated and compensated for their loss of land. This NTS and EIS does not address the issue of resettlement, and is currently being addressed via another process  
This can cause a Medium to High level of impact on local people.  
TL Cement is currently working with the Directorate of Land, Property and Cadastral Services (DLPCS) to map affected households, farmland, and other property. Once TL Cement has secured the mining license and environmental licenses required for the project, the GoTL will enter into discussions with those affected households and property owners. Based on the mapping and negotiations, the GoTL will prepare a Resettlement Plan.  
The development of a Resettlement Action Plan will provide greater detail on the monitoring and reporting requirements in relation to the potential social and economic impacts associated with the development of the project. |
| **Cultural Heritage** | Impacts of the mine on Cultural Heritage for the local area is limited with no known sites to be impacted.  
Local area sites may have access controls.  
The impact is Low.  
The EMP will be implemented in coordination with the community and the Secretariat of Arts and Culture that documents the process and procedures to be followed during the project, including the management and protection of new and known sites during the project life.  
Access to the sites during the life of the project shall be considered in the context of the importance of the sites to the local community and the broader Timorese culture. Where safe access cannot be guaranteed, those sites which are located adjacent to |
The project should be fenced off, access restricted for the project life or relocated, in consultation with the community.

Where a site is located inside the location of the proposed mine pit and the impact is unavoidable, the impact should be documented, exhumation of bones (where applicable) and relocated in consultation with the local community.

Traffic Impacts associated with the development of the project can be adequately managed if the following mitigation measures are adopted and implemented for the life of the project:

- Minimising vehicle movement – good planning and scheduling can limit the number of vehicle movements required which will reduce the likely impacts to the condition of the roads and public safety. Transporting workers in buses will reduce individual vehicle traffic. Having a camp within the plant site is additional mitigation limiting the need for travel off the project site.
- Limit vehicle reversing, as it is major cause of fatal accidents. Implementation of one-way systems, ensuring reversing sensor/alarms are installed on all vehicles and mobile equipment and signage in reversing areas can reduce the risk of reversing accidents.
- Traffic signage – all traffic signage should be clearly and prominently displayed in well-lit areas. Signage should be posted to indicate speed limits, restricted access, visitor parking, headroom, and other route hazards.
- Speed limits should be implemented and enforced.
### Aspect

<table>
<thead>
<tr>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Road widening may be required as a minimum road width of 6.5 meters is recommended for heavy vehicles (BBS, 2015c).</td>
</tr>
<tr>
<td>• Limit vehicle idling time and keep vehicles well maintained to minimise particulate and gaseous emissions (Holtec, 2015a).</td>
</tr>
<tr>
<td>• Where appropriate, pedestrian crossing points should be provided in the mist visible and obvious pedestrian routes. The crossing points should be appropriately sign posted.</td>
</tr>
<tr>
<td>• Regular review, maintenance and repair of road pavement and drainage should be undertaken.</td>
</tr>
</tbody>
</table>

### Water

All water for the operation of cement plant is to be abstracted from groundwater through the drilling of borewells at the Uaidei River. During operation this will be 3.15 ML/day.

Impacts on the local ecosystem and the local users are expected to be Medium.

The Environmental Management Plan incorporating monitoring measures for groundwater impact.

Monitoring boreholes should be drilled at strategic locations around the infrastructure to monitor the background water quality as well as provide an indication of the presence of contaminants in the surrounding aquifer.

Groundwater modelling for the water supply should be undertaken to determine the radius of influence of the drawdown in the local aquifers. This will enable the project to manage abstraction and dewatering to minimise impact on the vegetation and river base flow.

Ground water extraction can be minimized with the use of sea water for power plant cooling and further optimized by closed circuit water condensers to recycle.
The water:
- Contamination of the aquifer from the project should be mitigated through the Environmental Management Plan and all spills immediately cleaned up and disposed of appropriately.
- All chemicals used on site are to be stored, handled and disposed of in accordance the Environmental Management Plan.
16.8 Stakeholder Engagement Process

This project has involved consultation with people who may be affected by the project and other project stakeholders. This includes the public, such as those who will be directly affected, women and vulnerable groups. As can be seen by Figure 16-5, public engagement consultation is a continuous process throughout the EIA process and has already been initiated.

The public consultation process for the environmental assessment is being carried out in accordance with the Draft Ministerial Diploma for the "Regulation on the Public Consultation Procedures and Requirements during the Environmental Assessment Process" dated 22 April 2014.

![Figure 16-5: Stakeholder Engagement and Consultation](image)

The stakeholder consultation list to date is shown in Table 50.

**Table 50: Consultation Summary**

<table>
<thead>
<tr>
<th>Stakeholder</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Government Ministries</strong></td>
</tr>
<tr>
<td>Ministry of Commerce, Industry, and Environment</td>
</tr>
<tr>
<td>• National Directorate for Environment</td>
</tr>
<tr>
<td>Ministry of Petroleum and Mineral Resources</td>
</tr>
<tr>
<td>• National Directorate of Mines and Minerals</td>
</tr>
<tr>
<td>• Institute of Petroleum and Geology</td>
</tr>
<tr>
<td>Ministry of Justice</td>
</tr>
<tr>
<td>• National Directorate of Land, Property and Cadastral Services</td>
</tr>
<tr>
<td>Ministry of Finance</td>
</tr>
</tbody>
</table>
TL Cement and Worley Parsons conducted follow up consultation in the local community during site visits in February 2015 and May 2015.

These meetings were attended by the following community members:

- Chefe Suco Tirilolo: Ricardo Ernesto Belo (RB)
- Chief of Community Police in Suco Tirilolo: Norberta Belo (NB)
- Chefe Aldeia Lialailesu: Cipriano Belo (CB)
- Chefe Aldeia Parlamentu: Manuel Belo (MB)
- Chief of Traditional Practice (Lia-Nain): Duarte Belo (DUB)
- Secretary of Suco Tirilolo: Zeca Belo (ZB)
- Representative of youth of Suco Tirilolo: Damião Belo (DB)
Local Youth Organizations
Local Women’s Organizations
Local Fishermen’s Organization
Baucau Parish

**Civil Society/Local NGOs**
Lao Hamutuk
Luta Hamutuk
Haburas
Rede ba Rai
Belun
Kapeliwa

**Other Organizations**
International Finance Corporation
Conservation International
BESIK (Bee, Saneamentu no Ijiene iha Komunidade) Rural Water Program

*End of the Non Technical Summary*
17 REFERENCES


CSIRO (2010). Climate change in Timor-Leste. A brief overview on future climate projections. Prepared by the CSIRO.


