TL CEMENT, LDA

VOLUME I
Baucau Cement Project
Environmental Impact Statement Limestone Mine

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## ABREVIATIONS AND ACRONYMS

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<tbody>
<tr>
<td>$</td>
<td>American Dollar</td>
</tr>
<tr>
<td>%</td>
<td>Percentage</td>
</tr>
<tr>
<td>(WHO AQGs)</td>
<td>World Health Organization Air Quality Guidelines</td>
</tr>
<tr>
<td>&lt;</td>
<td>Less than</td>
</tr>
<tr>
<td>&gt;</td>
<td>Greater than</td>
</tr>
<tr>
<td>°C</td>
<td>Degrees Celsius</td>
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<tr>
<td>µg</td>
<td>micrograms</td>
</tr>
<tr>
<td>µg/m³</td>
<td>Micrograms per cubic meter</td>
</tr>
<tr>
<td>µm</td>
<td>Micrometer</td>
</tr>
<tr>
<td>µScm</td>
<td>micro-Siemens per centimeter</td>
</tr>
<tr>
<td>3D</td>
<td>3 dimensional</td>
</tr>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
</tr>
<tr>
<td>ANFO</td>
<td>Ammonium Nitrate Fuel Oil</td>
</tr>
<tr>
<td>ANZECC</td>
<td>Australian and New Zealand Environment and Conservation Council</td>
</tr>
<tr>
<td>AQGs</td>
<td>Air Quality Guidelines</td>
</tr>
<tr>
<td>ARI</td>
<td>Average Reoccurrence Intervals</td>
</tr>
<tr>
<td>BBS</td>
<td>Bita Bina Semesta</td>
</tr>
<tr>
<td>BP</td>
<td>Before Present</td>
</tr>
<tr>
<td>C_{10}H_{16}</td>
<td>Terpene</td>
</tr>
<tr>
<td>C_{5}H_{8}</td>
<td>Isoprene</td>
</tr>
<tr>
<td>CFB</td>
<td>Circulating Fluidized Bed</td>
</tr>
<tr>
<td>CITES</td>
<td>Convention on International Trade in Endangered Species</td>
</tr>
<tr>
<td>cm</td>
<td>Centimeter</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon monoxide</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organisation</td>
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<td>Acronym</td>
<td>Description</td>
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<tr>
<td>---------</td>
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</tr>
<tr>
<td>CSR</td>
<td>Corporate Social Responsibility</td>
</tr>
<tr>
<td>dB</td>
<td>Decibels</td>
</tr>
<tr>
<td>dBA</td>
<td>Decibel</td>
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<tr>
<td>DLPCS</td>
<td>Timor-Leste National Directorate for Land, Property, and Cadastral Services</td>
</tr>
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<td>DNGAR</td>
<td>Timor-Leste National Department of Water Resources</td>
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<tr>
<td>DNPDT</td>
<td>Timor-Leste National Directorate of Tourism Planning and Development</td>
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<tr>
<td>DNSAS</td>
<td>Timor-Leste National Directorate for Water and Sanitation</td>
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<tr>
<td>e.g.</td>
<td>example</td>
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<tr>
<td>EA</td>
<td>Environmental Assessment</td>
</tr>
<tr>
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<td>Environment Basic Law</td>
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<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EIS</td>
<td>Environmental Impact Statement</td>
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<td>ELL</td>
<td>Environmental Licensing Law</td>
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<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>ENSO</td>
<td>El Niño–Southern Oscillation</td>
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<tr>
<td>EPA</td>
<td>Environmental Protection Authority</td>
</tr>
<tr>
<td>ETAP</td>
<td>East Timor Archaeological Project</td>
</tr>
<tr>
<td>etc.</td>
<td>Etcetera</td>
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<tr>
<td>GHGs</td>
<td>Greenhouse Gases</td>
</tr>
<tr>
<td>GL</td>
<td>Gigaliter</td>
</tr>
<tr>
<td>GL/yr</td>
<td>Gigaliter per year</td>
</tr>
<tr>
<td>GSHAP</td>
<td>Global Seismic Hazard Assessment Program</td>
</tr>
<tr>
<td>ha</td>
<td>Hectare</td>
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<tr>
<td>HAT</td>
<td>Highest Astronomical Tide</td>
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<tr>
<td>HEME</td>
<td>Heavy Earth Moving Equipment</td>
</tr>
<tr>
<td>IFC's</td>
<td>International Finance Corporation</td>
</tr>
<tr>
<td>Symbol</td>
<td>Term</td>
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<td>--------</td>
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</tr>
<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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<td>LAT</td>
<td>Lowest Astronomical Tide</td>
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<tr>
<td>Ld</td>
<td>Day Sound Level</td>
</tr>
<tr>
<td>Ldn</td>
<td>Day-Night Sound Level</td>
</tr>
<tr>
<td>Leq</td>
<td>Equivalent Sound Level</td>
</tr>
<tr>
<td>Ln</td>
<td>Night Sound Level</td>
</tr>
<tr>
<td>Lp</td>
<td>Sound Pressure Levels</td>
</tr>
<tr>
<td>m</td>
<td>Meters</td>
</tr>
<tr>
<td>m³</td>
<td>Cubic meter</td>
</tr>
<tr>
<td>MAF</td>
<td>Timor-Leste Ministry of Agriculture and Fisheries</td>
</tr>
<tr>
<td>mg/L</td>
<td>Milligram per liter</td>
</tr>
<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>
</tr>
<tr>
<td>MLWM</td>
<td>Mean Low Water Neaps</td>
</tr>
<tr>
<td>MLWS</td>
<td>Mean Low Water Springs</td>
</tr>
<tr>
<td>mm</td>
<td>Millimeter</td>
</tr>
<tr>
<td>MOF</td>
<td>Materials Offloading Facility</td>
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<td>Acronym</td>
<td>Description</td>
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<tr>
<td>MoT</td>
<td>Timor-Leste Ministry of Tourism</td>
</tr>
<tr>
<td>Mph</td>
<td>Miles per hour</td>
</tr>
<tr>
<td>MRAP</td>
<td>Marine Rapid Assessment Program</td>
</tr>
<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\text{\textsubscript{\text{w}}}</td>
<td>Moment magnitude</td>
</tr>
<tr>
<td>NAPA</td>
<td>Timor-Leste National Adaptation Programme of Action toClimate Change</td>
</tr>
<tr>
<td>NDPCEI</td>
<td>Timor-Leste National Directorate for Pollution Control and Environmental Impact</td>
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<tr>
<td>NEPC</td>
<td>Timor-Leste National Environment Protection Council</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-government Organisation</td>
</tr>
<tr>
<td>NMH</td>
<td>Non-Methane Hydrocarbons</td>
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<tr>
<td>NMHC</td>
<td>Non-methane hydrocarbons</td>
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<tr>
<td>NO\textsubscript{2}</td>
<td>Nitrogen dioxide</td>
</tr>
<tr>
<td>NO\textsubscript{x}</td>
<td>Nitrogen oxides</td>
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<td>Non-Technical Summary</td>
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<td>Project Affected Families</td>
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<tr>
<td>pcuph</td>
<td>passenger car units per hour</td>
</tr>
<tr>
<td>PM\textsubscript{10} and PM\textsubscript{2.5}</td>
<td>Particulate matter</td>
</tr>
<tr>
<td>Ppb</td>
<td>Parts per billion</td>
</tr>
<tr>
<td>Ppm</td>
<td>Parts per million</td>
</tr>
<tr>
<td>SEIS</td>
<td>Simplified Environmental Impact Statement</td>
</tr>
<tr>
<td>SEPFOPE</td>
<td>Timor-Leste State Secretary for Employment Policy and Vocational Training</td>
</tr>
<tr>
<td>SO\textsubscript{2}</td>
<td>Sulphur dioxide</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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</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>
</tr>
</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, Limestone Mine 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 Decree 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 Limestone Mine and associated infrastructure components.

This EIS and EMP should be read in conjunction with the document, Baucau Cement Plant, Jetty and Associated Infrastructure EIS and EMP. Under the instructions of the NDCEPI, the project environmental impact statements were separated into two separate EIS and EMP’s i.e. Baucau Cement Plant & Jetty and Associated Infrastructure; and Limestone Mine. This EIS and EMP is a component of the entire project and each component cannot be implemented without the other. Where impacts have been assessed, they are generally cumulative impacts of the entire operation which have been repeatedly documented in both of the Impact Assessments submitted. This is significant when understanding the approach to implementation of the EIS and EMP because the mitigation measures and monitoring actions as recommended in the EIS and EMP are applicable to the overall project impact. All mitigation measures are applicable to occur once, for the project as a whole; all monitoring events which are recommended are a single monitoring event, which has been duplicated in the two separate documents. Similarly, all reporting to the regulator and community are single reporting events.

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 NDPCRI. WorleyParsons has compiled this
document in good faith that the content will assist the NDPCRI 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 Limestone Mine covers an area of 5.76 km², referred to in the project prospecting
license as Block I-1 (Bucoli North Area-1). The prospecting block is located in Suco Tirilolo of Baucau
Administrative Post in Baucau Municipality and covers an area of 5.76 km². Of the total concession
area, an area of 1.82 km² (183 ha) was delineated by the proponent as potential mining area for
general exploration.

Based on geological investigations, it is estimated that there is 105.7 million tonnes of recoverable
limestone reserves within Block I-1 (Holtec, 2015a). Given a reject value of approximately 30%, these
reserves will provide approximately 2.1 million tonnes of limestone for cement production per year.
Block I-1 will provide sufficient reserves for approximately 50 years of production.

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 project requires a limestone supply of suitable chemical composition and with sufficient quantity
to provide for at least 50 years of production. The most significant limestone deposit in Timor-Leste is
known as the Bucoli Limestone Deposit located on the Baucau plateau. This is the area granted to the
proponent by the Government of Timor-Leste for prospecting, thus other regions in Timor-Leste are
not considered as they would not be feasible for limestone mining. Within the Bucoli Deposit, the
project proponent has been granted three mineral licenses known as Block I-1, Block I-2, and Block II.

The alternative to developing Block I-1 was considered. Block I-2 has an estimated 399 million tons of
limestone reserves or approximately four times more than Block I-1. Block 1-2 is located in sucos
Tirilolo and Bahu, northeast of Baucau Airport and north of the Dili-Baucau Road. Like Block I-1,
development of Block I-2 would not result in the displacement of a significant number of people;
however, it would result in the loss of subsistence farm land used by local communities. Block I-2 is
further away from the coast and a longer conveyor would be required to export the material,
increasing the project cost. It is also closer to Baucau, potentially increasing the impacts on a larger community.

The third prospecting area, Block II has approximately 792 million tons of limestone reserves or approximately eight times more limestone than Block I-1. Block II is located southwest of Baucau Airport along the Baucau-Viqueque road in sucos Gariwai, Tirilolo, and Wailili. Block II is located in upland areas underlain by karst limestone formations. Like Block I-1, development of this site would not result in the displacement of a significant number of people; but would result in the loss of subsistence farm land used by local communities. This was a feasible alternative, however the distance from the coast and presence of caves and groundwater resources made this option less favourable.

Of the 1.65 mpta of clinker to be produced, 1.15 mpta clinker is to be exported and the remaining 0.50 mpta 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).

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. The potential negative impacts are the reduced export revenue generated for the country and the company and fewer employment opportunities. It would also render the project unfeasible from an investment perspective.

If the project was limited to production for export, this would reduce the limestone demand by approximately 30 percent to approximately 1.15 mtpa, however this would reduce the local benefits of product to be used and marketed locally. It would also render the project unfeasible from an investment perspective.

If feasible, underground mining could result in a reduction in the area of affected land use as surface disturbance would be limited to shaft openings and haul roads. However, underground mining typically is a more hazardous operation. Underground mining can cause earthquakes, land subsidence, and cave-ins. The certain likelihood of cave-ins has resulted in underground mining not being a feasible option for the project. The limestone is located at or near to the surface and underground mining is not necessary to exploit the resource.

The no development scenario would see no employment creation by the mining operations and no government revenues would be generated. If the project is not developed, local communities may be disappointed at the loss of potential employment and future development initiatives in the area may be treated with mistrust. In addition, the ability of Timor-Leste to be self sufficient in cement production for its own needs would be comprised with Timor-Leste being exposed to high cost of cement imports which will consequently increase the cost of development and housing projects in Timor-Leste. Overall investor confidence for onshore projects would also be diminished.

Block I-1 was selected as the preferred development option due to its proximity to the coast for export, located in a relatively undeveloped community farmland area and sufficient distance away
from the key population centre at Baucau, limiting the potential negative impact on the community. The resource at Block I-1 can be mined utilizing the open pit mining method and the impact on cultural heritage has been quantified as part of this EIS; and can be managed accordingly.

1.4 Affected Environment

The mine site is located across NE to NW facing stepped slopes and plains on limestone outcrops with higher slopes on the southern edge of the site and flatter plains towards the northern boundary. The site is predominantly uniform woodland to open woodland contiguous (95%) with isolated small patches of Closed Tropical Forest (5%) occurring in minor ravines and gullies, and grassland.

The open woodland varies in the degree of disturbance and degradation dependent on physical barriers such as exposed limestone outcrops, which appears to restrict grazing animal access. The percentage of weed infestation varies from 3% to 45% across the surveyed locations. On average the canopy cover in the open woodland environments is approximately 10%. There is one IUCN Vulnerable flora species recorded within the mine site and two additional possibly present, but not recorded. One of the recorded IUCN species is classified as Least Concern, which indicates it is otherwise abundant.

The fauna survey recorded a total of 59 vertebrate fauna species including one amphibian, four reptiles (2 native taxa), 15 mammals (6 native taxa, 9 introduced species) and 40 bird species.

The open habitats of the Limestone Mine site hosted few fauna species of conservation concern and near threatened, restricted-range and forest specialized birds are associated with Closed Tropical Forest which is located at the perimeter of the prospecting licence block.

Adjacent to the north-east of the Limestone Mine are two springs used for community water supply at Caisidu, namely Uaimatabai and Uaisa springs. The water is very fresh and the flow ranges from 5 L/s to 10 L/s.

There are two communities located within 1 km of the Limestone Mine, although there are none located directly on Block I-1. These communities are Caisido and Osso-Ua, located in suco Trilolo.

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. Dewatering of water in the open pit 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 Pre construction

<table>
<thead>
<tr>
<th>Activity</th>
<th>Potential Impact</th>
<th>Level of impact</th>
<th>Mitigation measures</th>
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</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. The number of households that will be directly impacted or may need to be relocated is approximately 12 households at the Limestone Mine site.</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.</td>
</tr>
<tr>
<td>Clearing of Land resulting in loss of Cultural Heritage</td>
<td>There are two nationally-recognised civil architectural heritage sites located in the Limestone Mine area and 16 sacred cultural heritage and archeological sites will be permanently impacted by the project.</td>
<td>Potential impacts of the Project on Cultural Heritage for the local area are considered to be ‘High’, however with appropriate consultation this is deemed to be ‘Medium’.</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 Limestone Mine 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 of soil contamination should be addressed.</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Potential Impact</td>
<td>Level of impact</td>
<td>Mitigation measures</td>
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<tr>
<td>resulting in sedimentation</td>
<td>there may be an increase in sedimentation in site runoff</td>
<td>adverse impacts are considered unlikely</td>
<td>monitored through maintaining records of spill events Contouring and establishing drainage systems during pre-construction phase</td>
</tr>
<tr>
<td>Vehicle movements resulting in noise and dust</td>
<td>During pre-construction there is predicted to be an increase in vehicles using the site and unpaved roads</td>
<td>Impact is ‘Low’ due to the localised and short term nature of the impacts</td>
<td>Minimising vehicle movement good planning and scheduling Regular review, maintenance and repair of road pavement and drainage</td>
</tr>
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</table>
### 1.6.2 Construction

<table>
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<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 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 operations there is predicted to be an increase in vehicles using the local roads</td>
<td>During operation, heavy vehicles (10-ton trucks) will be transporting cement to Baucau for local sale, which will lead to up to 10 extra heavy vehicles per day on the roads, which is an increase from the 2.4 currently using the local roads. Most operational and work camps will be located within the project boundary and external workers will be transported using buses to the work 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>Dewatering of the mine area resulting in decreased spring flow</td>
<td>Impacts to spring flow from dewatering Groundwater has not been encountered in the exploration holes drilled, however further investigation is required to confirm the impacts. The impacts from dewatering are ‘Medium’ until better information becomes available.</td>
<td>Monitoring boreholes monitor the background water quality and levels Groundwater modelling for the dewatering plan to manage abstraction and dewatering impacts</td>
<td></td>
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1.6.3 Operations

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<td>Movement of vehicles and equipment resulting in increased Traffic</td>
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<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>Mine equipment operating resulting in Dust and Noise</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 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. Scheduled blast times Optimising the positioning of infrastructure to act as noise barriers</td>
</tr>
<tr>
<td>Runoff from site during rainfall</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>Operating resulting in spills and leaks</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>Dewatering of the mine area resulting in decreased spring flow</td>
<td>Impacts to spring flow from dewatering Groundwater has not been encountered in the exploration holes drilled, however further investigation is required to confirm the impacts. The impacts from dewatering are</td>
<td>Monitoring boreholes monitor the background water quality and levels Groundwater modelling for the water supply to manage abstraction and dewatering</td>
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</table>
1.6.4 Decommissioning

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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 mining 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.
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 documents are recommended for development and implementation to address the concerns associated with relocation and compensation. The impact of clearing and construction on the cultural heritage of the limestone mine site is to be mitigated procedures in place to relocate or remove sites prior to construction. 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 mine site.

Implementation of the Emergency Response Plan (ERP) contained in the EMP will mitigate the risk to contamination of surface and groundwater resources near the limestone mine. This includes strategies for oil spill management and disposal.

The environmental and social risks from the development of the limestone mine are readily mitigated and can be managed through the implementation of the Environmental Management Plan (EMP) and ongoing stakeholder consultation and management.
2 DETAILS OF PROJECT PROпонENT

TL Cement LDA 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, WorleyParsons is familiar with the project site and understands the challenges of working in Timor-Leste. With the delivery team located in-country, stakeholders are assured of unrestricted and long-term access to our personnel and resources. Our multi-disciplinary team has extensive experience in the delivery of environmental studies in Timor-Leste.

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 Oliveira:** 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). 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.

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

The EIS and EMP delivery has been led by Mr Daniel Hunter.
### Key Personnel

<table>
<thead>
<tr>
<th>Name</th>
<th>Qualifications and Experience</th>
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</table>
| **Daniel Hunter**  | *EIA Specialist*  
*B App Sci (Natural Resources Management), University of Melbourne*  
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. |
| **Chris Serjak**   | *Study Manager*  
*MSc, Sustainable Development, University of London*  
Chris 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. |
| **Annette Jacobs** | *ESIA and EMP Lead Author*  
*BSc (Hon) Geology, Rhodes University, Dip Project Management*  
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). |

Daniel has been supported by a team of experts:
### Key Personnel

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Alison Mratovich</td>
<td><strong>MA</strong></td>
</tr>
<tr>
<td><strong>Community Consultation</strong></td>
<td>Alison has 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. Focus 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><strong>MA, Hydrogeology and Engineering Geology</strong></td>
</tr>
<tr>
<td><strong>Water Resources</strong></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>
<tr>
<td>Stuart Atkinson</td>
<td>He has over 20 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.</td>
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<tr>
<td><strong>Water Resources</strong></td>
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| **Lekha Siraz**  
*Water Resources*  |
| 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. |
| **Grant Hickson**  
*Air Quality*  |
| 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. |
| **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. |
**Key Personnel**

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<th>Name</th>
<th>Qualifications and Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. IB Ardhana Putra</td>
<td>PhD, Engineering</td>
</tr>
<tr>
<td>Noise</td>
<td>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.</td>
</tr>
<tr>
<td>Titi Liliani Soedirdjo</td>
<td>MSc, Highway and Traffic Engineering</td>
</tr>
<tr>
<td>Traffic</td>
<td>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.</td>
</tr>
<tr>
<td>Dr. Hisyam Achmad</td>
<td>PhD, Anthropology</td>
</tr>
<tr>
<td>Social Impact &amp;</td>
<td>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.</td>
</tr>
<tr>
<td>Resettlement</td>
<td></td>
</tr>
<tr>
<td>Joana Belo</td>
<td>BSc, Environmental Science (Management)</td>
</tr>
<tr>
<td>Public Consultation field</td>
<td>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.</td>
</tr>
<tr>
<td>officer</td>
<td></td>
</tr>
</tbody>
</table>

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 in Baucau Municipality, Timor-Leste. The project will produce approximately 1.65 million tons per annum (mtpa) of Portland cement clinker. For the purposes of this EIS, the overall project will be referred to as the Baucau Cement Project.

The limestone required for the proposed clinker plant is to be provided by mining the Bucoli limestone deposit. This component of the Baucau Cement Project will be referred to as the “Project” for this EIS.

4.2 Project Category

The Environmental Authority for the 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 Decree Law 5/2011, the NDPCEI categorized the Limestone Mine component of the Baucau Cement Project as Category A.

4.3 Project Details

4.3.1 Project Location

The proposed Limestone Mine covers an area of 5.76 km², referred to in the project prospecting license as Block I-1 (Bucoli North Area-1). The prospecting block is located in Suco Tirilolo of Baucau Administrative Post in Baucau Municipality.

The coordinates of the centrepoint of the mine site are detailed in Table 1 below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limestone mine</td>
<td>S 8° 4' 62&quot;</td>
<td>126° 35' 61.82&quot;</td>
</tr>
</tbody>
</table>

In addition to the Block I-1, the Proponent has been granted a Prospecting License for additional two blocks for limestone mining. They are Block I-2 (Bucoli North Area-2) and Block II (Bucoli South area) which cover areas of 8.64 km² and 24 km² respectively. These prospecting blocks are spread over the Sucos of Tirilolo, Bahu, Caibada, Triloca, Bucoli, Wailili and Fatumaca in Administrative Posts of Baucau, Vemasse and Venilale in Baucau Municipality. Blocks I-2 and II are not addressed by this
EIS as Block I-1 is expected to provide sufficient limestone reserves for more than 50 years at proposed production capacity.

A formal environmental assessment process will be undertaken for Blocks I-2 and II in the future.

### 4.3.2 Nature of the project area

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 Limestone Mine site is located on NNE facing slopes and plains and 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 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 including Captive Circulating Fluid Bed Power Plant (33 MW)
2. Limestone Mine and associated infrastructure
3. Clay Extraction
4. Road Improvements and New Roads

The locations of these project components are shown in Figure 1. This EIS addresses only the Limestone Mine and associated infrastructure components. The other project components will be addressed in separate environmental assessments.
Table 2 Limestone Mine Project key characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project purpose</td>
<td>To mine 2.1 million tonnes of limestone</td>
</tr>
<tr>
<td>Project Life</td>
<td>50+ years</td>
</tr>
<tr>
<td>Area of Disturbance</td>
<td>The concession area, Block I-1 (Bucoli North Area-1) has an area of 5.76 km².</td>
</tr>
<tr>
<td></td>
<td>This will be fenced off and not accessible for the life of mine.</td>
</tr>
<tr>
<td></td>
<td>Up to 244 ha will be cleared and directly impacted within the concession area.</td>
</tr>
<tr>
<td>Mine Operation</td>
<td>24 hours a day, 7 days a week, 52 weeks a 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>o 0.33 ML/day for construction ; and</td>
</tr>
<tr>
<td></td>
<td>o 3.15 ML/day for operation</td>
</tr>
<tr>
<td>Project Timeline</td>
<td>o Pre-construction = 18 months;</td>
</tr>
<tr>
<td></td>
<td>o Construction = 2.5 years;</td>
</tr>
<tr>
<td></td>
<td>o Operations = 50 years+; and</td>
</tr>
<tr>
<td></td>
<td>o Decommissioning = 5 years</td>
</tr>
</tbody>
</table>
4.3.4 Limestone Mine

The Limestone Mine site is located 2 km southeast of the cement plant and 2.5 km south of the site of the marine jetty. A prospecting license has been issued for the site, known as the Block I-1 concession area, which covers an area of 5.76 km². Of the total concession area, an area of 1.82 km² (183 ha) was delineated by the proponent as potential mining area for general exploration.

Based on geological investigations, it is estimated that there is 105.7 million tonnes of recoverable limestone reserves within Block I-1. Given a reject value of approximately 30%, these reserves will provide approximately 2.1 million tonnes of limestone for cement production. Given operating parameters for the milling process, approximately 2.1 million tonnes of limestone will be required per year. Thus, Block I-1 will provide sufficient reserves for approximately 50 years of production, assuming full capacity operation.

Based on an anticipated demand of 2.2 mtpa of limestone, this will require approximately 7,400 tonnes per day of limestone to be mined, crushed and transported to the cement plant. Based on expected mining production rates and reject rates, this is expected to require processing of approximately 1,000 tph (tonnes per hour) of limestone.
The quarry will be developed progressively over the life of the mine with an illustration of the mine pit shown in Figure 2. The initial layout of the mine site is shown in Figure 3. The mine site at year 10 and year 20 is shown in Figure 4 and Figure 5. The final mine layout at completion is shown in Figure 6. The mine layout following decommissioning and rehabilitation is provided in the discussion of the Mine Closure Plan in Section 4.3.9 below. The mine is exploited from top to bottom in a descending order by forming a bench height of 10 m each, as shown in Figure 2.

The limestone shall be loaded by hydraulic excavators on 36 ton pay load capacity rigid body, rear dump trucks for transportation of limestone to crusher and rejects to waste dump yards. An access road will be constructed from the mine pit to a main haul road leading to the crusher.

**Figure 2: Illustration of mine pit**

**Mine Working Days**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total days/year</td>
<td>365 days</td>
</tr>
<tr>
<td>Sunday</td>
<td>52 days</td>
</tr>
<tr>
<td>Public Holidays</td>
<td>10 days</td>
</tr>
<tr>
<td>Work stopped due to misc. reasons</td>
<td>4 days</td>
</tr>
<tr>
<td>Net available working days</td>
<td>300 days</td>
</tr>
<tr>
<td>Working days per week</td>
<td>6 days</td>
</tr>
<tr>
<td>No. of operating shifts / day</td>
<td>2 shifts each of 8 hours duration</td>
</tr>
<tr>
<td>Effective working hours/ shift</td>
<td>6.0 hours</td>
</tr>
</tbody>
</table>

**Mining Method**
The Bucoli limestone deposit Block I-1 on the basis of its location, topography, lithology, structure and other mining parameters is considered amenable to fully mechanized opencast method of mining. This will be done by stripping from top and utilizing excavator-dump truck combination in conjunction with deep-hole blasting.

**Drilling**

A drilling machine of 110 to 152 mm diameter will be used to mine the limestone with the bench height of 10 m.

**Blasting**

Blasting may be done using either safety fuses or detonators. The holes are proposed to be adequately primed so as to minimize misfires and production of toxic fumes.

The delay detonators shall be used to blast multiple holes at a time with 2 to 3 rows in suitable pattern. Major blasting shall be attempted once or twice a week in general, utilizing Ammonium Nitrate Fuel Oil (ANFO) explosive with PETN/TNT based cast booster as primer charge to initiate ANFO explosive and maximizing blasting efficiency. In addition to optimize the reliability of initiation, PETN/TNT is used to reduce the chance of misfired holes and thus improves the safety of the explosive.

The oversized boulders generated during primary blasting shall be broken up by hydraulic rock breaker.

**Hauling Equipment**

A bulldozer with 300-350 HP diesel engine fitted with single shank ripper is proposed to be used to assist the operation of the hydraulic excavators, along with ancillary jobs like maintenance of roads etc. For transporting the limestone and inter-burden from mine location to the plant and waste dump area respectively, a rigid body rear dump truck of 36 tonne payload capacity (71,200 kgs Gross Vehicle Weight) will be used.

**Main Mining and Ancillary Equipment**

Table 3 lists in detailed all the main mining and ancillary equipment needed to conduct the mining of limestone.

**Table 3: Requirement of main mining and ancillary equipment**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description of equipment</th>
<th>Capacity / Size</th>
<th>No. required</th>
<th>Broad Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drilling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Drilling Machine</td>
<td>110-152 mm diameter</td>
<td>3</td>
<td>Crawler mounted, hydraulic type with on board compressor</td>
</tr>
</tbody>
</table>
### TL CEMENT, LDA

**BAUCAU CEMENT PROJECT**

**ENVIRONMENTAL IMPACT STATEMENT LIMESTONE MINE**

---

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description of equipment</th>
<th>Capacity / Size</th>
<th>No. required</th>
<th>Broad Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2</td>
<td>Hydraulic Excavator with Rock breaker</td>
<td>Suitable for 30 t class excavator</td>
<td>1</td>
<td>Hydraulic rock breaker suitable for 1.9 m³ bucket capacity backhoe fitted with about 3.0 tonne class rock breaker.</td>
</tr>
<tr>
<td>2</td>
<td>Loading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Hydraulic Excavator</td>
<td>4.5 m³ bucket capacity</td>
<td>3</td>
<td>Crawler mounted, diesel engine operated, of about 475 hp, minimum digging reach up to 10m</td>
</tr>
<tr>
<td>2.3</td>
<td>Loader</td>
<td>4.0 m³ bucket capacity</td>
<td>3</td>
<td>Tyre mounted, articulated, about 350 hp engine power</td>
</tr>
<tr>
<td>3</td>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Off-Highway dump truck for limestone &amp; inter-burden</td>
<td>Payload capacity 36 ton</td>
<td>5</td>
<td>Rigid body, Rear dump truck</td>
</tr>
<tr>
<td>4</td>
<td>Ancillaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Bulldozer with ripper</td>
<td>300 to 350 hp</td>
<td>1</td>
<td>Crawler mounted, fully hydraulic, straight blade</td>
</tr>
<tr>
<td>5</td>
<td>Explosive Van</td>
<td>2 tonne carrying capacity</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>ANFO Mixer</td>
<td>5 tonne capacity</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Exploders and blasting accessories</td>
<td></td>
<td>2 sets</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Grader</td>
<td>140 to 150 hp</td>
<td>1</td>
<td>Tyre mounted motor grader, blade length 3.50 m to 3.70 m.</td>
</tr>
<tr>
<td>9</td>
<td>Jeeps - Double Axle drive</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Water sprinkler (Truck chassis mounted)</td>
<td>10 kL</td>
<td>1</td>
<td>Truck mounted fixed tank with sprinkler system at the rear end of the tank.</td>
</tr>
<tr>
<td>11</td>
<td>Fuel tanker with pump and metering</td>
<td>5 kL</td>
<td>1</td>
<td>Fuel tanker on truck chassis with pump and metering arrangement</td>
</tr>
<tr>
<td>12</td>
<td>Mobile Service Van</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Portable Tower Lights</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Workshop</td>
<td></td>
<td></td>
<td>Workshop with all modern maintenance facilities like Fork Lift, Crane, Compressor, Welding machinery, Tyre handler, Tyre</td>
</tr>
</tbody>
</table>

---

Page 31  
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<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description of equipment</th>
<th>Capacity / Size</th>
<th>No. required</th>
<th>Broad Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>inflator etc. to maintain heavy earth moving equipment</td>
</tr>
</tbody>
</table>
Figure 3: The initial mine site layout
Figure 4: The mine site layout at year 10
4.3.5 Organization and Manpower

Manpower Requirement

The organizational set-up for the limestone mine component has been based on the following functional and sub-functional areas:

- General Management and Mines Office
- Time keeping, personnel welfare, training and safety
• Survey, development, exploration and quality control
• Mining operations
• Maintenance and repairs, garage, workshop and stores
• Operation and maintenance of crusher and sub-station
• Security

The manpower requirement for the different categories of personnel are detailed in Table 4 below.

**Table 4: Manpower requirement**

<table>
<thead>
<tr>
<th>Sn</th>
<th>DESCRIPTION</th>
<th>TOTAL NOS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mine Manager</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Vocational Training and Safety Officer</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Mining Engineer</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Mining Geologist</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Mechanical Engineer</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Electrical Engineer</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Office Assistant</td>
<td>1</td>
</tr>
</tbody>
</table>

**MINE OPERATION**

<table>
<thead>
<tr>
<th>Sn</th>
<th>DESCRIPTION</th>
<th>TOTAL NOS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drilling machine operator</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Excavator &amp; Wheel Loader Operator</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Dump truck operator – 36 ton capacity</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>Bulldozer operator</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Miscellaneous operator for rock breaker, grader, standby Operators and drivers</td>
<td>12</td>
</tr>
</tbody>
</table>

**MAINTENANCE & WORKSHOP STAFF**

<table>
<thead>
<tr>
<th>Sn</th>
<th>DESCRIPTION</th>
<th>TOTAL NOS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mechanical Foreman</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Mechanic</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Electrician</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Fitter/Turners</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Auto - Electrician</td>
<td>2</td>
</tr>
</tbody>
</table>
**Managerial and Administrative Staff**

- **Mines Manager**

The quarry is proposed to be worked under the supervision and control of a mines manager who shall be well qualified, possessing degree in Mining Engineering or geology with minimum 10 years of experience in large mechanized mines. 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 mines manager shall be responsible for total operation, maintenance and production of the mine.

- **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 Time Office, First Aid and other such allied activities.

- **Shift Managers**

Each operational shift shall be in-charge of an Assistant Mines Manager who shall be assisted by requisite number of mining foreman. Shift managers shall be qualified mining engineer or geologist with good experience of working in opencast mines.

- **Mining Geologist**

To guide and direct further exploration, conservation and quality of the mining product, a qualified and experienced mining geologist shall be appointed. The Mines Survey section is also proposed to be managed by him.

- **Mechanical Engineer**

The operation and maintenance of crusher, garage, workshop and departmental stores are important functions of a fully mechanized mines, is proposed to be managed by a well-qualified and experienced Mechanical Engineer. He is proposed to be assisted by an Automobile foreman, General Foreman, Shift Foreman, Maintenance and Store personnel.

- **Electrical Engineer**

The operation and maintenance of electrical equipment such as crusher, lighting etc. are equally important functions of the mine. The electrical equipment is proposed to be managed by a well-qualified and experienced Electrical Engineer. He is proposed to be assisted by an electrical foreman and other supporting staff.
4.3.6 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 Limestone Mine site 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.

4.3.7 Investment and Cost Production

The present Mine Design involves a capital block of USD $10.5 million for all mining and ancillary equipment. The operation cost per ton of uncrushed limestone made available at crusher works out to approximately USD 3.11/ton. This cost is inclusive of the depreciation and interest but is exclusive of manpower, government royalty and any other taxes, if any.

4.3.8 Utilities

No utilities are required to specifically support the proposed limestone mine. Power for site lighting will be provided by portable generators. Water will be trucked from the cement plant site to the mine site for dust suppression activities. Water demand for dust suppression will be approximately 100m³ (100,000 litres) per day. The Limestone Mine will derive power from the Cement Plant, which is subject of a separate EIS.

Communications on the Limestone Mine will be covered by walkie-talkies, telephone exchange and public address systems to be installed as part of the Plant and Jetty infrastructure. (Holtec, 2015)

4.3.9 Mine Closure

A Mine Closure Plan has been prepared for the project’s decommissioning phase. It takes into account the legal obligations, closure objectives, environmental and social considerations; technical mine design criteria, closure assumptions and relinquishment conditions. Its strategy will be to undertake closure activities that will result in a safe and stable landform, consistent with the post closure land use. The regulatory framework for closure is guided by local legislation and the EHS guideline on mining by IFC/World Bank. The local legislation for closure is contained in Draft Mining Code of Timor-Leste. Within Chapter V – Environmental Regime of the Draft requires mitigation
during operations and closure of site including Environmental Bond i.e. financial guarantee to ensure payment of the costs of rehabilitation and removal from site at closure of the Mineral Operations. Closure requirements are also specified in the Mining Sector of EHS guideline by IFC/World Bank. It outlines the requirements for the preparation of a Mine Reclamation and Closure Plan (MRCP) in draft form prior to the start of production. The EHS guideline also recommends that both physical rehabilitation and socio-economic considerations should be an integral part of the project life cycle.

Out of the total 5.76 km² mineral license area (Block I-1), a total of 302.55 ha will be utilized during the life time of the quarry and approximately 98.4% (297.7 ha) of the area shall be reclaimed and rehabilitated. A total of 258.7 ha shall be reclaimed and rehabilitated by afforestation and plantation and 37.8 hectares will be retained as a water reservoir. See Figure 6 for more details on the ultimate pit configuration.
The primary objective for mine closure is to return, when practical, all areas disturbed by mining operations to a safe and acceptable land use and capability.

4.3.9.1 SOIL

The overburden soil to be generated from the potential mining area of 1.82 m² will be transported to the designated overburden soil waste dump yard (OBS-1) located towards northwest of the quarry. For more details of the waste areas see Figure 7. The top soil will be utilized for afforestation. The inter-burden reject will be utilized in reclamation of the quarry by backfilling at the end of the project.
life. Inter-burden reject includes conglomeratic limestone, sandy limestone and components of limestone in contact with inter-burden, will be transported to the designated waste dumps are (WD-1). A soil remediation program will be implemented to ensure that any contaminated soils are managed in-situ throughout the life of mine, ensuring that the soils do not become a secondary source of contamination to other environmental media.
4.3.9.2 MINE INFRASTRUCTURE

It is proposed to refurbish the existing infrastructure such as mine office, workshop, stores and other office buildings within the mineral license area for use of local community at the closure. However, this shall be finalized in consultation with all stakeholders before the end of mine life.

A review of the water infrastructure will be undertaken to identify which structures are required at closure and which can be decommissioned. Any drainage infrastructure decommissioned will be
closed by backfilling. Embankments not required will be flattened by redistributing the material across the footprint.

Other infrastructure such as access roads, workshops, offices stores or any other buildings are proposed to be left for the socio-economic development of the region.

4.3.9.3 ROADS

A part of the road from crusher to the quarry pit has been considered for complete removal. TL Cement will rehabilitate all roads to ensure they are safe for the local community. Any unnecessary internal mine roads will be removed and rehabilitated to blend in with the surrounding landscape.

4.3.9.4 QUARRY

258.7 ha of the 302.55 ha quarry shall be rehabilitated by backfilling with inter-burden reject and 37.8 ha will be filled up with water from rainfall to create a permanent water reservoir feature.

4.3.9.5 SANITARY FACILITIES

All sanitary facilities will be decommissioned during closure and removed.

4.3.9.6 FUEL STORAGE AND DISPENSING

Fuel bowser and storage facilities including all pipelines in the mine area will be decommissioned. The closure of these facilities will focus on physical closure and investigation of potential subsurface contamination from petroleum products. This activity will include removing remaining fuel inventory and equipment, conducting soil testing around the facility such as quarry, crusher and parking areas and removing any contaminated soils identified. Additionally, the contaminated soils will be treated in-situ to acceptable standards or in a licensed facility if hazardous.

4.3.9.7 MONITORING

In addition to mine closure, post closure monitoring and maintenance will be also conducted. Annual reports will be prepared to document the results of monitoring, providing relevant information required to manage the ongoing closure activities during the closure and post-closure phases.

With regards to estimating closure liability, assumptions are being considered about general conditions and closure and the anticipated success of rehabilitation of the facilities at the quarry. As per the Article 81 of Draft Mining Code, financial guarantee will be provided either in the form of insurance policy, unconditional and irrevocable bank guarantee or deposit in a bank account opened solely for that purpose with a credit institution duly registered and licensed to operate in Timor-Leste, in favor of the member of Government responsible for the mineral resources sector. Moreover, the Closure Plan will be reviewed at every 10 years with a minimum of 5 revisions during the 50 years of mine life. Any change to the mining plan representing more than 10% change to area or volumes of
material or any new developments associated with the mine will trigger a revision of the Closure Plan and its budget to ensure that sufficient funds are available to cover any additional costs.

4.3.10 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 chemical combination of calcium, silicon, aluminum, 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 limestone required for the proposed clinker plant is to be provided by mining the Bucoli limestone deposit.

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 improved 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.

4.3.11 EIS 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 - Limestone Mine Component as prepared by our Consultant, WorleyParsons Services Pty Ltd.

Sincerely,

James Rhee, Managing Director
TL Cement

TL Cement LDA TIN: 1184223
Rua Complexo Hotel Ramelau Aimutin Comoro,
Dom Aleixo, Dili, Timor Leste
Web: www.tlcement.net Tel: +670 331 1206, +61 400 317 811
4.3.12 EIS Structure

This EIS and EMP should be read in conjunction with the document, Baucau Cement Plant, Jetty and Associated Infrastructure EIS and EMP. Under the instructions of the NDCEPI, the project environmental impact statements were separated into two separate EIS and EMP’s i.e. Baucau Cement Plant & Jetty and Associated Infrastructure; and Limestone Mine. This EIS and EMP is a component of the entire project and each component cannot be implemented without the other. Where impacts have been assessed, they are generally cumulative impacts of the entire operation which have been repeatedly documented in both of the Impact Assessments submitted. This is significant when understanding the approach to implementation of the EIS and EMP because the mitigation measures and monitoring actions as recommended in the EIS and EMP are applicable to the overall project impact. All mitigation measures are applicable to occur once, for the project as a whole; all monitoring events which are recommended are a single monitoring event, which has been duplicated in the two separate documents. Similarly, all reporting to the regulator and community are single reporting events.

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>
<tr>
<td>Decree Law 5/2011 Environmental Licensing Law</td>
<td>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 classification by the NDPCIEI as a ‘Category A’ project ‘that may...</td>
<td>The proposed project has been classified by the NDPCIEI as a ‘Category A’ project ‘that may...</td>
</tr>
</tbody>
</table>
(ELL) 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.

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

Draft Ministerial Diploma for General Regulations for Environmental Assessment

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.

The Environmental Assessment conducted in conformance with draft regulations.

Draft Ministerial Diploma Regulation on the Public Consultation Procedures

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 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.”</td>
<td>EIS Sections 0, 6.10.7, 9.13 and 9.16 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>

| UNTAET Regulation 2000/17 on the Prohibition of Logging Operations and the Export of Wood from East Timor (Timor-Leste) | 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 (Timor-Leste). It also prohibits the burning or any other destruction of forests. These prohibitions are subject to Section 3 which allow for exemption to be | |

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<table>
<thead>
<tr>
<th>Document Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft Decree Law on Forest Management, draft 7, received August 2013</td>
<td>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.</td>
</tr>
<tr>
<td>Draft Decree Law on Biodiversity, dated March 2012</td>
<td>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</td>
</tr>
</tbody>
</table>
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.


### 5.4 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>

### 5.5 Mineral Resources/Mining Legislation
### Name

**Ministerial Diploma 01/2008 on Licensing of Mining Activities**

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.

**Draft Mining Code**

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.

### Project Compliance

This EIS is prepared in support of the Application for Environmental License. The License is a requirement of the Mining License.
### 5.6 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>Sections 6.10.4, 6.10.8, 9.17 and 9.23 of this EIS provide the information on fisheries and aquaculture.</td>
</tr>
</tbody>
</table>

### 5.7 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</td>
<td>Sections 0 and 11 of this EIS provide 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>
programs. Where necessary, employers must provide safety equipment to workers.

5.8 Cultural Legislation

| Name                                                                 | Description                                                                                                                                                                                                                                                                                                                                 | Project Compliance                                                                                                                                                                                                                     |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Constitution of the Democratic Republic of East Timor (Timor Leste)  | 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.                                                                                                       | Sections 6.13 and 9.32 of this EIS provide the results of a detailed cultural study to avoid or minimize impact on archeological and cultural sites, manage and to protect heritage sites.                                                      |
| National Cultural Policy                                             | 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 (Timor Leste) and defining the actions to be taken by the nation, will allow to clarify the rights and duties of citizens towards cultural heritage, contributing to its safeguard and valorization.” |                                                                                                                                                                                                                                          |

5.9 Environmental and Social Sustainability Standard

| Name                                                                 | Description                                                                                                                                                                                                                                                                                                                                 | Project Compliance                                                                                                                                                                                                                     |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IFC’s Performance Standard on Environment and Social Sustainability 2012 | The Sustainability Framework comprises IFC's Policy and Performance Standards on Environmental and Social Sustainability. The Policy on Environmental and Social Sustainability describes IFC’s commitments, roles, and responsibilities related to environmental and social sustainability. IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced. There are eight performance standards including; Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts, Performance Standard 2: Labor and Working conditions, Performance Standard 3: Resource Efficiency and Pollution Prevention, Performance Standard 4: Community Health, Safety, and Security, Performance Standard 5: Land Acquisition and 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. | Environmental, social and cultural studies.                                                                                                                                                                                                 |
Involuntary Resettlement, Performance Standard 6:
Biodiversity Conservation and Sustainable Management of
Living Natural Resources, Performance Standard 7:
Indigenous Peoples, Performance Standard 8: Cultural
Heritage

5.10 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>Sections 6.6 and 9.9 of this EIS provide the results of noise impact modeling to predict the likelihood of impacts on sensitive receptors. The sections also provide 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>

5.11 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 AAQGs. 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,</td>
<td>Section 6.5 and 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. The sections also provide recommendations to mitigate or</td>
</tr>
</tbody>
</table>
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.

5.12 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>Sections 7 and 0 of this EIS assess the potential Climate Change impacts on the project and environment and identify necessary adaptation measures.</td>
</tr>
</tbody>
</table>

5.13 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 address compliance with the standards and protocols for chemical use.</td>
</tr>
</tbody>
</table>

5.14 Summary of Project Approvals

<table>
<thead>
<tr>
<th>Activity</th>
<th>Requirement</th>
<th>Legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearing of vegetation</td>
<td>Environment licence from DNSMA</td>
<td>Decree law 5/2011 on environment licensing law</td>
</tr>
<tr>
<td>Operating limestone mine</td>
<td>Environment licence from DNSMA</td>
<td>Decree law 5/2011 on environment licensing law</td>
</tr>
<tr>
<td></td>
<td>Mining License</td>
<td>Ministerial Diploma 01/2008 on Licensing of Mining Activities</td>
</tr>
<tr>
<td>Internal roads</td>
<td>Transport</td>
<td>Decree law 2/2003 on basic law on the road transport system</td>
</tr>
</tbody>
</table>
### 5.15 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>Decommission</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 ENVIRONMENT

A detailed description of the physical, ecological, economic and social environment 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 9). 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). El Niño-Southern Oscillation 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 leads 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 this section.

Temperature

The monthly average maximum temperatures occur 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 8.
Figure 8: Monthly average maximum and minimum temperatures recorded between April 2010 and March 2014 at the Baucau Meteorological Observatory (Meteorological Department at the Nicolau Lobato International Airport at Dili, 2015)

Rainfall

The average annual rainfall recorded between April 2010 and March 2014 at the Baucau Meteorological Observatory is 1643 mm. Ninety percent of the annual rainfall occurred each year between October and May. The 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 9). Almost no rain was recorded during the month of August for the duration of the record.
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 the highest occurs between December and March. The monthly average relative humidity recorded at Baucau Meteorological Observatory between April 2010 and March 2014 is shown in Figure 10.

Figure 9: Monthly rainfall recorded between April 2010 and March 2014 at Baucau the Meteorological Observatory (Meteorological Department at the Nicolau Lobato International Airport at Dili, 2015)

Figure 10: Average relative humidity recorded between April 2010 and March 2014 at the Baucau Meteorological Observatory (Meteorological Department at the Nicolau Lobato International Airport at Dili, 2015)
Wind Speed and Direction

The average wind speed recorded between April 2010 and March 2014 varies from 5 km/h to 11 km/h. The predominant wind direction is south-east during April to November and west during wet season from December to March (Figure 12). The monthly average wind speed at Baucau is shown in Figure 11.

![Average Wind Speed](image)

**Figure 11: Average wind speed recorded between April 2010 and March 2014 at the Baucau Meteorological Observatory (Meteorological Department at the Nicolau Lobato International Airport at Dili, 2015)**

Maximum wind speed have been derived from the National Oceanic and Atmospheric Administration (NOAA) as shown in Figure 12 below.

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

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

Timor-Leste falls within the southern hemisphere cyclone zone (Figure 13). 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 one 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/h, while maximum wind speed for a one in 500 year cyclone are 360 km/h.
Figure 13: Cyclones in the greater area (historic cyclone tracking)

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.

Figure 14 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).

![Observed and Projected Relative Sea-Level Change Near East Timor](image)

**Figure 14:** Pacific Climate Change Science Program sea level rise estimates for East Timor (Timor Leste). 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 0.15–0.2°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 0.4-1.0°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. Despite this, 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 center (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 stretches 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 15.

![Figure 15: Timor-Leste showing topography (and bathymetry) along with the major towns and districts (Source: Grantham et al., 2011)](image)
The area of the proposed limestone mine site consists of undulating terrain with small hills and a valley. The elevation rises gently from north to south (Figure 16, Figure 17). The north-west corner has an elevation of approximately 25 m above mean sea level and the south-east corner has an elevation of about 395 m. The digital terrain model of the topography of the limestone mine area is shown in Figure 18.

Figure 16: Panoramic view of limestone mine site

Figure 17: Topography of mineral license area looking from north to south
6.3 **Geology and Geomorphology**

Based on the exploration carried out in the area, the sequence of geological formations in the order of top to bottom in the mineral licence area for the limestone mine is: top soil, limestone, conglomeritic limestone, sandy limestone and clay.

The limestone currently is exposed on the surface with sporadic occurrences of soil. The individual geological units encountered are described below.

*Top Soil*

Top soil is reddish brown in colour and silty in nature. It occurs in relatively flat to gentle areas. The thickness of top soil encountered through borehole exploration varies from 1.0 m to 3.8 m (Holtec, 2015a).

*Limestone*

The limestone belongs to the Baucau formation and is grey to brown in colour. The limestone is fossiliferous in nature, and has bio-clast or skeletal fossil fragments within its matrix. The thickness of the limestone layer from borehole exploration varies from 3.7 m to 91.5 m thick (Holtec, 2015a).
Conglomeritic Limestone

Conglomeritic limestone is pale white to brown in colour and has a calcareous matrix, meaning it contains calcium carbonate. The thickness of the conglomeratic limestone layer varies from 1.5 m to 14.7 m (Holtec 2015a).

Sandy Limestone

Sandy limestone is pale grey to brown in colour and has a sandy appearance due to it being a mixture of sand pebbles within limestone. The thickness of the sandy limestone layer varies from 4.0 m to 24.0 m thick (Holtec 2015a).

Clay

Clay is the deepest geological layer present in the proposed limestone mine area. The clay is dark grey to purple in colour and is fine grained in nature. The thickness of the clay layer estimated from borehole exploration varies from 1.1 m to 41.8 m thick (Holtec 2015a).

Structure

The limestone and associated rock formations in the area are horizontal to gently dipping and shows an undulating structure attributable to being formed in a depositional environment. A typical geological cross section of the area is presented in Figure 19.

![Figure 19: Cross section of limestone mine area (Holtec, 2015)](image)

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 20 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 the year 2000, fifteen 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).

\[\text{Figure 20: Maximum peak ground acceleration (mm/year) over the last 475 years}\]

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.

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\(^1\) 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.
Based on tsunami zone was produced by Puslitbang SDA, as indicated in Figure 21 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 21: Tsunami mapping zone with return period of 100 years. Source: Pustlibang SDA (2004)

6.5 Air Quality

Air quality was assessed at seven sensitive receptor locations by sampling in 2015. The receptor locations are in proximity to the mine site (Figure 24). These locations are listed in Table 5. These sites were used 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 (PM₁₀ and PM₂.₅), nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and ozone (O₃). Hydrocarbons standards are included in the discussion below.
Table 5: Sampling locations for collection of primary air quality data

<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
<th>Zone</th>
<th>Easting</th>
<th>Northing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AQ-01 Bahu</td>
<td>52L</td>
<td>216789</td>
<td>9063590</td>
<td>Settlement Area East – South East of Limestone Mine</td>
</tr>
<tr>
<td>2</td>
<td>AQ-02 Check Point Triloca</td>
<td>52L</td>
<td>210449</td>
<td>9060528</td>
<td>Settlement Area South of Limestone Mine</td>
</tr>
<tr>
<td>3</td>
<td>AQ-03 Aldeia Parlementu</td>
<td>52L</td>
<td>212219</td>
<td>9065491</td>
<td>School Area East of cement plant and North East of Limestone mine</td>
</tr>
<tr>
<td>4</td>
<td>AQ-04 Aldeia</td>
<td>52L</td>
<td>209130</td>
<td>9065049</td>
<td>Settlement Area</td>
</tr>
</tbody>
</table>
No. | Location          | Zone | Easting | Northing | Description
--- | ------------------ | ---: | ------: | -------: | ----------------------------------
1.  | Osso-ua           |      |         |         | Close to Limestone Mine area
    |                   |      |         |         | Figure 22 & Figure 23
6.  | AQ-06 Wailacama   | 52L  | 204204 | 9060553 | Settlement Area
7.  | AQ-07 Bucoli     | 52L  | 207767 | 9060792 | Settlement Area
    |                   |      |         |         | South of Limestone Mine

**Figure 24: Location of air quality measurement equipment**

**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/m$^3$. 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 25. The one hour concentrations were measured between 218 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).

Figure 25: 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$_{10}$ and PM$_{2.5}$ at the seven locations listed in Figure 24 are shown in Figure 26 and Figure 27. All measured PM$_{10}$ concentrations are below the standard health limit of 150 µg/m$^3$ recommended by the US EPA (2015a) and WHO (2005). Similarly, 24 hour ambient concentrations of PM$_{2.5}$ are also below the standard health limits of 75 µg/m$^3$ recommended by WHO (2005), and 35.75 µg/m$^3$ recommended by the US EPA (2015a).

![Figure 26: 24-hour ambient concentration of PM$_{10}$ (BBS, 2015a)](image_url)
Nitrogen Dioxides

Nitrogen dioxides (NO₂) 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 of NO₂ emitted into the atmosphere as air pollution can be significant. NO₂ is also produced naturally by lightning as well as through the natural oxidation of NO with the help of ozone.

NO₂ 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 Figure 24 can be seen in Figure 28. All measurements were below the standard limit of 200 µg/m³ are recommended by WHO (2005) and European Union (European Commission, 2015). The measured concentration recorded ranged between 7 and 28 µg/m³ (BBS 2015a).

Figure 27: 24-hour ambient concentration of PM₂.₅ (BBS, 2015a)
Sulphur Dioxide

Sulphur dioxide (SO\textsubscript{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\textsubscript{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\textsubscript{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\textsubscript{2} is linked with a number of adverse effects on the respiratory system.

SO\textsubscript{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\textsubscript{2} include volcanos, the ocean, decomposition processes and natural forest fire. The 24 hour average concentration of SO\textsubscript{2} originating from natural sources is about 10 µg/m\textsuperscript{3} (EMEP-MSC-W 1995).

The results of SO\textsubscript{2} measurements at the seven locations listed in Table 5 show that SO\textsubscript{2} concentrations are well below the recommended standard limit of 196 µg/m\textsuperscript{3} recommended by WHO (2005) (Figure 29). The measured concentrations range between <8.5 µg/m\textsuperscript{3} to 18 µg/m\textsuperscript{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/m³). Other types of hydrocarbons that are measured in the very low concentrations include isoprene (C₅H₈) at 0.6 – 2.5 ppb (2-7 µg/m³) and terpene (C₁₀H₁₆) at 0.03 – 2 ppb (0.2 – 11 µg/m³).

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 listed in Table 5 are presented in Figure 30. The figure shows the 3-hour ambient concentrations are well below the standard limit of 160 µg/m³ 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/m³ as shown in Figure 30.
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 measurements taken at the seven locations listed in Table 5 are shown in Figure 31. 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 hydrocarbons) 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/m³ (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 (Table 6 and Figure 33) 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 6: 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>
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<th>Northing</th>
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</tr>
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<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>
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<td>209131</td>
<td>9065049</td>
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Figure 32: Noise measurement at Aldeia Osso-Ua (N04) (BBS, 2015b)
<table>
<thead>
<tr>
<th>Figure 32</th>
<th>Location</th>
<th>Area</th>
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<tr>
<td>N05</td>
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<td>N07</td>
<td>Bucoli</td>
<td>Settlement Area</td>
<td>52L</td>
<td>207768</td>
<td>9060793</td>
</tr>
</tbody>
</table>
Figure 33: Noise baseline measurement locations (BBS, 2015b)
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 Table 7. 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 7: Noise baseline measurement data Leq and the calculated Ld, Ln, and Ldn with incidental noise eliminated (BBS, 2015b)

<table>
<thead>
<tr>
<th>Measurement Point</th>
<th>N01</th>
<th>N02</th>
<th>N03</th>
<th>N04</th>
<th>N05</th>
<th>N06</th>
<th>N07</th>
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<td>Ldn (dBA)</td>
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<td>55.52</td>
<td>50.20</td>
<td>54.83</td>
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<td>Ld (dBA)</td>
<td>53.98</td>
<td>54.30</td>
<td>49.17</td>
<td>52.80</td>
<td>49.83</td>
<td>41.20</td>
<td>50.32</td>
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<tr>
<td>Ln (dBA)</td>
<td>53.53</td>
<td>50.77</td>
<td>46.57</td>
<td>51.66</td>
<td>48.78</td>
<td>42.03</td>
<td>46.06</td>
</tr>
</tbody>
</table>

Figure 34: Estimated noise baseline at Limestone Mine area with incidental noise eliminated (in dBA) Legend: Blue <55 dBA Green >55dBA

6.7 Surface water

No permanent rivers exist within the Limestone Mine areas. Some natural drainage lines 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 significant watercourse is the Manulede River located approximately 9 km from the proposed Cement Plant site. The river only flows when there is rainfall but is quite extensive as it drains the western side of the Baucau Plateau (Furness, 2015). The river also feeds the underground karst aquifer (groundwater) discharge.

Significant catchment areas and drainage lines within the study area were mapped using a Digital Elevation Model (DEM) developed using ASTER data (NASA) and shown in Appendix 3 ‘Surface Water Impact Assessment Report’. The catchment area associated with the mine and plant site has an area of approximately 29.2 km². Runoff from the higher ground, to the south of the project area, flows northwards, via ephemeral watercourses, toward the ocean.

Karst Baucau limestone is present throughout the majority of the catchment areas reporting to the mine site, which limits rainfall-runoff. Karst features such as including springs, caves, collapsed caves, sink holes, and sharp outcrops are present in the study area (Furness, 2015). The Baucau Limestone aquifer is recharged by rainfall infiltrating on the Baucau Plateau during the wet season. The infiltration rate for the exposed karst features on the plateau was estimated by Furness (2015) to be approximately 40% of the annual rainfall.

Anecdotal evidence (personal communication L. Furness, 2015) suggests there is very little runoff during rainfall events and therefore surface water flows are only expected in the upper catchment areas during extreme rainfall events. This is evident in the air photographs where watercourses are poorly defined. Watercourses become better defined between the mine site and coastline, in proximity to the plant site where limestone sediment/soils and alluvials are present (Advisian, 2015).
Figure 35: Springs near the Limestone Mine

The two largest springs are Uaisarake and Uaillia (Figure 36 and Figure 37) on the eastern side of the plateau and produce 200 L/s and 50 L/s, respectively. These springs are not within the Limestone Mine area, they are more than 5km away.
Figure 36: Uaisarake Spring in Baucau (WorleyParsons, 2015c)

Figure 37: Uaililia Spring (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 Bacau Cement Plant. It has been observed that the limestone has karst features of springs, caves, collapsed caves, sink holes, and sharp outcrop.

A hydrogeological map of Timor-Leste was developed by Geoscience Australia (2010) from the geology map and ground-truthing and is shown in Figure 38. The Baucau Limestone is identified in the study area as the green karst limestone (fissured aquifer (karst) high yield).

Coastal alluvium is indicated in Figure 38 dark blue and is located to the west of the proposed Baucau cement mine.

![Figure 38: Hydrogeological map of Timor-Leste (Geoscience Australia, 2010)](image)

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 1956 – 1974) (Lindsay, 2015). Recharge has been observed by monitoring cumulative rainfall and cave river levels at Uaileaveri Cave. Recharge takes an hour or two in a storm to infiltrate to the cave stream (about 6 metres below ground level) (WorleyParsons, 2015c).

Discharge at the main spring in Baucau has been monitored over several years and has been observed that there is a delay of about 9 months between the wet season rainfall and peak flow of the spring. This observation supports the theory that the karst aquifer is bimodal in storage and transmission of water. Fast recharge and flow occurs through fractures and caves whereas very slow flow occurs in the low porosity of the limestone rock mass into the caves (WorleyParsons, 2015c).

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 (WorleyParsons, 2015c).

A dye tracing experiment was carried out to test which cave streams were connected to which spring discharges (Furness, 2011). Monitoring for traces of dye was carried out in approximately 12 springs over a 3 month period.

The dye tracing experiment was followed up with a time domain electromagnetic monitoring survey at Uaileamata Cave and Uaileaveri Cave by CSIRO (2012). The results (Figure 39) show 3 distinct layers of dry limestone (dark blue) at the surface, then wet limestone (light blue) underlain by Clay (orange to red). The thickness of saturation is variable, but is thought to be mainly a thin layer at the base of the limestone.
Airborne Geophysics

Based on the results of the dye tracing experiment (Furness, 2011) and the TEM study (CSIRO, 2012) at the caves an airborne geophysical survey of the Baucau Plateau was also undertaken to determine features of the karst aquifer and the flow lines of the main fractures and caves. The airborne geophysical study (Furness 2011, Fugro 2012) was also undertaken because there had been a failure of a number of new bores to locate any water in the limestone around Baucau.

Flow Estimations

From the geophysical survey it is estimated that approximately 10 km² of the Baucau plateau collects recharge and drains towards the mine area. With an annual rainfall of 1,200 mm and an estimated recharge rate of 0.4 this is equivalent to 4.8 GL/yr and is sufficient to meet the mine demand of 1.15 GL/yr with sufficient throughflow to meet village water supplies and environmental requirements (Furness 2011, Fugro 2012). The pathway(s) of the water flow and flow rates of individual streams are not known. It is clear that recharge occurs across the plateau and that discharge occurs around the edges of the plateau where the limestone thins and springs surface (WorleyParsons, 2015c).

Water Quality

The karst water is very fresh and is suitable for all uses except for in a boiler where it will need treatment to remove calcium and possibly silica (WorleyParsons, 2015c). A typical analysis of metals and metalloids from Uaillia Spring at Baucau is in Table 8.
Table 8: 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 Uidasime/Uailili</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
</tr>
<tr>
<td>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>Baucau Town Uailia Spring</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
</tr>
<tr>
<td></td>
<td>0.01</td>
<td>&lt;0.04</td>
<td>0.008</td>
<td>&lt;0.0002</td>
<td>84</td>
<td>&lt;0.004</td>
<td>&lt;0.005</td>
<td>&lt;0.004</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
</tr>
<tr>
<td></td>
<td>&lt;0.005</td>
<td>0.007</td>
<td>&lt;0.01</td>
<td>0.63</td>
<td>13</td>
<td>&lt;0.005</td>
<td>3</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
</tr>
<tr>
<td>Mercury</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
</tr>
<tr>
<td></td>
<td>&lt;0.005</td>
<td>0.007</td>
<td>&lt;0.01</td>
<td>0.63</td>
<td>13</td>
<td>&lt;0.005</td>
<td>3</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
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<tr>
<td>Sulphur</td>
<td>&lt;0.01</td>
<td>3.2</td>
<td>&lt;0.04</td>
<td>8.2</td>
<td>&lt;0.02</td>
<td>&lt;0.004</td>
<td>&lt;0.003</td>
<td>&lt;0.04</td>
</tr>
<tr>
<td>Antimony</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selenium</td>
<td>&lt;0.01</td>
<td>1.2</td>
<td>&lt;0.07</td>
<td>6.1</td>
<td>&lt;0.02</td>
<td>0.5</td>
<td>&lt;0.004</td>
<td>&lt;0.04</td>
</tr>
<tr>
<td>Silica</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strontium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titanium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vanadium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.8.1 Caisidu Springs

The village of Caisidu lies at the northern edge of the proposed Limestone Mine 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).

The major spring discharge (142 m elevation) is located about 400 m downslope from Uaimatabai along the spring line. It is called the Uaisa Spring 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 µS/cm. Water is piped and run in open channels to the sub-villages at lower elevation.
Figure 40: Uaimatabai Spring (WorleyParsons, 2015c)

Figure 41: Uaisa Spring (WorleyParsons, 2015c)
6.8.2 Uaiono Spring

The third spring in the line is Uaiono (Figure 42) and this discharges into the sea at the proposed port 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.

Figure 42: Uaiono Spring

6.8.3 Coastal Alluvial Aquifer

The hydrogeology map (Figure 38) of Timor-Leste shows coastal alluvium in dark blue. 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 proposed mine 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 metres and the drilling log indicated two gravel layers separated by marine clay formations. The water in the aquifer was fresh (743 µS/cm) 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. 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).

6.9 Soil

The mine site is located across NE to NW facing stepped slopes and plains on limestone outcrops with higher slopes on the southern edge of the site and flatter plains towards the northern boundary. There are minor ravines and gullies, and grassland present. The site is characterized by shallow limestone soils and extensive scattered, small to medium sized limestone rock outcrops (Trainor & Easton, 2015).

6.10 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; Wikramanayake et al., 2002b).

6.10.1 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.

6.10.2 Mangroves

Mangroves are an important coastal habitat. Mangrove extent has 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.

6.10.3 Coral

The Limestone Mine is located inland so corals have not been assessed for this EIS.
6.10.4 Fisheries

The Limestone Mine is located inland so fisheries have not been assessed for this EIS.

6.10.5 Protected Areas and National Parks

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.

6.10.6 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).

Flora

Botanical surveys undertaken in Timor-Leste have recorded more than 1,000 plant species and it is predicted (based upon a comparison with many other Malaysian islands) that around 2,500 species might occur on Timor Island (Cowie, 2006).

A terrestrial flora and fauna survey was undertaken across the Limestone Mine area in May 2015 by Colin Trainor and Brett Easton. The survey results indicate the following International Union for Conservation of Nature (IUCN) listed flora species were recorded within the Limestone Mine area:

- *Indigofera linifolia* (pea family, creeping shrub with pink flowers) – Least Concern
- *Santalum album* (Sandalwood) – Vulnerable
- *Intsia bijuga* (Borneo Teak) - Vulnerable

A search of the IUCN database indicates that threatened flora species which occur, and are likely to occur at the Limestone Mine are summarised in Table 9 below (Trainor & Easton, 2015a).

<table>
<thead>
<tr>
<th>Common name</th>
<th>IUCN</th>
<th>Threats</th>
<th>Presence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandalwood</td>
<td>VU</td>
<td>Habitat loss, fires, agriculture, extraction</td>
<td>Recorded</td>
</tr>
<tr>
<td><em>Santalum album</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Indigofera linifolia</em></td>
<td>LC</td>
<td>Habitat loss, fires, agriculture, extraction</td>
<td>Recorded</td>
</tr>
<tr>
<td>Borneo Teak</td>
<td>VU</td>
<td>Habitat loss/selective logging</td>
<td>Possible</td>
</tr>
<tr>
<td><em>Intsia bijuga</em></td>
<td></td>
<td></td>
<td>Recorded within 1km from the</td>
</tr>
</tbody>
</table>
Rosewood
*Pterocarpus indicus*

| Habitat loss, agriculture, selective logging | Possible |

IUCN Status: DD= Data deficient (A taxon with inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status); NT= Near threatened ("may be considered threatened with extinction in the near future, although it does not currently qualify for the threatened status"); VU= Vulnerable ("likely to become endangered unless the circumstances threatening its survival and reproduction improve"); EN= Endangered (facing a very high risk of extinction in the wild); CR= Critically endangered (facing an extremely high risk of extinction in the wild). LC= Species that have a relatively low extinction risk compared with those taxa that are assessed as threatened or Near Threatened. This usually includes widespread and abundant taxa, but can also include taxa that have a restricted range but have no current or potential threats, or for very widespread and currently abundant taxa that are very slowly declining.

The vegetation assemblages and forests at the mine site are described below in Section 6.10.7.

In conclusion, there is 1 IUCN vulnerable flora species recorded within the mine site and two additional possibly present, but not recorded. One of the recorded IUCN species is classified as Least Concern, which indicates it is otherwise abundant.

**Fauna**

As Timor-Leste is located close to Asia and Australia, the fauna found on the island originate from these two areas. In addition, of the recorded 168 species of resident birds, 32 are endemic to the Lesser Sundas islands, and eight are endemic to the island (Grantham et al., 2010).

There are also 35 native species of mammals on the island, two of which are endemic to Timor-Leste, and of the 40 recorded reptile species, one species is known to be endemic (Grantham et al., 2010). These numbers are likely to increase with more intensive surveys and re-examinations of taxonomic distinctiveness for many taxa (Trainor, 2010).

The fauna survey recorded a total of 59 fauna species including one amphibian (introduced), four reptiles (two native taxa, two introduced (Figure 48), 15 mammals (six native taxa, nine introduced species (Figure 47)) and 40 bird species (Table 10) (Trainor & Easton, 2015a). Three landsnail taxa were also recorded. The fauna was highly typical of lowland woodland habitats on Timor in particular, with some forest specialized birds present.

A large proportion of the recorded fauna, especially among amphibians, reptiles and mammals consisted of 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 at the proposed Limestone Mine site. All five bat species recorded were native species (Trainor & Easton, 2015a).

A total number of 59 fauna species were recorded at the Limestone Mine site. Only two individuals of native frogs were seen and local assistants reported that Long-tailed Macaque were also present (Trainor & Easton, 2015a).
Table 10 shows the number of fauna species recorded. The number of invasive or livestock species is shown in parentheses. In addition, three landsnail taxa were recorded at the Limestone Mine (Trainor & Easton, 2015a).

Table 10: Fauna species richness at study sites

<table>
<thead>
<tr>
<th>Amphibians</th>
<th>Reptiles</th>
<th>Mammals</th>
<th>Birds</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limestone Mine</td>
<td>1(1)</td>
<td>4(2)</td>
<td>15(9)</td>
<td>39</td>
</tr>
</tbody>
</table>

Of the 39 bird species recorded in the Limestone Mine area, 13 were globally restricted-range species, five species were IUCN Near threatened species (all of these were also restricted-range species) and 14 species are considered as “forest specialists”. The open habitats of the Limestone Mine site hosted few bird species of conservation concern and were dominated by woodland-open country (non-forest specialist) bird species (Trainor & Easton, 2015a). Patterns of bird species distribution closely follow vegetation patterns, with near threatened, restricted-range and forest specialized birds strongly associated with Closed Tropical Forest which had isolated patches at the Limestone Mine site.

The Limestone Mine site is comprised of mostly of open woodland, providing habitat for common and introduced fauna species. Microhabitats such as Water Buffalo wallows may increase opportunities for introduced and invasive Black-spined Toad to breed.

The isolated patches of Closed Tropical Forest (Figure 49) in the Limestone Mine area potentially supports four near-threatened bird species and the caves present, potentially support one vulnerable bat species.

Table 11: IUCN listed fauna at the Limestone Mine site

<table>
<thead>
<tr>
<th>Species</th>
<th>IUCN</th>
<th>Type</th>
<th>Habitat specialisation</th>
<th>Threats</th>
<th>Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aprosmictus jonquillaceus Olive shouldered parrot</td>
<td>NT</td>
<td>Bird</td>
<td>Forest</td>
<td>Habitat loss, fires, agriculture, extraction</td>
<td>Recorded (Figure 45)</td>
</tr>
<tr>
<td>Lonchura fuscata Timor dusky sparrow</td>
<td>NT</td>
<td>Bird</td>
<td></td>
<td>Habitat loss/selective logging</td>
<td>Recorded (Figure 43)</td>
</tr>
<tr>
<td>Saxicola gutturalis White belled bush chat</td>
<td>NT</td>
<td>Bird</td>
<td>Forest</td>
<td>Habitat loss, agriculture, selective logging</td>
<td>Recorded (Figure 44)</td>
</tr>
<tr>
<td>Geokichla peronii Orange-sided Thrush</td>
<td>NT</td>
<td>Bird</td>
<td>Forest</td>
<td>Habitat loss, agriculture, selective logging</td>
<td>Recorded (Figure 46)</td>
</tr>
<tr>
<td>Todiramphus Australasia Cinnamon banded</td>
<td>NT</td>
<td>Bird</td>
<td>Forest</td>
<td>Habitat loss, agriculture, selective logging</td>
<td>Recorded</td>
</tr>
<tr>
<td>kingfisher</td>
<td>Rhinolophis canuti</td>
<td>VU</td>
<td>Bat</td>
<td>Caves, forest and open woodland</td>
<td>Habitat loss, agriculture, selective logging</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------</td>
<td>----</td>
<td>-----</td>
<td>---------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Canuts Horseshoe Bat</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

IUCN Status: DD= Data deficient (A taxon with inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status); NT= Near threatened ("may be considered threatened with extinction in the near future, although it does not currently qualify for the threatened status"); VU= Vulnerable ("likely to become endangered unless the circumstances threatening its survival and reproduction improve"); EN= Endangered (facing a very high risk of extinction in the wild); CR= Critically endangered (facing an extremely high risk of extinction in the wild).
Figure 43: Timor dusky sparrow (*Lonchura fuscata*) seen at the Limestone Mine site (Trainor, 2015a)

Figure 44: White bellied chat (*Saxicola gutturalis*) seen at the Limestone Mine site (Trainor, 2015a)
Figure 45: Olive shouldered parrot (*Aprosmictus jonquillaceus*) seen at the Limestone Mine site (Trainor, 2015a)

Figure 46: Orange-sided Thrush (*Geokichla peronii*) seen at the Limestone Mine site (Trainor, 2015a)
6.10.7 Forests

The mine site is located across NE to NW facing stepped slopes and plains on limestone outcrops with higher slopes on the southern edge of the site and flatter plains towards the northern boundary. The site is predominantly uniform woodland to open woodland contiguous (95%) with isolated small patches of Closed Tropical Forest (5%, Figure 51) occurring in minor ravines and gullies, and grassland (Figure 50, Figure 49). The site is characterized by shallow limestone soils and extensive scattered, small to medium sized limestone rock outcrops. Nine survey sites radiated out from the test drill locations and targeted different vegetation assemblages wherever available.

The open woodland varies in the degree of disturbance and degradation dependent on physical barriers such as exposed limestone outcrops, which appears to restrict grazing animal access. Across the majority of open woodland sites weed species, including *Hyptis sauvleons*, *Chromolaena odorata*, *Jatropha gossypifolia*, *Lantana camara*, *Tecoma stans* and *Ziziphus mauritiana*, were the secondary dominant species in each of the stratum. The percentage of weed infestation varies from 3% to 45%
across the surveyed locations. On average the canopy cover in the open woodland environments is approximately 10%.

*Santalum album* (Sandalwood) was present at survey site MI03-001 and is listed as Vulnerable on the International Union for Conservation of Nature (IUCN) Red List. *Indigofera linifolia* was also identified at MI02-001 and is listed as Least Concern. All survey sites will be subject to impact during mine and infrastructure development.

Figure 49: Limestone Mine Flora (Source: Trainor & Easton, 2015a)
Figure 50: Open woodland typical of the Limestone Mine site (Trainor, 2015a)

Figure 51: Small area of closed tropical forest similar to that at the Limestone Mine site (Trainor, 2015a)
6.10.8 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.

As the Limestone Mine site is located 5 km inland, coastal resources have not been assessed for this EIS.

6.11 Economic Component

6.11.1 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 Caisid 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 work in their farms, a small number of the locals also work as public servants, school teachers, police officers or public sector employees (BBS, 2015c).

6.11.2 Infrastructure Facilities

There is minimal existing infrastructure in the project area. The existing infrastructure is limited and is of lesser standard.
Amenity

The following amenities are determined to be present in Tirilolo, closest to the Limestone Mine 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 12 below lists in details the existing facilities and their capacities.

**Table 12: Description of facilities in Caisido and Aldeia Ossu-Ua, Suco Tirilolo (Limestone Mine 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>
<tr>
<td>Capacity/Size</td>
<td>348 students</td>
<td>48 students</td>
</tr>
<tr>
<td></td>
<td>7 permanent teacher</td>
<td>1 permanent teacher</td>
</tr>
<tr>
<td></td>
<td>2 temporary teacher</td>
<td>1 temporary teacher</td>
</tr>
<tr>
<td>Condition</td>
<td>8 school room</td>
<td>4 school rooms (semi-Concrete building)</td>
</tr>
<tr>
<td></td>
<td>1 teacher room</td>
<td>1 chapel</td>
</tr>
<tr>
<td></td>
<td>1 room for coordinator</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 library</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Warehouse</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 separate toilets (2 for teachers)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 Kaurabela approximately 8 km west of the Cement Plant site.

The existing paved national road (Dili-Baucau road) is about 5m wide. There is an also unpaved road linking from the national road to the Limestone Mine site. Vehicles can travel to the Limestone Mine site fairly easily in most sections, travelling between 20-40 km/h (see Figure 60).
Road improvements will be required for the existing access road from Karabela to the Limestone Mine site. In addition, internal roads will need to be constructed connecting the mine site to the rest of the project infrastructure (see Figure 53).

Figure 52: Paved road from Dili to Baucau

Figure 53: Unpaved road from Baucau to Project Site
6.11.3 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 rice field plots watered from springs in Bucoli (Palmer, 2011:145).

Land cultivation is done by dragging a plough, 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 limited training; the local population find 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 to the 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 Limestone Mine 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 (Parlemento, Caisido, Lialialeso, and Osso-Ua) and this land is mostly dry land planted during the rainy season. Gardens 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 in December or January annually. In the event that the rains begin in December, the planting process is more likely to fail. The work from August to November consists of land clearance and burning of the felled vegetation. Vegetation clearance can be done with the aid of unpaid labor from close relatives in return for help in clearing relative’s 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. The management of the orchards is generally performed only by members of the nuclear family. Every person/household has an associated garden or orchard. There are no sharecropping arrangements.
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 occurs in an irregular fashion to utilise non-rocky patches of soil. The most significant crops are maize and groundnuts. The maize is consumed by the family and livestock, while the groundnuts are primarily used as a cash crop. Other crops commonly planted in the area are tubers (e.g. cassava and sweet potatoes) and vegetables (e.g. green tomatoes and capsicum). The tubers are primarily subsistence crops while the vegetables are usually intended for both subsistence and cash.

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

The horticultural situation in Osso-ua is relatively better than in Parlemento, Caisido, dan Lialaileso. 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) means that the farmers are limited in their abilities to sell their produce. The produce is usually sold to buyers who travel from the city (the old market) to trade 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 Tirilolo 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 harvested 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 wasteland or government property. Linear piles of stones mark out field boundaries and indicate that the land is reserved for future use. Each farmer knows the boundaries of their plots. Most of the bushes and scrubland in Caisido are located outside the Limestone Mine area (BBS, 2015c).
6.11.4 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 area;
- Assessment of the road network condition, including at intersections and assessment the existing road furniture;
- Conduct 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 are discussed in the Impact Section 0.

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 55.
Figure 55: Road network between the main towns or places around proposed project area (BBS, 2015c)
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 road 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 on to the west of the Limestone Mine 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 56). 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 Karabela.

Figure 56: Coastal Road condition adjacent to the mouth of the Uaisai River. (BBS, 2015c)
Road furniture

The road network within the Baucau Municipality generally lacks road furniture\(^2\) 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 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 13 and Figure 57), however have been excluded in any of the further analysis as it was considered to be side friction\(^3\) (BBS, 2015c).

Table 13: 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 Baru-Dili</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>
<td>192</td>
</tr>
<tr>
<td>12:00 – 14:00</td>
<td>312</td>
<td>464</td>
<td>72</td>
<td>72</td>
<td>100</td>
</tr>
<tr>
<td>16:00 – 18:00</td>
<td>396</td>
<td>248</td>
<td>72</td>
<td>72</td>
<td>176</td>
</tr>
</tbody>
</table>

Figure 57 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 make up a small percentage of the road traffic within and outside the study area (typically less than 20%) (BBS, 2015c).

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\(^2\) Street furniture is a collective for objects and pieces of equipment installed on streets and roads for various purposes. It includes benches, traffic barriers, post boxes, phone boxes, street lamps, traffic lights, traffic signs, bus stops, taxi stands, fountains, memorials, public sculptures, and waste receptacles. An important consideration in the design of street furniture is how it affects road safety.

\(^3\) 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.
Figure 57: Traffic flow as percentage by vehicle type. (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 58, 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 58: Trip attraction and generation for the Baucau Municipality. (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 characteristic 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 59. 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 Tirilolo.
Travel speed was estimated at four locations: L1, L2, L3, and TC03 (see Figure 55). The mean speed for each of these four locations is approximately 40 kmph between Bucoli and Tirilolo (L1), approximately 45 kmph between Tirilolo and Bahu/Baucau (L2), approximately 20 kmph between Tirilolo and Caisido (L3) and 63 kmph between Bucoli and Vemasse/Western Zone (TC03).

Mean speed between destination nodes has been plotted in Figure 60. 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 60, 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).
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 61). 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 61. 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).
6.11.5 Use of Forests and Other Natural Resources

Sandalwood *Santalum album* is used to make salves 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). In the project area, there was no indication that the open forest is used for agriculture. Livestock were seen grazing the open woodland (Colin Trainor, pers.comm)

6.11.6 Fishing

Activities relating to the marine environment have not been considered in the Limestone Mine EIS and will not be discussed further.

6.11.7 Agriculture

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 percent of the population live 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 communities surrounding the Limestone Mine. The crops being cultivated include peanuts, coconut, corn and vegetables like beans, tomatoes, cassava, potatoes, etc. The important fruit trees are banana and papaya.

There are 12 households with a household size of 4-5 persons whose lands are located on the proposed mining lease for the Limestone Mine (BBS, 2015d).

6.11.8 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 62 below) has been the stopover/transit spot for many tourists and local visitors who are visiting other municipalities such as Lospalos and Viqueque.

![Figure 62: The white sand Wataboo beach in Bahu, Baucau](image)

There are not many significant tourism areas and/or activities found near or around the Project Site. However, there are some recreational areas including Wataboo and Asa-Lai-Ana Beaches (Figure 63) that are anticipated to become tourism destinations in the future (BBS, 2015d). These two
beaches are located in Suco Bahu and Tirilolo respectively. These locations are at the coast and are not considered in the impact area of the Limestone Mine.

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

6.11.9 Other Industries

There is no presence of large scale industry in Baucau. Several small scale and family-owned businesses are spread around Bucoli-Tirilolo area. The identified businesses are as follows:

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

Most are produced and sold locally, with the exception of candlenut oil, which is being exported to Hawaii.
6.12 Social Component

6.12.1 Population and Communities

The population of the sub-districts around the Project area is 41,895 for the Baucau Sub-district. Compared to the census figures from 2010, the Baucau population has experienced a 4% decline (BBS, 2015d).

Nearly all sucos in the Baucau Subdistrict exhibited population growth in 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 14).
Table 14: Population Growth in Suco, Direct, and Indirect Affected Areas for 2010-2015

<table>
<thead>
<tr>
<th>Sub-district</th>
<th>Suco</th>
<th>Direct Area</th>
<th>Indirect Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Population</td>
<td>Population Growth (%)</td>
<td>No. of Population</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>2015</td>
<td></td>
</tr>
<tr>
<td>Baucau</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tirilolo</td>
<td>2815</td>
<td>6441</td>
<td>18</td>
</tr>
<tr>
<td>Bahu</td>
<td></td>
<td>5188</td>
<td>6727</td>
</tr>
<tr>
<td>Bucoli</td>
<td></td>
<td>2179</td>
<td>2711</td>
</tr>
<tr>
<td>Buruma</td>
<td></td>
<td>15664</td>
<td>3063</td>
</tr>
<tr>
<td>Buibau</td>
<td></td>
<td>3708</td>
<td>4705</td>
</tr>
<tr>
<td>Wailili</td>
<td></td>
<td>3519</td>
<td>3573</td>
</tr>
<tr>
<td>Samalari</td>
<td></td>
<td>1534</td>
<td>2183</td>
</tr>
<tr>
<td>Garuai</td>
<td></td>
<td>4518</td>
<td>4663</td>
</tr>
<tr>
<td>Triloca</td>
<td></td>
<td>2442</td>
<td>2193</td>
</tr>
<tr>
<td>Saical</td>
<td></td>
<td>1876</td>
<td>2231</td>
</tr>
<tr>
<td>Caibada</td>
<td></td>
<td>3057</td>
<td>3549</td>
</tr>
<tr>
<td>Total</td>
<td>45695</td>
<td>37613</td>
<td>-3.82</td>
</tr>
</tbody>
</table>


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, 2015).

6.12.2 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 15 and Figure 64 and Figure 65 below). The
clinch 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 (BBS, 2015d).

Table 15: Health table by age group per year

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<td>17</td>
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<td>Source: Tabulation from Clinic Caisido Statistical Report 2015 (BBS, 2015d)</td>
<td>Figure 64: Health data by age group. Source: Tabulation from Clinic Caisido Statistical Report 2015 (BBS, 2015d)</td>
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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 complains 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 begins 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; the large number of anemia, rheumatism, bronchitis and gratitis cases hints that the local people’s physical condition tend to deteriorate as they enter advanced age.

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, natural disasters or disturbances render the local population vulnerable.
6.12.3 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).

6.12.4 Community Structures, Family Structures

Basic Social Structure of the Community

Within the Caisido communities (the Aldeias Parlemento, Caisido, Lialailesi, 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 (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. 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).

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).

6.12.5 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 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 (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 the 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).

6.12.6 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 Limestone Mine.

Forested areas are found in the Wallacama 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).

### 6.13 Cultural Component

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

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\(^4\) 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.

The study undertaken by Oliveira (2015) revealed that the areas investigated in the Suko\(^5\) 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

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\(^4\) Shell middens are places where the debris from eating shellfish and other food has accumulated over time.

\(^5\) Suko is a village administration unit, many of which make up a District.
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.

Sites were classified in accordance with the Timor-Leste government’s inventory process (Oliveira, 2015), which includes (Table 16):

- Cultural Heritage/Architectural (Civil, military or religious including burial sites, well, built stone structures, roads or houses)
- Archeological (Cave/rock shelter, rock art, shell midden or open air)
- Sacred Heritage (Spring, Ceremonial altar, Cave/rock shelter or stone)

Table 16: Summary of the cultural heritage and archeological aspects recorded in the Limestone Mine area (Oliveira, 2015)

<table>
<thead>
<tr>
<th></th>
<th>Limestone Mine</th>
<th>Outside within 300m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Heritage / Architecture</td>
<td>Religious – 3</td>
<td>Religious – 1</td>
</tr>
<tr>
<td></td>
<td>Civil – 2 (2 Nationally important)</td>
<td>Civil – 3</td>
</tr>
<tr>
<td></td>
<td>Sacred religious - 1</td>
<td></td>
</tr>
<tr>
<td>Archeological</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Sacred Heritage</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

6.13.1 Cultural Heritage

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

6.13.1.1 Inside the Limestone Mine area

Three religious architectural heritage sites, two civil architectural heritage sites and one sacred and religious architectural heritage site are located within the Limestone Mine area. The three religious architectural sites are grave sites, constructed of coral stone or limestone blocks. One is in Bad condition, one in Fair condition, and the third is in Good condition, the latter two being maintained by relatives of the deceased (Oliveira, 2015).

One of the civil architectural sites consists of the remains of an old village site located close to a garden and a sparse coconut grove. The site was reportedly abandoned after 1975 when it was burned by Indonesian troops; however the nearby gardens are still used by traditional custodians (Oliveira, 2015). The condition of the site is considered Destroyed.
The second and third civil architectural heritage sites are part of the Old Portuguese Road that existed between Dili and Baucau. The road was estimated to have been built in the twentieth century, before there were cars in Timor. It was in use until after World War II when the existing road crossing through Bucoli was inaugurated. Reportedly the section of road still visible was built by the local community and was used mostly by troops travelling to and from Baucau. It is in Good condition and parts of the old road are still clearly visible. This site is of national importance.

6.13.1.2 Outside the Limestone Mine area within 300m

One other religious architectural site, two civil architectural sites and a traditional architectural heritage site are also located outside and within 300 m of the mine lease boundary (Block I-I). The religious architectural site is within 200 m of the boundary. This is a grave site consisting of small and large coral stones covering four or five grave sites, each containing the remains of five or more individuals. The site is in Poor condition as it is no longer maintained by the local community. However, the site is visited by some relatives once a year (Oliveira, 2015).

Of the two civil architectural heritage sites, one is the remains of an old village site inside a stone walled garden. A few stone walls are still visible but the site has abandoned after 1975 when it was burned by Indonesian troops. The site is considered Destroyed. The gardens nearby are still in use by traditional custodians (Oliveira 2015).

The traditional architectural heritage site is a traditional house built of perishable materials (e.g. wooden poles and frames, bamboo windows and a thatched roof). The site contained two sacred houses before 1972, which were destroyed in 1975 by the Indonesian military. The house was rebuilt in 2003 and is used for ritual ceremonies related to agriculture (corn) and to strengthen the traditional lineage. It is considered to be in Good condition as it is looked after by the community and regularly used for ritual ceremonies (Oliveira 2015).

6.13.2 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.

6.13.2.1 Inside the Limestone Mine area

Six archaeological sites were identified within the Limestone Mine area. Two are rock shelters with a fenced stone wall garden in the front of them. They were used in the past as more permanent shelters for people, and are now intermittently used as temporary shelters when tending to the gardens in the front. There is evidence of stone tools and marine shells outside the shelter (Oliveira 2015). They are both in Fair condition.

A third rock shelter is smaller and was also used in the past as a shelter for humans. Currently it is used as a goat pen (Oliveira, 2015). It is in Good condition. A small overhang was also identified which houses a bamboo frame bed and evidence of recently dried maize. It is reportedly used as a
temporary shelter when harvesting palm wine and when tending nearby gardens. It was also reported to have been used during World War II as a hideout against Japanese troops (Oliveira, 2015). The site is in Good condition and is visited and maintained regularly.

A fifth site is a small shelter that has evidence of stone tools, pottery and marine shell outside the shelter and within the gardens in front of the shelter (Oliveira 2015). This site is in Fair condition.

The sixth is a large shelter with a wide terrace that is still used by communities to collect water and used as an animal pen. It has evidence of pottery outside the shelter and in the gardens in front of the shelter (Oliveira 2015). The site is in Fair condition and the shelter is well preserved.
6.13.2.2 Outside the Limestone Mine area within 300m

A further eight archaeological sites are outside of the Mine Lease area, but within 300 m of the lease boundary. One is a rock shelter with main entrance and back entrance facing onto small gardens. It is a sacred site to communities nearby who use it to perform ritual ceremonies when the rainy season comes late. It has been tested and excavated and has a sequence of C14 dates ranging back to around 8,500 years with evidence of human occupation throughout this period (Oliveira, 2015). Large quantities of marine shell, pottery, stone tools and charcoal have been found here. The site is in Fair condition and the rock shelter is regularly used as a goat pen.
A similar shelter nearby is also used to perform ceremonies when the rainy season comes late. It was first recorded and extensively excavated in 1967 and later re-identified and re-dated by C14 with the earliest phase of human occupation going back to ca. 26,500 years (Oliveira, 2015). Its history and significant is closely related to the previous mentioned site, with similarly large quantities of marine shell, pottery, stone tools and charcoal excavated from the site. The site is also in Fair condition and currently the cave is regularly used as a goat pen.

A third site consists of three small caves with one containing a stone bowl from where people occasionally drink. It has been used in the past for human shelter and reportedly used during World War II. The cave was used by Portuguese troops travelling from Dili to baptize people from the local community, using the water from one of the caves (Oliveira, 2015). The site is in Good condition and is occasionally visited by people who come to drink from one of the caves.

A fourth site also consists of three small caves, with walled gardens that appeared unattended covering their entrances. There is evidence of pottery and marine shell, and the site is in Fair condition, though it appears no longer to be used and the walled gardens visited only sporadically (Oliveira, 2015).

Another site is a long, deep cave, which has evidence that a house was built inside it and was used as a permanent shelter until 1974 when it was burned by Indonesian troops. Today it is used as a goat pen. There is evidence of large quantities of stone tools, as well as pottery and marine shell. The site is in Good condition and is currently used as an animal pen and to cultivate tobacco (Oliveira, 2015).

A further two sites are rock shelters located nearby, which also have been used as a temporary shelter and goat pen. Both have evidence of large quantities of stone tools as well as pottery and marine shell within and outside of the shelter. One also has an existing wooden rack which suggests that it is used regularly as a shelter. Both are in Good condition and are used regularly as an animal pen and to cultivate tobacco (Oliveira, 2015).

A final site consists of a rock shelter that has evidence of recent fire which suggests it is regularly used as a temporary shelter, probably in relation to the walled gardens that exist at the front of the shelter. It is also used as a goat pen and also has evidence of large quantities of stone tools as well as pottery and marine shells within and outside of the shelter (Oliveira, 2015). This site is also in Good condition.

One site is an archaeological and sacred heritage site. This site is a large rock shelter with a sacred pole visible inside the shelter where traditional ceremonies are performed. The site is used for ceremonial purposes when the rainy season comes late and reportedly has graves nearby of people who were killed during the Indonesian occupation, however this was not investigated (Oliveira, 2015). The site is in Good condition and is used at least once a year to conduct traditional ceremonies.

6.13.3 Sacred Heritage sites

Sacred heritage sites include sacred a spring, Ceremonial altar, Cave/rock shelter or stone. In the project area, altars and rock platforms are common.
6.13.3.1  INSIDE THE LIMESTONE MINE AREA

Six sacred heritage sites are located inside the Limestone Mine footprint. These include platforms, circular stones and a stone platform. One of the sacred heritage sites is a stone platform made of limestone blocks located under a tree and is rarely used and is in poor condition. The second sacred heritage site is a circular limestone block structure about 80cm high. It marks the border between Tirilolo and Bucoli and is used to perform ceremonies every 5 to 10 years. It is in good condition and is well maintained.

The third sacred site is a large stone platform under a tree and people come during time of harvest to perform ceremonies. The site is in good condition and is visited regularly.

The fourth sacred site located within the Limestone Mine area is a stone platform made of coral stone blocks with an accompanying garden. It is in good condition and is visited regularly.

The fifth and sixth sacred heritage sites are a cluster of platforms made with coral stones. These sites mark the original location of the village of Badunau. It is used twice per year for ritual purposes and is in good condition.

6.13.3.2  OUTSIDE THE LIMESTONE MINE AREA WITHIN 300M

One sacred site is located immediately outside of the Mine Lease area, but within 300 m of the lease boundary that is an archaeological and sacred heritage site.

6.13.4  Historical Sites

No historical sites were identified within the proposed Limestone Mine area.

6.13.5  Unique Landscapes

No unique landscapes were identified in or around the Limestone Mine area.
7 CLIMATE CHANGE IMPACTS

This section describes relevant climate change considerations relevant to the construction, operation and decommissioning of the proposed project. Most of the background information 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, and 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 – 0.8°C over the century, while data for 1979-2005 suggests a lower decadal increase of 0.1-0.3°C with a mild acceleration over the later decades.

The Seeds of Life/Fini 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. 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 Meterological Station in 2014 was 32.4°C.

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

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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 Meterological 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 1 cm given tectonic activity. Globally, IPCC forecasts the following scenario for sea level rise relative to 1990 data:

- 3.2 to 10 cm by 2020,
- 8.9 to 27.8 cm by 2050,
- 18 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

The NAPA process identified potential climate change vulnerabilities and adaptation options. These vulnerabilities (impacts) are described in Table 17. A discussion of how these relate to the proposed project and/or local environment is also provided.
Table 17: Climate Change Impacts

<table>
<thead>
<tr>
<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>
</table>
| Sea Level       | - Inundation of lower lying areas  
                 | - Changes to flow and flooding regimes of rivers and drainages  
                 | - Saltwater intrusion of aquifers | Groundwater  
                 |                                                                  | Flora  
                 |                                                                  | Fauna  
                 | - Potential impacts to the coastal infrastructure associated with the Limestone Mine and Plant facilities, making the jetty and MOF inaccessible or unsafe  
                 |                                                                  | - Potential impacts to the water supply for the Limestone Mine and Plant from increased salinity due to intrusion  
                 |                                                                  | - Potential impacts to the post-closure land use and decrease in success of rehabilitation due to inundation |
| Rainfall        | - Changes to rainfall patterns with increased or decreased rainfall  
                 | - Increase in extreme rainfall events e.g. cyclones  
                 | - Changes to flow and flooding regimes of rivers and drainages | Surface Water  
                 |                                                                  | Groundwater  
                 |                                                                  | Flora  
                 |                                                                  | Fauna  
                 | - Potential impacts to the Limestone Mine and Plant infrastructure and accommodation from flooding and cyclones  
                 |                                                                  | - Potential impacts to the productivity of the Limestone Mine and Plant due to extreme weather delays (e.g. shipping)  
<pre><code>             |                                                                  | - Potential impacts to the post-closure land use and decrease in success of rehabilitation due to a drying climate |
</code></pre>
<table>
<thead>
<tr>
<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>• Changes to ambient temperature</td>
<td>Community Health</td>
<td>• Potential impacts to human health and comfort due to</td>
</tr>
<tr>
<td></td>
<td>• Increased evaporation</td>
<td>Infrastructure</td>
<td>increasing temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flora</td>
<td>• Potential increase in power consumption due to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fauna</td>
<td>increased use of air conditioning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Potential impacts to the post-closure land use and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>decrease in success of rehabilitation due to a hotter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>climate</td>
</tr>
</tbody>
</table>
7.4 Adaptation methods

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 18.

Table 18: 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 9.10.4.</td>
</tr>
<tr>
<td></td>
<td>The mine plan should consider the potential adverse effects of future climate change.</td>
</tr>
<tr>
<td></td>
<td>In particular, quarry benches and slopes should be designed to address the increased potential for landslides.</td>
</tr>
<tr>
<td></td>
<td>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 9.11.4.</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.</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.</td>
</tr>
<tr>
<td></td>
<td>During extreme heat events, working hours should be adjusted to avoid the hottest parts of the day.</td>
</tr>
<tr>
<td></td>
<td>Refer to mitigation measures recommended for impacts to community health in Section 9.27.</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 kTe- 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.


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.

### 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

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<tr>
<th>Type of Activity</th>
<th>Preconstruction</th>
<th>Construction</th>
<th>Operation</th>
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<td>Power Generation</td>
<td>Diesel Generators</td>
<td>Power Generation Captive Power Plant (CPP) using Circulating Fluidized Bed Technology (CFB)</td>
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<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; • Lock down procedures for securing all structures/objects/machinery (temporary and permanent);</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 cyclone/earthquake/tsunami identification methods and warning systems; • Communication</td>
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<td>Construction</td>
<td>Operation</td>
<td>Decommissioning</td>
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<td>•</td>
<td>Emergency action plans and evacuation procedures; and</td>
<td>• Emergency action plans and evacuation procedures; and</td>
<td>methods for workers and local populace;</td>
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<td>•</td>
<td>Distress notification if additional aid is required</td>
<td>• Distress notification if additional aid is required</td>
<td>• Cyclone and earthquake proofing for all structures/objects/machinery</td>
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<td>• Distress notification if additional aid is required</td>
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</table>
8 ALTERNATIVES CONSIDERED

This section provides a summary description of the realistic alternatives to the proposed 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 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 20.

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

8.1 Description of Alternatives

8.1.1 Alternative Locations

The project requires a limestone supply of suitable chemical composition and with sufficient quantity to provide for at least 50 years of production. The most significant limestone deposit in Timor-Leste is known as the Bucoli Limestone Deposit located on the Baucau plateau. This is the area granted to the proponent by the Government of Timor-Leste for prospecting, thus other regions in Timor-Leste are not considered as they would not be feasible for limestone mining.

Within the Bucoli Deposit, the project proponent has been granted three mineral licenses known as Block I-1, Block I-2, and Block II as shown in Figure 3.
Alternative Location 1: Block I-2

Block I-2 has an estimated 399 million tons of limestone reserves or approximately 4x more than Block I-1. Block I-2 is located in sucos Tirilolo and Bahu, northeast of Baucau Airport and north of the Dili-Baucau Road. The mine site would be located on higher ground than the Block I-1 site to the east of the Caibada unpaved road.

The environmental and social characteristics of the Block I-2 site are generally similar to those of proposed location.

- **Physical Impacts:** This alternative would result in similar physical impacts as the proposed project. The location is close to the preferred location and the physical environment is similar.

- **Ecological Impacts:** This alternative would result in reduced physical impacts compared to the proposed project. Based on a review of available literature and a site visit, the vegetation and habitat at Block I-2 is more degraded than Block I-1 with signs of extensive livestock grazing, field clearance, and invasive species. Block I-2 has less closed forest than Block I-1. As a result, mining of Block I-2 is expected to result in less impact to the terrestrial ecology.

- **Economic Impacts:** There is a greater infrastructure investment requirement with this option due to a longer road being required to move the mined material to the Plant.

- **Social Impacts:** Both Blocks I-1 and I-2 are located within the Caisido region of suco Tirilolo. As the same four aldeias would be affected by the project under either scenario, no substantial difference in social impacts is anticipated.
• Cultural Impacts: Block I-2 was not surveyed as part of this study; however, several nearby important archaeological sites are known from previous studies in the area. These sites are outside of the affected area but within 2km of Block I-2. These sites contain artifacts and rock paintings.

Like Block I-1, development of this site would not result in the displacement of a significant number of people; however, it would result in the loss of subsistence farm land used by local communities.

Alternative Location 2: Block II

Block II has approximately 792 million tons of limestone reserves or approximately 8x more limestone than Block I-1. Block II is located southwest of Baucau Airport along the Baucau-Viqueque road in sucos Gariwai, Tirilolo, and Wailili. Block II is located in upland areas underlain by karst limestone formations. Like Block I-1, development of this site would not result in the displacement of a significant number of people; but would result in the loss of subsistence farm land used by local communities.

• Physical Impacts: The karst limestone in Block II is believed to contain potentially significant groundwater which could be a future source for Baucau; although, recent groundwater investigations performed by the Australian-funded BESIK rural water program failed to identify any potentially exploitable aquifers in this area. If groundwater is found in this area, development of the mine site could preclude its use as a water source for the Baucau area.

• Ecological Impacts: Vegetation on Block II was mapped by Metzner (1977) as Eucalyptus alba woodland and shrub, with a weedy, invasive understory. Birds in Eucalyptus woodland and shrubland was dominated by widespread open-country birds that are abundant and occur widely on Timor. As a result, mining of Block II is expected to result in less impact to the terrestrial ecology.

• Economic Impacts: There is a greater infrastructure investment requirement with this option due to a longer road being required to move the mined material to the Plant.

• Social Impacts: The Block II mine site would be developed in a largely unsettled and road less upland area south of the proposed project site. Development of this site would impact on the communities in Gariwai, Tirilolo, and Wailili instead of the Caisido region. Given the larger scale of the mine site and the amount of limestone estimated to be available, it is assumed that the mine plan could be developed to avoid the need for relocation of any communities. It is anticipated that the scale of social impacts would be similar to the proposed project.

• Cultural Impacts: Block II has not been assessed for archaeological/cultural resources. Most of the archaeological sites found in Timor-Leste to date have been in coastal areas as opposed to upland areas like the Block II area; however, this may be due to accessibility for investigation rather than inferring absence of sites in the upland areas. Ecological field studies conducted within Block II identified numerous caves and springs which could contain archaeological remains or be the location of potential sacred cultural sites. Further investigation would be required prior to developing Block II.
8.1.2 Different Project Sizes or Design

The proposed cement plant is designed to produce 1.65 mtpa of cement clinker. In order to provide raw material for this output, the limestone mine must provide 2.10 mpta of limestone. The calculated limestone reserve within the Block I-1 mining area is estimated to be approximately 105 million tons. This reserve will provide a 50-year operating life for the mine.

Of the 1.65 mpta of clinker to be produced, the Proponent proposes to export around 1.15 mpta clinker and the remaining 0.50 mpta 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).

**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.

**Export Production**

If the project was limited to production for export, this would reduce the limestone demand by approximately 30 percent to approximately 1.46 mtpa. The project commercial feasibility study suggests that the cement plant would not be profitable with production for only export 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.
8.1.3 Alternative Technologies/Methods

The Mine Plan reviewed the potential need for underground mining. This method of mining is adopted for extracting mostly precious minerals/metals, which are typically found at greater depths with considerable overburden. The mineral is exploited by driving a mine shaft to the depth of the deposit and then mining horizontally along the zone of mineralization.

- **Physical Impacts:** If feasible, this alternative methodology could result in a reduction in the area of affected land use as surface disturbance would be limited to shaft openings and haul roads. However, underground mining typically is a more hazardous operation. Underground mining can cause earthquakes, land subsidence, and cave-ins.

- **Ecological Impacts:** Ecological impacts could be less due to the reduction in the affected area which would allow the mine plan to avoid sensitive areas.

- **Economic Impacts:** Open cast mining is less expensive than underground mining. However, as underground mining has higher production costs this could make the project less commercially feasible

- **Social Impacts:** Social impacts would be expected to be similar to the proposed project.

- **Cultural Impacts:** Cultural impacts could be less due to the reduction in the affected area which would allow the mine plan to avoid sensitive areas.

The site geology indicates high likelihood of cave-ins and thus underground mining was deemed not technically feasible.

8.1.4 No-Project Alternative

The “No Project Alternative” would result in no mine being developed as part of the Baucau Cement Project.

- **Physical Impacts:** No physical impacts would result from development of the mine. The effects of climate change would continue to increase pressures on local communities and the environment. Other physical features would remain the same.

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

- **Economic Impacts:** No beneficial economic impacts would occur. No jobs would be created by the mining operations or the larger cement manufacturing project. No government revenues would be generated. No foreign investment in Timor-Leste would be realized.

- **Social Impacts:** No social impacts would occur as a result of development of the mine. 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.
8.2 Comparison of Impacts

The potential impacts of each of alternative have been identified, assessed, and compared to the proposed project as described below. A summary of the comparative impacts is provided in Table 19.

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 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 19: Alternatives Evaluation Matrix

<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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<td>Cultural Archeological Sites</td>
<td>Cultural Sacred Sites</td>
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</tbody>
</table>

**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 19, 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.

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.
### Table 20: Alternatives Evaluation Matrix

<table>
<thead>
<tr>
<th>Component</th>
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<td>Population &amp; Communities</td>
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<td>Archeological Sites</td>
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<td>Sacred Sites</td>
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Red – Higher Risk/More Significant Negative Impact/Less Beneficial Impact
Yellow – Comparable Risk/Comparable Impact
Green – Lower Risk/Less Significant Negative Impact/Greater Beneficial Impact

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TL CEMENT, LDA
BAUCAU CEMENT PROJECT
ENVIRONMENTAL IMPACT STATEMENT LIMESTONE MINE
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8.4 Project component equipment and technology

Images which show the generalized infrastructure typical of a Limestone Mine are included below.

Figure 8-69 Limestone Mine and supporting infrastructure from the Cement Plant – 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. Refer to Figure 8-3 showing an example of an excavator that will be used to clear vegetation during pre-construction.
8.4.2 Construction

During construction, heavy plant and equipment will be used to construct the Limestone Mine and Waste Rock Dump. Refer to Figures below.
Figure 8-71 Example of excavator loading a dump truck
8.4.3 Operation

During operation, the mine will be operational and blasting and rock breaking will occur. Trucks and other vehicles will be used around the site to transport material and people to and from the workplace.
Figure 8-74 Example of a waste rock dump and stockpile
Figure 8-75 Example of limestone blocks being mined

Figure 8-76 Example of blasting of rock in an open pit of a mine
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 8-78 Example of decommissioning process (implosion of a power station) (Photo: sandiegouniontribune.com)

Figure 8-12 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 NDPCET. 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 (Table 22). The baseline condition of the factors has been determined from the specialist investigations on site which are detailed in Section 5.14, Description of the Environment. In the Impact Assessment (This chapter), 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 project life) or short term (<10% of the project life)
2. Environmental cost i.e. cost of restoring to baseline condition or relative loss of habitat
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 measure. This is termed ‘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 quantify 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 mine 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
4. Environmental cost: Ease of remediation following impact

The result of the assessment of the significance of an impact classifies the impact from Low to Extreme. The projects’ environmental and social impacts can then be evaluated, from the perspectives required by GOTL legislation i.e.

- 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 in terms of environmental cost and benefits.
Table 21: Definitions used in the Impact Assessment

| Aspect                          | Land clearing, spills, dredging, emissions, discharge, construction works, concrete pouring  
|                                | Used interchangeably with “Activity” in other texts  
| Baseline / Base Case           | This is also termed the “do nothing” scenario.  
|                                | The condition of the environmental and social factors as they exist prior to project development.  
| Factor                         | Flora, Fauna, wetlands, groundwater, surface water, heritage  
| Policy / Regulatory Framework  | Regulatory requirements, stakeholder expectations  
| 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 area 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 Impact                | Impact of the project on aspects e.g. flora and fauna, contamination of water, effect on heritage areas or artefacts AFTER management/mitigation measures have been implemented  
| 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  
50 year project duration (this project) i.e. <5 year term |
| **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 |
| **Localised / Local** | The project area and the area within 20km 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 |
Table 22  Impact significance matrix

<table>
<thead>
<tr>
<th>Factor</th>
<th>Significance</th>
<th>Extreme</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
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<tbody>
<tr>
<td><strong>Physical components</strong></td>
<td></td>
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<tr>
<td>Climate</td>
<td>Regional long term change in climate as a result of project activities through GHG emissions &gt; <strong>e.g. Kyoto pre-1990 levels of CO2 emissions in TL</strong></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>
<td></td>
</tr>
<tr>
<td>Topography, Geology, and Soils</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>
<td></td>
</tr>
<tr>
<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></td>
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</tr>
<tr>
<td>Air quality &amp; Dust(excl. GHG)</td>
<td>Regional long term change in air quality</td>
<td>Ground level concentrations significantly higher than baseline at sensitive receptors PM2.5 exceeds IAAQS standards &gt;10% of the time or greater at sensitive receptors</td>
<td>Localised, short term exceedance of IQAAQS standards PM2.5 exceeds IAAQS standards at sensitive receptors 10% of the time or fewer</td>
<td>No measurable air quality impacts</td>
<td></td>
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<tr>
<td>Factor</td>
<td>Significance</td>
<td>Extreme</td>
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<tr>
<td>Noise &amp; Vibration</td>
<td>Regional long term change in noise levels</td>
<td>Regional long term change in noise levels</td>
<td>Ambient noise levels are significantly higher than baseline at sensitive receptors resulting in community annoyance / complaints Ambient noise levels exceed UNTAET (2001) ( Leq = 70 \text{dB} ) more than 10% of the time of the project duration at sensitive receptors</td>
<td>Minor increases to ambient noise levels above baseline values at sensitive receptors. Ambient noise levels exceed UNTAET (2001) ( Leq = 70 \text{dB} ) less than 10% of the time of the project duration at sensitive receptors</td>
<td>No measurable noise impacts or short term localised increases of noise exposure level</td>
</tr>
<tr>
<td>Surface water</td>
<td>Permanent/ long term changes to water quality of local resources in excess of applicable guidelines (e.g. drinking, agriculture, WWTP discharge) Major changes to surface water hydrology and flow regimes which affect ecological integrity and can be remediated in the long term</td>
<td>Localised, short term changes to water quality exceeding applicable guidelines Long term, local and major changes to catchment surface hydrology i.e. baseflow</td>
<td>Minor changes to local water resources resulting in local short term reduction in water quality but not exceeding guidelines Local and minor changes to sub catchment surface hydrology</td>
<td>Local short term impact on quality and surface water flows which can be easily remediated</td>
<td></td>
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<tr>
<td>Groundwater</td>
<td>Long term effects on groundwater supply, groundwater</td>
<td>Long term, local and major changes to groundwater supply, groundwater</td>
<td>Minor changes to local groundwater resources resulting</td>
<td>Local short term impact on quality and groundwater recharge which can be</td>
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<td>Factor</td>
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<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 term change not easily 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>
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<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 Long term perimeter impact</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 clearing occurs in project area</td>
<td>Local short term reduction of flora species Local loss of a species or vegetation community Closed Tropical Forest occurs on perimeter of / within 1km of project area</td>
<td>Local short term reduction in the abundance of a species or vegetation community</td>
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<td>Factor</td>
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<tr>
<td>Wetlands</td>
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<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>
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<tr>
<td>Mangroves</td>
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<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>
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<tr>
<td>Fauna (Terrestrial)</td>
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<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>
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<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>Local short range localized impact on a specific protected fauna species e.g. Canuts</td>
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<td>Local long term reduction in abundance of an IUCN or</td>
<td>Short term perimeter impacts</td>
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<td>regionally significant species</td>
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<td>Short term, regional impact on a specific protected fauna species e.g.</td>
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<td>Horseshoe Bat, Crocodiles</td>
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<td>Long term perimeter impact</td>
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<td>Long term Impact on a specific</td>
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<td>protected fauna species e.g. Canuts</td>
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<td>Horseshoe Bat, Crocodiles</td>
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<tr>
<td>Marine fauna, including fisheries</td>
<td>Extinction of one or more species</td>
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<td>Local short term impact to communities and populations</td>
<td>Local short term impact to communities and populations</td>
<td>No detectible impact to communities and populations</td>
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<td>As consequence of this project,</td>
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<td>the species meet criteria for listing</td>
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<td>Regional, long term and irreversible</td>
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<td>impact to communities and populations</td>
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<td>Species of marine fauna become</td>
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<td>regionally extinct</td>
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<td>Marine habitats, including corals</td>
<td>Long and short term loss to benthic habitat</td>
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<td>Reversible, short term loss (5 years since initial impact) of benthic</td>
<td>Localised seasonal reduction in benthic habitat growth</td>
<td>No detectible impact to communities and populations</td>
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<tr>
<td>Damage to local unique landform</td>
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<td>habitat</td>
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<td>habitat</td>
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Economic components
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<th>Extreme</th>
<th>High</th>
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</thead>
<tbody>
<tr>
<td>Traffic and Transport</td>
<td>Long and short term negative impact on community mobility and livelihood</td>
<td>Periodic negative impact on community mobility and livelihood</td>
<td>Limited negative impact on community mobility and livelihood</td>
<td>No negative or only positive impact on community mobility and livelihood</td>
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<td>More than 50% increase in vehicle traffic to/from the site and local communities</td>
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<td>Periodic negative impact on community mobility and livelihood</td>
<td>Limited negative impact on community mobility and livelihood</td>
<td>No negative or only positive impact on community mobility and livelihood</td>
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<td>More than 50% increase in vehicle traffic to/from the site and local communities</td>
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<td>Limited negative impact on community mobility and livelihood</td>
<td>Limited negative impact on community mobility and livelihood</td>
<td>No negative or only positive impact on community mobility and livelihood</td>
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<td>Less than 50% increase in vehicle traffic to/from the site and local communities</td>
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<td></td>
<td></td>
<td>No negative or only positive impact on community mobility and livelihood</td>
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<tr>
<td>Employment</td>
<td>Long and short term negative impact on community livelihood</td>
<td>Periodic negative impact on community livelihood</td>
<td>Limited negative impact on community livelihood</td>
<td>No negative or only positive impact on community livelihood</td>
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<td></td>
<td></td>
<td>Periodic negative impact on community livelihood</td>
<td>Limited negative impact on community livelihood</td>
<td>No negative or only positive impact on community livelihood</td>
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<tr>
<td>Infrastructure</td>
<td>Long and short term negative impact on existing local infrastructure</td>
<td>Periodic negative impact on existing local infrastructure</td>
<td>Limited negative impact on infrastructure incl. water supply infrastructure and building material</td>
<td>No negative or only positive impact on infrastructure in the project area</td>
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<td>Long term reduction in the availability of water supply infrastructure and building materials.</td>
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<td></td>
<td>Periodic negative impact on existing local infrastructure</td>
<td>Limited negative impact on infrastructure incl. water supply infrastructure and building material</td>
<td>No negative or only positive impact on infrastructure in the project area</td>
<td></td>
</tr>
<tr>
<td>Economic Use of Forests and Other Natural Resources</td>
<td>Long and short term negative impact on community livelihood</td>
<td>Periodic negative impact on community livelihood</td>
<td>Limited negative impact on community livelihood</td>
<td>No negative or only positive impact on community livelihood</td>
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<td>Periodic negative impact on community livelihood</td>
<td>Limited negative impact on community livelihood</td>
<td>No negative or only positive impact on community livelihood</td>
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<tr>
<td>Fishing</td>
<td>Permanent loss to more than 20% of fishing areas in the local</td>
<td>Commercial and subsistence decline of species for two</td>
<td>Commercial and subsistence loss due to short term, localized</td>
<td>No measureable impact on commercial</td>
<td></td>
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<tr>
<td>Factor</td>
<td>Significance</td>
<td>Extreme</td>
<td>High</td>
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<td></td>
<td>area</td>
<td>seasons or medium term in the local area</td>
<td>change in species abundance or subsistence fishing</td>
<td>positive impact on fishing due to provision of alternative and assistance/training</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Significant threat to subsistence and commercial fishing in the local area</td>
<td>Readily rectified by pursuing alternative areas within reasonable distance</td>
<td></td>
<td>positive impact on fishing due to provision of alternative and assistance/training</td>
</tr>
<tr>
<td>Socio Economic Agriculture</td>
<td></td>
<td>Long term impact on subsistence crops / grazing (Not re-established, access eliminated altogether)</td>
<td>Short term impact on subsistence crop / grazing (Re-established elsewhere, access maintained, area not broadly suitable, no assistance provided)</td>
<td>Local, periodic impact on subsistence crop / grazing (Alternative planting location provided, assistance provided to re-establish, water and soil broadly suitable)</td>
<td>No impact on subsistence crop / grazing positive impact on agriculture due to provision of alternative and assistance/training partial resettlement / relocation of families in the suco</td>
</tr>
<tr>
<td>Tourism</td>
<td></td>
<td>Permanent loss to more than 20% of tourism areas in the local area</td>
<td>Decline of Commercial and independent tourism activity for two seasons or medium term in the local area</td>
<td>Commercial and independent operators loss due to short term, localized change in tourism performance</td>
<td>No measureable impact on commercial or independent tourism positive impact on tourism due to provision of alternative and assistance/training</td>
</tr>
</tbody>
</table>
## TL CEMENT, LDA
### BAUCAU CEMENT PROJECT
#### ENVIRONMENTAL IMPACT STATEMENT LIMESTONE MINE

<table>
<thead>
<tr>
<th>Factor</th>
<th>Social components</th>
<th>Extreme</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population and Community</td>
<td>Regional, long and/or short term changes to population numbers and composition which cannot be addressed by administrative mechanisms</td>
<td>Local short term changes to population numbers and composition which can be addressed by administrative mechanisms</td>
<td>Local periodic changes to population numbers and composition which can be addressed by administrative mechanisms</td>
<td>No discernable local or regional impact of the project on the population and community from the status quo</td>
<td></td>
</tr>
<tr>
<td>Community Health</td>
<td>Regional, long and short term permanent negative changes to community health which cannot be addressed by administrative mechanisms</td>
<td>Local short term changes to community health which can be addressed by administrative mechanisms</td>
<td>Local periodic changes to community health which can be addressed by administrative mechanisms</td>
<td>No discernable local or regional impact of the project on the community health from the status quo</td>
<td></td>
</tr>
<tr>
<td>Institutions, Schools, and Health Facilities</td>
<td>Regional, long and short term, permanent changes to access to schools, institutions</td>
<td>Local short term changes to access to schools, institutions</td>
<td>Local periodic changes to access to schools, institutions and health</td>
<td>No discernable local or regional impact of the project on the access to schools,</td>
<td></td>
</tr>
</tbody>
</table>

- **Population and Community**
  - Regional, long and/or short term changes to population numbers and composition which cannot be addressed by administrative mechanisms
  - Local short term changes to population numbers and composition which can be addressed by administrative mechanisms
  - Local periodic changes to population numbers and composition which can be addressed by administrative mechanisms
  - No discernable local or regional impact of the project on the population and community from the status quo

- **Community Health**
  - Regional, long and short term permanent negative changes to community health which cannot be addressed by administrative mechanisms
  - Local short term changes to community health which can be addressed by administrative mechanisms
  - Local periodic changes to community health which can be addressed by administrative mechanisms
  - No discernable local or regional impact of the project on the community health from the status quo

- **Institutions, Schools, and Health Facilities**
  - Regional, long and short term, permanent changes to access to schools, institutions
  - Local short term changes to access to schools, institutions
  - Local periodic changes to access to schools, institutions and health
  - No discernable local or regional impact of the project on the access to schools,
<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>schools, institutions and health facilities cannot be addressed by administrative mechanisms</td>
<td>and health facilities which can be addressed by administrative mechanisms with extensive support and investment</td>
<td>facilities which can be addressed by administrative mechanisms with extensive support and investment</td>
<td>institutions and health facilities from the status quo</td>
<td></td>
<td></td>
</tr>
<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 local 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</td>
<td>Short term or long term regional</td>
<td>Short term local impact on</td>
<td>Localised, single point impact on</td>
<td>No impact on heritage values, cultural</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>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>sites, sacred sites</td>
<td></td>
<td>or local impact on internationally-recognised heritage and cultural values</td>
<td>heritage and cultural values and artefacts. Information and data insufficient for the area or site; to adequately assess the impact of the activities Impacts are to nationally-recognised heritage and cultural values.</td>
<td>heritage values with some destruction or relocation of cultural artefacts required Impacts are to district recognised heritage and cultural values which are recognized by &gt;10% of the population.</td>
<td>artefact or significance in the project area Impacts are to heritage and cultural values which are recognized by &lt;10% of the population in the district.</td>
</tr>
<tr>
<td>Unique Landscapes</td>
<td></td>
<td>Long or Short term reduction in amenity for stakeholders</td>
<td>Long term, insignificant reduction in amenity Short term, significant reduction in amenity for stakeholders</td>
<td>Insignificant reduction in amenity for stakeholders</td>
<td>No reduction in amenity for stakeholders</td>
</tr>
</tbody>
</table>
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 was described in detail and understood and potential impacts to the environment were identified, as based on the specialist environmental and social investigations undertaken by experienced and qualified personnel;
- The Significance based framework (Table 23) was applied and resulting classification from Low to Extreme was determined.

<table>
<thead>
<tr>
<th>Impact status</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 regional</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 NDE. Consulting key stakeholders and the wider community was an integral part of identifying the key issues and concerns regarding the project.
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; and

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

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 5.14 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 NDE, the potential impacts from the project have been assessed based on the following phases (Table 25):

**Table 25: Project phases and activities occurring in each phase**

<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 mine and plant site/area – excavation, piling, pouring of concrete foundations and permanent establishment of accommodation, offices and workshops</td>
<td>Mining 12 hours a day, 7 days a week</td>
<td>Mine Closure and Rehabilitation</td>
</tr>
<tr>
<td>Clearing of access roads internal to the project area</td>
<td>Building structures in concrete and steel for cement equipment</td>
<td>Blasting</td>
<td>Revegetation activities</td>
</tr>
<tr>
<td>Establishment of Laydown areas and preliminary office infrastructure such as portable toilets and shipping containers for storage</td>
<td>Establishment of bunds, drainage areas and mine stope</td>
<td>Truck hauling</td>
<td></td>
</tr>
<tr>
<td>Relocation of people and animals</td>
<td></td>
<td>Maintenance clearing (e.g. tree lopping for power lines)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preconstruction</th>
<th>Construction</th>
<th>Operation</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>within the project area</td>
<td>markers ahead of mining commencing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation of power supply infrastructure corridors via clearing, excavation and pegging</td>
<td>Construction of internal access roads and haul roads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geological studies including bore drilling and pit surveys</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Establishment of exclusion zones around springs (known impact, appropriation of natural asset)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 9.5 Impact assessment summary table

<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>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>
<td>Limited impact on climate change from greenhouse gases. Sources include vehicles and plant used for construction site works.</td>
<td>Some impact from vehicles and plant used to decommission project</td>
<td>Ensure vehicles and equipment are regularly serviced</td>
<td>Adoption and implementation of clean technology</td>
<td>Ensure vehicles and equipment are regularly serviced</td>
<td>Adoption and implementation of clean technology</td>
</tr>
<tr>
<td>Impact</td>
<td>Mitigation</td>
<td>Decommissioning</td>
<td>Pre construction</td>
<td>Construction</td>
<td>Operations</td>
<td>Topography</td>
<td>Geology and Soil</td>
<td>Pre construction</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>-----------------</td>
<td>----------------</td>
<td>--------------</td>
<td>------------</td>
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<td>----------------</td>
</tr>
<tr>
<td>Topography</td>
<td>Reshaping and excavation of landforms in order to prepare for construction will impact the current topography</td>
<td>Increased erosion and run-off from a bituminised area will likely change the water quality of the ocean, springs and rivers</td>
<td>Increased erosion and run-off from a bituminised area will likely change the water quality of the ocean, springs and rivers</td>
<td>Decommissioning will involve the rehabilitation of the open pit area</td>
<td>Soil management measures</td>
<td>Controlled storage areas for oils, chemicals and hydrocarbons</td>
<td>Drainage management across the site</td>
<td>Regular maintenance and servicing of plant and equipment</td>
</tr>
</tbody>
</table>
### Air Quality

<table>
<thead>
<tr>
<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>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 certain emission regulation. Use a good quality of fuel.</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 certain emission regulation. Use a good quality of fuel.</td>
<td>Ensure maximum efficiency of combustion in kiln. Performance guarantee of suitably designed Bag filters. Efficiency of each air pollution control equipment. Continuous dust monitoring. Performance guarantee of SO2, NOx, and CO emissions from stacks. A well-designed low NOx burner.</td>
<td>All roads and material excavated, 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 certain emission regulations. Use a good quality of fuel.</td>
</tr>
</tbody>
</table>
## Noise and Vibration

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impact from Vehicle movements and earthworks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>All equipment and noise emission sources are rated at 85dB 1m from source Storage areas located away from sensitive receptors</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Noise Impact from processing plant activities</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>All noise emission sources are rated at 85dB 1m from source Storage areas located away from sensitive receptors</td>
<td></td>
<td></td>
</tr>
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<td><strong>Impact from Vehicle movements and earthworks</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>All noise emission sources are rated at 85dB 1m from source Storage areas located away from sensitive receptors</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Noise Impact from processing plant activities</strong></td>
<td></td>
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<td></td>
<td></td>
<td>All noise emission sources are rated at 85dB 1m from source Storage areas located away from sensitive receptors</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Impact from Vehicle movements and earthworks</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>All noise emission sources are rated at 85dB 1m from source Storage areas located away from sensitive receptors</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Noise Impact from processing plant activities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>All noise emission sources are rated at 85dB 1m from source Storage areas located away from sensitive receptors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*All equipment and noise emission sources are rated at 85dB 1m from source Storage areas located away from sensitive receptors.*

*Equipment modification, such as dampening of metal surfaces.*
### Surface Water

<table>
<thead>
<tr>
<th>Pre construction</th>
<th>Impact Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
<th>Pre construction</th>
<th>Mitigation Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<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 mine to determine the baseline condition and monitor subsequent changes.</td>
<td>Diversion trenches and soakwells Paving and bitumen ground cover Drains down-gradient Waste water treatment plant Establish weir and surface water stream flow gauges</td>
<td>Diversion trenches and soakwells Paving and bitumen ground cover Drains down-gradient Waste water treatment plant Establish weir and surface water stream flow gauges</td>
<td>Contouring and decommissioning of waste material to reduce ongoing impact from to drainage.</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Pre construction</td>
<td>Impact Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
<td>Pre construction</td>
<td>Mitigation Construction</td>
<td>Operations</td>
</tr>
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<td>------------</td>
<td>-----------------</td>
<td>-----------------</td>
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<td>------------</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 Monitoring boreholes will be drilled at strategic locations around the infrastructure. All chemicals used on site will be stored, handled and disposed of in a responsible manner</td>
<td>Implementation of an Emergency Response Plan Monitoring boreholes will be drilled at strategic locations around the infrastructure. All chemicals used on site will be stored, handled and disposed of in a responsible manner</td>
<td>All chemicals used on site will be stored, handled and disposed of in a responsible manner</td>
</tr>
</tbody>
</table>
## Flora

<table>
<thead>
<tr>
<th>Pre construction</th>
<th>Impact Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
<th>Pre construction</th>
<th>Mitigation Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct loss of vegetation due to clearing</td>
<td>Positive impact due to revegetation activity</td>
<td>Indirect loss of vegetation cover due to depletion of water sources</td>
<td>Positive impact due to revegetation activity</td>
<td>Minimise the disturbance footprint as far as practicable. Undertake stripping and stockpiling of vegetation and topsoil</td>
<td>Dust suppression measures implementation of the site controls for alien invasive plants.</td>
<td>Dust suppression measures implementation of the site controls for alien invasive plants.</td>
<td>Afforestation and plantation of local species Sequential rehabilitation to be conducted as soon as possible at the completion of operation</td>
</tr>
</tbody>
</table>

**Impact**

- Flora: Direct loss of vegetation due to clearing

**Mitigation**

- Flora: Direct loss of vegetation due to clearing

**Operations**

- Flora: Dust suppression measures implementation of the site controls for alien invasive plants.

**Decommissioning**

- Flora: Afforestation and plantation of local species Sequential rehabilitation to be conducted as soon as possible at the completion of operation
<table>
<thead>
<tr>
<th>Fauna</th>
<th>Impact Pre construction</th>
<th>Mitigation Pre construction</th>
<th>Impact Construction</th>
<th>Mitigation Construction</th>
<th>Impact Operations</th>
<th>Mitigation Operations</th>
<th>Impact Decommissioning</th>
<th>Mitigation Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct loss of habitat through vegetation clearing; Harm/death/displacement of individual IUCN listed species;</td>
<td>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.</td>
<td>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 animals Changes to natural drainage affecting fauna and their habitat; Disturbance fauna activities due to noise, vibration and lightning impacts.</td>
<td>Prior to site entry all vehicles, plant and equipment will be cleaned down. Implementation of the Biodiversity Action Plan</td>
<td>Positive impact with rehabilitation</td>
<td>Prior to site entry all vehicles, plant and equipment will be cleaned down.</td>
<td>Implementation of the Biodiversity Action Plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre construction</td>
<td>Impact Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
<td>Pre construction</td>
<td>Mitigation Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
</tr>
<tr>
<td>-------------------</td>
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<td>-----------------</td>
<td>------------------</td>
<td>------------------------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
<tr>
<td><strong>Traffic</strong></td>
<td></td>
<td>Increase in traffic to the area due to pre-construction</td>
<td>Increase in traffic due to construction</td>
<td>Limited traffic increase during operations, mainly on the project site</td>
<td>Increase in traffic due to decommissioning</td>
<td>Minimising vehicle movement Limit vehicle reversing All traffic signage will be clearly and prominently displayed Speed limits will be implemented and enforced.</td>
<td>Minimising vehicle movement Limit vehicle reversing All traffic signage will be clearly and prominently displayed Speed limits will be implemented and enforced.</td>
<td>Minimising vehicle movement Limit vehicle reversing All traffic signage will be clearly and prominently displayed Speed limits will be implemented and enforced.</td>
</tr>
</tbody>
</table>
## Impact and Mitigation

<table>
<thead>
<tr>
<th>Employment</th>
<th>Pre construction</th>
<th>Impact Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
<th>Pre construction</th>
<th>Mitigation Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some short term employment and training opportunities</td>
<td>Longer term employment and training opportunities</td>
<td>Long term employment and training opportunities</td>
<td>Reduction in employment opportunities as the project decommissions</td>
<td>Continue to engage with community and other stakeholders Grievance Policy</td>
<td>Continue to engage with community and other stakeholders Grievance Policy</td>
<td>Continue to engage with community and other stakeholders Grievance Policy</td>
<td>Continue to engage with community and other stakeholders Grievance Policy</td>
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<tr>
<th>Infrastructure</th>
<th>Pre construction</th>
<th>Impact Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
<th>Pre construction</th>
<th>Mitigation Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<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>
<td>Positive impact on local infrastructure</td>
<td>Long term positive impact on local infrastructure</td>
<td>Prioritise the upgrades and construction of new infrastructure required for the construction and operation of the Project</td>
<td>Ongoing maintenance of the project infrastructure</td>
<td>Ongoing maintenance of the project infrastructure</td>
<td>Refurbish existing infrastructure for use by local community; Remaining equipment will be drained disposed of as hazardous waste; Buildings to be demolished</td>
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</table>
### TL CEMENT, LDA
### BAUCAU CEMENT PROJECT
### ENVIRONMENTAL IMPACT STATEMENT LIMESTONE MINE

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</tr>
</thead>
<tbody>
<tr>
<td><strong>Economi c Use of Forestry</strong></td>
<td>Loss of access to land by community</td>
<td>No further impact during construction</td>
<td>No further impact during operations</td>
<td>Positive impact on community who get access to the revegetated and rehabilitated forests</td>
<td>Minimise the disturbance footprint as far as practicable. Undertake stripping and stockpiling of vegetation and topsoil. Topsoil to be stock piled separately</td>
<td>Minimise the disturbance footprint as far as practicable. Undertake stripping and stockpiling of vegetation and topsoil. Topsoil to be stock piled separately</td>
<td>Rehabilitation ongoing during operations</td>
<td>Rehabilitation and revegetation as per the Closure Plan.</td>
<td></td>
</tr>
<tr>
<td>Socio Economic Agriculture</td>
<td>Pre construction</td>
<td>Impact Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
<td>Pre construction</td>
<td>Mitigation Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
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<tr>
<td>Population and Community</td>
<td>Pre construction</td>
<td>Impact Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
<td>Pre construction</td>
<td>Mitigation Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
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<tr>
<td>Resettlement of affected families</td>
<td>Influx of workers to the pre-construction site</td>
<td>Influx of workers to the construction site</td>
<td>Daily movement of some employee during operations</td>
<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>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
<td>Early development of alternative livelihood strategies for employees</td>
<td></td>
</tr>
<tr>
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<td>Influx of workers to the construction site</td>
<td>Influx of workers to the construction site</td>
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<td>Grievance redress mechanism in place to monitor community concerns.</td>
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<tr>
<td>Influx of workers to the construction site</td>
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<td>Influx of workers to the construction site</td>
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<td>Changes to the income source of people in the community due to project decommissioning</td>
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<td>Grievance redress mechanism in place to monitor community concerns.</td>
<td>Early development of alternative livelihood strategies for employees</td>
<td></td>
</tr>
<tr>
<td>Community Health</td>
<td>Pre construction</td>
<td>Impact Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
<td>Pre construction</td>
<td>Mitigation Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
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<tr>
<td>Increase in respiratory ailments due to an influx of people</td>
<td>Increase in respiratory ailments due to an influx of people</td>
<td>Increase in respiratory ailments due to an influx of people</td>
<td>Increase in respiratory ailments due to an influx of people</td>
<td>Positive reduction in prevalence of diseases and dust-related ailments.</td>
<td>Awareness training for workers</td>
<td>Elimination of potential breeding habitat for mosquito</td>
<td>Spraying residual insecticide to walls</td>
<td>Provision of prophylactic drugs</td>
<td></td>
</tr>
<tr>
<td>Increase in the level of respiratory ailments due to increased dust</td>
<td>Increase in the level of respiratory ailments due to increased dust</td>
<td>Increase in the level of respiratory ailments due to increased dust</td>
<td>Increase in the level of respiratory ailments due to increased dust</td>
<td></td>
<td>Awareness training for workers</td>
<td>Elimination of potential breeding habitat for mosquito</td>
<td>Spraying residual insecticide to walls</td>
<td>Provision of prophylactic drugs</td>
<td></td>
</tr>
<tr>
<td>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>
<td>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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<td></td>
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<td>Provision of prophylactic drugs</td>
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<td></td>
<td>Prior to decommissioning and closure, consultation with all stakeholders (relevant authorities, government and local community)</td>
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</tbody>
</table>

Prior to decommissioning and closure, consultation with all stakeholders (relevant authorities, government and local community).
## TL CEMENT, LDA
### BAUCAU CEMENT PROJECT
#### ENVIRONMENTAL IMPACT STATEMENT LIMESTONE MINE

<table>
<thead>
<tr>
<th>Institutions</th>
<th>Pre construction</th>
<th>Impact Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
<th>Pre construction</th>
<th>Impact Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools and Health Facilities</td>
<td>Increased pressure on health services infrastructure</td>
<td>Increased pressure on health services infrastructure due to population influx</td>
<td>Increased pressure on health services infrastructure due to population influx</td>
<td>Positive impact on community health with legacy investments</td>
<td>Regular water sprinkling on the roads and application of dust suppressants</td>
<td>Possible participation via CSR programs in community development/sustainability plans to support infrastructure development in the area</td>
<td>Regular water sprinkling on the roads and application of dust suppressants</td>
<td>Possible participation via CSR programs in community development/sustainability plans to support infrastructure development in the area</td>
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</tr>
<tr>
<td>The acquisition of land for the project may cause impacts on community and family structure</td>
<td>Impacts to household subsistence and ability to generate income</td>
<td>Impacts to household subsistence and ability to generate income</td>
<td>Change of employment status may affect the households' income</td>
<td>Monitor the GoTL's Implementation of the Resettlement Action Plan</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
<td>Encourage and create strategies for sustainable economic empowerment</td>
</tr>
<tr>
<td>Land Ownership and Land Rights</td>
<td>Pre construction</td>
<td>Impact Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
<td>Pre construction</td>
<td>Mitigation Construction</td>
<td>Operations</td>
<td>Decommissioning</td>
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</tr>
<tr>
<td>The acquisition of land for the project may cause impacts on the land ownership and land rights</td>
<td>Limited ongoing impact on land rights during construction</td>
<td>Limited ongoing impact on land rights during construction</td>
<td>The change in land use and decommissioning of the Cement Plant and Jetty and the may potentially cause conflict around land owners and communities.</td>
<td>Monitor the GoTL’s Implementation of the Resettlement Action Plan</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
<td>Implement the Closure Plan</td>
<td></td>
</tr>
</tbody>
</table>
### Natural Resources Rights

<table>
<thead>
<tr>
<th>Pre construction</th>
<th>Impact Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
<th>Pre construction</th>
<th>Mitigation Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>The acquisition of land for the project may cause impacts on the natural resources rights</td>
<td>No additional impact once construction commences and resettlement has occurred.</td>
<td>No additional impact once operations commences and resettlement has occurred.</td>
<td>The change in land use and decommissioning of the Cement Plant and Jetty and the may potentially cause conflict around land owners and communities.</td>
<td>Monitor the GoTL’s Implementation of the Resettlement Action Plan</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
<td>Grievance redress mechanism in place to monitor community concerns.</td>
<td>Implement the Closure Plan</td>
</tr>
</tbody>
</table>

- Develop strategies to address the provision of sustainable, alternative livelihoods upon cessation of operations, decommissioning and closure.

### Impact Mitigation

<table>
<thead>
<tr>
<th>Cultural Heritage and Archeology</th>
<th>Pre construction</th>
<th>Impact Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
<th>Pre construction</th>
<th>Mitigation Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some sites destroyed as a result of the Limestone Mine pre-construction and construction</td>
<td>Access to sites may be restricted for safety reasons</td>
<td>Some sites destroyed as a result of the Limestone Mine pre-construction and construction</td>
<td>Access to sites may be restricted for safety reasons</td>
<td>Positive impact. Sites with restricted access for safety reasons will be lifted</td>
<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>
<td>Grievance redress mechanism in place to monitor community concerns</td>
<td>Implement the Closure Plan Consultation with community regarding lifting of access controls</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;
- NGER Act, 2007; and
- IPCC AR5, 2009

9.6.3 Impact Assessment

It is considered that the development of the project will have a limited, insignificant impact the climate of Timor-Leste through its contribution to global warming and the CO₂ emissions.

The construction and operational phase of the project is likely to see a localised increase in the emission of CO₂ 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 cement plants:

- 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
The project proposes to use a Captive Power Plant (CPP) using Circulating Fluidized Bed Technology (CFB) boiler to produce 33 MW and a 3-5 MW capacity Solar Power Plant. 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. An assessment of the potential greenhouse gas emissions was undertaken, with a result of around 293 kT e- per annum generated from the worst case scenario of emissions with the CPP burning coal. The best case scenario is 2 kT e- per annum from the CPP burning biomass and alternative fuels. (NGER Act, 2007)

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/PerformanceStandards/emissions).

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.

There will be some limited impacts on greenhouse gas emissions from the operation of vehicles and plant equipment which uses diesel fuel. These emissions are expected to be negligible, however mitigation of these impacts follows best practice expectations and that of The Regulations (Draft, 2012).

The project is therefore expected to have a low impact on Climate. The impact has been mitigated in the design phase by the selection of cleaner technologies and proposing to use a solar power plant and waste heat recovery plant to supplement requirements.

No further mitigation measures are proposed for the power plant.

The potential impacts to climate during the operation of the Limestone Mine are considered to be ‘Low’ based on the localised and relatively short-term nature of the potential impacts associated with the increased emission of greenhouse gases.

Mitigation measures have been included in the selection of the technology for power generation and the residual impacts are ‘Low’.

9.6.4 Mitigation Measures

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

- Combustion of carbon contained in wastewater (WBCSD, 2011).
• Adoption and implementation of clean technology to ensure emissions of greenhouse gases are minimised.

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

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

9.6.5 Monitoring and Reporting

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

Monitoring of 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

• 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)

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 guidelines: Assessment and management of contaminated sites (Department of Environment and Regulation, 2014).

Other relevant standards for determining the thresholds for measured contaminant values are contained in Australia’s National Environment Protection (Assessment of Site Contamination) Measure, 2013

Guiding Principles for the Quantitative assessment of soil degradation, 2004 The International Soil Reference and Information Centre

9.7.3 Impact Assessment

Pre-construction

Potential impacts of the preconstruction activities associated with the Limestone Mine on the topography, geology and soils are:

- Reshaping and excavation of landforms in order to prepare for construction will impact the current topography, however the amount of earthworks at the mine site will be limited to road levelling and construction. The impact is low.

- 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 minor with the nearest spring to the mine site located 200m from the mine boundary.

- Vegetation clearing resulting in a permanent change to soil type and arability. The area to be cleared for the Limestone Mine is 243ha. The mine site is not currently used for formal agriculture and the impact is low.

- Earthworks and soil ripping will change the soil surface, permeability and type. The earthworks will alter the soil type and the plant area will be paved or bituminised. The topsoil will be stockpiled during pre-construction and the impact on the soil is low.

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

- The overall impact of pre-construction on the soil is low.

Construction

- Reshaping and excavation of landforms in order to erect bunds, drainage features and establish offices and workshops will have an impact on the current topography and drainage behaviour, and the impact is expected to be low because the earthworks required construct
this infrastructure area of the mine are minor compared to the overall size of the mine area. The mine is located on a terraced and steep-sloped area.

- Vegetation clearing ongoing effects of increased erosion and run-off, changing the water quality of the ocean, springs and rivers. Run off from the mine site will be controlled through drainage measures so the impact will be low.

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

- The impact on soil, geology and topography during construction of the mine is expected to be low with localised contamination of soil and erosion.

**Operation**

- Reshaping and excavation of landforms during mining will impact the current topography, and the impact is expected to be extensive and the mine will create a mine void, permanently remove a large volume of geological material which is then stockpiled or exported. The mine void will impact the topography permanently on a local scale.

- The changes to downstream water quality by contaminant transport through the soil are expected to be minor and controlled through management measures.

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

The impact on soil, geology and topography during operation of the mine is expected to be low with permanent localised changes to the topography which can be readily remediated.

**Decommissioning**

- Reshaping and backfill of mining void and areas is likely to have a positive impact on the topography

- Soil rehabilitation and vegetation regrowth in the mine area is expected to be a slow process but will likely to continue indefinitely following the initial revegetation of the mining area post decommissioning. Therefore, the impact is considered to be ‘Medium’ due to the prolonged timeframes for flora and fauna reestablishment.

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

- Waste generated during the decommissioning phase may cause local contamination, transfer contamination elsewhere during its disposal and may cause long term contamination of the soil and geology, however with appropriate management of waste this is expected to be low.
9.7.4 Mitigation Measures

Pre-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 pre-construction plant and equipment which is fuel efficient, built and maintained to minimise chance for spills, leaks and drips.

The site should 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.

Staged clearing of vegetation in the Limestone Mine area should 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 impact from soil erosion in should be mitigated with drainage and storm water management implemented across the site. This includes drainage design to minimise scour and control runoff across the site.

Staged clearing of vegetation in the Limestone Mine area has been considered to minimise soil erosion.

The site should 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.

Operation

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 impact from soil erosion in should be mitigated drainage and storm water management implemented across the site. This includes drainage design to minimise scour and control runoff across the site.

Staged clearing of vegetation in the Limestone Mine area has been considered to minimise soil erosion.
Decommissioning

In order to minimise the impact from reshaping and excavations of landforms during decommissioning, implement the reclamation and rehabilitation mitigation measures recommended by the Mine Closure Plan.

Revegetation during decommissioning and rehabilitation should be supported by a plan to source local native vegetation seeds and root stock for planting based on the current Biodiversity mapping contained in this report.

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 shall be no backfilling or dumping of waste locally.

9.7.5 Monitoring and Reporting

Impacts on soil post-mitigation are expected to be low so soil specific monitoring measures are not recommended.

All incidences of spills should be recorded and investigated so that continuous improvement practices are implemented.

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 ($\mu g/m^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide</td>
<td>International Ambient Air Quality Standards (IAAQS)</td>
<td>1 hour = 40,000 $\mu g/m^3$ 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 $\mu g/m^3$ 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 $\mu g/m^3$ a,c</td>
</tr>
<tr>
<td>Photochemical oxidants (as ozone)</td>
<td>International Ambient Air Quality Standards (IAAQS)</td>
<td>1 hour = 235 $\mu g/m^3$ d</td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>International Ambient Air Quality Standards (IAAQS)</td>
<td>1 hour = 350 $\mu g/m^3$ c</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 hour = 125 $\mu g/m^3$ a</td>
</tr>
<tr>
<td>Particles as PM2.5</td>
<td>International Ambient Air Quality Standards (IAAQS)</td>
<td>24 hour = 75 $\mu g/m^3$ a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual = 70 $\mu g/m^3$ 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

9.8.2.1 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 area during the construction and operation phase. The results of the models prediction were presented in the form isopleth maps to describe the dispersion of potential air pollutants over the project surrounding areas and sensitive receptors.

Figure 80, 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>
</tr>
</thead>
<tbody>
<tr>
<td>AQ-1</td>
<td>Bahu</td>
<td>216789</td>
<td>9063590</td>
<td>Settlement area</td>
</tr>
<tr>
<td>AQ-2</td>
<td>Check Point Triloca</td>
<td>210449</td>
<td>9060528</td>
<td></td>
</tr>
<tr>
<td>AQ-3</td>
<td>Aldeia Parlementu</td>
<td>212219</td>
<td>9065491</td>
<td>School area</td>
</tr>
<tr>
<td>AQ-4</td>
<td>Aldeia Osso-ua</td>
<td>209130</td>
<td>9065049</td>
<td>Settlement area</td>
</tr>
<tr>
<td>AQ-5</td>
<td>Jetty Plan</td>
<td>207556</td>
<td>9065473</td>
<td>Coastline area</td>
</tr>
<tr>
<td>AQ-6</td>
<td>Wailacama</td>
<td>204204</td>
<td>9060553</td>
<td>Settlement area</td>
</tr>
<tr>
<td>AQ-7</td>
<td>Bucoli</td>
<td>207767</td>
<td>9060792</td>
<td></td>
</tr>
</tbody>
</table>

Table 28: Sampling Location and Method for Collecting Primary Air Quality Data

<table>
<thead>
<tr>
<th>Sampling Location No.</th>
<th>Parameter</th>
<th>Sampling Method</th>
<th>Sampling Duration (Hours)</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PM10</td>
<td>Gravimetric method, Japan International Standard (JIS)</td>
<td>24</td>
<td>Low Volume Sampler</td>
</tr>
<tr>
<td>2</td>
<td>PM2.5</td>
<td>No. Z 8814 1994</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Carbon Monoxide</td>
<td>Iodine Pentoxide Method</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Nitrogen Dioxide</td>
<td>Griess Saltzman Method, ASTM D1607 - 91(2011).</td>
<td>1</td>
<td>Midget Impinger, Spectrophotometry,</td>
</tr>
<tr>
<td>5</td>
<td>Sulphur Dioxide</td>
<td>Pararosaniline Method, ASTM 2914 (2007)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Ozone</td>
<td>Methods of Air Sampling and Analysis, 1989</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Hydrocarbon</td>
<td>NIOSH 1501, 2003</td>
<td>3</td>
<td>Absober, Gas</td>
</tr>
</tbody>
</table>
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 80: Location of Air Quality Measurement (BBS, 2015a)
Pre-construction

The Air Quality Impact Assessment Study Report (BBS, 2015a) did not assess potential pre-construction impact. However, it is likely that if there are any impacts to air quality 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 air quality during the pre-construction phase are considered to be ‘Low’.

Construction

The modelling results indicate that for the construction phase:

- The 24 hour average concentration for PM10 is predicted to be as high as 114 µg/m³ (Figure 4.2 in Appendix 1); which is less than the IAAQS standard of 150 µg/m³ for a 24 hour period;
- The highest annual average concentration of PM10 is predicted to be 17 µg/m3 (Figure 4.3 in Appendix 1), which is within the IAAQS standards;
- The highest 24 hour average concentration for PM2.5 during construction is calculated to be 25 µg/m³ (Figure 4.4 in Appendix 1), which is within the IAAQS standard of 75 µg/m³ for a 24 hour period;
- The annual average of PM2.5 concentration is calculated to be about 35 µg/m³ (Figure 4.5 in Appendix 1), which is equal to the standard of 35 µg/m³ for a year; and
- The highest 1 hour average concentrations of CO, NO₂ and SO₂ are 0.25 ppm, 0.12 ppm and 0.2 ppm respectively (Figures 4.6 to 4.14 in Appendix 1); and
- All the pollutants modelled (PM₁₀, PM₂₅, CO, NO₂ and SO₂) 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.

Table 29 provides a summary of the predicted 1st high 1 hour, 24 hour and annual concentrations for each pollutant during the construction phase.

It is anticipated that any impacts to air quality during construction of the limestone mine would be localised and short term in nature. 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 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 plant and 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 NW but they pollutants may disperse 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.

- 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.

Table 30 provides a summary of the predicted 1st high 1 hour, 24 hour and annual concentrations for each pollutant during the construction phase.

The potential impacts to air quality from the operational phase are considered to be 'Medium' due to the localised, regional exceedance of the IAAQS standards. Residual impacts through the implementation of mitigation measures are anticipated to be ‘Low’.

Decommissioning

The Air Quality Impact Assessment Study Report (BBS, 2015a) did not assess potential decommissioning impact. However, it is likely that if there are any impacts to air quality during this phase of the project they would 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>1st 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>203171.72</td>
<td>9058782,81</td>
<td>Mining and cement plant area, north west of sources</td>
<td>Figure 3.2</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>70</td>
<td>17</td>
<td>203171.72</td>
<td>9058782,81</td>
<td></td>
<td>Figure 3.3</td>
</tr>
<tr>
<td>PM₂.₅</td>
<td>24 hours</td>
<td>75</td>
<td>25</td>
<td>203171.72</td>
<td>9058782,81</td>
<td></td>
<td>Figure 3.4</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>35</td>
<td>3.81</td>
<td>203171.72</td>
<td>9058782,81</td>
<td>Plant and Jetty area, north west of sources</td>
<td>Figure 3.5</td>
</tr>
<tr>
<td>CO</td>
<td>1 hour</td>
<td>40000</td>
<td>287</td>
<td>207662,54</td>
<td>9065361,09</td>
<td></td>
<td>Figure 3.6</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>125</td>
<td>4.67</td>
<td>207662,54</td>
<td>9065361,09</td>
<td></td>
<td>Figure 3.7</td>
</tr>
<tr>
<td>NO₂</td>
<td>24 hours</td>
<td>100</td>
<td>28</td>
<td>207662,54</td>
<td>9065361,09</td>
<td></td>
<td>Figure 3.8</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>200</td>
<td>109</td>
<td>207662,54</td>
<td>9065361,09</td>
<td></td>
<td>Figure 3.9</td>
</tr>
<tr>
<td>SO₂</td>
<td>24 hours</td>
<td>40</td>
<td>28</td>
<td>207662,54</td>
<td>9065361,09</td>
<td></td>
<td>Figure 3.10</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>125</td>
<td>1.96</td>
<td>207662,54</td>
<td>9065361,09</td>
<td></td>
<td>Figure 3.11</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>35</td>
<td>0.7</td>
<td>207662,54</td>
<td>9065361,09</td>
<td></td>
<td>Figure 3.12</td>
</tr>
<tr>
<td></td>
<td>24 hours</td>
<td>125</td>
<td>0.2</td>
<td>207662,54</td>
<td>9065361,09</td>
<td></td>
<td>Figure 3.13</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>125</td>
<td>0.012</td>
<td>207662,54</td>
<td>9065361,09</td>
<td></td>
<td>Figure 3.14</td>
</tr>
</tbody>
</table>
### Table 30: Predicted 1st High Air Pollutant Concentration for 1 hour, 24 hours, and Annual Avg Concentration during Operation Phase (BBS, 2015A)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Averaging time</th>
<th>Standard (µg/Nm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1st High Concentration (µg/Nm³)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Easting</td>
</tr>
<tr>
<td>PM10</td>
<td>24 hours</td>
<td>150</td>
</tr>
<tr>
<td>PM10</td>
<td>Annual</td>
<td>70</td>
</tr>
<tr>
<td>PM2.5</td>
<td>24 hours</td>
<td>75</td>
</tr>
<tr>
<td>PM2.5</td>
<td>Annual</td>
<td>35</td>
</tr>
<tr>
<td>CO</td>
<td>1 hour</td>
<td>40000</td>
</tr>
<tr>
<td>CO</td>
<td>24 hours</td>
<td>40000</td>
</tr>
<tr>
<td>CO</td>
<td>Annual</td>
<td>6</td>
</tr>
<tr>
<td>NO2</td>
<td>1 hour</td>
<td>200</td>
</tr>
<tr>
<td>NO2</td>
<td>24 hours</td>
<td>200</td>
</tr>
<tr>
<td>NO2</td>
<td>Annual</td>
<td>40</td>
</tr>
<tr>
<td>SO2</td>
<td>1 hour</td>
<td>350</td>
</tr>
<tr>
<td>SO2</td>
<td>24 hours</td>
<td>125</td>
</tr>
<tr>
<td>SO2</td>
<td>Annual</td>
<td>1,66</td>
</tr>
</tbody>
</table>
9.8.3 Mitigation Measures

The impacts on air quality are expected to be medium during the operations phase of the project and mitigation measures are recommended to ensure the residual impacts are Low.

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

- All material excavated, stockpiled, or graded shall be sufficiently watered, treated, or covered to prevent fugitive dust from leaving the property boundaries.
- Watering should occur at least twice daily, with complete site coverage.
- All land clearing, grading, earth moving, or excavation activities on a project should be suspended as necessary to prevent excessive windblown dust when winds are expected to exceed 20 mph.
- All areas with vehicle traffic shall be watered or have a dust palliative applied as necessary for regular stabilization of dust emissions.
- All on-site vehicle traffic shall be limited to a speed of 15 mph on unpaved roads.
- All material to be transported off-site shall 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 unnecessarily.
- Reduce the number of vehicle movements through better planning.
- Set an appropriate speed limit on haul routes.
- All heavy duty vehicles should meet emissions regulations from local NDPCEI, or similar standard e.g. ADR 80/03 Standards under the Motor Vehicles Standards Act 1989 (Australia Federal Law, 2006)
- Engines and exhaust systems should 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.
- Dust suppression systems (water spraying) will be adopted at faces/ sites before and after blasting and while loading.
- Dust generated due to blast hole drilling will be suppressed by using water injecting system of dust collectors.
- Use of sharp drill bits for drilling holes and drills with water flushing systems (wet drilling) to reduce dust generation.
Timing of blasting will avoid high wind speeds and when workers are away from the mining face (for example: midday).

9.8.4 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 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 at the following sensitive receptors:

- AQ1 - settlement area in Bahu, east-south east of the Limestone Mine;
- AQ3 - School area in Aldeia Parlemento, north east of the Limestone Mine;
- AQ5 - representing the project area; and
- AQ4 - settlement area in Aldeia Osso-ua.
The monitoring program should assess and report on the following air quality parameters to the local Environmental Protection Agency:

- PM10;
- PM2.5;
- CO;
- NO₂;
- SO₂; and
- Ozone.

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 emissions do not impact on the health, welfare and amenity of the population, land uses and environmental values.
- To ensure that noise emissions, both individually and cumulatively, comply with the appropriate statutory requirements.
- To ensure design and procurement activities incorporate measures for minimising noise emissions during all phases of the project.
- To ensure that all reasonable and practicable measures are undertaken during construction and operations to minimise noise 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

Table 31 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

The noise impact assessment of the construction and operation of the project used modelling tools which evaluated baseline environmental noise levels and assessed the project's potential noise emissions during the construction and operation phases against the. The results of the models prediction are presented in the form noise contour maps to describe the extent of potential noise impacts from the project on surrounding areas and sensitive receptors.

The Noise Impact Assessment identified seven locations (Table 32 and Figure 81 below) to represent sensitive receptors around the Project area. The sites were selected based on the following considerations:

- Locations which may be impacted by noise from the project activities; and
- Locations which were occupied by local people.

The full Noise Impact Assessment Report (BBS, 2015b) is provided in Appendix 2. The report provides full details of the:

- Assessment of baseline environmental noise;
- Assessment and modelling methods used to determine potential noise impacts; from the project activities;
- Prediction of potential noise impacts based on the modelling input and outputs; and
- Potential mitigation measures during the construction and operational phase of the project.

Table 32: Coordinates of noise baseline measurement point (representative locations of sensitive receptors)

<table>
<thead>
<tr>
<th>Measurement Point</th>
<th>Location</th>
<th>Description</th>
<th>Co-ordinates (Zone 52L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Easting</td>
</tr>
<tr>
<td>N01</td>
<td>Bahu</td>
<td>Settlement Area</td>
<td>216790</td>
</tr>
<tr>
<td>N02</td>
<td>Check Point Triloca</td>
<td>Settlement Area</td>
<td>210450</td>
</tr>
</tbody>
</table>
### TL CEMENT, LDA
### BAUCAU CEMENT PROJECT
### ENVIRONMENTAL IMPACT STATEMENT LIMESTONE MINE

<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
<th>Area Type</th>
<th>Longitude</th>
<th>Latitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>N03</td>
<td>Aldeia Parlementu</td>
<td>School Area</td>
<td>212220</td>
<td>9065492</td>
</tr>
<tr>
<td>N04</td>
<td>Aldeia Osso-ua</td>
<td>Settlement Area</td>
<td>209131</td>
<td>9065049</td>
</tr>
<tr>
<td>N05</td>
<td>Jetty area</td>
<td>Coastal Area</td>
<td>207557</td>
<td>9065473</td>
</tr>
<tr>
<td>N06#</td>
<td>Wailacama</td>
<td>Settlement Area</td>
<td>204205</td>
<td>9060554</td>
</tr>
<tr>
<td></td>
<td>(more than 5km from Limestone Mine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N07</td>
<td>Bucoli</td>
<td>Settlement Area</td>
<td>207768</td>
<td>9060793</td>
</tr>
</tbody>
</table>
Figure 81: Location of Noise Baseline Measurement
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 33 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 (LÂmax) than time-weighted average levels.

Table 33: 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 (Wallacama)</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 34 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 34: 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)</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 Parlementu)</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.

• Blasting activities in the Limestone Mine should be limited to set hours e.g. (1:00pm to 2:00pm) when there are less human activities and during favourable atmospheric conditions (Holtec, 2015a).

• Drilling should be carried out with sharp drill bits which would help reduce noise (Holtec, 2015a).

• Secondary blasting shall be totally avoided and hydraulic rock breaker is to be used for breaking boulders (Holtec, 2015a).

• PPE (e.g. ear plugs) will be provided to all employees (Holtec, 2015a).

• Development of a Greenbelt around the Limestone Mine and along haul roads to minimise the propagation of noise (Holtec, 2015a).

• Use of down-the-hole initiation techniques, which produce less vibration and noise (Holtec, 2015a).

• The number of blast holes per day are proposed to be kept to as few as possible (Holtec, 2015a).

• Controlled blasting shall be adopted and optimum use of explosive energy helps in reducing the noise and air pollution.

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.

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.

9.10 Surface Water

9.10.1 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 surface water
- Minimise long term damage to catchment function
- Minimise potential impact to infrastructure from stormwater and surface water drainage

9.10.2 Applicable Standards and Legislation

- Western Australian Water in Mining Guideline (2013)
- Environmental Guidelines for the Concrete Batching Industry (1998)

9.10.3 Impact Assessment

Pre-construction and Construction

The results of the surface water assessment (Appendix 3) suggest the proposed developments associated with the Baucau Cement 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 (Appendix 3) suggest the proposed development associated with the Baucau Cement 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 the springs used for public water supply, Closed Tropical Forest vegetation identified along watercourses and drainage lines and the associated fauna species will be protected by implementing the 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 Limestone Mine site.

The impacts on surface water quality and quantity from the operation of the Limestone Mine 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 (Appendix 3) suggest the proposed developments associated with the Baucau Cement 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 model assumes that any surface water to runoff on the surface of the backfilled mine is captured by the water reservoir and that the diversion drains installed remain operational post-closure. The impacts on surface water quality and quantity from the closure of the Limestone Mine 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 impacts from the decommissioning phases are expected to be “Low”.

**9.10.4 Mitigation Measures**

- Installation of culvert and/or floodway waterway crossings along access/haul roads to maintain flow paths.
- Diversions are to be redirected back into the same watercourse downstream where possible to minimize impacts on the hydrological regime.

Diversion drains are to be developed in accordance with Figure 82, below.

- Runoff from disturbed areas is to be managed using drainage systems to minimize impacts on the hydrological regime and recharge to aquifers. Incorporate detention/sedimentation
basins into the drainage design if/as required and allow for discharge of treated runoff back to natural watercourses.

- Divert floodwater from undisturbed catchment areas around mine and plant sites to prevent mixing with runoff from disturbed areas, and to protect the infrastructure from flooding during extreme rainfall events.
- Capture direct rainfall runoff from disturbed areas (cleared areas, stockpiles, waste dumps etc) in drainage systems and direct it to sedimentation ponds to remove suspended sediment prior to discharge to the environment. This will prevent direct discharge of suspended sediment loads into the environment.
- Sedimentation ponds should be designed to capture sediment particles greater than or equal to 75µm (fine sand/silt) prior to discharging the treated water into the downstream environment.
- Emergency Response Plans shall be implemented to contain contamination at source, to remediate spills, to control dust and erosion and to protect flora and fauna. During both construction and operations, care must be taken to minimise generation of contaminants and to restrict transport to groundwater and surface waterway systems.
- Hydrocarbons will be managed to avoid leaks and spills. Fuel handling areas will be bunded to capture any spills for remediation and will be located outside of floodplains and karst limestone areas and appropriately elevated to avoid the risk of flood inundation. Bunded areas must be capable of containing the combined volume of runoff from a 20 year ARI 72 hour duration design flood event and 110% of the tank contents in accordance with the DoW Water Quality Protection Guidelines (2000).
- Stormwater runoff from workshop pavements, fuel unloading and storage areas and from vehicle washdown areas shall be directed to grit and oil interceptors to remove pollutants prior to discharge of the water. Accidental spills outside controlled areas must be appropriately remediated to avoid contamination of groundwater or surface waters.
9.10.5 Monitoring and Reporting

Monitoring of surface water flows and water quality in watercourses and drainage lines is recommended to establish baseline conditions and for compliance monitoring.

A rain gauge will be installed as part of the Automated Weather Station in the catchment.

Water level loggers should be installed in all watercourses to collect streamflow data at sub-daily increments to improve the accuracy of runoff estimates.

The water level and rainfall data should 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 should occur, with interpretation of data at a six monthly interval for the duration of the project. This frequency should 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.
Spills are to 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
- 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);
- Water Decree Law 2004/04; and

9.11.3 Impact Assessment

The full Preliminary Groundwater Study (WorleyParsons, 2015c) is provided in Appendix 4.

Pre-construction

- The preconstruction activities of plant, equipment and chemical use as well as land clearing may cause groundwater quality impacts via contamination. The nearest spring to the mine is 150 m north of the mine site boundary (Uaisa Spring). This spring has a flow rate of 10 L/s and is an important local water supply source. The studies to date indicate that there is likely to be connectivity between the regional aquifers and the springs and the mine is located up-gradient from the spring. There is a potential for groundwater quality impacts on the spring from the pre-construction activity.

- Groundwater has been identified as the primary water source for the mine and the water requirements for the project during pre-construction and construction are 350 m³/day (4 L/s). The water supply borehole location is expected to be near the Uaidei River, 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 pre-construction phase impacts on the groundwater are expected to be localised and long term. The impacts are moderate.
Construction

- The preconstruction activities of plant, equipment and chemical use as well as land clearing may cause groundwater quality impacts via contamination. The nearest spring to the mine is 150m north of the mine site boundary (Uaisa Spring). This spring has a flow rate of 10 L/s and is an important local water supply source. The studies to date indicate that there is likely to be connectivity between the regional aquifers and the springs and the mine is located up-gradient from the spring. There is a potential for groundwater quality impacts on the spring from the pre-construction activity.

- The surface water study indicates that the effect of vegetation clearing on infiltration and runoff is negligible compared to the pre development state (WorleyParsons, 2015c).

- Groundwater has been identified as the primary water source for the mine and the water requirements for the project during construction are 350 m$^3$/day (4 L/s). The water supply borehole location is expected to be near the Uaidei River, 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 long term. The impacts are ‘Low’.

The implementation of mitigation measures in the construction phase will result in the residual impacts being ‘Low’.

Operations

- The operational activities of equipment and chemical use may cause groundwater quality impacts via contamination. The nearest spring to the mine is 150 m north of the mine site boundary (Uaisa Spring). This spring has a flow rate of 10 L/s and is an important local water supply source. The studies to date indicate that there is connectivity between the regional aquifers and the springs and the mine is located up-gradient from the spring. It is expected that there is a potential for groundwater quality impact on the spring from the mining activity, especially considering the position of the waste rock stockpile immediately adjacent to the spring.

- The surface water study indicates that the effect of vegetation clearing on infiltration and runoff is negligible compared to the pre development state (WorleyParsons, 2015c). Groundwater has been identified as the primary water source for the project. 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 Uaidei River, located more than 5 km from the Limestone Mine site, 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, due to the unknown quantity of drawdown impact from abstraction.

- Dewatering of the aquifer as a result of mine operation is unquantifiable because no groundwater was intersected in the four exploration boreholes drilled in the mining area and the
water table is expected to be deeper than 43 m ASL. The impacts of mining in the limestone aquifer cannot be assessed by conventional methods and the bores drilled in the limestone to date have failed to intersect water. The potential for intersecting water still exists and cannot be adequately assessed at this stage. The potential impacts are medium.

The operations phase impacts on the groundwater are expected to be localised and long term. The impacts are ‘Medium’.

**Decommissioning**

- 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 area compared to the operations phase.

- Groundwater has been identified as the primary water source, however during decommissioning this is expected to be negligible.

The operations phase impacts on the groundwater are expected to be readily mitigated, localised and long term. The impacts are ‘Low’.

**9.11.4 Mitigation Measures**

**Pre-construction, Construction, Operation and Decommissioning**

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.

Contamination of the aquifer from the project should be mitigated through the Emergency Response Plan and all spills immediately cleaned up and disposed of appropriately.

**9.11.5 Monitoring and Reporting**

**Pre-Construction, Construction, Operation and Decommissioning**

Monitoring boreholes should be drilled at strategic locations around the mine infrastructure to monitor the background water quality as well as provide an indication of the presence of contaminants in the surrounding aquifer.

Monitoring of the water quality should include analysis and technical review of water quality parameters and levels in monitoring boreholes, springs and drainages features within and surrounding the project.

Water quality analysis and recording of flow rates of any water strikes encountered during mining activity. Interpretation of this data should occur in conjunction with twice-yearly reporting and interpretation.
Flow rates in springs and drainages should be recorded and monitored at least monthly. The following sensitive receptors and groundwater features should be monitored for flow and quality:

**Table 35: Groundwater monitoring locations (WorleyParsons, 2015c)**

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiono Spring</td>
<td>Coastal area closest to the Limestone Mine</td>
</tr>
<tr>
<td>Uaisa Spring</td>
<td>&lt; 100m from the mining area</td>
</tr>
<tr>
<td>Uai Matabai</td>
<td>&lt; 100m from the mining area</td>
</tr>
<tr>
<td>Wai Spring</td>
<td>3km north-east of the mining area</td>
</tr>
<tr>
<td>Uainoi Spring</td>
<td>&gt;10km south of the mine area</td>
</tr>
<tr>
<td>Uaililea Spring</td>
<td>&gt;10km south of the mine area</td>
</tr>
</tbody>
</table>

The project's Environmental Management Plan should contain appropriate emergency response processes to observed decreases in spring and drainage flows and deterioration in water quality compared to the baseline and water quality standards.

Contamination of the aquifer from the project activities should be reported to the regulator within an appropriate timeframe and the process and procedure for identifying and managing the contamination detailed in the Emergency Response Plan.

### 9.12 Coastal and Marine Waters

The impact of the Baucau Cement Project on Coastal and Marine Waters is assessed as part of the Plant and Jetty impact assessment.

There is no discernible environmental impact of the Limestone Mine on Coastal and Marine waters.

### 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 International Union for Conservation of Nature (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;
- floristic diversity that has not been documented;
- agricultural land and subsidence gardens;
- food crops and estates e.g. coconuts and bananas;
- timber for fuel source; and
• cash crops e.g. sandalwood.

The mine site vegetation was recorded as predominately uniform Woodland to Open Woodland with small, isolated patches of Closed Tropical Forest occurring in minor ravines and gullies. The Open Woodland environment is dominated by relatively uniform *Eucalyptus alba* and *Sclerichera olesa* assemblages. Additional native species occurring included: *Acacia* sp, *Alstonia actinophylla*, *Gmelina arborea*, *Dalbergia timoriensis*, *Miliusa* sp, *Santalum album*, *Senna timoriensis* and *Syzigium nervosum*. The degree of disturbance and degradation in the Open Woodland varied and seemed to be dependent on physical barriers such as excessive exposed limestone outcrops, which appears to restrict grazing. Across the majority of Open Woodland sites weed species, including *Hyptis sauvleons*, *Chromolaena odorata*, *Jatropha gossypifolia*, *Lantana camara*, *Tecoma stans* and *Ziziphus mauritiana* were recorded (Trainor & Easton, 2015).

The isolated patches of Closed Tropical Forest is dominated by mature *Schleichera oleosa* but also included lesser examples of *Acacia* sp, *Cryptocarya foetida*, *Dalbergia timoriensis*, *Syzigium nervosum* and *Santalum album* (Trainor & Easton, 2015).

The *Santalum album* which was recorded at site MI03-001 is listed as Vulnerable on the IUCN Red List. *Indigofera linifolia* was also identified at MI02-001 and is listed as Least Concern (Trainor & Easton, 2015).

The total area of the vegetation to be cleared for the construction of the limestone mine is calculated to be 244 ha. Table 36 below provides a breakdown of this total based on each vegetation association recorded at the Limestone Mine.

**Table 36: Vegetation Associations to be cleared for the Construction of the Limestone Mine**

<table>
<thead>
<tr>
<th>Vegetation Association</th>
<th>Area to be cleared (hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degraded Open Woodland</td>
<td>235</td>
</tr>
<tr>
<td>Degraded Closed Tropical Forest Patch</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>244</strong></td>
</tr>
</tbody>
</table>

The Closed Tropical Forest is considered to have high biological significance despite historical and ongoing human use (Trainor & Easton, 2015).

Therefore, based on the impact significance framework, the potential impacts to terrestrial flora at the Limestone Mine during pre-construction and construction are considered ‘Medium’.

Mitigation measures proposed include a comprehensive revegetation program as part of the Mine Closure Plan; and establishment of a Greenbelt alongside the haul road in the Limestone Mine area. Residual impacts on vegetation are ‘Low’.

**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
The project will have any significant impacts on terrestrial flora. The key impacts during construction include the establishment and spreading of weeds through vehicle movement.

The potential impacts to terrestrial flora at the Limestone Mine during operation of the project are considered ‘Low’.

**Decommissioning**

The decommissioning phase of the project will see positive impacts for terrestrial flora as the areas cleared for the construction and operation are rehabilitated and restored to their natural, pre-construction condition. Refer to Section 1.11.4 [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 flora at the Limestone Mine during decommissioning of the project are considered ‘Low’.

### 9.13.4 Mitigation Measures

**Pre-construction and Construction**

The following mitigation measures should be implemented for the pre-construction and construction phases of the project:

- Minimise the disturbance footprint as far as practicable.
- Preserve the Closed Tropical Forest locations identified on the Limestone Mine site as far as practicable;
- Undertake a wet and dry season flora survey of the area adjacent to the Limestone Mine site to develop a detailed floristic species composition register to inform the required updates to the Mine Closure Plan;
- Undertake stripping and stockpiling of vegetation and topsoil for reuse in the decommissioning and rehabilitation phase.
- Site clearing to be conducted sequentially.
- Prior to site entry all vehicles, plant and equipment should be cleaned down and inspected to reduce the likelihood of spreading weeds.

**Operation**

The following mitigation measures should be implemented during the operational phase of the project:

- Implementation of site controls for alien invasive plants (i.e. Weeds and biological pathogens).
- 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:

- Source seeds and seedlings for revegetation from local suppliers and representative habitats.
- Implement industry best practice seed and root stock management practices.
- Sequential rehabilitation to be conducted as soon as possible at the completion of operation.
- Afforestation and plantation of local species in areas degraded during the pre-construction, construction and operation phases of the project (Holtec, 2015a).

Refer to the Mine Closure Plan (Holtec, 2015a) for further details on the rehabilitation and closure plan strategy.

9.13.5 Monitoring and Reporting

The impacts on flora are medium due to being permanent and localised, however the impacts are largely mitigated through the development and implementation of the Mine Closure Plan (Holtec, 2015a).

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.

9.14 Wetlands

There are no wetlands within or adjacent to the project area. Therefore, no impact assessment has been undertaken for this factor as there are no potential impacts.
9.15 Mangroves

There are no mangroves within or adjacent to the project area. Therefore, no impact assessment has been undertaken for this factor as there are no potential impacts.

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 International Union for Conservation of Nature (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 International Union for Conservation of Nature (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 (Timor Leste) 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 phase 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 area could lead to a change in the fire regime, potentially impacting on resident terrestrial fauna species and habitat; and
- Disturbance to natural fauna activities due to noise, vibration and lightning impacts.

The fauna habitat recorded at the Limestone Mine site was predominantly savanna woodland dominated by *Eucalyptus alba* and *Schleichera oleosa*, with a grassy or weedy ground cover. Rock cover was high, but these were often embedded in soil, with no cliffs, caves or particularly rugged rock outcrops observed which can form key refuges for reptiles, mammals and landsnails (Trainor & Easton, 2015).

The fauna recorded at the Limestone Mine site was typical of woodland-open country comprising mostly introduced or tramp amphibian and reptile species. Five insectivorous bat species were recorded. The invasive Black-spined Toad was commonly observed in the study area especially on roads just outside the study area. The bird fauna consisted of a mixture of woodland-open country species and several forest specialized birds. A total of five of the six Near threatened birds recorded during the surveys were recorded at the Limestone Mine and in total 14 globally restricted-range species were recorded. Many of these were non-forest species, but the Cinnamon-banded Kingfisher, Timor Oriole *Oriolus melanotis* and Timor Figbird *Sphecotheres viridis* are typically considered as forest specialist bird species (Trainor & Easton, 2015).

Based on the significance based assessment framework, the potential impacts to fauna at the Limestone Mine during pre-construction and construction are considered ‘Low’ given there are no
IUCN species, 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 phase, 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;
- Increase in feral or invasive fauna species such as cats, rodents and frogs as a result of anthropogenic factors e.g hygiene, poor waste management, sanitation etc.
- 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 area could lead to a change in the fire regime, potentially impacting on resident terrestrial fauna species and habitat;
- Disturbance to natural fauna activities due to noise and lightning impacts.

The potential impacts to terrestrial flora at the Limestone Mine during operation of the project are considered ‘Low’.

Decommissioning

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 their natural, pre-construction condition. Refer to 9.16.4 and the Mine Closure Plan (Holtec, 2015a) for further details

Therefore, the potential impacts to terrestrial fauna at the limestone mine during decommissioning of the project are considered ‘Low’.

9.16.4 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.
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 should be implemented during the operational phase of the project:

- Implementation of site controls for alien fauna including rodents and frogs.
- Environmental education training program, including refresher sessions, for all employees, contractors and families surrounding the project area.

**Decommissioning**

The following mitigation measures should be implemented during the decommissioning phase of the project:

- 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 planation of local species in areas degraded during the pre-construction, construction and operation phases of the project (Holtec, 2015a).

Refer the Mine Closure Plan (Holtec, 2015a) for further details on the rehabilitation and closure plan strategy.

**9.16.5 Monitoring and Reporting**

The following monitoring and reporting requirements should be implemented for the limestone mine site:

**Pre-construction and Construction**

Any incidents of fauna injury and death should be recorded.

**Operation**

Any incidents of fauna injury and death should be recorded.

**Decommissioning**

Feral and invasive fauna should be dealt with by appropriate procedures.

The success of rehabilitation should be assessed through fauna monitoring within 5 years following decommissioning.
9.17 Marine Fauna including Fisheries

The impact of the Baucau Cement Project on Marine Fauna is assessed as part of the Plant and Jetty impact assessment.

There is no discernible environmental impact of the Limestone Mine on Marine Fauna.

9.18 Marine Habitats including Corals

The impact of the Baucau Cement Project on Marine Habitats including Coral is assessed as part of the Plant and Jetty impact assessment.

There is no discernible environmental impact of the Limestone Mine on Marine Habitats.

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.

- 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 known relevant standards or legislation application to 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

- 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 of Clinker Cement Project 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, Construction, Operations and Decommissioning**

Traffic and vehicles movements associated with the pre-construction and construction of the Limestone Mine are likely to be all within the project footprint and on dedicated haul roads.

Therefore, the significance framework deems the potential impacts from transport and traffic during the project pre-construction and construction phase are ‘Low’, owing to the short-term, and localised nature of the impact.

**Operations**

Traffic and vehicles movements associated with the operation of the Limestone Mine are likely to be all within the project footprint and on dedicated haul roads. Secondary or indirect impacts on traffic will result from the road-based transport of domestic cement supply to Dili and other local regional centres. For the Limestone Mine site as primary impact area, the significance framework deems the potential impacts from transport and traffic during the operation phase are ‘Low’, owing to the localised nature of the impact.

**Decommissioning**

Traffic and vehicles movements associated with the decommissioning of the Limestone Mine are all within the project footprint and on dedicated haul roads.

Therefore, the significance framework deems the potential impacts from transport and traffic during the project decommissioning phase are ‘Low’, owing to the short-term, and localised nature of the impact.

**9.19.4 Mitigation Measures**

Traffic impacts from the Limestone Mine are deemed to be Low and mitigation measures are not required, however the following mitigation measures for Traffic are recommended to improve overall project performance:
• 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 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.
• 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. Chapter ()[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:

• 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.
• 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:

• Law 4/2012 Labor Code.

9.20.3 Impact Assessment

Pre-construction

The project proposal has created significant 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 impacts for the community and their livelihoods as the project will provide the opportunity for skill development and training. Therefore, the significance framework 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 development is the opportunity of employment and training/skill development. As discussed in Section 4 the employment opportunities associated with the construction of the project are expected to be in the order of 3,000 persons.

While the development of the project will predominantly 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 significance framework 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 the 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 17 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 significance framework 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 significance framework determines the potential impacts associated with employment during the decommissioning phase are considered to be ‘Low’.

9.20.4 Mitigation Measures

Pre-Construction, Construction, Operation and Decommissioning

TL Cement is expected to continue to engage with project stakeholders 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 encourage 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 no known relevant standards or legislation application to infrastructure.
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 significance framework 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 significance framework classifies the potential impacts to infrastructure during the operation phase to be ‘Low’.

Decommissioning

The significance framework 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

TL Cement 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 Mine Closure Plan (Holtec, 2015a) provided in Appendix 7 provides full details all the closure plans for the Limestone Mine.
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;
  - 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;
  - All subsurface cavities such as reinforced concrete tunnels under septic tanks will be backfilled;
  - 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:
  - Culverts and ducts will be removed;
  - The natural water flow will be restored and any disturbed section of the watercourse will be stabilised and revegetated;
  - Road surfaces, shoulders and embankments will be graded to a slope suitable to prevent erosion;
Cuttings will be assessed and where necessary measure to improve safety and erosion stability will be implemented; and
- 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

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 0 Social Impact 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 (Timor Leste);
- 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 natural resources as a source of income. This loss of land the resources on it, will place greater pressure and demand on other areas and natural resources. The development of the Limestone Mine will result in clearing a total of 244 ha of vegetation (refer to Section 0 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.

Flora and Fauna), some of which may be utilised by the local communities as a source of commercial firewood. As detailed in Section 11 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 significance framework classifies the potential impacts to the economic use of forests and other natural resources during the pre-construction and construction phase to be ‘Medium’. The loss of trees and other natural resources as an income stream is difficult to quantify and will vary from family to family.

The implementation of the Resettlement Plan by the GoTL will mitigate the effects from loss of livelihood and the area will be rehabilitated to the same condition as pre-development at the end of the project.

The residual impact on the Economic use of Forestry resources is expected to be ‘Low’.

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 significance framework 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 significance framework 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.
- Site clearing to be conducted sequentially.

Operation

The following mitigation measures should be implemented during the operational phase of the project:

- Implementation of the control plan 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.
- Afforestation and planation of local species in areas degraded during the pre-construction, construction and operation phases of the project (Holtec, 2015a).

Refer the Mine Closure Plan (Holtec, 2015a) for further details..

9.22.5 Monitoring and Reporting

Pre-construction and Construction

The total area of vegetation cleared during the pre-construction and construction phase should be recorded.

The impacts on the community are to be monitored and managed through the Complaints and Grievances mechanism detailed in the EMP and the ongoing consultation recommended by the EIS.

Operation

The impacts on the community are to be monitored and managed through the Complaints and Grievances mechanism detailed in the EMP and the ongoing consultation recommended by the EIS.

Decommissioning

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

The Limestone Mine development is not expected to impact Fishing and has not been evaluated in this EIA.

9.24 Socio-Economic Agriculture

The following section provides a brief overview of the potential impacts and mitigation measures associated with socio-economic agriculture. Chapter 0 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 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.

9.24.2 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 (Timor Leste);
- 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 agriculture is the chief occupation of the people living in the Project Area. The crops being cultivated include peanuts, coconut, corn and vegetables like beans, tomatoes, cassava, potatoes, etc. The important fruit trees are banana and papaya (6.11.3).
There are around 12 households with a household size of 5-12 persons whose land are located on the proposed mining lease for the Limestone Mine (Section 11.1.2 Land use).

According to the impact significance framework, this impact is 'High'.

The development of the limestone mine will result in clearing a total of 244 ha of vegetation and access restriction to an additional 297ha, some of which may be utilised by the local communities for agricultural purposes.

Land clearing and access restriction will impact the local socio-economic agricultural system, through land clearing and access restriction with up to 12 households directly affected.

The significance framework classifies the potential impacts to socio-economic agriculture during the pre-construction, construction and operation phase to be 'Medium'.

Implementation of resettlement by the GoTL to limit impacts on their economic status as a result of restricted access to traditional farmlands. The resettlement is being addressed through a separate process to the EIS.

Decommissioning

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 should 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:

- The GoTL is responsible for undertaking resettlement for those families whose homes and farmland are directly affected by the Limestone Mine construction and operation. TL Cement are working with the GoTL to address resettlement by a separate process to the EIS.

- Minimise the disturbance footprint as far as practicable.

- Undertake stripping and stockpiling of vegetation and topsoil for reuse in the decommissioning and rehabilitation phase.

- Implementation of controls for alien invasive plants. To mitigate the possible negative impacts associated the loss of cash income with the termination of employment, the locals should be
encourage to utilise the cash income, during employment, for investments that will assist with increasing productivity of the local agricultural sector (BBS, 2015d).

Operation
The following mitigation measures should be implemented for the operational 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 should be encourage to utilise the cash income, during employment, for investments that will assist with increasing productivity of the local agricultural sector (BBS, 2015d).

Decommissioning
The following mitigation measures should 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 should be encourage 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.
- Afforestation and planation 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

Pre-construction and Construction
The total area of vegetation cleared during the pre-construction and construction phase should be recorded.

Operation
W 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.

9.25 Tourism

While Baucau itself is an important tourism centre in Timor-Leste, the project is not considered to be a tourism drawn card. 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. Chapter 0[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 are to:

- Limit the negative impacts associated with rapid increase in population including infrastructure pressures and impacts to the community fabric; and
- Maximise the potential positive impacts of the project on the population and community through educational and professional development and local investment.

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, Operation and Decommissioning

The number of households that will be directly impacted or may need to be relocated is approximately 12 households at the mine site.
The GoTL is responsible for undertaking resettlement for those families whose homes and farmland are directly affected by the Limestone Mine construction and operation. TL Cement is working with the GoTL to address resettlement by a separate process to the EIS. According to the impact significance framework, this impact is ‘Medium’ to ‘High’.

9.26.4 Mitigation Measures

The GoTL is responsible for undertaking resettlement for those families whose homes and farmland are directly affected by the Limestone Mine construction and operation. TL Cement is working with the GoTL to address resettlement by a separate process to the EIS.

The mitigation measures to be implemented by the GoTL are not applicable in the context of this EIS. Infrastructure development strategy to be developed and implemented in consultation with the local, regional and national ministry responsible for the development of supporting infrastructure to cope with population influx e.g. healthcare, transport, water supply, housing and waste management.

9.26.5 Monitoring and Reporting

The impacts on the community are to be monitored and managed through the Complaints and Grievance Mechanism.

9.27 Community Health

The following section provides a brief overview of the potential impacts and mitigation measures associated with community health. Chapter 0 [Social Impact and Economic Assessment] provides greater detail on the potential impacts relating 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: family registration; nutrition assistance and child health promotion; maternal health and family spacing; hygiene, sanitation and malaria prevention; ambulatory primary care; and health promotion activities. (Human Resources for Health Country Profile Timor-Leste. Ministry of Health. 2012; SISCA Guidelines, Dr. Nelson Martins PhD).
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 phases of the project:

- Increase in the number of respiratory ailments such as tuberculosis 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 TL Cement will commit to a number of health care initiatives and programmes, as outline in Mitigation Section 9.27.4 below.

The significance framework 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 significance framework 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:
• Determine the requirement for and prioritisation of building health clinics, hospital upgrades and expansion, expanded and improved training capacity, improved health communications and improved ambulance / transport in the local health sector;

• Facilitate education and awareness programs throughout the lifespan of the project;

• Design roads and implement driver training to improve traffic safety. More specifically, the main trunk roads and the roads around the project.

• Upgrading and providing the project roads with all-weather, 24 hr capability.

• 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; 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, communities near the project facilities, risk groups (e.g. commercial sex workers and truck drivers)
  − Prevention, voluntary counselling for HIV testing, as well as anti-retroviral treatment for employees and surrounding communities (Holtec, 2015a);

• 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);

• Within the overall GOTL Management Framework for the region, TLC to assist partially through its CSR activities, to identify 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 (Holtec, 2015a);

• Collaboration with local health authorities and other relevant stakeholders to develop an integrated mosquito control strategy, which may also include:
  − Awareness training and campaigns to inform employees of symptoms and treatment available for workers;
  − Elimination of potential breeding habitat for mosquito larvae, such as pools of unusable standing water on project site;
  − Spraying residual insecticide to walls of living quarters of employees within the camp;
9.27.5 Monitoring and Reporting

Pre-construction, Construction and Operation

The impacts on the community are to be monitored and managed through the operation of the Grievance Committee and regular stakeholder consultation events.

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;
- 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

- The impacts on the community are to be monitored and managed through the operation of the Grievance Committee and regular stakeholder consultation events.

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. Chapters 0 and 11 [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:

- Maintain the integrity and sustainability of the existing facilities especially due to influx of workers from outside of local region.
- Minimise potential impacts and disturbances to facilities especially during their scheduled operation hours.

9.28.2 Applicable Standards and Legislation

The following legislation is applicable 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 and Construction

The potential impacts of the pre-construction and construction activities associated with the limestone mine on institutions, school and health facilities are:

- Constant movement of vehicle from Baucau along the Caisido road will increase dust ($PM_{10}$ & $PM_{2.5}$) 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, the Church and the health clinic in Caisido.
- Increased of noise level due to movement of manpower, earth moving and vegetation clearing activities, use of construction equipment and civil and mechanical construction will affect activities at St. Francis of Assisi Primary School, the Village Hall, the Church and a health clinic in Caisido.
- Continuous noise impact on facilities and habitation near the mining area resulting from night-time construction at the quarry.
- Air-blast noise impact on facilities and habitation near the mining area resulting from blasting at the quarry during construction.
- Increased pressure on healthcare and education infrastructure due to project related influx.
Operation

- Increased noise level from the equipment used including noise from blasting 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.
- Safety impacts to local communities and other road users due to increased road accident.

Decommissioning

- Decommissioning of the infrastructure will involve dismantling and removal of certain equipment which may produce noise.

9.28.4 Mitigation Measures

Pre-construction and Construction

- 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.
- Green Belt/plantation will be developed around the mining activity area and along haul roads as the plantation minimizes propagation of noise (Holtec, 2015a).
- Where required, noise barriers can be constructed to abate the noise impacts.
- Construction phase blasting at the quarry proposed in afternoon hours during 1:00 pm to 2:00 pm (Holtec, 2015a).

Operation

- 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.
- Construction activities in the quarry to be planned during day time hours i.e. from 7:00 am to 7:00 pm.
- Construction phase blasting at the quarry proposed in afternoon hours during 1:00 pm to 2:00 pm (Holtec, 2015a).
- Possibility of use of surface miner shall be explored to avoid blasting (Holtec, 2015a).
Decommissioning

- Noise barriers can be constructed to abate the noise impacts during dismantling and removal of certain equipment.

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 0 provides greater detail on the potential impacts relating 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 as a part of resettlement plan.
- 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 Leaderships and Their Election
- Parliamentary Law 11/2009, Territorial Administrative Division

9.29.3 Impact Assessment

Pre-construction, Construction, Operation and Decommissioning

The acquisition of land for the Limestone Mine and the construction of roads to the mine area potentially cause impacts on the community and family structure in the form of:
1. Conflicts over the status of land (i.e. private owned or state owned);
2. Conflicts over land acquisition systems and process/values;
3. Impacts to household subsistence and ability to generate income;
4. Conflicts over the dismantling of graves and customary/traditional ritual houses; and
5. 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 12 households at the mine site.

According to the impact significance framework, this impact is ‘Medium’ to ‘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. Chapter 0 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 the management of land ownerships 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 5.14 [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 are 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).

All of these factors may also contribute to potential conflicts with the land as TL Cement negotiate with landowners and determine appropriate prices/value and the type or model of compensation.

Another major issue is the choice of compensation. Generally, land acquisition involves the outright sale of land, which suits the preference of most project investors. However, this may not be the most suitable for the subsistence communities, as the money is suddenly injected into a subsistence economy it is likely to be squandered in consumptive pursuits, leading to more problems as locals become trapped in a position even more uncertain as they have lost their original source of livelihood (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 significance framework determines the potential impacts associated with land ownership and land rights during the pre-construction phase is considered to be ‘Medium’ to ‘High’. The implementation of the Resettlement Plan by the GOTL and ongoing stakeholder and community consultation has the potential to mitigate this impact, resulting in a ‘Medium’ level of residual impact.

**Construction and Operation**

The majority of the impacts on land ownership 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 significance framework determines the potential impacts on land ownership and land rights during construction and operation to be ‘Medium’ to ‘High’.
The implementation of the Resettlement Plan by the GOTL and ongoing stakeholder and community consultation has the potential to mitigate this impact, resulting in a 'Medium' level of residual impact.
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 significance framework determines the potential impacts on land ownership and land rights during decommissioning to be ‘Low’.

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

Natural resources rights pertain to the use of the natural resources by the community through agriculture and collection of wood from the forest.

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 as a part of resettlement plan.
- Minimize potential impacts on the surrounding environment
- Use local knowledge or traditional norms (Tara Bandu) relating to resources exploitation and ritual rite.

9.31.2 Applicable Standards and Legislation

- 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)
• Draft Expropriation Law;
• United Nations Convention to Combat Desertification;
• Decree Law 6/2004 on General Bases of the Legal Regime for Fisheries and Aquaculture
  Management and Regulation (amended by Decree Law 4/2005);
• IFC’s Performance Standard on Environment and Social Sustainability 2012.

9.31.3 Impact assessment

Pre-construction, Construction, Operation and Decommissioning

As detailed in Section 5.14 [Existing Environment], the use of the area of the Limestone Mine 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 should be implemented for the pre-construction and construction
phases 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.
• Site clearing to be conducted sequentially.
• Prior to site entry all vehicles, plant and equipment should be cleaned down and inspected to
  reduce the likelihood of spreading weeds.

Operation

• The mining area will be off-limits during operation. No further mitigation measures apply.

Decommissioning

• Implement the Mine Closure Plan taking into account Natural Resources Rights.

9.31.5 Monitoring and reporting

No specific monitoring requirements have been identified for Natural Resources rights, however the
EMP details monitoring measures the natural environment including water resources, air quality and
noise.
9.32    Cultural Heritage, Archaeological and Sacred Sites

9.32.1    Management Objectives

- Minimise the number of recorded heritage sites which are directly impacted by the project and will no longer be present in that location once the project commences
- Ensure that the management of the relocation of known sites is undertaken in accordance with best practice standards
- Ensure transparency and consultation occurs in relation to the required impacts on known heritage sites in the project area

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
- World Bank Operational Policy 4.11 Physical Cultural Resources

9.32.3    Impact Assessment

There are a number of heritage sites within the Limestone Mine area; namely:

- 6 sacred heritage;
- 1 sacred and religious architectural;
- 3 religious architectural;
- 2 civil architectural; and
- 6 archaeological (Oliveira, 2015).

Impact on these sites cannot be avoided within the current mine plan and the relocation of these sites should be effected in consultation with the local community and their leaders.

The cultural heritage sites have been assessed in the context of their international, national, local and family significance; and of the 18 sites to be impacted above, two are nationally significant (2 civil architectural, Old Portuguese Road).

Impacts of the mine on Cultural Heritage are considered to be significant with a number of sacred heritage sites being directly and permanently impacted by clearing and excavation activities. Because the sites which are impacted are locally or at family-level of importance, the significance framework determines the potential impacts on Cultural Heritage are 'Medium'.

There are sites situated on the boundary of the mine site namely:

- 4 sacred heritage;
- 1 religious architectural;
- 2 civil architectural;
- 1 traditional architectural;
- 8 archaeological; and
- 1 archaeological and sacred heritage (Oliveira, 2015).

Access to the sites during the life of the project should 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 should be fenced off, access restricted for the project life or relocated.

9.32.4 Mitigation Measures

Pre-construction and Construction

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.

For sites located within the mine area that will be directly impacted the following types of mitigation should be implemented:

- Ceremonial platforms or altars should be properly document and eventually removed to a different location;
- Burial sites must be properly documented, excavated and relocated to an agreed upon site; and
- Archaeological sites must be test excavated. It should be noted that as a mitigation measure, it is very difficult to predict the results of test excavation or how long the excavation may last for. Therefore, it is recommended that all test excavation commence in the pre-construction phase (Oliveira, 2015).

All archaeological excavations within or adjacent to the study area should be authorised by the State Secretariat of Tourism, Art and Culture and undertaken by a team of professional archaeologists (Oliveira, 2015).
The exhumation and relocation of any burial site within or adjacent to the project site should be carried out by a qualified forensic anthropologist or by a professional archaeologist with certified experience in excavation of human remains (Oliveira, 2015).

**Operation**

For sites that will not be directly impacted during the construction and operation of the project, access to the sites during the life of the project should 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 should 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 should 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 construction and operations land clearing activities should be monitored by a responsible person appointed to verify that the relocation or heritage site impact activities are being carried out in accordance with the proposed mitigation measures.

The compliance with the mitigation measures shall be reported in the annual environmental report submitted to the regulator.
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 area 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, Lialaielse, 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 sweer 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 sitesTenure 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, Lialaleso, 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</th>
<th>Lialailesi</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>120 200</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 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.

**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 (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.

## 10.3 Recommendations

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.”

10.4 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
10.5 Purpose and Objectives

The Social Impact Assessment (SIA) 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 undertaken with the following activities:

- Preliminary observation : 5th – 9th May 2015
- Ethnographic study : 20th May – 2nd June 2015 (This ethnographic study was conducted by two anthropologists)

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 village. This comparison was meant to figure out the 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 (especially productive age groups). For the purpose of analyzing impacts upon the villages that may incur indirect impacts from
the project, the old but easily available data from the 2010 census can still be used to obtain a general idea of the number of working-age residents, levels of education among family members, the numbers of employed and unemployed residents, the number of vulnerable households, and other relevant data.

Other important secondary data include demographic records at the hamlet or aldeia level, which was obtained from family cards. These cards contained data about the names, age, education, and occupation of all family members, whether male or female. Unfortunately, most hamlets within the project’s likely impact area did not have such an extensive record of family cards as the one found in the Tirilolo Village. Although complete demographic records in the form of family cards were only available in Tirilolo, it is possible to describe the pattern of occupation and education levels among village households in the project’s likely impact area with the use of the demographic picture obtained from the two aldeia groups of Tirilolo Village (two aldeia at the center of Baucau City) and four aldeia in rural areas (Caisido).

Another secondary data source that provides information similar to the demographic data in family cards was monthly reports from the 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. The monthly reports recorded the number of visits and the number and type of medical complaints reported by the visitors, categorized by age group. This data is very important since it correlates with the socio-economic condition of the local population’s residential environment.

10.6 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;
f) Impact consequences with and without the project;

10.7 Description of the Socio-Cultural, Institutional, Historical and Political Context

10.7.1 Study Area

The area is traditionally known as the Caisido region, consisting of the Parlemento, Caisido, Lialaileso, 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 clinker cement project is administratively located in Suco Tirilolo, Baucau Subdistrict. The Limestone Mine site is located within the Osso-ua aldeia. Access roads to the Osso-ua aldeia pass through the Parlemento, Caisido, and Lialaileso aldeia. All four aldeia comprise a region within Suco Tirilolo historically known as Caisido. The Limestone Mine site is 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 approx. 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.

10.7.2 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 Waikeke (west) and finally to Baucau. Immigrants from Waihaloi are dominated by the Da Costa group. The first destination at Waikeke 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 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 area 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.

10.7.3 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 (Timor Leste). 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.

10.7.4 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 mine and 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/second 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 Secretariate on Electricity (Secretario Du Estado Elekritisidade).

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 Parlamento 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.
10.7.5 Institutes of Authority

The Baucau District 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.

10.7.5.1 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 bairo 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 bairo. 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 and is further divided into several suco. As the intermediate institution between the district and the suco, the sub-district 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 plant 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 chieftain at the suco level (lia nain) (BBS, 2015d).

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.

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) do these staff perform their office at the suco’s administrative center? 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 (see Appendix 8). 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 suspicons 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.

10.7.6 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 37). 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 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.

Table 37: 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>Caiaada 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.

10.7.7 Marriage System and the Debt of Exchange

It has been explained above that the basic social structure of the Caisido communities (the aldeias Parlamento, 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 with 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)
10.7.8 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, 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.

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 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).

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.

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.

10.7.9 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.
10.8 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;
- 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 Limestone Mine in the area.

b) The community and youth in Caisido (38 traditional houses), will not impede the progress towards the development of the Limestone Mine and will be working with the GoTL 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 cement factory 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 a 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
• 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."

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:

− 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, Lialailea, 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:

− The planned 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;
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.

10.8.1 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?

10.9 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:

- Impact due to project pre-construction
- Impact due to project construction
- Impact due to project 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.

10.9.1 Pre Construction Phase

The major activities in the pre-construction phase are the acquisition of land for the mine and 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.
- Potential damage to household subsistence condition

10.9.1.1 Potential Positive Impacts

1. High Expectations among the Local People

The plans for the construction of a cement factory 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).

10.9.1.2 PRIMARY POTENTIAL NEGATIVE IMPACTS

1. Conflict over the Status of Land

The required amount of land for limestone extraction is around 541 ha, while the requirements for the clay site, access roads, processing plant, additional facilities, and the jetty have not been fully calculated. 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. However, this may not be suitable for the subsistence landscape of the Caisido communities, since the money suddenly injected into a subsistence economy is likely to end up being squandered in consumptive pursuits. This would lead to more problems as the local people become trapped in a position of even more uncertain livelihood than before since they have lost their original source of livelihood. This tendency would have a particularly pronounced effect upon vulnerable groups. Compensation through cash payments could lead to potential follow-on impacts such as the proliferation of impoverished households, reduced environmental quality, the perpetuation of substandard housing.

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 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 rute 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.

3. Resettlement

The construction of a cement factory would require the resettlement of 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. Resettlement 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 lain) 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 that the GoTL negotiators should be willing to engage in multiple and repeated consultation sessions.

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.

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 cement industry 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.

**10.9.1.3 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 such as an NGO or the Church.

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 factory, 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 12 households in the vicinity of the mine site and 3 households near the 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.

10.9.2 Construction Phase

10.9.2.1 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 cement industry are estimated to require a peak number of around 1000 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, in our opinion, 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.

10.9.2.2 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 prove to future project employees.

Field productivity can be increased in two ways, namely with the more extensive planting of marketable crops, improved irrigation system and the introduction of fertilizers. These two 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 traditional 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.

10.9.2.3 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.

Based on our experiences and 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. In our opinion, 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 nonrepeatable since similar opportunities would not always be available. The potential negative impacts from improper management can be put under control to prevent their perpetuation.

In our opinion, 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 makes 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.

10.9.2.4 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, we predict 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 cement industry 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 prudeful 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.

10.9.3 Operations Phase

10.9.3.1 Primary Potential Positive Impact

1. 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.

10.9.3.2 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 cement industry. 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.

**10.9.3.3 PRIMARY POTENTIAL NEGATIVE IMPACTS**

1. **Potential Conflict over Employee Recruitment and the Distribution of Opportunities**

During the consultative meetings, the sucos outside the project area 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 in the cement industry/factory 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

10.9.3.4 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 (Corporate Social Responsibility) 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 project’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 cement industry 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 mine and plant site 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, there is a risk that dust (PM10) concentrations will exceed the acceptable standards, however the dispersed only around the Plant or Mine Site where the operation phase is undertaken to the North West Direction.

Higher concentration of theses pollutant 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 sugessted to provide buffer zone or green belt around plant site and/or mine site. Moreover, for safety reason, it is necessary to re-develop the settlement near the 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.

10.10 Strategy to Achieve Social Development Outcomes

Table 38 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 38: Summary of Proposed Impact Mitigation Measures

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Proposed Mitigation Measures</th>
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<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>
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<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>
<td>Establishment of a labor recruitment institution</td>
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<td>Recruitment of workers and distribution of employment opportunities</td>
<td>Establishment of a regional development board</td>
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<td>Loss of women's bargaining power</td>
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<td>Dependence upon cash income in household economic subsistence systems</td>
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<td>Transformation of traditional agriculture and the promotion of regional development</td>
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10.10.1 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 productiviy 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 cement industry 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;
- The establishment of a regional economy board;
- Empowerment of women's role in agricultural production (ricefields and gardens/orchards);
- 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 cement industry 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;
- 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.
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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 and in Osso-Ua 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 Status

The Caisido people in Tirilolo (Aldeia Parlemento, Caisido, Lialaleso and Osso-Ua) distinguish various types of land according to their status and usage.

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 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.

11.1.2 Land use

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

11.1.2.1 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 Vemasse 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 Vemasse 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 Vemasse, 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.

11.1.2.2 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.

11.1.2.3 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 x 50 m or 50 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. We do not study this matter in detail in this study since it is deemed irrelevant for a social assessment. 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.

11.1.2.4 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.

11.1.3 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.

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 to 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.

11.1.4 Animal Husbandry

Animal husbandry is one of the traditional sectors in the livelihood of the Caicido 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 39 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 39: Livestock table and ownership

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Caisido</th>
<th>Lialaileso</th>
<th>Parlemento</th>
<th>Osso-Ua</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Total</td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Family</td>
<td>Owner</td>
<td>Animal</td>
<td>Owner</td>
</tr>
<tr>
<td>Goat</td>
<td>120</td>
<td>110</td>
<td>90</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>250</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Sheep</td>
<td>100</td>
<td>115</td>
<td>90</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>230</td>
<td>120</td>
<td>150</td>
</tr>
<tr>
<td>Horse</td>
<td>15</td>
<td>11</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>36</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Cow/Buffa</td>
<td>8</td>
<td>17</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>60</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Pig</td>
<td>180</td>
<td>129</td>
<td>118</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>160</td>
<td>230</td>
<td>260</td>
</tr>
<tr>
<td>Chicken</td>
<td>182</td>
<td>180</td>
<td>118</td>
<td>238</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>360</td>
<td>230</td>
<td>260</td>
</tr>
</tbody>
</table>

Source: Tabulation Form Suco Tirilolo 2015

11.1.4.1 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.

11.1.4.2 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.

11.1.4.3 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.
11.1.4.4 Buffalo

Are the most valuable type of livestock and also very important in traditional religious rituals as well as belis contributions. Buffalo 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).

11.1.5 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 50-75 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.

11.1.6 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 lianain. 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 broker, but neglected to mention it for unknown reasons.

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Apart from these mercantile activites, 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 (Table 40), categorized by the type of main staple crop:

Table 40: Garden and Orchard Production for Subsistence Needs in Caisido

<table>
<thead>
<tr>
<th></th>
<th>Case Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Total Garden (pagar)</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>
</tbody>
</table>
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 10kg can depend whether the nuts have been peeled or not, meanwhile, in scarcer times
groundnuts can sell for as much as $30 - $40 per 10kg 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.

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 25kg 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.

The livestock and crop prices at the time of this EIS are presented in Table 41 (BBS, 2015d).

**Table 41: 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>Unit Name</td>
<td>Price</td>
<td>Unit</td>
<td>Note</td>
</tr>
<tr>
<td>--------------</td>
<td>---------</td>
<td>------------</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>1³ m or 40 pieces firewood with 2 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 10kg</td>
<td></td>
</tr>
<tr>
<td>White Jati/Philiphina’s Jati</td>
<td>$100</td>
<td>1m³</td>
<td></td>
</tr>
</tbody>
</table>

Note: Rice’s price for 1 sack (25kg) equal $12-$15.

11.4 Economic analysis of impacts

The Economic assessment of the key environmental impacts is qualitatively described in Table 42. 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.

This EIS and EMP should be read in conjunction with the document, Baucau Cement Plant, Jetty and Associated Infrastructure EIS and EMP. Under the instructions of the Director of the NDCEPI, the project environmental impact statements were separated into two separate EIS and EMP’s i.e. Baucau Cement Plant & Jetty and Associated Infrastructure; and Limestone Mine. This EIS and EMP is a component of the entire project and each component cannot be implemented without the other. Where impacts have been assessed, they are generally cumulative impacts of the entire operation which have been repeatedly documented in both of the Impact Assessments submitted. This is significant when understanding the approach to implementation of the EIS and EMP because the mitigation measures and monitoring actions as recommended in the EIS and EMP are applicable to the overall project impact. All mitigation measures are applicable to occur once, for the project as a whole; all monitoring events which are recommended are a single monitoring event, which has been duplicated in the two separate documents. Similarly, all reporting to the regulator and community are single reporting events.

The qualitative assessment of the cost of impact as presented below represents a single cost applicable to the overall project.

### Table 42: Qualitative assessment of the cost of environmental impacts (World Bank, 2003)

<table>
<thead>
<tr>
<th>Impact</th>
<th>Cost benefit</th>
<th>USD</th>
<th>Cost impact</th>
<th>USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearing of vegetation</td>
<td>Revegetation at the end of the project life will aim to improve the vegetation condition and cover compared to the pre-development case. Increase the economic value of forest / agriculture Reduction in weed infestation in the project area</td>
<td>$5/bundle firewood/person/day (Section 11.1.2.2)</td>
<td>Limestone Mine area used for livestock grazing 10 families (maximum) directly impacted by loss of native vegetation</td>
<td>Monitoring and weed eradication costs: $5.6M Fauna relocation and monitoring, re-introduction and elimination of pests: $670k Rehabilitation costs (Labour and materials): $?</td>
</tr>
<tr>
<td>Air quality and dust</td>
<td>30MW energy provided by CFB Technology which has a lower carbon footprint than a standard 30MW Coal fired</td>
<td>$? Equivalent cost of a 30MW fossil fuel power station Greenhouse Gas</td>
<td>Dust suppression techniques include water spraying and enclosing equipment</td>
<td>Dust suppression sprayer and labour: $? 2000/month</td>
</tr>
</tbody>
</table>
### Impact

<table>
<thead>
<tr>
<th>Impact</th>
<th>Cost benefit</th>
<th>USD</th>
<th>Cost impact</th>
<th>USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Plant</td>
<td>Emissions</td>
<td></td>
<td>Monitoring costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Potential increase in illness and health impacts to the local population</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Resettlement costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cost of illness and loss of productivity: $?</td>
<td></td>
</tr>
<tr>
<td>Noise</td>
<td></td>
<td></td>
<td>Noise limitation technology within strict global emissions criteria incorporated into engineering design at cost of USD$2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monitoring costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Potential increase in illness and health impacts to the local population</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Resettlement costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cost of illness and loss of productivity: $?</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></td>
<td>Monitoring costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cost of illness from lack of access to clean water: $?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cost of transporting water from other sources: ?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monitoring costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rehabilitation costs in the unlikely event of a spill event</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Spill and contamination mitigation measures incl. water separators and bund controls in the engineering design at cost of $?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Water Quality Monitoring costs: $1,4M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Water Quantity Monitoring costs: $970k</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rehabilitation costs in the event of a spill: $?</td>
<td></td>
</tr>
</tbody>
</table>

The economic value 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 impact from vegetation clearing and on heritage
3. Identification of key forest areas to be retained at the perimeter of the mining tenement to reduce the 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 approaches
5. Selection of the project implementation approach to ensure access to employment opportunities for the local people; and
6. Selection of the Best Available Technology (BAT) for electricity generation and water supply.

The Limestone Mine 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 Cement Plant and Limestone mine in Baucau, WorleyParsons mapped the project stakeholders. The list of identified stakeholder is summarized in Table 43.

Table 43: list of identified stakeholders for the Limestone Mine

<table>
<thead>
<tr>
<th>Governments</th>
</tr>
</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>
<tr>
<td>General Director for Environment</td>
</tr>
<tr>
<td>Nacional Director for Industries and Manufacturing</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Ministry of Petroleum and Mineral Resources</td>
</tr>
<tr>
<td>Minister of PMR</td>
</tr>
<tr>
<td>National Directorate of Minerals</td>
</tr>
<tr>
<td>Institute of Petroleum and Geology (IPG)</td>
</tr>
<tr>
<td>Ministry of Justice</td>
</tr>
<tr>
<td>Secretary of State for Land and Property</td>
</tr>
<tr>
<td>Ministry of Finance</td>
</tr>
<tr>
<td>Minister of Finance</td>
</tr>
<tr>
<td>Ministry of Planning and Strategic Investment</td>
</tr>
<tr>
<td>Minister of PSI</td>
</tr>
<tr>
<td>Ministry of Public Works, Transport and Communications</td>
</tr>
<tr>
<td>Minister of PWTC</td>
</tr>
<tr>
<td>Directorate of Ports/APORTIL</td>
</tr>
<tr>
<td>National Directorate for Water Quality and Control</td>
</tr>
<tr>
<td>Ministry of Tourism, Arts and Culture</td>
</tr>
<tr>
<td>Secretary of State for Arts and Culture</td>
</tr>
<tr>
<td>Secretary of State for Employment Policy and Vocational Training</td>
</tr>
<tr>
<td>Secretary of State for EPVT</td>
</tr>
</tbody>
</table>

**Municipality (District) Government**

<table>
<thead>
<tr>
<th>Baucau Municipality (formerly Baucau District Administration)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baucau Administrative Post (formerly Baucau Sub-District Administration)</td>
</tr>
<tr>
<td>PNTL Baucau Municipality</td>
</tr>
<tr>
<td>PNTL Baucau Administrative Post</td>
</tr>
<tr>
<td>BOP Baucau Municipality</td>
</tr>
<tr>
<td>F-FDTL Baucau Municipality</td>
</tr>
<tr>
<td>Baucau Municipality Directorate of Land, Property and Cadastral Services</td>
</tr>
<tr>
<td>Baucau Municipality Directorate of Pollution Control and Environmental Impact</td>
</tr>
<tr>
<td>Baucau Municipality Health Directorate</td>
</tr>
<tr>
<td>Baucau Municipality SEPFOPE</td>
</tr>
<tr>
<td>Local Government</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
</tr>
<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>
</tr>
<tr>
<td>Baucau Municipality Electricity Directorate</td>
</tr>
</tbody>
</table>

Local Government

| Suco Council Tirilolo                           |
| Suco Council Triloca                           |
| Suco Council Caibada                           |
| Suco Council Bahu,                             |
| Suco Council Bucoli                            |

Local Community

| Chefes de Aldeia                               |
| Lia’nain                                       |
| Local Youth Organizations                      |
| Local Women’s Organizations                    |
| Local Fishermen’s Organization                 |
| Baucau Parish – Old Town                       |
| Baucau Parish – New Town                       |
| Baucau Bishop                                  |

Civil Society/Local NGOs

| La’o Hamutuk                                   |
| Luta Hamutuk                                   |
| Haburas                                       |
| Rede ba Rai                                    |
| Belun                                         |
| Kapeliwa (Local NGO)                           |

Other Organizations
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 through local radio stations such as Radio Popular Coulelemal Bucoli and Radio Komunidade Lian Matebian in Baucau commencing on the 27th of November to 4th of 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 SEPFOPE Directorate
- Tirilolo Suco Hall

The document was made available for viewing during normal business hours and made available free of charge.

A copy of the document was made available at a local school, church, or other public facility near the proposed project and available outside of normal work hours.

The document was also posted on TL Cement’s public website at http://www.tlcement.net/.
13.3 Summary of Consultation Activities

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 2 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.

![Figure 2: WorleyParsons Staff meeting local Lia-Nain](image)

13.3.2 Meeting Survey Team

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 3.

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)
• 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 9.

Figure 3: Community representatives meet survey team members

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 10) was distributed to be 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 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.
13.3.4 Consultation of draft TOR

On the 3rd September 2015, a public consultation 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 5 below.
Figure 5: Member of governments and local communities attended public consultation on draft TOR, held by TL Cement and WPTL

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 would respect 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. Translator was available to translate presentations and consultation sessions.

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. 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 or WorleyParsons representatives. All questions and responses were recorded.

A record of the meeting has been included in the EIS, including attendance registers and all comments and opinions given by any member 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 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.

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 and the GOTL will then initiate discussions with those affected households and property owners through a Resettlement Plan.

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 44 show 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 managing director of TL Cement, James Rhee and WorleyParsons’ representatives.

Table 44: 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>2</td>
<td>Jaime (school teacher), Suco Parlamento; Deonisio Belo,</td>
<td>James Rhee</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></td>
<td>Suco Trilolo; 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?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TL Cement respects all cultural heritages including evidence of ancient human habitation found within the project site. TL Cement will work with the community and the Secretariat of Arts and Culture to conduct procedures and/or traditional rituals required relocating sacred site and/or tombs including the management and protection of new and known sites during the project life. 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?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water requirement for mining and plant operation is to</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>Will the amount withdraw from the well affect the spring located in Osso-ua?</td>
<td>be abstracted from groundwater through the drilling of borewells at the Uaidei River. 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 Osso-Ua Spring.</td>
</tr>
<tr>
<td>7</td>
<td>Has the company identified properties that may be found within the project site? What will be the negotiation regarding these properties?</td>
<td>TL Cement is currently working with the Directorate of Land, Property and Cadastral Services (DLPCS) (GoTL) to map affected households, farmland, and other property. Once TL Cement has secured the mining and environmental licenses required for the project, the GoTL will enter into discussions with those affected households and property owners.</td>
</tr>
<tr>
<td>8</td>
<td>If the properties (Farm land, house etc) are taken by the company, will there be compensation to the owners?</td>
<td>Yes.</td>
</tr>
<tr>
<td>9</td>
<td>Recommendation: Cement must be produced in Timor-Leste. No clinker to be transported to Australia.</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>10</td>
<td>What will be the salary range for local worker? Will the local get pension?</td>
<td>TL Cement is competing with Indonesia and Vietnam in 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>11</td>
<td>Recommendation: Management plan for local reservoir/spring so to avoid waste water contamination from the plant.</td>
<td>Noted</td>
</tr>
<tr>
<td>11</td>
<td>It is mentioned that traffic will increase from 3 to 71 passenger cars in a day during construction and</td>
<td>Dust suppression using water.</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>12</td>
<td>Ricardo Belo, Chief of Village (Chefe Suco)</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>What will be the mitigation measure towards dust caused by this high traffic?</td>
<td></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 accordance with a Waste Management Plan.</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>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>
<tr>
<td>17</td>
<td>Thomas Freitas, Administrative Post of Vemasse</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>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.</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>18</td>
<td>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>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>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</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>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</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>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</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>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</td>
<td>James Rhee</td>
</tr>
<tr>
<td></td>
<td>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, eg. Documenting impact of cash compensation on Suai population especially for women. 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, eg. 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 eg, 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 on draft EIS

Figure 6: Preparation for consultation by WPTL and TL Cement teams
Figure 7: Traditional welcome ceremony
Figure 8: Community Leader attendees

Figure 9: Presentation by WPTL and TL Cement
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.
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 Limestone Mine and the results required careful analysis and interpretation to determine the impacts from the Limestone Mine;
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. The 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. Key documents are recommended for development and implementation to address the concerns associated with relocation and compensation.

The impact of clearing and construction on the cultural heritage of the Limestone Mine site is to be mitigated through appropriate strategies and procedures in place to relocate or remove sites prior to construction.

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 mine site.

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 Limestone Mine are readily mitigated and can be managed through the implementation of a robust Environmental Management Plan (EMP) and ongoing stakeholder consultation.
16 NON TECHNICAL SUMMARY

A Non Technical Summary used in the Public Consultation in December 2015, which provides a comprehensive, plain and simple overview of the project EIS is included in the section which follows.
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 overall 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).

16.1.1 Purpose of this document

This document is a Non-Technical Summary (NTS) of the EIS for the Limestone Mine. 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.

16.1.2 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 11: Location of Baucau Cement Project limestone mine
16.1.3 Key project characteristics

The key project characteristics are listed in Table 45.

Table 45: Summary of Baucau Cement Project Characteristics

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project life</td>
<td>Limestone reserves for 50 years at full production capacity</td>
</tr>
<tr>
<td>Investment</td>
<td>$400 million USD</td>
</tr>
<tr>
<td></td>
<td>Largest industrial project undertaken in Timor-Leste to date</td>
</tr>
<tr>
<td>List of major project components</td>
<td>Limestone mine (up to 5.76 km²)</td>
</tr>
<tr>
<td>Area of disturbance</td>
<td>Limestone mine – 244 ha</td>
</tr>
<tr>
<td>Power Supply</td>
<td>30 Mega Watt Biomes and Recycle Power Generation power plant</td>
</tr>
<tr>
<td></td>
<td>3-5 Mega Watt Solar Power Plant</td>
</tr>
<tr>
<td>Water Supply</td>
<td>Groundwater from borewells at the Uaidei River</td>
</tr>
<tr>
<td></td>
<td>• 0.35 ML/day for construction</td>
</tr>
<tr>
<td></td>
<td>• 3.15 ML/day for operation</td>
</tr>
<tr>
<td>Number of jobs of all project components</td>
<td>3000 jobs during peak of construction</td>
</tr>
<tr>
<td></td>
<td>1000 permanent jobs during operations</td>
</tr>
</tbody>
</table>

16.1.4 Operations

When in operation, limestone will be mined from the ground in an open pit and 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. 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 12.
Figure 12: The Baucau Cement Plant Project once in operation
16.2 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 46. 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 16.3, along with identified mitigation measures to manage and reduce the impacts.
### Table 46: 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>
</table>
| **Pre-construction**           | • Clearing of fence lines & Installing fences  
                                  • Clearing of access roads internal to the project area  
                                  • Establishment of Laydown areas and preliminary office infrastructure such as portable toilets and shipping containers for storage  
                                  • Relocation of people and animals within the project area  
                                  • Exploratory water source drilling and installation of water supply wells.  
                                  • Installation of power supply infrastructure corridors via clearing, excavation and pegging  
                                  • Geological studies including bore drilling and pit surveys  
                                  • Weir installation in streams  
                                  • Establishment of exclusion zones around, boreholes and springs (known impact, appropriation of natural asset)  | • Clearing of natural vegetation (Low)  
                                  • Displacement of people (High)  
                                  • Exclusion of people from, boreholes and springs (Low)  
                                  • Increased traffic and transport (Low)  
                                  • Increased noise and increase in air pollution (Low)  
                                  • Disturbance of heritage sites (Low)  
                                  • Increased groundwater usage (Low)  
                                  • Disturbance of cultural heritage at the mine site (High)  |
| **Construction**               | • Building structures in concrete and steel  
                                  • Establishment of bunds, hauling roads, drainage areas and mine stope markers ahead of mining commencing  | • Clearing of natural vegetation (Low)  
                                  • Displacement of people (High)  |
| **(Duration of approximately 2 years)** |                                                                                               |                                                                                         |
| **(Duration of approximately 18 months)** |                                                                                               |                                                                                         |
| Construction of internal access roads and haul roads | Visual impact (High) |
| Discharge into landfill – solid and liquid waste | Increased noise, increased air pollution (Low) |
| | Increased traffic and transport (Low) |
| | Increased light and heavy vehicle interaction with pedestrians and motorbikes (Medium) |
| | Increased groundwater usage (Low) |
| | Increase in waste (Low) |
| | Clearing of coral (Low) |

**Operation**

*Duration of approximately 35-50 years*

- Mining 12 hours a day, 7 days a week
- Blasting
- Truck hauling
- Discharge to landfill – solid waste

- Increased traffic and transport (Medium)
- Increased noise, increased air pollution (Low)
- Disturbance to community from blasting (Medium)
- Increased light and heavy vehicle interaction with pedestrians and motorbikes (Medium)
### De-Commissioning

(Duration of approximately 5 years)

- Mine Closure and Rehabilitation

| | • 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 |
16.3 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 47 below.
Table 47: Key Potential Impacts, Mitigation Measures and Monitoring and Reporting

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement / Resettlement</td>
<td>Local people will be displaced and will require relocation in order for this project land to be acquired.</td>
</tr>
<tr>
<td></td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>This can cause a Medium to High level of impact on local people.</td>
</tr>
<tr>
<td>Cultural Heritage</td>
<td>A Cultural Heritage Management Plan will be prepared 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.</td>
</tr>
<tr>
<td></td>
<td>Access to the sites during the life of the project should be considered in the context of...</td>
</tr>
<tr>
<td>Aspect</td>
<td>Mitigation Measures</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>permanently impacted causing a Medium impact.</td>
<td>the importance of the sites to the local community and the broader Timorese culture.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>Traffic</td>
<td>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:</td>
</tr>
<tr>
<td></td>
<td>- 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</td>
</tr>
<tr>
<td></td>
<td>- 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.</td>
</tr>
<tr>
<td></td>
<td>- Traffic signage – all traffic signage should be clearly and prominently displayed in well-lit areas. Signage should be posted to indicate speed limits, restricted</td>
</tr>
</tbody>
</table>

An increase in heavy vehicle numbers and movements is likely to cause damage to the condition of the local road network and also poses a Moderate safety risk for the local road.
### Aspect

users and pedestrians.

#### Mitigation Measures

- access, visitor parking, headroom, and other route hazards.
  - Speed limits should 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).
  - Limit vehicle idling time and keep vehicles well maintained to minimise particulate and gaseous emissions (Holtec, 2015a).
  - Where appropriate, pedestrian crossing points should be provided in the mist visible and obvious pedestrian routes. The crossing points should be appropriately sign posted.
  - Regular review, maintenance and repair of road pavement and drainage should be undertaken.
  - A management plan for dealing with the health and safety implications for all vehicle incidents and recommending improvement should be developed and updated annually.

### Water

All water for the operation of the mine 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

<table>
<thead>
<tr>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation of a Groundwater Management Plan</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>Groundwater modelling for the water supply should be undertaken to determine</td>
</tr>
<tr>
<td>Aspect</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>Moderate.</td>
</tr>
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<td></td>
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</tr>
</tbody>
</table>
16.4 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 13, 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 13: Stakeholder Engagement and Consultation

The stakeholder consultation list to date is shown in Table 48.

Table 48: 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>
<tr>
<td>Ministry of Planning and Strategic Investment</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 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 non technical summary***************
17 REFERENCES


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