

**SIMPLIFIED ENVIRONMENTAL IMPACT STATEMENT
(SEIS) - BAUCAU MUNICIPAL CAPITAL
WATER SUPPLY PROJECT
(Updated)**



**THE DEMOCRATIC REPUBLIC OF TIMOR-LESTE -
THE MINISTRY OF PUBLIC WORKS**

**APRIL 2026
(UPDATED)**

Note:

The Simplified Environmental Impact Statement (SEIS) has been prepared by AdP Timor-Leste/ENGIDRO Engineering Solutions (as the Consultant consortium) for the Baucau Municipal Capital Water Supply and Sanitation Project in 2022 on behalf of and for exclusive use of the Government of the Democratic Republic of Timor-Leste, through the Ministry of Public Works and Be'e Timor-Leste in accordance with the legal requirements in effect in Timor-Leste. This work was undertaken based on the Contract RFP/039/MOP-2019 on Consulting Services for Detailed Engineering Design of Timor-Leste Four Municipal Capitals Water Supply and Sanitation Project. AdP/Engidro and its partner companies accept no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any third party, or any versions of said document, in any language other than English.

Subsequent to the changes in the project design to only focus in implementing the water supply component in Baucau municipal capital, including replacement of the spring water source and new/adjustment locations for water storage/distribution tanks, the SEIS has been updated ("this document") by the Project Management Unit (PMU) of the Ministry of Public Works in April 2026.

ACRONYMS AND ABBREVIATIONS

ADB	: Asian Development Bank
ACM	: Asbestos Containing Materials
ANLA	: <i>Agencia Nacional de Licenciamento Ambiental</i> (The National Agency for Environmental Licensing)
BTL	: <i>Bee Timor-Leste Empresa Publica</i>
CESMP	: Construction Environmental and Social Management Plan
CMD	: Cubic Meter Per Day
CFU	: Colony Formed Unit
DED	: Detailed Engineering Design
DMA	: District Metered area
DiMA	Dili Metropolitan Area
EHS	: Environment, Health and Safety
EMP	: Environmental Management Plan
ESF	: Environmental and Social Framework
ESS	: Environmental and Social Standards
GoTL	: Government of Timor-Leste
GMP	: Grievance Management Procedure
IBA	: International Bird Areas
IEE	: Initial Environmental Examination
IFC	: International Financial Cooperation
MCM	: Million Cubic Meter
MPW	: Ministry of Public Works
PMC	: Project Management Consultant
PMU	: Project Management Unit
PPE	: Personal Protective Equipment
SEIS	: Simplified Environmental Impact Statement
The Bank	: The World Bank
WHO	: World Health Organization
WTP	: Water Treatment Plant

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1 EXECUTIVE SUMMARY

1.1 Context and Justifications of the Project

Around 3,456 m³/day was supplied to the population for Baucau city of 24,358 people in 2020 through a total of transmission and distribution pipelines of approximately 70-km long. However, the water supply has not been able to meet the growing demand and good quality for the consumers, because the existing springs are not producing sufficient flow and the capacity of water storage tank is very small. On the other hand, national BTL as the water supply and sanitation company was only established in 2020 and has limited capacity and management system to operate the water supply system.

On the other hand, the existing distribution network is not quite integrated due to various old pipes built during the Indonesian occupancy combined with several NGO projects, leading to constant leakages. Issues of intermittent water supply and high incidence of illegal connections are part of the main issues, resulting in the water system is unable to adequately serve the Baucau population and revenue loss for the government. As of April 2026, the water supply system in Baucau has approximately 2,000 customers, comprising about 1,300 connections installed with water meter and 700 connections without water meters.

The Baucau Municipal Capital Water Supply Project (“the project”) is one of the four Municipal Capitals Water Supply Project (4MWSP) designed under the Master Plan of water supply and sanitation designed under the Master Plan for Baucau, Lautem, Viqueque and Manufahi municipal capitals under the Technical Assistance from Asian Development Bank (ADB) in 2016. Prior to this, the consultancy firm Aurecon (ADB, 2016), commissioned by the ADB to carry out the Technical Assistance (TA-8064) for the Second (2nd) District Capitals Water Supply Project (46160-001) and produce a demand responsive investment Masterplan to meet the water supply and sanitation needs of Timor-Leste’s urban populations in Baucau, Lospalos, Viqueque and Same Municipalities in line with the Timor-Leste Strategic Development Plan 2011 - 2030.

However, shortage of investment funds, skilled personnel, and inadequate operation and maintenance (O&M) budgets, hinders the municipalities from providing adequate, cost-effective water supply, even though the Decentralization Policy (2016) and the Statute of the Municipal Authorities (2016), establishing municipalities as an autonomous government institution with responsibility for these services, after a transition period. Therefore, implementation of the Baucau water supply project planned to start in 2027 is well justified (after cancellation in 2025), and it will be funded through the International Development Assistance loan administered by the World Bank.

The Ministry of Public Works (MPW) is responsible for planning, implementation, regulation, and monitoring of the project construction, and then handed over to Be’e Timor-Leste (BTL) of Baucau Municipality for operation and maintenance of the water supply system, scheduled for 2030/2031. The project will now focus in implementing the water supply component for the municipality with a replacement of one of the spring water sources, from Sirimanamana to Uaisarake, and replacement/adjustment of the water storage/distribution tanks site.

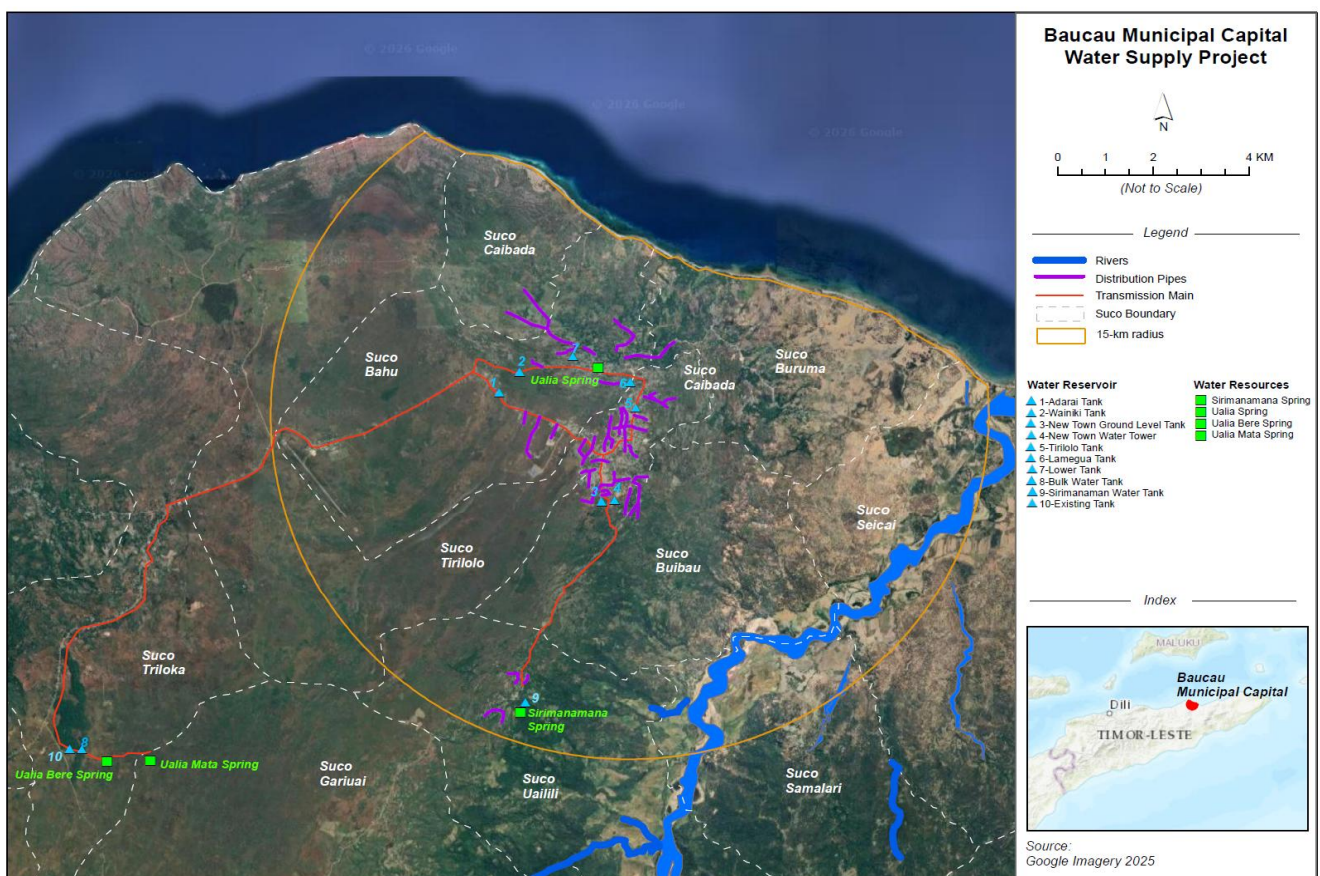
1.2 The Scope and Schedule of the Proposed Project

The scope and key components of the project are designed to include two components as follows:

- **Component 1: The Construction of the Centralized Water Supply System.** This component will be implemented to deliver a safely managed (potable) water supply of up to 90 liters per second (at the end of the project implementation by 2031) with the following scope of works:
 - Detailed engineering design (DED) updates and/or rehabilitations necessary to ensure the sustainability and climate resilience of the overall water supply system, including hydraulic modelling and infrastructure;
 - Rehabilitation of existing spring water intakes and construction of the new ones, covering Uailewa (currently used to supply water to Baucau), Uailia Mata, Uailia Bere, and Uaisarake springs and protecting the respective water sources;
 - Increase in storage tank capacity, including construction of bulk, ground-level and elevated water storage tanks, total 9 tanks.
 - Installation of water softener and chlorination facilities;
 - Construction of storage room and water quality laboratory including provision of associated analytical equipment;
 - Replacement and extension of the transmission mains and existing pumps, including installation of bulk meters and SCADA system; and
 - Replacement and extension of water distribution network, with household connections and micro-metering to serve 9 water distribution zones.

The project's coverage and main components are shown in the figure below.

Figure 1.1. Baucau Water Supply Project Coverage



- **Component 2: Project Supervision Consultant.** This component will include: Construction supervision works (including environmental and social safeguards, gender, and technical reporting; Part 2: Operation and Maintenance (O&M) Technical Assistance; DED modification and adjustment; and Sustainability Improvement Plan.

1.3 Environmental and Social Impact Assessment and other Studies

The MPW recognized its regulatory duty, as project proponent, as mandated in Decree Law No. 5/2011 on Environmental Licensing, to prepare the Simplified Environmental Impact Statement (SEIS) and Environmental Management Plan (EMP) following classification of the project as Category B. Following the evaluation of the SEIS and EMP, the environmental license of the project was granted by ANLA in October 2024. Further, the SEIS and EMP has been updated in April 2006 to align with the changes in the project scope described earlier. (Note: The current Environmental License will be expired in October 2026 and will need to be renewed prior to commencement of the construction.) In addition, field investigation and other studies that have been conducted for the project are summarized in the following table.

Table 1.1. Field Investigation and Design Conducted

Study/Field Investigation	Description Activities
Geological study in October 2021	Identify the local geology and geomorphology for Baucau Municipality as well as its geotechnical implications for the engineering design. The site investigation works have been done, however, very little information obtained, essentially concerning bibliographical data coming from diverse sources, namely <i>Instituto do Petróleo e Geologia</i> , investigation works and scientific papers.
Hydrogeological study in November 2021	Pumping tests have been conducted by the research team in the existing springs to estimate the hydraulic properties of aquifers to evaluate the well performance and identify aquifer boundaries. The test activity includes a field experiment in which a well is pumped at a controlled rate and water-level response is measured in one or more surrounding observation wells (control well) itself.
Topography survey In January 2021	A topographic survey was conducted for the proposed water tank sites along with associated access road to obtain the main physical features on the ground.
Water quality testing in October 2014, February - April 2018, and October - November 2021, and Mar - April 2026	The water quality testing was conducted as part of the initial environmental examination (IEE) document to meet ADB requirements. The other water quality testing for Uailewa Spring was conducted by the National Directorate for Sanitation and Water (now BTL) to detect any occurrence of water contamination for human consumption including analyses of physical, chemical and bacteriological analyses defined in the relevant WHO Standards.
Preliminary Engineering Design of Four Municipal Capitals Water Supply & Sanitation Project - Baucau City (March to Feb 2021) - ADB Technical Assistance	This preliminary engineering design provides a framework/scope for the detailed engineering design (DED), water sources and infrastructure locations, layouts and main characteristics of the proposed systems and reviews the water demands estimation; and provides a preliminary cost estimate of all infrastructures including different scenarios and options. In parallel, an initial environmental examination (IEE) document was prepared to meet the Safeguard Policy Statement (2009) of

Study/Field Investigation	Description Activities
	Asian Development Bank (ADB). This environmental assessment was conducted for the Baucau city water supply and sanitation project, based on the preliminary engineering design, and (ii) most likely environmentally sensitive components
Social baseline survey (June 2021)	<p>The main objectives of the mentioned survey were:</p> <ul style="list-style-type: none"> • To calculate the number of consumers that is currently and will be served with a water distribution system by 2040. The team has been referencing the 2015 Census and 2015 Masterplan for this analysis. • To conduct inventory of landowners and farmers that will be affected by the project and provide them with a grievance redress mechanism in the event that they have complaints.
Geotechnical studies (December 2021 to January 2022)	<p>Standard Penetration tests (SPT) and Lefranc water tests were done for determining geomechanical and hydraulic properties of foundations for water tanks and water treatment plants. Trial pits were useful to investigate ground properties for pipes and small structures. Both boreholes and trial pits samples were submitted to laboratory tests to investigate physical and mechanical properties of the soil.</p> <p>25 boreholes were drilled and 3 piezometers installed to evaluate geotechnical characteristics underlying the water pressure release tanks and water storage tanks. A total of 48 soil analysis was performed for sieve analysis, Atterberg limits, moisture content and bulk specific gravity; 20-point load tests in rock specimens; and 18 tests of the soil chemical properties.</p> <p>Soils sampled by trial pits along the transmission mains (TM) pipes total 34 units and 45-meter-long excavation. Majority of the trail pits has a depth of less than 1.5m, due to the hardness of ground materials. Laboratory tests performed over collected samples consisted of 34 identification tests for sieve analysis, Atterberg Limits, moisture content (W%) and specific gravity, 34 field density tests, and 20 proctor compaction tests.</p>

1.4 E&S Risk and Impact Assessment

Key Regulatory Framework and Applicable Standards. The updated environmental and social impact assessment (“this SEIS”) of the project was prepared to be aligned with changes in the project scope and the requirements of the Decree Law 5/2011 and to accommodate the requirements of the World Bank Environmental and Social Framework (2017) including relevant Environmental and Social Standards (ESS). The EMP has also been updated and presented in a stand-alone document separate from the SEIS as required by the mentioned decree.

The SEIS covers the following chapters: (i) Executive Summary; (ii) The Project Proponent; (iii) The SEIS and EMP Consultant; (iv) Project Description; (v) Key Policy and Regulatory Framework; (vi) Environment and Social Baseline; (vii) Project Alternatives; (viii) Climate Change; (ix) Impact Assessment and Mitigation Measures; (x) Summary of Environmental Management Plan and Institutional Responsibility; (xi) Public Consultation and Information Disclosure; (xii) Difficulties Encountered; (xiii) Conclusions and Recommendations; (xiv)

Non-Technical Summary; (xv) Non-Technical Summary (in Tetum Language); and (xvi) Bibliography

Environmental and Social Risk and Impacts of the Project. The SEIS assesses the project's impact significance through the application of an evaluation matrix and impact assessment rating for all components and activities in the Pre-construction, Construction, Operation and Decommissioning Phases of the Project. The significance of the impacts was assessed according to the condition of the affected environmental and social components at the time of evaluation and the scale of impact should the impact persist.

The adverse impacts of this project, particularly the construction phase, is more likely to generate adverse impacts towards the environment and the local community than the remaining phases of the projects, albeit temporary. Other than the pipe laying works (new and/or rehabilitation), the remaining construction activities will be restricted to their respective confined area, thus the interference with the public and surrounding community should be minimal. Negative impacts to be generated are predicted as mostly temporary, such as noise and air pollution (that causes disturbance to the nearby dwellings and commercial buildings), construction waste (solid and liquid), increased traffic (especially in narrow roads), as well as health and safety risk to workers, declining of water quality, soil erosion, etc.

The EMP including for social aspects of each significant impact is presented as a stand-alone document as required by the environmental licensing law and Ministerial Diploma No. 47/2017. The EMP addresses E&S impacts evaluated in the SEIS and associated mitigation measures to apply during the different phases of the project, as well as the monitoring programs to keep up-to-date with the progress of the project as well as a grievance redress mechanism (GRM) to process complaints and concerns that may be raised during project implementation. Upon contract award, the Contractor is required to develop a specific Construction Environmental and Social Management Plan (C-ESMP) for the project, which is a detailed plan that sets out the contractor's approach to implementing the required mitigation measures, including GRM. The activities and mitigation measures should be specific to the conditions of the project components and of Baucau Municipal Capital.

1.5 Stakeholder Engagement and Information Disclosure

Throughout the DED phase and the IEE under the ADB process, the consultants undertook Public Consultation for Baucau city in the Baucau Municipality Administrative Assembly Room on 3 October 2020, participated by local government agencies and authorities (Chief of Suco and Village), and representative members of the communities within the project area, where the issues of significant social concern, predicted environmental impacts and proposed mitigation measures were presented, in order to collect all useful and relevant inputs from them, for the project construction phase. The stakeholders presented their concerns, suggestions and recommendations for the project implementation, focusing mainly on issues such as Land & Property, Acceleration of the Project Implementation, Project Area, Water distribution system does not serve all villages, misuse by consumers (and direct impact on water availability in the distribution system and measurement for structural preservation of cultural and religious assets within the project area.

The team involved and collaborated with several local and national level institutions, including Baucau Directorate of Water and Sanitation; Chief Department of the Environment for Baucau BTL; Ministry of Agriculture and Fisheries; Secretary of State for Arts and Culture; and Local Authorities of Chief of Suco Bahu, Caibada, Buibau, Tirilolo, Uailili, Samalari, Triloca, and Buruma.

In addition, 7 other Public Consultations were carried out on 4 February 2021 in Suco Caibada, Suco Bahu and Suco Tirilolo, on 5 February 2021 in Suco Gariuai, Suco Tiriloca, on 6 February 2021 in Suco Buibau and on the 9 February 2021 in Suco Uailili. Further, the public consultation as part of SEIS preparation was carried out on 1 - 2 June 2022 in Suco Bahu and Tirilolo. These consultations were aimed to address expectations and concerns raised in the previous public consultations in February 2021 and reassured the team that there is very little risk of any water conflicts or impacts felt by the community during implementation and operation of the future system.

2 THE PROJECT PROPONENT

The Ministry of Public Works (MPW) is responsible for planning and implementation of the water supply project and is the proponent for the Baucau Water Supply Project, supported by a dedicated project management unit (PMU) who will oversee the overall project preparation and construction activities. Be'e Timor-Leste (BTL) in Dili and Baucau will be the future operator of the water supply system. The project proponent and representative details/contacts for the project is as follows:

<p>Proponent Ministry of Public Works (MPW), Mr. Samuel Marçal, Minister MPW Corporate Services Building Avenida 20 de Maio, Caicoli, Díli, Timor-Leste</p>	<p>Proponent Primary Contact Be'e Timor-Leste (BTL EP) Mr. Gustavo da Cruz, President Compound Avenida 20 de Maio, Caicoli, Díli, Timor-Leste Telephone: +670 7732 6859</p>
<p>Proponent Secondary Contact Be'e Timor-Leste (BTL EP) Mr. Joao Babtista da Cruz Cardoso, Dir. DEI BTL Office Avenida 20 de Maio, Caicoli, Díli, Timor-Leste (Telephone: 7777 4344)</p>	<p>Proponent Tertiary Contact BTL Baucau Regional Office Mr. Adriana Belo da Rosa, Team Leader Suco Tirilolo, Vila nova, Baucau, Timor-Leste (Telephone: +670 77312363)</p>

In undertaking his day-to-day task in relation to the project, the Project Management Unit (PMU) has been established under the MPW and it will be responsible for overseeing and implementation of the required procurement process, project construction, supervision and commissioning. The PMU will be assisted by a project supervision consultant (PSC) which will be tasked to supervise the contractor mobilization, construction and commissioning activities and assist the PMU in preparing the required progress reports as well as other reports as required by the Government and the World Bank.

3 THE CONSULTANTS PREPARING THE SEIS AND ESMP

The draft of the SEIS and EMP documents of the Baucau Water Supply Project was prepared by the Ministry of Public Works (MPW) in 2021 - 2022 who contracted the consortium Águas de Portugal Timor-Leste and Engidro to prepare these documents. Mr Vasco Leitão is the Environmental specialist responsible in preparing these documents under the lead of Mr Mario Santos on behalf of ADP-TL/Engidro. The lead specialist was supported by several OASIS technicians. This consortium consultant also prepared the Detailed Engineering Design of Four Municipal Capitals Water Supply and Sanitation Project of Baucau, Manufahi, Lautem and Viqueque, financed by the Infrastructure Fund of the Government of Democratic Republic of Timor-Leste.

The latest draft of the SEIS and EMP was submitted to the Bank in 2022 for review, but then the project was cancelled. Subsequently, the project was reactivated for implementation in early 2026 at the request of the Government of Timor-Leste and, therefore, the draft SEIS and EMP shall be updated to reflect changes in the scope of the project to focus on the water supply component and updates on environmental and social baseline information as well as the risk and impact assessment. This document update was undertaken by the PMU of the project assisted by an environmental consultant.

4 DESCRIPTION OF THE PROJECT

4.1 Key Components of the Project

The area of the Baucau Municipal Capital water supply project including selected nine villages (Suco) is located within approximately 15-km radius from the capital city. The project area generally borders with Vemasse Administrative Post (to the west), Laga and Quelicai Administrative Posts (to the east), Venilale Administrative Post (to the south) and Banda Sea (to the north) as shown in the following figure. Geographic coordinates of the project site are in the South-West latitude of 8°32'22.81" South and longitude of 126°23'29.15" East and North-East latitude of 8°24'20.39" South and longitude of 126°31'36.24" East.

Based on the DED and follow-up conversations with the PMU, the construction project to be put out for tender will cover the following scope and as shown in the figure below:

- (a) Rehabilitation and expansion of the existing water supply system to deliver a safely managed water supply system at 90 liters per second (L/S) for a total of up to 5,700 connections that would benefit up to 37,000 beneficiaries by 2031 (at the end of the project timeline). Unaccounted water is designated at 20% from the overall system, primarily within the transmission mains, treatment plants and distribution network.
- (b) Rehabilitation/improvement of the existing Uailewa spring intake located in Baucau city and currently used to supply clean water for the community; and Waisarake spring intake; and construction of new water intakes for Uailia Mata and Uailia Bere springs to supply the water.
- (c) Rehabilitation/improvement of three existing water storage tanks and construction of six new water storage tanks for a total capacity of up to 6,300 m³ to distribute water to the service connections;
- (d) Improvement of water treatment equipment for injection of for a water softener agent (known as 'Calgon') and disinfection using calcium hypochlorite; One building will be constructed for storage and preparation of these chemicals
- (e) Rehabilitation/improvement of up to 36.15-km long water transmission mains and 104.62-km long pipeline to distribute water to Baucau municipal capital including nine (9) selected 'sucos' (villages) i.e., Bahu, Buibau, Buruma, Caibada (Makasae), Caibada (Uaimoa), Gariuai, Tiriloca, Trilolo, and Uailili.
- (f) Rehabilitation and improvement of the associated pumping systems, primarily to deliver raw water from the intake to the water storage tanks and relatively small power supply required to operate dosing pumps, storage area and small offices to support the water supply operation. Water distribution from the storage tanks to individual connection at households and other public facilities will be through pipelines using gravity system.
- (g) Installation of SCADA system and new bulk metering system within the distribution network and replacement and/or installation of domestic meters for all existing and new water connections for proper accounting of water use.

4.2 Hydrogeological Setting of the Project Area

Baucau municipality is located in the eastern part of Timor-Leste, where is situated the second largest city in the country, also named Baucau. The water resources supply in Baucau Municipality is mainly supported by a spring, namely the Uailewa spring. Uailewa springs, like all the springs in the region, has a karst origin due to the presence of an important limestone formation in the area.

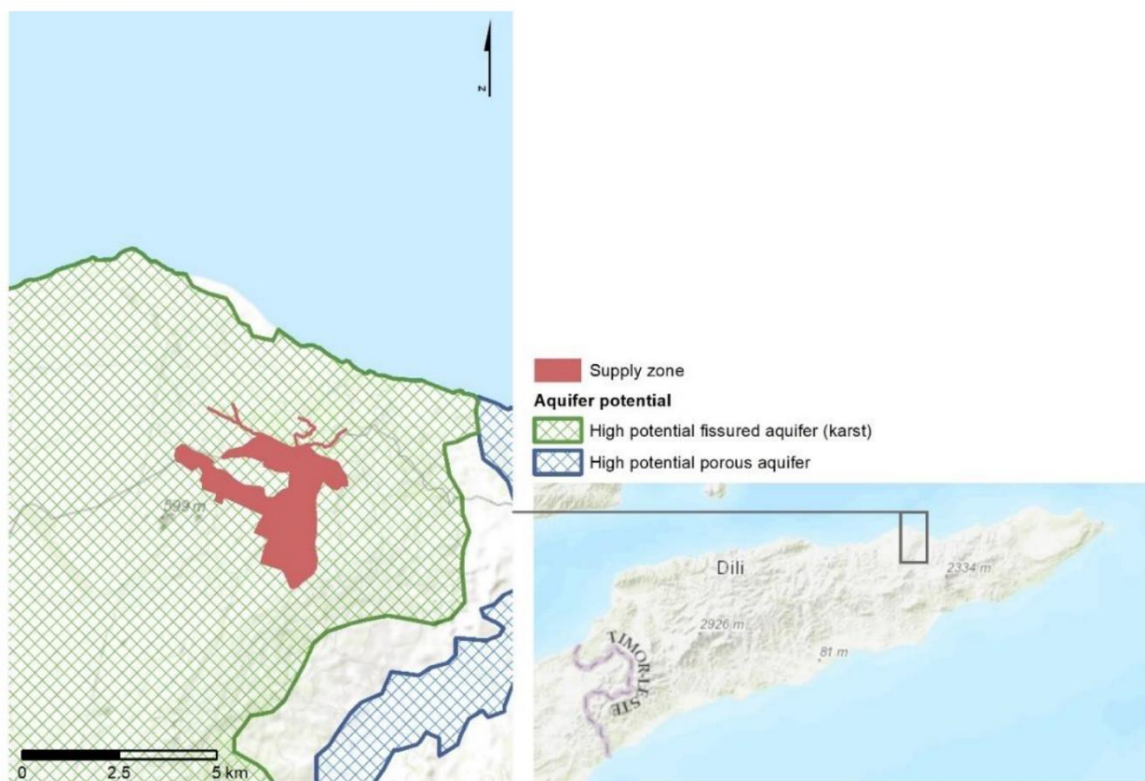
Around 85% of the urban area is built on the limestones. In the Northern part and Baucau Plateau, the thickness of the limestones is about 40 m (based on borehole data). In the Southern part, the thickness is estimated to be around 25 m. The base of the limestone consists of impermeable layers of clay, sand, and silts with some gravel.

Due to this hydrogeological setting, the Baucau municipality region is considered a Karst aquifer system, with a complex morphology. The complexity of the aquifer results from the high dissolution of limestone that originates many irregular fissures, flow paths and caves. This aspect turns the groundwater reservoir characterization into a task rather difficult. Another characteristic of this type of formation is the absence of surface water lines, as they present a high infiltration rate.

In terms of quantity, based on the Baucau plateau size, the aquifer can preserve a large volume of water. Furthermore, most water is conducted in flow paths discharging in the springs. Therefore, another significant part is preserved in the aquifer. The primary water sources of this region are contact springs, where the limestone contacts impermeable formations. A simple hydrogeological conceptual model of Baucau is represented in the following figure.

The work of Wallace et al. (2012) characterizes the entire Baucau region with a high hydrogeological potential associated with karst formations (Figure 2-45). However, this potential is not easy to exploit. It depends on existing natural karst structures, such as karst windows and contact springs. The construction of boreholes is mostly the times unproductive.

Figure 4.1. Aquifer Potential of Baucau Region



4.3 Raw Water Sources

According to the DED of the project (2022) and subsequent discussions with PMU in April 2026, four spring water sources will need to be abstracted to meet the safely managed water supply at 90 L/s at project completion date. The Uailewa and Uaisarake spring intake and pumping system will require rehabilitation and improvement, meanwhile the new intake and pumping system will be constructed for Uailia Mata and Uailia Bere.

Water Balance. As shown in the following table, the estimated maximum yield of the four water sources totals to approximately 353 L/s while the project plans to abstract up to 110 L/s to enable delivery of up to 90 L/s of safely managed (potable) water supply to the service connections. Approximately 110 L/s (or 31% of the maximum yield) of water remains available for community use and 96 L/s (or 27% of the maximum yield) of water is maintained as ecological flow in the water system. The DED indicates a flow rate of 43 L/s will be abstracted from Uailewa spring which is the only source used to supply water for Baucau city. To complement this existing source, water abstractions will be required from Uailia Mata, Uailia Bere and Uaisarake at a rate of, respectively 24 L/s, 10.0 L/s and 30 L/s.

Table 4.1. Available Water Sources, Demand and Remaining Flow (in Liters/second)

Spring Water Sources	Maximum Yield (Estimate)	Planned Extraction (up to 2031)	For Community Use	Ecological Flow
Uailewa spring ¹	120.4	43.0	12.5	24.9
Uailia Mata	35.0	24.0	3.0	8.0
Uailia Bere	13.0	10.0	0.4	2.6
Uaisarake	185.0	30.0	94.0	61.0
Amount	353.4	107 L/s (to deliver 90 L/s of safely managed water supply)	109.9	96.5

Source: Updated water balance of Baucau water supply project (provided in April 2026)

Note: ¹Currently used to supply water to Baucau city via BTL.

The Uailewa Spring. The existing intake and pumping system of this spring is in Suco Bahu will be rehabilitated to follow the proposed gradual incremental extraction from currently 13.5 L/s which flows exclusively to the existing pumping station at Baucau to supply the customer within its municipal capital and to be increased up to 83.0 L/s to meet the project requirement. Given this spring is located in the center of Baucau city, thus it has some degree of contamination risk resulting from the lack of sanitation services and the presence of hospital upstream of the spring.

The Uailewa spring is the current water source for the Baucau water supply stored in three separate reservoirs, namely Wainiki, Lamegua and Lower Tanks, with a total capacity of 600 cubic meters. The water from these tanks is delivered to the community using gravitational system. There are smaller reservoirs associated with the pump stations at Wainiki and Lamegua, but these two pumps are out of operation due to lack of maintenance. In addition, this spring provides water supply to the community downstream, and agricultural activities in Baucau (i.e., the Caisido and Buruma agricultural farms) outside the existing water distribution network operated by BTL.

Figure 4.2. Uailewa Spring Current Condition



The emergence of the above spring is diffuse in nature, distributed amongst several points, and it is associated with the contact of limestone with a less conductive base formation. As it is diffuse, the abstraction of water becomes problematic since it emerges in several places. Besides the public supply system, the Uailewa spring also supplies other communities downstream, including irrigation. This leads to a necessary management plan to avoid water use competition among the users. Nevertheless, the springs that supply these communities are independent from the Baucau main water source. The only relationship with the springs used for Baucau refers to the surplus that is not used, thus being directed to the supply channel of these communities. The following presents the current condition of the Uailewa Spring.

Figure 4.3. Water Use of Uailewa Spring Outside the Distribution System



Spring water uses for washing, shower and irrigation



Current use of spring water outside the existing distribution network

Uailia Mata Spring. The Uailia Mata (window karst) is located in the centre of the Baucau plateau. Its nature is closer to a groundwater river than to spring. The surroundings are of the spring are vegetated areas planted with corn and other staples vegetation and appear to have minimal risk for contamination compared to the spring described earlier. The established agriculture fields are dispersed, and no traces of cattle are found near the water source. The pumping test at Uailia Mata spring took place on 5 - 6 November 2021. In order to maintain the ecological flow from the abstraction of Uailewa Spring, the project will need to develop the Uailia Mata Spring (in Suco Gariuai) at a rate of up to 24 L/s. The spring water provides numerous advantages in terms of water availability, low risk of contamination and its location at relatively high-elevation allowing water to be delivered using gravitational system and reduce energy costs.

The Uailia Mata Spring is a diffuse source, occurred the water in different points and it is associated with the contact of limestone with a less conductive base formation. It is a sacred spring and currently not used due to a very significant difference of flow depending on the season. The community still carries out yearly cultural ceremony for this spring as a form of gratitude to the nature.

Figure 4.4. Uailia Mata Spring



Aerial view



Pumping line inside the spring

Uailia Bere Spring. This spring reportedly serve three communities i.e., Darasula, Uiaibole and Kiloimatu. The existing yield and proposed abstraction rate of the spring are analysed as part of the DED to determine the long-term yield of the water sources. The DED recommends that the spring should be included as a water source of the project to complement the flow of Uailia Mata spring. There is an assumption that the Uailea Bere and Uailia Mata springs are inter-connected in a cave, and therefore, water abstraction of one spring may affect the flow of another spring.

Figure 4.5. Uailia Bere Spring



The existing condition of the spring



The aerial landscape view of the spring

Uaisarake Spring. This spring is located between the limestone and a low permeability formation. The nature of the spring is diffuse, emerging in several places. The use of the spring by local communities for washing, irrigation, livestock, recreation, and supply of water tanks may limit their use for the Baucau system. However, the calculation conducted indicates that the maximum yield of the spring collectively is estimated at 185 L/s while the project only needs 30 L/s, so the remaining water balance for other uses is significant.

Figure 4.6. Uaisarake Spring



Existing water pumping system



Public swimming pool containing the spring water

4.4 Spring Water Quality and Treatment Required

The following presents the analytical results of spring water samples collected in 2021 as part of DED of the project. The samples were analysed for physical, chemical and bacteriological parameters and the results are presented below. As the Uailewa spring is

currently used to supply water for the customers within Baucau municipality, recent water quality data are available and also presented herein.

Physical Parameters. All spring water samples analysed for physical parameters indicated waters a normal reading of the concentration within the standards. Temperature across all four springs was consistent, ranging from 25.8°C to 27.5°C, reflecting stable ambient conditions. The value of pH ranged from 7.4 to 8.34, indicating slightly alkaline condition associated with the limestone geological formation where the spring water sources originate, all within the acceptable range of 6.5 - 8.5. Electrical conductivity and Total Dissolved Solids (TDS) were measured well below their respective WHO threshold values of 2,500 µS/cm and 1,000 mg/L respectively in all samples. Dissolved oxygen levels were healthy, ranging from 74 to 96% well above the minimum value of 30%. Turbidity was low in all samples, except at Uailia Mata where it was elevated at 55.3 NTU well above the threshold value of 5 NTU.

Table 4.2. Spring Water Quality (2021) - Physical Parameter

Parameter	Units	Threshold Value	Uailewa Spring	Uailia Bere Spring		Uaisarake Spring	Uailia Mata Spring
Dissolved Oxygen	% saturated O ₂ (minimum)	30	94.4	96.1	88.8	74.0	94.7
Temperature	°C	-	27.3°C	26.6	25.8	27.5	26.4
pH	Sorensen	6.5- 8.5	8.34	8.18	7.4	8.2	7.69
Electrical conductivity	µS/cm	2,500	444	459	461	483	464
Total dissolved solids	mg/l	1,000	222	229	230	242	232
Turbidity	NTU	5	2.35	1.57	1.98	3.66	55.3*
Salinity	‰	-	0.2	0.2	0.2	0.2	0.2

Chemical Parameters. Most chemical parameters analyzed across the four springs were below the respective WHO guideline values, except ammonia of Uailewa Spring was significantly elevated at 1,765 mg/L, well above the WHO threshold of 0.5 mg/L, whereas that of the other three springs detected within a range of 0.007 - 0.326 mg/L, with Uailia Mata recording no detection). Manganese concentrations exceeded the WHO guideline value of 0.05 mg/L at Uailewa detected at 0.33 mg/L, Uaisarake at 0.053 mg/L and Uailia Bere at 0.046 mg/L.

Lead was reported at values of <0.1 mg/L or under range (UR) across all springs. Given that the WHO guideline value for lead is 0.01 mg/L, the detection limit applied in this analysis was insufficient to detect the presence of lead in the water samples. All other heavy metal parameters analyzed, including zinc and copper, were measured well below their respective WHO threshold values.

Bacteriological Parameter. Total coliform and E. Coli were detected in all four spring waters as shown in the following table. E. coli was detected in Uailewa at 3.4 colony forming units (CFU)/100 ml, Uailia Bere at 13.6 CFU/100 m and Uailia Mata at 48.3 CFU/100 mL), exceeding the WHO guideline value of 0 CFU/100 mL for drinking water. Total coliform presence was also detected. These results indicate that all spring waters are not safe for drinking without treatment.

Table 4.3. Spring Water Quality - Chemical Parameter

Parameter	Threshold Value	Uailewa Spring	Uailia Bere		Uaisarake	Uailia Mata
Chemical Parameter						
COD	30	10.27	8.51	3.29	8.42	3,67
Lead	0.01	<0.1	<0.1	UR ¹	<0.1	UR ¹
Zinc	4	0.22	0.08	0.11	0.1	0.12
Copper	2	0.06	0.059	0.502	0.179	0.567
Boron	1- 2.4	0.113	0.089	0.062	0.129	0,083
Aluminum	0.2	ND	ND	ND ²	ND	ND ²
Total chromium	0.05	0.02	0.02	0,03	0.01	0.03
Ammonia nitrogen	0.5	ND	1,765	0.007	0.326	ND ²
Nitrate	11	1.74	1.71	1.65	1.74	1.58
Nitrite	0.15	0.057	0.011	0.016	0.053	0.019
Total alkalinity	NS	176.6	190.7	216.1	200.1	185.3
Total hardness	110 - 500	206.2	213.6	208.1	221.4	201.5
Calcium	100	71.3	75.4	72.1	77.3	70.2
Magnesium	50	6.89	6.18	6.87	6.9	6.4
Iron	0.3	0.01	ND	0.04	0.02	0.02
Chlorides	250	1.68	1.58	1.45	1.43	1,15
Manganese	0.05	0.33	0.07	0.046	0.053	0.043
Sulfate	250	15.2	14.7	14.4	14.5	14.5
Fluorides	1.5	ND	0.101	ND ²	0.047	ND ²
Colour (as Pt-Co)	20	0	0	0	0	10*
Phenols	0.1	0	0	0.05	0	0.05
Anionic Surfactants	?	0.246	0.28	0.2	0.144	0.345
Cyanide	0.05	Nao foi testado devido á toxicidade dos subprodutos				
Bacteriological Parameter (in colony-forming units/CFU per 100 ml)						
Total Coliform	0	<100	<100	+	<100	+
E. Coli	0	3.4	<100	13.6	<100	48.3

Langelier Index. As shown in the table below, the Langelier Saturation Index (LI) was positive across all four springs, ranging from 0.1 to 1.0, with Uailewa recording the highest value of 1.0. A positive LI indicates that the water is mildly saturated with calcium carbonate with the potential to cause scaling within the water supply system.

Table 4.4. Langelier Index of Spring Water Sources

Sources	pH	T (°C)	TDS (mg/l)	Ca Hard (mg Ca/l)	Alk (mg CaCO ₃ /l)	pH	Langelier Index
Uailewa	8.34	27.3	2.35	176.6	71.3	7.4	1.0
Uailia Bere	8.18	26.6	1.57	190.7	75.4	7.3	0.8
Uailia Bere*	7.4	25.8	1.98	216.1	72.1	7.3	0.1
Uaisarake	8.2	27.5	3.66	200.1	77.3	7.3	0.9
Uailia Mata	7.69	26.4	55.3*	185.3	70.2	7.3	0.3

*The pH value is not consistent with the other analyses, whereby the LI must be greater than 0.1

Water Treatments Required. The spring water quality to be tapped for the project is relatively in good condition as it is clear, odorless and have normal range of concentration for its physical, chemical parameters except for few parameters as they originates from spring water that are located in remote areas and relatively undisturbed, except Uailewa spring located in the centre of Baucau city that may have been contaminated due to community direct access and the public facilities including the presence of hospital upstream of the water intake site. Considering that the spring is located within the limestone (karst) geological formation, the water quality typically has a high value of calcium carbonate causing elevated water hardness and calcium deposit in the water distribution system. In general, water hardness is not a health concern, while bacteriological contamination indicated by total coliforms is a health concern.

To enable the water to be potable as per the DED and meet the Timor-Leste standards, Calgon solution (sodium hexametaphosphate) will be applied as water softener and disinfection used to minimize bacteriological contamination in the treated water prior to distribution. Water treatment, depending on the spring locations, will be undertaken at the water source and this is the case for Uailewa Spring, as example, but some treatments will be undertaken within the tank such as the water sourced from Uailia Mata and Uailia Bere.

Calcium or sodium hypochlorite are both commonly used for the disinfection of water supplies. It was suggested that re-chlorination with Calcium hypochlorite will be required to maintain a free chlorine concentration of at least 0.5 ppm within the water distribution system. Key facilities and equipment required for the disinfection system are: chemical storage areas; mixing tanks equipped with mechanical mixers to dissolve sodium hypochlorite in water; chlorination dosing and re-chlorination dosing pumps and associated control system to maintain 0.5 mg/l - 1.5 mg/l of free chlorine in the water distributed to service connections; and a relatively minimal power supply for lighting, mixers, dosing pumps and control system.

This dosing is required to inhibit the formation of calcite in calcium rich waters and reduce water hardness. To design this operation the solution concentration assumed is 5% and the maximum Calgon dose is 6 mg/l. The dosing system and overall requirements for this dosing is similar to those of the disinfection system.

4.5 Water Storage/Distribution Tanks

The capacity of the water storage tanks is designed to be equivalent to 13 hours of MDP (Maximum Day Production) capacity, which includes the diurnal fluctuation and the emergency storage. The MDP includes the water demand plus the water losses on the distribution network. To guarantee the reliable operation of the different supply zones, the water storage required for each supply zone (diurnal fluctuation and emergency storage), meaning that the main tanks will only include the storage resulting from the needs of the networks which will be supplied directly from these tanks. A minimum of two chambers shall be constructed within the tank so that water supply will not be interrupted while one of the chambers require maintenance. The following table presents the three existing water storage tanks that will be rehabilitated and six new tanks that will be constructed to have an overall storage capacity of 6,300 m³ as presented in the table below.

Table 4.5. Water Storage/ Distribution Tanks

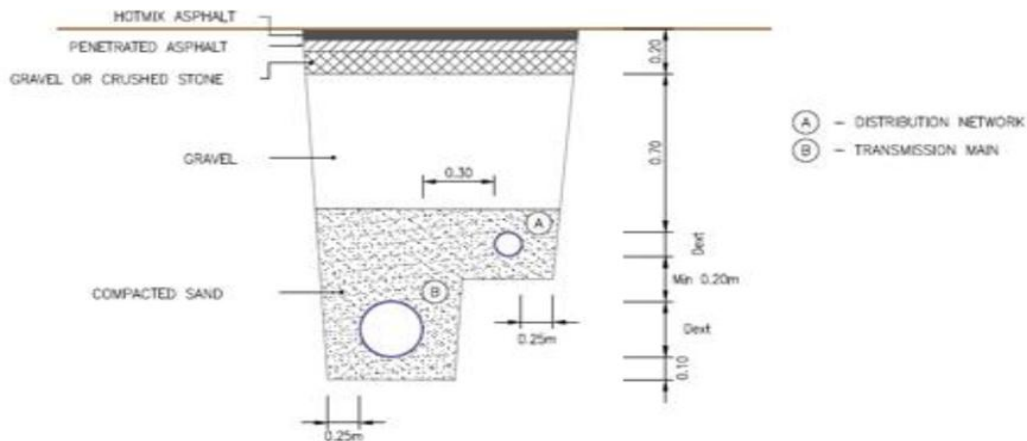
Tank Name	Capacity (m ³)	Elevation (m)
Adarai (existing tank)	1,000	520
Wainiki (existing tank)	300	425
Wailili (Existing tank)	300	425
New Town Ground Tank	1,900	466
New Town Tower Tank	150	492
Tirilolo	500	417
Lamegua	300	364
Lower tank	900	339
Bulk water tank	1,200	691

The layout of water flow from the springs and treated water delivered to the distribution networks are illustrated in the following figure. The bulk water tank starts an 8515 meters long gravity transmission main that will feed Adarai Tank at 520 m elevation and, from there, two gravity transmission mains, with 3930 and 2230 meters long, respectively, will supply the New Town Ground Tank at 470 m elevation and water tower at 495 m elevation, and Uainiki Tank at 425 m elevation. Tirilolo Tank, at 420 m elevation, will be supplied by the New Town ground tank by means of a 2550 meters long gravity transmission main. The system's lay-out includes the possibility of strengthening water supply during the dry season, since there is the possibility that Tirilo, Uainiki and Lamegua Tanks can be supplied by reversible systems, tendentially gravitic, starting at Uailia Mata spring in the wet season, and pumped from Uailewa spring in dry season.

Table 4.6. Water Storage and Distribution Tanks Layout

for new pipelines. For existing pipes that will be replaced, the pipeline may be located outside the RoW. Within Baucau city, the transmission mains will be laid below the distribution network to avoid interference while the water service connections are being constructed on each side of the road. If a water tank supplies distribution network that has more than one pressure zone, varying in a range of 10 - 60m the pressure zone will be set by the BPT or by pressure reducing valves (PRV).

Figure 4.7. Typical Cross Section of Transmission Mains and Distribution Network



Earthworks. Soils will be excavated for trenching activity as per the above design as per the information presented in the following table, where approximately, 82% of the volume of soils excavated will be backfilled and only 18% will be disposed as construction wastes. Approximately, 16,250 m³ gravel materials will be purchased for road surface restoration after pipeline installation has been completed.

Table 4.7. Material Balance Related to Trenching Activity

Materials	Volume (m ³)		
	Excavated	Backfilled	Disposed
Soils to be excavated	93,851	-	-
Excavated soils to be backfilled	-	76,750	-
Gravel materials to be purchased for road surface restoration	-	16,243	-
Spoil materials to be disposed			17,101

Pipeline Materials. A combination of High-Density Polyethylene (HDPE) and Ductile Iron Concrete Lined (DACL) pipelines will be used for transmission mains and distribution network, depending upon the water pressure, pipeline diameter, and location of the pipeline whether it is underground or above ground. The areas/zones are designed to serve selected nine 'sucos' and the Baucau municipal capital city as shown in the following figure.

Figure 4.8. Proposed Water Distribution Networks/Zones

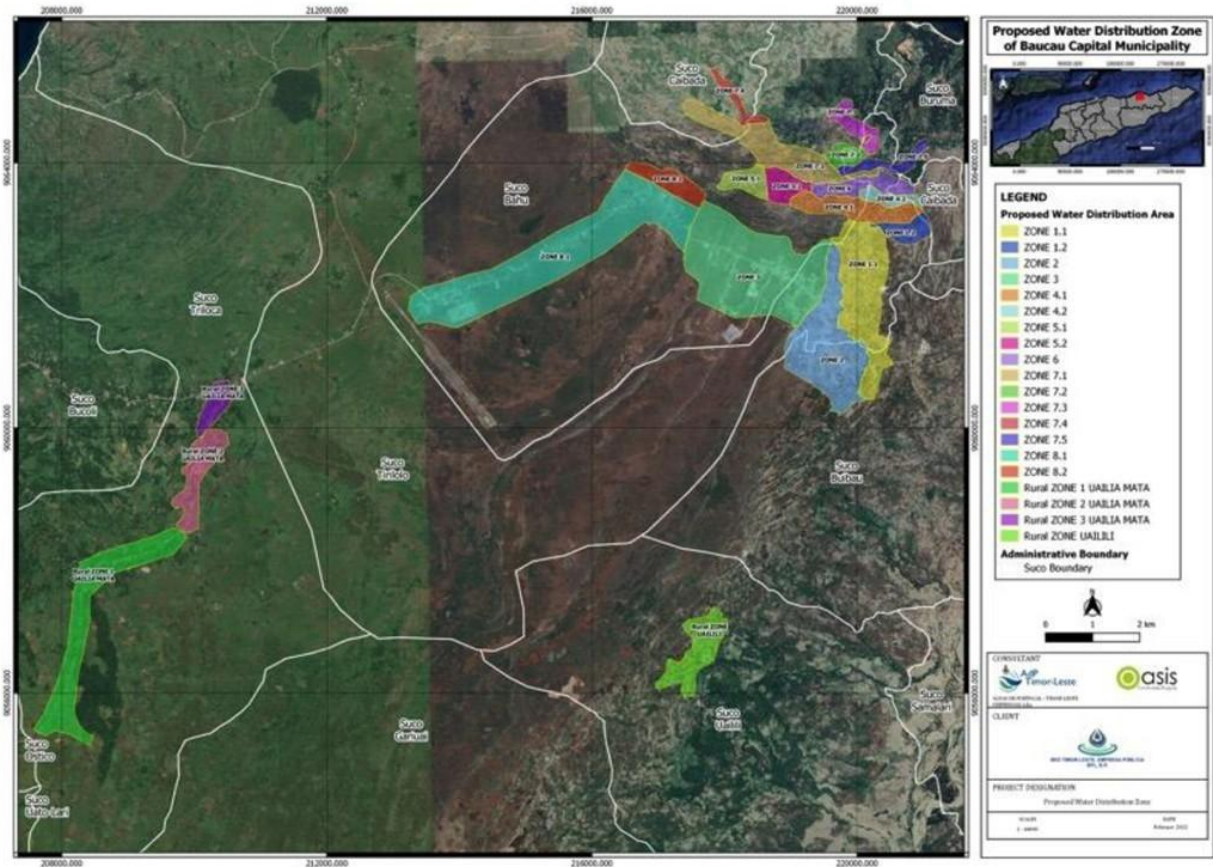


Figure 4.9. Water Distribution Pipeline



4.7 Bulk Metering and Service Connections

Bulk Metering System. It will be installed based on the following considerations i.e., at water tanks or pump stations outflow pipes, water sources where pump stations are needed, at specific locations where flow meter is needed to control treatment processes or to operate valve for flow control or at the springs which are located in remote locations where there is no power grid and where is possible a gravity flow water supply, it was not considered water metering. However, it is possible to equip the transmission main with a water meter, battery powered, installed inside a chamber downstream the spring intake (at

a convenient location) or, as an alternative, install a V-notch with level metering for instantaneous flow measuring.

Service Connections. It will be constructed to provide water supply from the distribution network to the customer building (household connections), in reliable flow and pressure conditions. When appropriate, the same building can be provided with more than one water supply pipeline for domestic or service purposes. As general criterion, commercial and industrial facilities should be provided with their own service connections. The connection should be taken from the nearest distribution pipe by a tapping saddle.

The minimum nominal diameter of the distribution pipeline for the service connections is 15 mm and the commercial or social connections, a larger diameter may be considered. The depth for the service connections pipes shall be 0.50-m below as shown in the typical trench figure presented in this SEIS. The service connection also comprises the installation in line of a volumetric water meter, to estimate the volume of water supplied to each customer. Regarding house connections, the outside tap should be installed as far inside the property as allowed under Timor-Leste Legislation since the wash facilities and kitchens are usually at the back of the houses.

4.8 Power Supply

The power supply required for operating the pumps and other equipment at the intake, water treatment building, transmission mains and distribution networks will be connected to the existing power grid system. As backup, a combination diesel-fueled power generator and battery-powered system will be installed at the spring and storage as well as distribution tank.

4.9 Site Establishment and Access Roads

The design of the platforms to construct the water intake, water tanks and related buildings, as well as for the access roads, were determined by the respective site topography/terrain. In some situations, it would be necessary to use retaining walls (gabion walls) to reduce the slopes in order not to compromise the stability of the terrain. All the proposed sites will have a fence. As a general criterion, the water tanks will be made of concrete.

The construction of access roads to the springs and tank locations will be constructed using aggregate layers whereas the roads inside these water facilities using bituminous layer in order to ensure greater resistance of the pavements and to facilitate cleaning. Around the buildings (i.e., chemical buildings, operation buildings and maneuver chambers which corresponds to the building located near the water cells and which houses the valves, flow meters and other equipment's included in the hydraulic circuits) a walk pathway will be constructed using concrete pavement with welded wire mesh.

The drainage of rainwater on the proposed platforms and roads, as well as the water from the surrounding terrains, are also contemplated with the construction of half round pipes and ditches. Water from the building's roof gutters will be conveyed to infiltration pits formed by rockfill areas. In some water tanks, where the surrounding terrain is flat, infiltration pits to drain the water cells overflow and the bottom discharges in order to avoid the construction of long discharge pipes. This solution is considered technically adequate since the geotechnical conditions in Baucau promote the infiltration of water in the soil.

5 KEY POLICY AND REGULATORY FRAMEWORK

5.1 The 2002 Constitution of the Democratic Republic of Timor-Leste

One of the most important pieces of legislation in Timor-Leste, it provides the guiding principle for environmental protection and recognizes the need to develop Timor-Leste's resources sustainably, providing a better quality of life for its citizens and a responsibility of the Government. Its article 61 stipulates that: "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 recognize the need to preserve and rationalize natural resources; and The State should promote actions aimed at protecting the environment and safeguarding the sustainable development.

5.2 Decree Law No. 26/2012 - Basic Environmental Law

Decree Law No. 26/2012 is the Basic Environmental Law, setting the framework for environmental protection in Timor-Leste, the environmental principles to follow and makes the State responsible to ensure that citizens are guaranteed for a healthy, ecologically balanced environment and the use of natural resources is undertaken in a sustainable way, It also sets the standard and commitment for all future environmental laws and policies (including all terrestrial and marine areas, soil and sub-soil), to single or collective persons, national or foreign, public or private, residing or undergoing activities in Timor-Leste.

It also commits the Government to compulsory Environmental Evaluation of its policies, plans and projects, and defines important procedures and requirements such as e.g., the Environmental Assessment and Licensing process and environmental standards, including the use of International Environmental Standards i.e., WHO or equivalent, if National Standards aren't established.

5.3 Decree Law No. 5/2011 - Environmental Licensing

As part of the E&S risk screening, the National Authority for Environmental Licensing (ANLA) of Timor-Leste classifies the Baucau Project under a Category B (e.g., similar to moderate-risk level project) according to the Decree Law No. 5/2011 (dated 9 February 2011). The Category B assigned to the project is justified, given that the project components does not fall within any sensitive or protected areas and it primarily comprise rehabilitation and expansion of the existing water network within a relatively developed landscape that have undergone significant land use change since almost 30 years ago. This classification is further justified based on the ANLA previously attributed Category B Environmental License for the Government Projects for Rehabilitation of Water Distribution Infrastructure in the District Capital Water Supply Project for Manatuto and Pante Macassar (2014). These two projects are of similar nature to the Baucau project while the scale of pipeline dimension and length, as well as water sourcing of the two projects mentioned earlier is larger than the ones of Baucau.

It is not likely that the rehabilitation and operation of these water sources will have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, or that potential impacts are unlikely to affect areas larger than the sites or facilities subject to physical works and in most cases mitigation measures can be designed with uncomplicated measures commonly used and known by civil works contractors.

As amended through the Decree Law No. 39/2022, the project classification for the Bacau Project remains unchanged as the changes is mainly on administrative procedure related to

environmental classification/screening, evaluation, decision, licensing and monitoring of development projects, throughout their construction, operation and decommissioning phases.

The ANLA responsibility includes: (i) Reviewing the applications for Environmental Licensing; (ii) Screening for the project categorization; (iii) Reviewing environmental and social impact assessment reports and related documents; (iv) forwarding the reviewed impact assessment report together with its technical opinions, suggestions and decision proposal to the SEA Secretary of State for Environment; and (v) Monitoring and evaluation of the impacts during project implementation.

5.4 Decree-Law No. 31/2020: Potable Water Quality Standards

The following table presents the potable water quality standards stipulated by the Timor-Leste Government that will be adopted for the project in order to deliver a safely managed water supply for the beneficiaries. Relevant water quality standard published by WHO (2017) are included in the table below for comparison, indicating that the water quality standards imposed in Timor-Leste is comparable to the WHO standard.

Table 5.1. Water Quality Standard for Human Consumption

Parameters	Units	Decree-Law No. 31/2020	WHO Guidelines ¹
Bacteriological			
Total Coliform	CFU/100 ml	0	0
Escherichia coli (E. coli)	CFU/100 ml	0	0
Physical and Chemical			
Aluminium	mg/l	0.2	0.2
Arsenic	mg/l	0.01	0.01
Ammonia	mg/l ⁽³⁾	0.5	1.5
Calcium	mg/l	100	100 - 300
Chlorides	mg/l	250	250
Chlorine	mg/l	0.2 - 0.6	5
Conductivity	µS/cm	2,500	
Colour	mg/l Platinum-Cobalt Scale	20	15
Fluoride	mg/l	1.5	1.5
Hardness	mg/L CaCO ³	110 - 500	200 - 500
Iron (Fe)	mg/l	0.3	0.3
Langelier Index	-	-0.5 to 0.5	-
Magnesium	mg/l	50	-
Manganese	mg/l Mn	0.05	0.1
Nitrate	mg/l ⁽⁴⁾	11	50
Nitrite	mg/l ⁽⁵⁾	0.15	3
pH	Sorensen	6.5 - 8.5	6.5 - 8.5
Sulphate	mg/l	250	250
Taste and odour	dilution rate	Free of taste and odour	Free of taste and odour
Total dissolved solids	mg/L	1000	1000
Turbidity	NTU	5	4

Note:

¹Guidelines for drinking-water quality: fourth edition incorporating the first addendum, World Health Organization, 2017

²The values are guideline values for microbiological indicators or chemicals that are of health significance in drinking water or recommended values based on other reasons, like the acceptability of water and corrosion control;

³Ammoniacal nitrogen (mg NH₄/l) for WHO and Decreto-lei n° 152/2017 and mg/l NH₄-N for Timor-Leste legislation

⁴Nitrate (mg NO₃/l) for WHO and Decreto-lei n° 152/2017 and mg/l NO₃-N for Timor-Leste legislation

⁵Nitrite (mg NO₂/l) for WHO and Decreto-lei n° 152/2017 and mg/l NO₂-N for Timor-Leste legislation

5.5 Other Key Laws and Regulations of Timor-Leste

The table below summarizes all other national laws, policies and guidelines stipulated by the Timor-Leste Government that are relevant to the project.

Table 5.2. Relevant National Laws, Policies and Guidelines in Timor-Leste

Policy/Law/ Guideline	Key Provisions	Implications for the Project
Decree-Law No. 6/2020: Legal Framework for Protection and Conservation of Biodiversity	This Law establishes guidelines for biodiversity conservation and sustainable use in Timor-Leste, covering both special areas within and outside the National Protected Areas System (Article 26). It also includes managing unique ecosystems such as swamps, estuaries, mangroves, coral reefs, marine grasses, and sacred Lulik sites. It includes the List of Protected (Annex I) and Exotic/Invasive Species (Annex II) and the rules and prohibited activities for their management (Chapters IV and V) and requires considerations to be taken in Environmental Impact Evaluations (Chapter VII).	These provisions do not directly apply for the project as none of its components overlap with key biodiversity area, except sacred Lulik sites. All the existing water sources in Baucau Municipal Capital and other areas are considered sacred according to the Timor-Leste's customs and norms.
Decree-Law No. 5/2016: National System for Protected Areas (PA)	It establishes the necessary legal instruments for the protection of declared sensitive ecological areas in Timor-Leste (Article 11) and their allowed and prohibited activities. It provides the list of Protected Areas (Article 50 and Annex I), their typology (Article 12) and geographical demarcation (Article 17) and management instruments (Article 23) for approved activities within Areas (Article 32) such as Land Use Zone i.e., allows infrastructure installation for human use.	These provisions do not apply for the project as none of the components are within a protected area defined by this Law.
Law no. 14/2017 - General Framework for Forestry	It defines the fundamental principles and norms on management, protection, conservation and sustainable use of forests and watersheds (Article 1), Forest Classification [State, Community and Private] (Article 8) and Forest (Article 14) and River Basin (Article 17) Management Plans and Forbidden Activities in these areas (Article 24). It also includes Climate Change requirements for Forest development (Article 28), for emissions	This may be relevant if the project components that traverse or are located within any type of forest in the project area.

Policy/Law/ Guideline	Key Provisions	Implications for the Project
	reduction and conservation of carbon stocks.	
Regulation UNTAET no.17/2000: Prohibition of Logging Operations and Wood Export	It establishes the prohibition for felling, burning or destroying trees or forests (Article 2) and the activities exempt of these prohibitions (Article 3)	Relevant to project components that will require cutting trees within alignments and ROWs.
Government Resolution No. 33/2011 - National Adaptation Plan of Action (NAPA) for Climate Change	It adopts trans-sectoral measures to reduce Climate Change vulnerability in essential sectors in Timor-Leste (Agro-forestry, water supply, biodiversity, health, infrastructure, natural disasters). Definition and Prioritization of Proposed Adaptation measures for said sectors (NAPA Table 13), particularly those indicated in Annex 2 Adaptation measures for the Water Sector (no. 1, 2, 4, 5, 6, 9, 11 and 13) and for Natural Disasters (no. 3)	Relevant to the project.
Decree-Law No. 33/2008: Hygiene and Public Order	This law establishes the administrative policy for Districts on hygiene and public order, defining the relations between public administration and the citizens in urban areas including specific locations within the districts. It defines the prohibitions in general (Article 5) regarding impact to public infrastructure and land, from the discharge of polluted waters, faecal sludge/sludge, waste in streets, drainage obstruction; spoils and construction material on sidewalks; and noise to community.	Relevant regarding project Work Camps, construction ROW.
Decree-Law No. 4/2004: Distribution of Water for Human Consumption	It establishes the conditions for the water distribution system for human consumption (Article 2). The Water and Sanitation Services are required to supply water to the public (urban) which is safe, sustainable with adequate quality.	Compliance with the Water Quality Standards in effect in Timor-Leste is required for the project.
Decree-Law No. 33/2017: Legal Framework for Cultural Heritage	It defines the concept of cultural heritage and the measures for its support, protection, preservation and conservation in Timor-Leste (Article 1) and its different cultural classification (Article 21). It also defines and regulates a 50 metre Protection Zone around immovable Heritage (Article 23) and the licensing requirements for general work within these Zones (Article 26).	It applies for the project on siting the construction camps, ROW construction, etc. When Heritage sites Protection Zones cannot be avoided, the project should consult with the authority.
Decree-Law No. 4/2012: Labour Code	It describes the duties and obligations of the private employer and employee while exercising their function within the scope of work, or within the bounds of a work contract (Chapter 1), with the aim of	It applies for the project and its contractors and workers.

Policy/Law/ Guideline	Key Provisions	Implications for the Project
	creating good working conditions (Article 20) and a fair, safe and healthy working environment (Article 35).	
Law No. 6/2017: Base Law for Planning	It provides basic rules for territorial planning in Timor-Leste, intended for the sustainability of urban areas and improvement of living conditions for citizens. Further it establishes the provisions on different soil uses (Article 8) and the Municipal Territory Plan and the Land Use Plan (Article 17).	Relevant to location of all project components.
Law No. 8/2017: Public Expropriation	Rules on land expropriation for public interest reasons, responsibilities, procedures, fair compensation, respect for vulnerable groups (Article 10) and project planning requirements that include expropriation, such as public consultation (Article 22), environmental licensing, and social/economic impact assessment (Article 19).	Relevant to location of all project components, particularly ROW. EMP implementation, Social Safeguards and LARAP are the overall measures to mitigate adverse impacts
Decree-Law No. 3/2016: Municipal Administration Statutes	It provides the local government with duties and powers to, among others: (i) conserve and protect their local environment and natural resources; (ii) plan, implement and/or operate and maintain local water supply projects; (iii) implement or arrange for implementation local sanitation/ sewerage/ solid waste and drainage projects; (iv) protect cultural heritage and religious sites; and/or (v) monitor project activities within their jurisdictions.	It provides the power/authority for the Municipality to monitor the environmental and social management performance of the project.
Decree-Law No. 2/2017: Urban Solid Waste Management System	It defines the rules that the urban solid waste management system led by the Municipal Authority (Article 2) as well as the obligations of all users of the system (Article 16) on management and collection of waste from construction works (Article 33). It also defines the requirements for disposal, import and production of plastic bags, packaging and and introduction to consumption (article 4) which prohibited to introduce for consumption any packaging or non-recyclable, oxo- biodegradable or oxo-degradable single-use plastic object.	Relevant regarding the use of plastic in the project site particularly for food catering for workers

5.6 The World Bank Environmental and Social Framework

The project is an investment project financing (IPF) funded through loan from the International Development Association to the Government of the Democratic Republic of Timor-Leste, and therefore, is subject to due diligence process of the WB ESF to ensure this

Project is implemented in a sustainable manner from E&S perspectives. The gaps between the relevant Timor-Leste laws and regulations and those of the World Bank Environmental and Social Standards (ESS) are identified in the following table, and therefore, gap filling measures are undertaken to bridge these gaps

Table 5.3. The Bank ESS Requirements Applicable for the Project

ESS	Key Requirements
ESS1 Assessment and Management of Environmental and Social Risks and Impacts	<p>This ESS is relevant for the project in identifying, assessing and mitigation of E&S risks and impacts, and the ESIA also includes:</p> <ul style="list-style-type: none"> - Description of key legal and institutional setting and responsibilities - Scope of ESIA including potential indirect and cumulative E&S risks and impacts - Mitigation measures and monitoring (ESMP) and reporting arrangements - Capacity building - Budget items to implement the ESMP - Resettlement Action Plan describing people, land and assets that may be affected by the project including relevant mitigation measures - Labor Management Plan (LMP) - Prevention procedures on sexual exploitation and abuse/sexual harassment (SEA/SH) - Grievance Redress Mechanism (FGRM)
ESS2 Labor and Working Conditions	<p>This ESS is relevant for the project as it would require construction workers. Another risk is the use of child labor and/or forced labor particularly in areas where job opportunities are scarce. The ESIA needs to include an assessment of potential risks and impacts related to labor and working conditions.</p> <p>Mitigation measures will be specified in the Labor Management Procedure (LMP), including guidance to address potential child and forced labor and arrangements for the labor’s Grievance Mechanism. Bidding documents and civil work contracts will need to include requirements for labor and working conditions reflecting the relevant elements specified in the LMP.</p>
ESS3 Resource Efficiency and Pollution Prevention and Management	<p>This ESS is relevant for the project where its DED incorporate climate resilience water supply design, good engineering and efficiency intended to minimize non-revenue water and energy use by distributing water using gravitational systems.</p> <p>Sourcing of construction materials will be undertaken from facilities and quarries that have valid operating permits.</p> <p>Hazardous and non-hazardous waste management, particularly construction wastes, spoils and used lubricants, will be conducted as an integral part of the Project implementation. The Project should identify for possible presence of asbestos containing materials and any hazardous substances and define</p>

ESS	Key Requirements
	safe handling and disposal of these materials and substances according to prevailing laws and regulations.
ESS4 Community Health and Safety	<p>This ESS is relevant for the project. Community health and safety risks and impacts will arise from the project’s construction and operation activities and are assessed in the ESIA. Measures to avoid, mitigate, and address potential safety impacts will be included in the ESMP. Health risks for the community in the surrounding areas may arise due to potential labor influx during construction, and mitigation measures will be developed in the ESMP.</p> <p>The Project will include requirements and procedures for GBV/SEAH risks management to be applied for project workers and subcontractors including feedback and grievance redress mechanisms and confidential reporting with safe and ethical documentation of GBV/SEAH cases.</p>
ESS5 Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement	<p>This ESS is relevant for the project. The project will not require land acquisition as most land is owned by the state and few plots required for the project have been donated by the community for the project. A resettlement action plan (RAP) has been prepared and updated for the project to identify affected people and impacts that may occur to them, considering changes in the location of spring water to be abstracted and adjustment/new location for the storage/distribution water tanks.</p>
ESS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources	<p>This ESS is not relevant as the preliminary screening indicates that none of the project footprint overlaps with protected areas or key biodiversity areas.</p>
ESS7 Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	<p>All communities in Timor-Leste are considered Indigenous People considering they have collective attachment to the areas, and therefore, ESS 7 is not relevant.</p>
ESS8 Cultural Heritage	<p>This ESS is relevant as the springs as the water source of the project is considered sacred sites according to Timor-Leste culture and norms. Therefore, some cultural practices may need to be undertaken as part of the project implementation, and therefore, included in the ESIA.</p>
ESS9 Financial Intermediaries (FI)	<p>The project will not involve financial intermediaries and will be direct lending instead, and therefore, ESS 9 is not relevant in this regard.</p>
ESS10 Stakeholder Engagement and Information Disclosure	<p>As part of the project preparation since 2020, stakeholder engagement at various levels, including government authorities, project management entities, and affected peoples have been undertaken. The recent engagement activity was undertaken in April 2026.</p> <p>The current project's Stakeholder Engagement Plan (SEP) will be updated, ensuring its relevance with the updated project’s DED and implementation plan.</p>

5.7 Good Industry International Practice on Pollution Control

In regards to pollution prevention and control technologies and practices, the Government of Timor-Leste has not yet stipulated the National Standards for air, water, and noise, and therefore, under the legal requirements of the Base Law for Environment, the use of international standards are recommended such as those published by World Health Organisation (WHO) guidelines and, where non-existent, the IFC Environmental, Health and Safety Guidelines are usually referred to as international good practice. Key environmental quality standards applied in Timor-Leste are listed below.

- *Ambient Air Quality Standards*

Table 5.4. WHO Air Quality Guidelines (2000) and Global Update (2005)

Parameter	Averaging Period(a)	WHO Air Quality Guidelines ($\mu\text{g}/\text{m}^3$)	Standards to be followed by Project	Parameter
		Global Update 2005(b)	Second Edition 2000(c)	
PM ₁₀	Annual	20	-	20
	24-Hour	50	-	50
PM _{2.5}	Annual	10	-	10
	24-Hour	25	-	25
SO ₂	24-Hour	20	-	20
	10-minute	500	-	500
NO ₂	1-year	40	-	40
	1-Hour	200	-	200
CO	8-hour	-	10,000	10,000
	15-minute	-	100,000	100,000
Pb	1-year	-	0.5	0.5

^a Due to short term duration of civil works, the shortest period will be more practical to use.

^b Source: World Bank Group. IFC. 2007. Environmental, Health and Safety General Guidelines.

^c Source: Air Quality Guidelines for Europe, Second Edition, 2000; WHO Regional Office for Europe, Copenhagen

- *Ambient Noise Level Standard*

Table 5.5. IFC's EHS General Guidelines (2007) - Noise Level

Receptor / Source	Standards to be Used for Project	
	WHO Guideline Values for Noise Measured Out of Doors ^a (one hour LAq in dBA)	
	Time: 07:00 - 22:00	Time: 22:00 - 07:00
Industrial Area ^a	70	70
Commercial Area ^a	70	70
Educational Area ^a	55	45
Rural Residential Area	55	45
Urban Residential Area	55	45
Mixed Residential Area	55	45
Quiet Area	55	45

Note: ¹ WHO Guideline Values for Noise Measured Out of Doors (one hour LAq in dBA)

6 DESCRIPTION OF ENVIRONMENT AND SOCIAL BASELINE

6.1 Data Collection and Analysis Methods

Baseline primary data was collected in 2020 - 2022 period for selected components which resorted fieldwork, GPS photo registry and aerial photography whilst an extensive secondary data collection which included site visits and meetings with staff and stakeholders, and literature review that was conducted to prepare the context and framework applicable to the study area and to understand policies, guidelines, and legal and regulatory requirements for the project impact assessment. The table below shows the list of environmental and social baseline of the project areas and its surroundings that are used for impact assessment purpose.¹ Some updated on social baseline information was undertaken in April 2026 due to changes in the location of one of the water sources and storage/distribution tanks.

Table 6.1. Components described in the environmental description

Component	Primary Data Sources	Secondary Data Sources
Physical Environment (Sub-section 6.2)		
Climate	No primary data collected.	Literature on the region, data collected from official authorities and from other studies or projects
Topography	Field survey of the project site (11 to 17 January 2021)	Literature on the region, data collected from official authorities
Geology	Field survey (3 October 2021)	Literature on the region
Air Quality and Noise	No data collection	Literature on the region, and data from other studies or projects
Water Resources and Hydrology	5 - 6 November 2021 (Pumping Tests)	Literature on the region, data collected from official authorities, data from other studies or projects
	Water sampling and analysis: April 2018; and Oct to Nov 2021	Literature on the region, data collected from official authorities since May 2014.
Soil	No data collection	Literature on the region, data collected from official authorities.
Ecological Components (Sub-section 6.3)		
Wetlands, mangroves, coral, protected areas, etc.	No data collection	Literature on the region, data collected from official authorities, other studies or projects
Economic Components (Sub-section 6.4)		
Employment Sector	No data collection	
Infrastructure Facilities	Field Survey (GPS photo registry and land use) on 15 June 2020	Literature on the region, data collected from official authorities, other studies or projects
Land use		
Use of forests and other natural resources		

¹ It is noted that no update of environmental baseline information has been undertaken since this SEIS was approved in October 2022, considering that no laboratory in Timor-Leste has the capacity to collect and analyse ambient air quality and noise level, except water quality. The pool of environmental and social consultant is also limited.

Component	Primary Data Sources	Secondary Data Sources
Fishing and Agriculture, Tourism	No data collection	
Any type of Common or Individual rights on natural resources	No data collection	
Social Components (Subsection 6.5)		
Population and Communities	No data collection	Literature on the region, data collected from official authorities, other studies or projects
Health Profile		
Institutions, School and health facilities		
Community and Family Structure		
Land ownerships and other rights over the land	Social Survey - June 2021	
Cultural Components (Subsection 6.6)		
Cultural heritage	Field Survey - Interviews (15 June 2020)	Literature on the region, data collected from official authorities, other studies or projects
Archaeological and Historic Sites		
Sacred Sites and Unique Landscape		

6.2 Physical Environment

6.2.1 Climate

Based on the Köppen climate classification, Timor-Leste's climate is classified as Type A. Köppen's A climates are controlled mainly by the seasonal fluctuations of the trade winds, the intertropical convergence zone (ITCZ), and the Asian monsoon (Beck et al, 2005). As located in tropical region i.e. Southeast Asia, experiences a tropical monsoon climate with two distinct seasons, dry and wet season. Due to its irregular topography, the country can be divided into three regions that present the same rainfall and temperature pattern:

- along the northern coast (between 0 and 600 m altitude) with annual average below 1,500 mm and average temperature above 24 °C,
- central region of the Island (mountainous areas) with annual average above 1,500 mm and average temperature below 24 °C (Sandlund et al, 2001) and
- southern coast with annual average of 2063 mm and average temperature above 24 °C (Bacon et al, 2013)

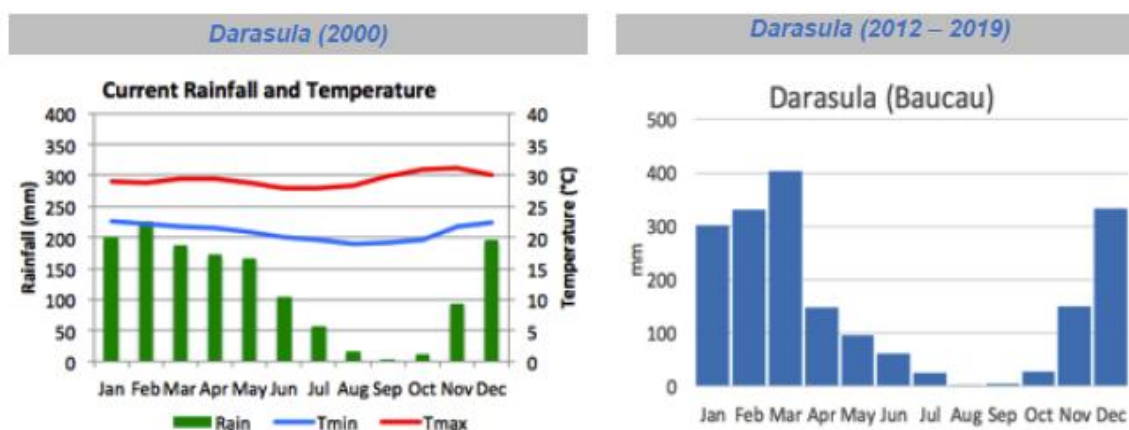
Likewise, the relative humidity also presents different values depending on the regions. On the north coast, the mean monthly relative humidity ranges from 69 to 78% (Yance, 2004). On the south coast, it varies from 73 to 80%, whereas in the highlands it varies from 75 to 78%.

The potential evaporation is one of the key factors of the hydrological cycle. It provides an indication of maximum possible evaporation under saturated surface conditions. Timor-Leste's potential evaporation varies, depending on the altitude of the regions. In the lowlands, the monthly evaporation ranges from 60 to 230 mm while in the highlands it is

100 to 190 mm per month. The average daily potential evaporation is range between 5.2 and 6.5 mm in the lowlands and 2.6 to 4.9 mm in midlands (Kirono, 2010).

Baucau climate is influenced by the West pacific monsoon with an average annual precipitation of approximately 1300 mm/year mostly occurring from November to April. Based on the recent observation data (2013-2019) collected from Automatic Weather Station (AWS) from (ALGIS, 2020) and (NDMG, 2019) suggest that the average annual temperature in northern side of Baucau (0-500 m) is 27 °C while in the central area (>500 m) have an annual mean temperature of 22 °C. Due to its localization in tropical region the annual climate is perceived as hot with maximum temperature reaches 32 °C, in the lower part of the municipality with humidity range between 57 - 88 % as shown in the figure below.

Figure 6.1. Average Temperature and Rainfall Patterns



Source: ALGIS, 2020.

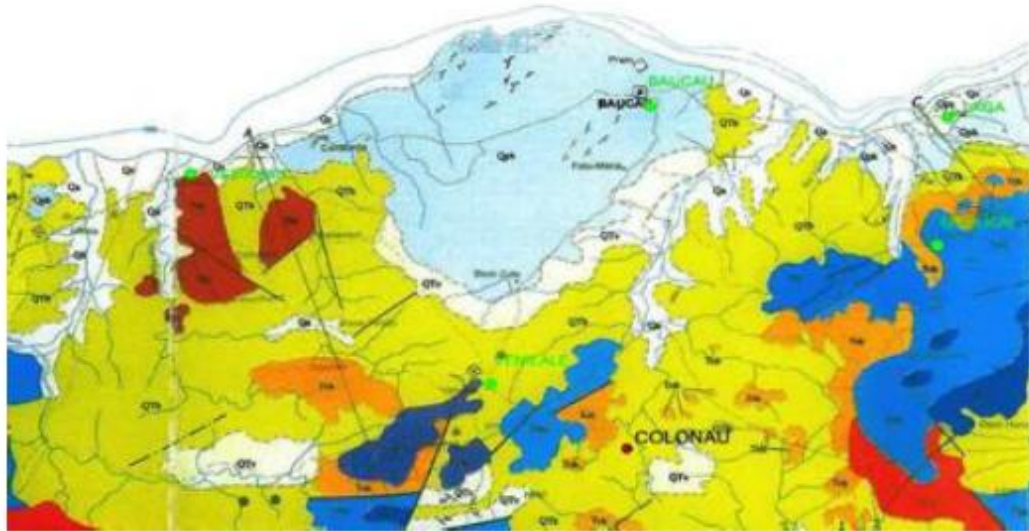
6.2.2 Topography

The city of Baucau lies on the north coast of Timor-Leste, at the top edge of the extensive Baucau Plateau, formed by uplift of Pleistocene coral terraces. Some of its northern and eastern areas are close to 600 m high, while the plain south of Baucau are marine plains underlain by fossil coral reefs. Heading Southwards, the Baucau plain slowly elevates towards to the Mountain ranges of Mount Mundo Perdido and Mount Laretame (Protected Areas where the latter is the closest to the project site, at 15 Km distance), towards Viqueque Municipality just after). To the Northeast, 20 Km distance from the Project Area is the highest mountain of the district, Mount Matebian at 2,316 m high and also a declared Protected Area.

6.2.3 Geology

According to the geological map of Timor-Leste, the region of Baucau is formed of recent sedimentary materials, aged of the Pleistocene (Qpb) named Baucau Formation (Horizon, 2005).

Figure 6.2. Geology of the Baucau Region



Source: Extract from the Geological Map of Timor-Leste, Scale 1:250.000

The flat lying Baucau limestone consists of grey, hard, cavernous, massive white coral-reef limestone well developed around Baucau city. The unit controls the topography in the Baucau and Lautem plateaus. A continuous outcrop occurs along the north coast. In the southern foothills, the Baucau limestone also crops out in scattered hills. The limestone occurs as coral-reef, calcarenite and a greywacke-pebbly sandstone facies. It seats on older units everywhere and overlies the Viqueque Formation, but locally, it is found on older formations.

The Baucau limestone is a 100 - 500m thick, shallow marine/beach limestone, of calcirudites and calcarenites of Pleistocene to Recent age. The unit is principally composed of reefs and is highly karst and terraced. The formation is widespread in the eastern half of the country and is laterally equivalent to the porous limestone (lacustrine) around Lake Surobeco and underlying Los Palos, here named Surobeco Formation.

In the type-locality around Baucau, the formation is comprised of hard, cavernous, massive, white coral-reef limestone, which weathers to a pale grey colour. The plateau is characterized by karst topography and dark reddish soil. Around there, are coral reef limestones, calcirudites - massive poorly bedded conglomerates of reef debris, calcarenites - sand grains of fragments of corals, bryozoans, Foraminifera, calcareous algae, molusc and echinoderms, and greywacke-pebbly sandstones.

The limestone has an unconformable base comprising former hills, the Viqueque Formation or Bobonaro Scaly Clay. Limited drilling around Baucau has indicated a white to brown clay base. The Baucau limestone conforms to a series of raised beaches that mark the stages of uplift of Timor during the Pleistocene and Holocene due to epirogenic uplift of Timor. Baucau seats over the headwall (top edge) of a giant landslide that has partly dismembered the edge of an extensive plateau formed by uplift of Pleistocene coral terraces. The northern and some of the eastern parts of the nearly 600m high plateau are fringed by uplifted reefs that record an extended period of uplift at presently poorly constrained rates and timing.

6.2.4 Ambient Air Quality and Noise Level

Air Quality Data. Air pollution is commonly defined as the introduction into the atmosphere of chemicals, particulate matter or biological materials that can cause adverse impacts on human health or other aspects of the environment. Air pollutants are by nature primarily emitted from anthropogenic sources (i.e., related to human activity) and very rarely by Natural causes i.e., volcanoes.

Under the agreement with ANLA and given primary air quality data is very scarce for the Baucau Region, the only available air quality data of Baucau Region can be sourced from the 2015 EIS Report of TL Cement Baucau Project, prepared by Worley Parsons (TL) LDA. They carried out an Air Quality Assessment in the project site, approximately 10 km away from the Baucau Project area. The details of sampling location of air quality can be found in Table 6.2, with two test sites close to the Baucau project, namely the AQ1 - Bahu and AQ3 - Aldeia Parlamentu.

Table 6.2. Air Quality in Suco Tirillolo, Baucau (BBS, 2015)

Location	Easting	Northing	Description	Note
AQ-1 Bahu	216789	9063590	Settlement Area	East, southeast of cement plant activities
AQ-2 Check Point Triloca	210449	9060528	Settlement Area	South of cement plant activities
AQ-3 Aldeia Parlamentu	212219	9065491	School Area	East of cement Plant and northeast of limestone mine
AQ-4 Aldeia Ossu-ua	209130	9065049	Settlement Area	Close to the plant area
AQ-5 Jetty Plan	207556	9065473	Jetty Area	Within the Jetty Area
AQ-6 Wailacama	204204	9060553	Settlement Area	Northeast of clay quarry
AQ-7 Bucoli	207767	9060792	Settlement Area	South of mine and plant, Northeast of clay mine

Their samples were collected at the above sampling sites and sent to a laboratory in Australia for testing against international standards, given the inexistence of Timorese standards at the time of the study. The analytical result of the air quality samples is presented in the following table. These standards are: WHO Air Quality Guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide (WHO, 2005); and WHO Air Quality Standards for Carbon Monoxide (WHO, 2010).

Table 6.3. Air Quality Baseline Survey for the Proposed Cement Plant (2015)

Parameter	Standard Value (WHO, 2005)	AQ1 - Bahu	AQ3 -Parlamentu
PM ₁₀	150 ug/m ³ (24 Hour)	23	22
PM _{2,5}	150 ug/m ³ (24 Hour)	20	14
CO	30,000 ug/m ³ (1 Hour)	275	430
NO ₂	200 ug/m ³ (1 Hour)	12	13
SO ₂	196 ug/m ³ (1 Hour)	<8.5	<8.5

The resulting baseline measurements of the above air quality samples were deemed representative of the ‘typical’ air quality in the region, where all the "below-threshold" results were typical of the activities existing in Baucau at AQ1 and AQ3 sites at the time. Regarding chemical compounds, the trace levels detected for NO_x and SO_x were representative of the emissions from vehicles and power generators in the city periurban area, while the higher proportions of particulate matter (PM) i.e., PM₁₀ and PM_{2.5} suggest uncombustible materials from local burning activities and vehicle-generated dust due to local unsealed roads in close proximity to the housing and busy business areas.

For the water supply project, and for the same area as the 2015 study (2 sampling sites), the team's site visits and meetings and interviews with local stakeholders identified the very same activities and situations that continue to be carried to date in the project area, mainly burning of vegetation (due to seasonal shifting agriculture), transportation or burning wood for domestic purposes, among others. Thus ambient air conditions in Baucau city can be said to be, to an extent, already slightly deteriorated due to everyday urban city life activities and the project's activities, especially the temporary dust generating construction activities, would not be significantly higher than the already existing emissions in the Dry season. The air quality in the project area is deemed to be generally good in the wet season but degenerate and become dusty in the dry season, given a great number of the city roads are in bad condition and unpaved or fugitive emissions from movement of vehicles.

Ambient Noise Level. As shown in the table below, noise measurement in the project area was also presented based on the EIS of TL Cement Baucau Project (2015) area to describe activities and noise background for 24 hours by measuring a minimum of 4 times at noon and 3 times at night. The locations of sensitive receptors studied at the time are the same as those of air quality and presented in the following table, and those representative to the Baucau water project are NO1 - Bahu and NO3 - Parlamentu. The standards used by the TL Cement Project, as reference to noise impact, were US EPA 550/9-74-004 whose thresholds are similar to the WHO Guideline Values for Community Noise (2009).

Table 6.4. Noise Measurements from TL Cement Project (2015)

Measurement Event of Laeq (dBA)	1	2	3	4	5	6	7	8	9	10	11	12
NO1 - Bahu	54.0	54.4	55.6	64.2	60.7	53.6	54.1	52.8	52.6	57.5	58.1	52.5
NO3 - Parlamentu	55.5	43.6	45.1	48.9	50.3	50.2	51.1	46.2	46.5	47.5	45.9	50.2

Source: WorleyParsons Resources & Energy

The resulting baseline measurements conducted during the fieldwork were deemed representative of the ‘typical’ noise quality in the region. NO1 - Bahu were located close to the main Caravela - Baucau Road, thus the registering of several results above the WHO Outdoor Living Areas threshold of 55 dBA. On the other hand, NO3 - Parlamentu is located in the periurban area of the city, away from busy roads or activities and therefore the values were below the WHO thresholds. These results were deemed typical of the activities existing in Baucau NO1 and NO3 at the time.

For the Baucau project, and for the same area as the 2015 study (2 sampling sites), the team's site visits and meetings and interviews with local stakeholders identified the very same activities and situations that continue to be carried to date in the project area, especially the main road traffic activity. One can assume that if this is such at the outskirts of the city, but close to a main road, then in the centre of the city, at higher peak hours

A. Surface and Groundwater

The hydrological system in the project area, namely Baucau Administrative Post, falls into the Seical Watershed, considered a High Priority [Red] (JICA, 2017). The rivers Seiçal, Borauai, Lequinamo, Binagua and other small rivers lie to the east of the city of Baucau. Of these only the Seiçal River has water all year round (ADB, 2016). Around 85% of the urban area is built on top of the limestones. Due to the hydrogeological setting, the region where Baucau municipality is located is considered a Karst aquifer system, with a complex morphology and spatial characterization of groundwater flow. This is because the limestone is easily dissolved giving origin to many irregular fissures, flow paths and caves, which in turn makes the reservoir characterization a task rather difficult.

In terms of quantity, due the size of the Baucau plateau, the aquifer has the capacity to preserve a large volume of water. Most of water is known to be conducted in flow paths discharging in the springs, while other significant part is preserved in the aquifer. The main sources of water of this region are contact springs, where the limestone contacts impermeable formations. The hydrogeological conceptual model is shown in the next figure for a better understanding of the groundwater flow regime in the region.

B. Water Quality

Water sampling and testing have been carried out since 2000 up to 2021 to several water sources in Baucau city, particularly those used for the existing water distribution system and during the preparation of Masterplan in 2014 (ADB, 2016). As described in Section 4 of this SEIS, most of the indicators are generally acceptable within the World Health Organization (WHO) limits for human consumption despite several occurrences of high-level turbidity in certain cases, which could be attributed to rainy season or other. There is a historical trend of occurrence of water contamination results due to the presence of Total Coliforms and faecal coliforms which may relate to the common agricultural husbandry and human settlement related activities.

6.2.6 Coastal and Marine Waters

In Timor-Leste, coastal areas have been the most important area and preferred to be inhabited by rural communities who are mainly dependent on (semi) subsistence farming and fishing. Nationally, only few urban settlements are located directly along the coast i.e., Dili, however, it is significant that 66% of the population lives in the coastal and lowland areas below the elevation of 500m (UNDP, 2018). Coastal zones of Timor-Leste generally have shallow seas with valuable marine resources such as fish, seagrasses, seaweeds, coral reefs, etc. Most evident vegetation along Timor's coast is mangroves forest, which are found predominant in the northern coast, and some coastal forests, including arid woodlands (UNDP, 2018). Timor is also the home for 1,200 reef fish species and 400 reef building coral species (UNDP, 2018) which classifies Timor-Leste as an important region of the coral triangle.

The coastal resources in Baucau Municipality Northern Coast boast special importance in marine richness and diversity and is marked as an important key biodiversity area (KBA) within 15-km radius from the centre of the project area i.e., Baucau Municipal Capital City. However, this KBA is located well outside the 15-km radius of the project area, and therefore unlikely to be impacted by the project activities.

6.2.7 Soil Characteristics

The top plateau of Baucau is characterized by karst topography and dark reddish soil (Audley-Charles, 1968). One of the formations into four distinct lithologies is Coral-reef limestone, insitu growths of coral and calcareous algae. The thickness of the Baucau limestone has been identified from geophysics as reaching a maximum of about 80 meters on the plateau. Core drilling by Timor Cement on the flanks of the plateau indicates limestone thickness up to 100 metres. The site of TL Cement Project is characterized by shallow limestone soils with scattered limestone rock outcrops, minor ridges and gullies sloping towards the beach (Trainor & Easton 2015).

6.3 Ecological Components

Situated within the Wallacea Biodiversity Hotspot (defined as the islands in the Indonesian archipelago and Timor- Leste between the Sunda and Sahul continental shelves), Timor-Leste hosts a number of quite significant ecosystems and endemic species, originated from Asia and Australasia and spread through the Wallacea region but through long isolation have developed very high levels of endemism (G-RDTL, 2010), many of which are threatened with extinction by IUCN. Additionally, according to NEGA (2010), Timor-Leste is also part of the Coral Triangle, harbouring many important species, such as: "...76% of the world's coral species; six of the world's seven marine turtle species, more than 3,000 reef fish species, whale sharks, manta rays and a diversity of marine mammals, such as 22 dolphin species and a variety of whale species".

However, the natural ecosystems in Timor-Leste have been severely depleted in the last century, through intensive deforestation, forest degradation, loss of soil due to 'slash-and-burn' agricultural methods and heavy rains, mangrove destruction, pollution of waters and sedimentation of rivers. Native vegetation is a fundamental element of ecosystems, encompassing most of its biomass and has therefore been equally affected.

6.3.1 Coastal and Marine Ecosystem.

The enormous marine resource places Fisheries in Timor-Leste as a primary food source, although it is still considered small-scale and mainly for subsistence purposes, where fishermen use non-motorized boats with gill nets and hook and line to capture reef and surface-dwelling fish. The Fish and Animal Consumption and Availability Survey conducted in 2011 by Regional Fisheries Livelihoods Program in five Timorese municipalities, estimated average fish consumption to be 6.1 kg/person/year all throughout Timor-Leste, while people living near the coast stood at 17.6 kg/person/year versus those living inland consumed 4/kg/person/year (Poblacion, 2013).

Line fishing and net fishing from boats are the most widespread fishing activities in Timor-Leste, occurring adjacent to 11 coastal municipalities, including Baucau (Worldfish, 2019). The top fish species that fishers in Timor-Leste consider most important for sale include Sardines (*Sardinella spp.* and others) and a short-bodied mackerel (*Rastrelliger spp.* and possibly some *Decapterus spp.*), while other species ranked highly for trade included bullet tuna (*Auxis spp.*), garfish (*Hemiramphus sp.*), , grouper/rock cod (*Epinephelus sp.*). As explained above, given the substantial distance of the project to the coast, the project is not expected to contribute with an impact that may affect this component such as i.e., siltation of coastal waters directly from the project activities.

Thus, the coastal zone (and habitats) of Timor-Leste is subject to a high degree of human dependency and impact on said resources, be it for Tourism or socioeconomic activities i.e.,

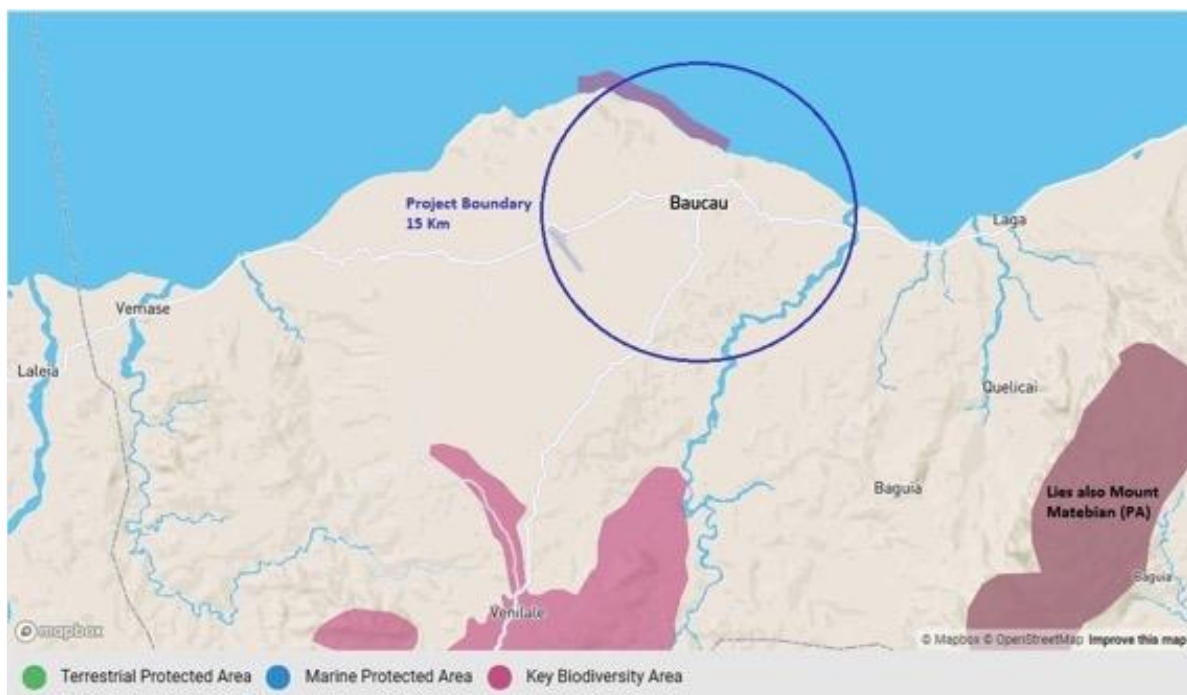
mangrove forests, have been reduced at an alarming rate throughout decades since 1940, due to timber harvesting, wood collection for fire and opening up spaces near the mangrove forests for shrimp and fishponds.

The coastal resources in Baucau Municipality Northern Coast are considered of special importance and is marked as an important key biodiversity area. However, this location is well outside the 15-km radius of the project area and unlikely to be impacted by construction activities of the project.

6.3.2 Terrestrial Ecosystems including Protected Areas

Protected Areas. Timor-Leste has a total of 49 declared Protected Areas (PA), according to Decree-Law No. 05/2016 on Protected Areas Network in Timor-Leste, containing the majority of the country's remaining primary forest cover. The majority of these areas are mountainous and have high species endemism. The closest PAs to the project area are Mount Matebian (~24,000 ha) and Mount Laritame (~16,429 ha) which are approximately 20 km and 15 km away. These PAs are also classified as key biodiversity areas according to the Integrated Biodiversity Assessment Tool (IBAT) as shown in the following figure. None of the KBA overlaps with the project area.

Figure 6.4. Key Biodiversity Areas near the Baucau Project



(Source: www.IBAT-alliance.org, accessed 21.01.2021)

The Consultant team met with Mr. João Antalmo, the National Director for Protected Areas on 12 September 2020, to procure updated GIS documentation on the National Protected Areas Borders. Whilst at the time these were not available, the team further complemented this consultation with a meeting with the Director General for Forestry, Mr. Raimundo Mau on 10 December 2020, where it was confirmed that the 2018 boundaries should be used as the most current PA boundary reference. Updated GIS data were supplied which have made it possible to define the areas of the project that may be in and out of the PA.

Flora. In general, forest and woodland of several structural types are the predominant original vegetation throughout much of Timor-Leste. Tall evergreen forests grow in areas with high moisture while drier and more extreme climatic conditions lead to the appearance of semi deciduous and tropical dry forests (JICA, 2013). Prior to the country's independence, its forest had been significantly exploited due to the foreign demand of country products, such as sandalwood (*Santalum album*). From 1.5 million hectares of total land in Timor, 57% are classified as forest or woodland (GovTL, 2010). The identified forest woodland has been degraded due to timber harvesting and illegal logging, and slash-and-burn for agricultural practices.

Based on a preliminary survey of the flora and fauna of Timor-Leste conducted in collaboration with Birdlife International, more than 251 tree species had been identified as native with a great deal of biodiversity in agriculture. The agro-biodiversity database elaborated by MAF, GIZ/AMBERO, UNTL and Permatil lists 200 crop species in 555 varieties that are cultivated and/or used by Timorese farmers. While the database only includes data from 26 pilot villages (sucos) distributed over five districts, actual diversity is likely to be much higher.

The economically/locally important vegetation types and species recorded in 2015 (ADB, 2016), in the Baucau area were the following: Narra (*Pterocarpus indicus*); teak tree (*Tectona grandis*); ai samtucu (*Falcataria moluccana*.P); eucalyptus (*Eucalyptus globus*); acasia (*Samanea saman*); mahogany (*Swietenia mahagoni*); balete (*Ficus stipulosa* Miq.Linn.); ipil-ipil (*Leucaena leucocephala*); madre de cacao (*Gliricidia sepium*); coconut (*Cocos nucifera*); mango (*Mangifera indica*); coffee (*Coffea Arabica*); banana (*Musa x paradisiaca*); papaya (*Carica papaya*); guava (*Psidium*); jackfruit (*Artocarpus heterophyllus*); breadfruit (*Artocarpus altilis*); guyabano (*Annona muricata*); atis (*Annona squamosa*); banana (*Musa sp.*); water lettuce (*Pistia*); corn (*Zea mays*); taro (*Colocasia esculenta*); mango (*Mangifera sp.*); Ipot palm (*Areca ipot*); Palmyra palm (*Borassus flabellifer*) and banyan tree (*Ficus microcarpa*).

The Consultant team conducted site visit and characterization on June 15, 2020 in several locations within 15-km radius of the project area such as zone 3,5,6,7 and 8, Caisido area, along the road to Uailili Spring, Bui-Sama Street, Southwest part of the project area (near Baucau airport), and Seical river area, and the identified Coconut trees (*Cocos nucifera*), Breadfruit (*Artocarpus altilis*), Madre de cacao (*Gliricidia sepium*), Jackfruit (*Artocarpus heterophyllus*), Albizia (*Falcataria Moluccana*), Siam weeds (*Chromolaena odorata*), Rain tree (*Samanea saman*), Junghuhniana trees, Palmyra palm (*Borassus*), and Sandalwood (*Santalum album*). The only identified sensitive vegetation within the 15-km radius of the project area is Sandalwood tree (*Santalum album*) near Baucau airport that declared as a protected flora under Annex 1o the Decree Law No. 6/2020 on Legal Regime for the Protection and Conservation of Biodiversity.

Fauna. The 5th UNCBD Report (GovTL, 2015) indicates that bird life in Timor-Leste is usually better documented than the non-bird fauna of Timor-Leste, although some main species groups such as mammals, reptiles and amphibians have been studied to some degree at some locations within the country. Roughly half of the bird fauna originates from Asia and Australasia, whereas the mammal, amphibian and reptile faunas are dominated by Asian families and species. New species of bats, frogs, geckos and skinks have been discovered with evidence indicating high levels of endemism.

The country hosts around 262 bird species and 39 of them are threatened or restricted range species, 8 of which are endemic to Timor-Leste (GovTL, 2010). Realizing the importance of

conserving the birds to maintain the ecosystem services that the species are offering, the country has determined Important Bird Area (IBA) with accumulative land of 1,852 km² across the municipalities in Timor (Trainor, 2007). They are 16 IBAs, 14 on the mainland and two (2) on offshore islands (i.e., Atauro and Jaco islands), covering roughly 12.5% of Timor-Leste's total land area, supporting populations of both restricted-range birds of the Timor and Wetar Endemic Bird Area (EBA) as well as globally threatened bird species.

Three (3) bird species are identified as endangered, namely the Timor Green Pigeon [*Treron psittacea*, local name (LN): Punai Timor], the Timor Imperial Pigeon (*Ducula cineracea*, LN: Pergam Timor) and the Wetar Ground Dove (*Gallicolumba hoetdii*, LN: Delimukan Wetar). Additionally, Yellow-Crested Cockatoo (*Cacatua sulphurea*, LN: Kakatua jambulkuning) is classified as endangered species and Timor Sparrow (*Padda fuscata*), LN: Gelatik Timor is classified as vulnerable species

Previous studies (ADB, 2016) have identified several species of land mammals, reptiles, avifauna and bat species in the overall project area that are of conservation significance, such as: canut's horseshoe bat (*Rhinolophus canuti timoriensis*), beach thickknee (*Esacus magnirostris*), slaty cuckoo dove (*Turacoena modesta*) and Timor bush-chat (*Saxicola gutturalis*). The study also mentions three sightings of the yellow-crested cockatoo (*Cacatua sulphurea*), listed as Critically Endangered on the IUCN Red List, in the area, which will be further reviewed and/or corroborated in the field visit. Two amphibians sighted around Baucau district, included the Asian black-spined toad (*Duttaphrynus melanostictus*), an introduced species often called the Interfet toad and the rice paddy frog (*Fejervarya sp.*).

6.4 Economic Components

6.4.1 Demographics and Employment Sectors

The project situated in Baucau Municipality and its population was projected in 2015 to be at 47,294 persons. The predominant form of livelihood for households in Baucau municipality, with the exception of the urban area of Baucau city, is a mix of peri-urban services and a large percentage of subsistence agriculture (70% of the employed population of Baucau focussed on the production of primary staple crops such as i.e. maize, cassava, rice, etc for farmer households, whilst a large proportion of livestock activities i.e. cattle, spread out towards the area from the outskirts of Baucau town to the highland plain or east towards the Seical lowland area. (General Directorate of Statistics, 2015).

Human interaction within the employment setting results in several land-uses in the country such as agricultural, forestry, settlements, industry and dry lands land use. According to the Timor - Leste Agricultural Census (2019), the agriculture sector is predominant form of livelihood in Baucau Municipality, with a total 18,366 agricultural households (HHs) or 80,6% of total enumerated HHs, while the Baucau Post Administrative where the project area located has a total of 6,046 Agricultural Households (HHs) or 72% of total enumerated HHs, mostly near subsistence swidden agriculture for the production of primary staple crops such as maize, cassava, etc for farmer households, whilst a larger proportion of livestock activities i.e., buffalo, spread out towards the lower land areas towards the lower land areas to Baucau.

The majority of the population is mostly composed of self-employed farmers (21.65% of the municipality population, representing 72.2% of the total employed population in the Municipality) with 5% in Baucau Municipality and 2.2% in Baucau Administrative post unemployed/looking for work. Water has been an important source for securing their activity so as to have a sustainable income, since agriculture is heavily dependent to the

amount of rainfall in a given year, followed by harvesting water from the nearest water stream. While a smaller percentage are engaged in fishing activities in the municipality (2.6%), Baucau, being the capital, is the centre of urban development of the Municipality. Industries evident in the city are Construction (road and housing) and commercial and business areas within an urban and peri-urban setting, represent the remaining 8.23%.

Table 6.5. Demographic Profile of Baucau Municipality

Units	Total population over 10 years old	Employer / Self Employed	Employed / Unpaid family workers	Unemployed (looking for work)	Economically Inactive
Baucau Municipality	74,683 (100%)	18,544 (24.8%)	6,924 (9.3%)	3,728 (5%)	45,487 (60.9%)
Baucau Administrative Post/City	26,646 (100%)	5,097 (19.1%)	2775 (10.4%)	1,678 (6.3%)	17,096 (64.2%)
Timor-Leste (overall)	583,194 (100%)	132,929 (22.8%)	50,930 (8.7%)	30,420 (5.2%)	368,915 (63.3%)

6.4.2 Infrastructure and Public Facilities

In 2018 the Baucau Municipality represented the municipality with more schools, with 18 preschools, 362 primary schools, 45 high schools, 17 vocational/technical schools and 3 universities, totalling to 43,055 enrolled students and 2,372 teachers. However, there is a strong dropout rate in the basic education phase.

Baucau city is an established urban agglomerate and the former capital during the Portuguese colony and is considered as the second largest city in the country after Dili. It claims for its considerable commercial activity i.e., hospitality, commerce, trade and construction, a regional hospital and airport (although inactive) with a large enough runway for large-scale aircrafts for long-haul services to connect those coming from Dili to the Municipalities of Lautem (in the East) and Viqueque and Manufahi (in the South).

Baucau city comprises several touristic sites such as the Baucau Pouzada Pool, Uailili pool, and the Watabo beach in the northern coast of Baucau city. On a municipal level, Mount Matebian also has the potential on attracting local and international tourists for hiking and religious activities. The Pouzada Baucau performs an international quality service for its hospitality sector. The Association of Baucau-Oan (People of Baucau) also takes an important role on the establishing of almost all the infrastructures such as hotels and restaurants which benefits the livelihood of the locals and increase their per capita incomes.

Baucau Municipality has various mineral deposits with substantial economic values especially for manganese and copper extraction. Sand and gravels in Baucau municipality are ubiquitous natural resources alike other municipalities. Some of the mineral resources in Baucau city are still requiring further exploration while several mining activities have been in operation for some time as shown in the table below.

Table 6.6. Potential Mineral Resources in Baucau City

Natural Resources	Location	Potential	Observation
Manganese	Rahameta Baucau		

Natural Resources	Location	Potential	Observation
Sand and gravels	Kalauai and Mata River		DRN Ind. 1996
Sand and gravels	Seical River	5,175,000 m ³	
Limestone	Suco Bucoli	18,000,000 m ³	
	Suco Buruma	11,812,000 m ³	
Phosphorus	Northern coast of Baucau city	1,969 - 2,200 tons	
Travertine	Suco Buruma	-	Explored by PTAT (1991)
White sand	-	-	Investment required for further study

Source: *Planu Estratejiku Desenvolvimentu Municipiu Baucau (2020)*.

6.4.3 Land Use and Natural Resources

Land Use and Terrain. An assessment of the land use and cover in 2010 (JICA, 2013) indicated forest as the largest land use/cover category in the country (occupying about 60% of the total land area) and the second largest being grassland and shrubs (at 27% of the total land area). The remaining areas consisted of bare land (3.3%), rice and agricultural fields (2.8%) and dry farm (1.5%) while settlement covers 0.2% of the total land area.

Baucau Municipality consists of tropical denser forest vegetation where from the west and around to the East of Baucau highland, the landscape begins to rise from the sea, sloping upwards towards the Baucau plateau. It is mostly cultivated with coconut palm and other fruit trees and extensive rice-fields and other related agricultural activities in opened forest patches in several valleys along the rise. Whilst to the north of the Baucau Plain, following up a steeper landscape rise from small sandy beaches in the coast, the vegetation type and land use activity is similar to the western rise occasionally shaded by large banyan trees, but peri-urban and urban organisation and infrastructure (housing and other) begin to appear and become denser until the top of the plain is reached, at the centre of the Baucau urban city (IBP, 2011).

Forest Resources. The mountainous terrain prevents generalized agricultural and industrial uses in many areas, and the lower and flatter areas are preferred for a range of agricultural crops and land uses that may limit activities such as reforestation or commercial tree plantations.

Wood is the main product harvested from the forests that still exist in the Baucau Municipality, specifically, within the 15 Km project boundary which are close to the airport, Uailia Bere and Uailia Mata Springs. The local households mainly use it for cooking. Other uses of wood are for building of houses, furniture and lighting. A portion of the forests has been deforested through slash and burn for agricultural purposes.

Baucau rivers outside the protected area are utilized for sand and gravel, particularly the Seical and Manulede River, to support the development of infrastructure in the municipality. Whilst rivers within the protected area network are sparsely used, utilized mainly by local communities and are not used for industrial purposes.

Fishing and Agriculture. Fish farming in Baucau was observed in Watabou area, situated on the “Tasi Feto” Northern shore, the most promising in terms of fishing. As the dominant households in Timor-Leste are engaged in agriculture, producing crops, mainly rice, corn, cassava and vegetables. Baucau city owns to 126.7 ha of rice field, 2,276 ha of mixed-crops land, and 3,125 trees of Sandalwood tree (DGE, 2018).

Corn and cassava are commodity crops that are grown substantially across Timor-Leste. Corn is grown by 60% of Timorese-families with an average yield of 1.6t/ha however 30% are loss during the post-harvest stage due to poor storage. Cassava is an important crop for food security in upland rural areas (GovTL, 2011).

Horticulture initiatives resulted in 19,200-ton products in 2017 with tomato being the top product (1,520 ton/ha/year), breadfruit (320 ton/ha/year), banana (90 ton/ha/year). Livestock in 2018, chicken production was the highest with 26,677, then pigs around 16,151 and cows around 7,271. About 36 ha of land is irrigated in a traditional way.

6.4.4 Common or Individual Rights on Natural Resources

Community land management is commonplace in the project area. Tara bandu, as a communal method of natural resources management. It is necessary to take into consideration that almost all springs, proposed and currently in use i.e., Uailewa, Uailia Mata, Uailili and Uailia Bere springs, are and have always been involved in and have a spiritual importance to the community, under cultural/animistic protection. The Uailia spring is considered sacred and is currently not used due to a very significant difference of flow during seasonal change.

Therefore, it is important to involve the ‘lia na’in’ i.e., cultural leader, and communities to lead in the preparation of cultural ceremony preparation i.e., “opening” and Tara Bandu for authorization to i.e., yearly ceremonies at above mentioned springs or while conducting investigations for existing and proposed water sources, their use, continuance of use and/or cultural/natural protection of the source water resource, to avoid conflicts and distribution interruptions.

6.5 Social Components

6.5.1 Public Health Profile and Services

According to the 2015 Census, there were 36,200 births and 9,209 deaths reported to have occurred in 2015 by the Government of Timor- Leste, which gives an approximate 4 birth to 1 death ratio in Timor-Leste. The healthy life expectancy in 2019 for the people of Timor-Leste is at 69.5 years for both female and male (World Bank, 2019). Fertility rate woman aged 14 to 49 in Baucau municipality was on average of 4.5 births per woman which is similar to that at the national level. (Census, 2015). The mortality rate of people under 5-year-old was 160 deaths/1,000 births) compared to the national average of 72 deaths/1,000 live births. Further, the nutritional status of children in the country also suffering from stunting growth and malnutrition. Based on recent data from General Directorate of Statistics indicates in 2018, Baucau has 40 children malnutrition from under age 1 up to 15 years old.

The top 10 causes of death in Timor-Leste have been (in descending order): tuberculosis, lower respiratory infections, Ischaemic heart disease, stroke, birth asphyxia and birth trauma, diarrheal diseases, preterm birth complications, road injury, neonatal sepsis and infections and cancer. The prevalent disease is tuberculosis, causing 800 death cases in 2012 (WHO, 2015). The leading causes of death for children are acute respiratory infections, birth asphyxia, prematurity, diarrhoea, neonatal sepsis, injuries, congenital anomalies and

malaria. Diarrhoea remains to be the second leading cause of child mortality under 5 years of age.

In terms of facilities in Baucau Administrative Post, there are 25 health centres and private clinics with 84 Health professionals (DGE, 2019). The only hospital for the entire municipality is located in Baucau city, as well as the main administration building and the centre pharmacy.

6.5.2 Community and Family Structures

Despite being a 95% Catholic country, there is an underlying and very vast animistic culture in all the ethno-linguistic communities of Timor-Leste, maintaining institutional forms associated with the importance of the “Sacred” or Lulik beliefs in contemporary social life. Society and households in Timor-Leste engage with in a variety of ways, engaging in exchange relationships and customs that maintain narrative stories and founding myths, ancestral regalia and inherited knowledge, as well as landed property and ritual practices. These extend to the ritual of agriculture management and seasonal monsoons, life cycle ceremonies (birth, marriage and funerals), clan group rituals of solidarity and, more importantly, as a traditional approach to land management.

Baucau society follows (with slight local variation e.g., local dialect) in line with the general indications of those practiced in Timor-Leste, where the sacred or Lulik plays a central role in their contemporary social relationships and community, especially in what regards agricultural management and conservation of resources and ‘lulik’ areas appear in more disperse but nevertheless important symbols such as trees or water sources.

In regard to springs as the water sources, the ‘Lia Na’in’ (or traditional leader) has the primary role to lead a procession accompanied and witnessed by the representative of community, local authorities, and other interested parties throughout the ritual. Offerings are usually provided before commencing the ritual according to the objective that the interested party wants to achieve. The Lia Nain will then start to pray whilst presenting the offerings to God, ancestors and sacred objects.

There are several types of symbolic actions used for this practice. In agriculture, objects may be hung near or a piece of rattan tied around the trunk of specific trees or next to a garden to indicate custodianship of the resource. It is also widely believed that people who steal the goods subject to Tara bandu may suffer from an accident, misfortune or illness, while the Tara Bandu itself also provides for mediation of land disputes.

6.5.3 Land Ownership and Rights over the Lands

As part of the SEIS prepared in 2022, the Social Team of the Consultant carried out a survey regarding land ownership within the project area, namely public/government, private, and community land. Subsequently a resettlement action plan (RAP) was prepared as a land due diligence exercise. The objective of the survey was to register the land and its status as well as related impacts to project affected persons (PAP) if such land is acquired for the project. Following the changes in the project designs as described elsewhere in the report, the RAP was updated based on the social surveys conducted by PMU supported by the consultant in April 2026. The complete result of this updated is presented in the updated, draft RAP (April 2026), and the relevant result is summarized below.

The 2026 social surveys identified that project will rehabilitate the existing water storage tanks and construct the new ones, totalling to nine tanks. The total land required for the construction of these tanks amounts to 12,159 m², consisting of 2,821 m² of land claimed as

privately-owned lands by five households and 9,338 m² of government/municipal owned land. A municipality-owned land of 2,003 m² where the Lamegua tank is situated was recently claimed by one affected household (AH). The project is overall anticipated to directly affect 17 households with a total of 102 household members as shown in the following table.

Table 6.7. Affected Household (AH) based on the Project Area

Suco	Number of AH within Water Sources	Number of AH at Storage Tank Sites and Access Roads
Bahu	-	4
Uailili	2	-
Tirilolo	-	4
Gariuai	2	-
Buibau	-	5
Total	4	13

Source: Social survey conducted by the consultant mobilized by the Bank (April 2026)

Permanent and temporary structures, trees and crops as well as type of lands affected by the project is summarized in the following table, and these are owned by 10 project affected households (or a total of 43 affected persons).

Table 6.8. Type of Structures and Assets Affected

Structures/Assets	Magnitude of Impact	
	Number of units	Area/length
Structures		
Permanent residential structure	1	52.5 m ²
Temporary warehouse (ancillary) structures	1	24 m ²
Temporary kiosk (ancillary) structures	1	25 m ²
Permanent tank	1	5 m ²
Temporary kitchen	2	30 m ²
Trees and Crops		
Fruit trees (e.g., coconut, banana soursop)	414	-
Timber trees (industrial)	163	-
Crops (e.g., taro, potato)	3,711 (total)	-
Lands		
Productive land	7 plots	4,083 m ²
Barren/municipality-owned land	7 plots	10,994 m ²
Public land ²	13 plots	To be confirmed

Source: Social survey conducted by the consultant mobilized by the Bank (April 2026)

² Including the long area for the transmission & distribution lines

6.6 Cultural Components

6.6.1 Cultural Sites

Baucau society follows local variations of culture albeit still in line with the general indications of those practiced in Timor-Leste, where the sacred or Lulik plays a central role in their contemporary social relationships and community, especially in what regards agricultural management and conservation of resources. While the most significant areas with possible sacred sites appear to be scattered throughout the area such as i.e., springs (where all the springs visited were considered lulik, the project area is a predominantly mix-use setting i.e., urban with some rural activity such as garden and fruit/veggie patches, and lulik areas may appear in more disperse but nevertheless important symbols such as trees or other symbols.

During the site visit, the team carried interviews and received information from the Chefe Sucos in related to the historical and other cultural sites which located nearby the distribution alignments. The traditional customs in Timor-Leste also contribute to conserving the natural resources such as forest and crops, a communal protection system known as Tara Bandu.

Socio-cultural and heritage building mentioned in the table below are adjacent to the distribution network of the proposed water supply system, were the contractor should be aware of during the construction phase so that it will not damage or interfere to the heritage building as according to decree law no. 33/2017, which states that immovable assets should have a protection zone of 50 metres radius and take into account the established mitigation measures. (See also the figure in this section showing the distribution of cultural sites within the proximity of the project area)

Table 6.9. List of Cultural Heritage Sites Identified in Baucau

No.	Places	Type	Coordinates
1.	Monument 1	Heritage	8° 27.772'S / 126° 25.703'E
2.	Cemetery 1	Socio-cultural	8° 27.306'S / 126° 26.500'E
3.	Chapel	Socio-cultural	8° 27.365'S / 126° 26.579'E
4.	Hospital de Baucau - Portuguese administration	Heritage building	8° 27.478'S / 126° 26.843'E
5.	Sacred tree & traditional house	Socio-cultural	8° 27.590'S / 126° 26.920'E
6.	Private grave 1	Socio-cultural	8° 27.600'S / 126° 26.887'E
7.	Private cemetery	Socio-cultural	8° 27.656'S / 126° 26.972'E
8.	Private grave 2	Socio-cultural	8° 27.620'S / 126° 27.014'E
9.	Pousada de Baucau	Heritage, Touristic	8° 27.667'S / 126° 27.007'E
10.	Monument 2	Heritage	8° 27.663'S / 126° 27.046'E
11.	Monument 3	Heritage	8° 27.726'S / 126° 27.149'E
12.	Administrator Residence - during Portuguese time	Heritage	8° 27.701'S / 126° 27.165'E
13.	Old Pharmacy - during Portuguese time	Heritage building	8° 27.729'S / 126° 27.186'E
14.	Cathedral	Heritage building	8° 27.715'S / 126° 27.206'E
15.	National Hospital - during Portuguese time	Heritage building	8° 27.832'S / 126° 27.613'E

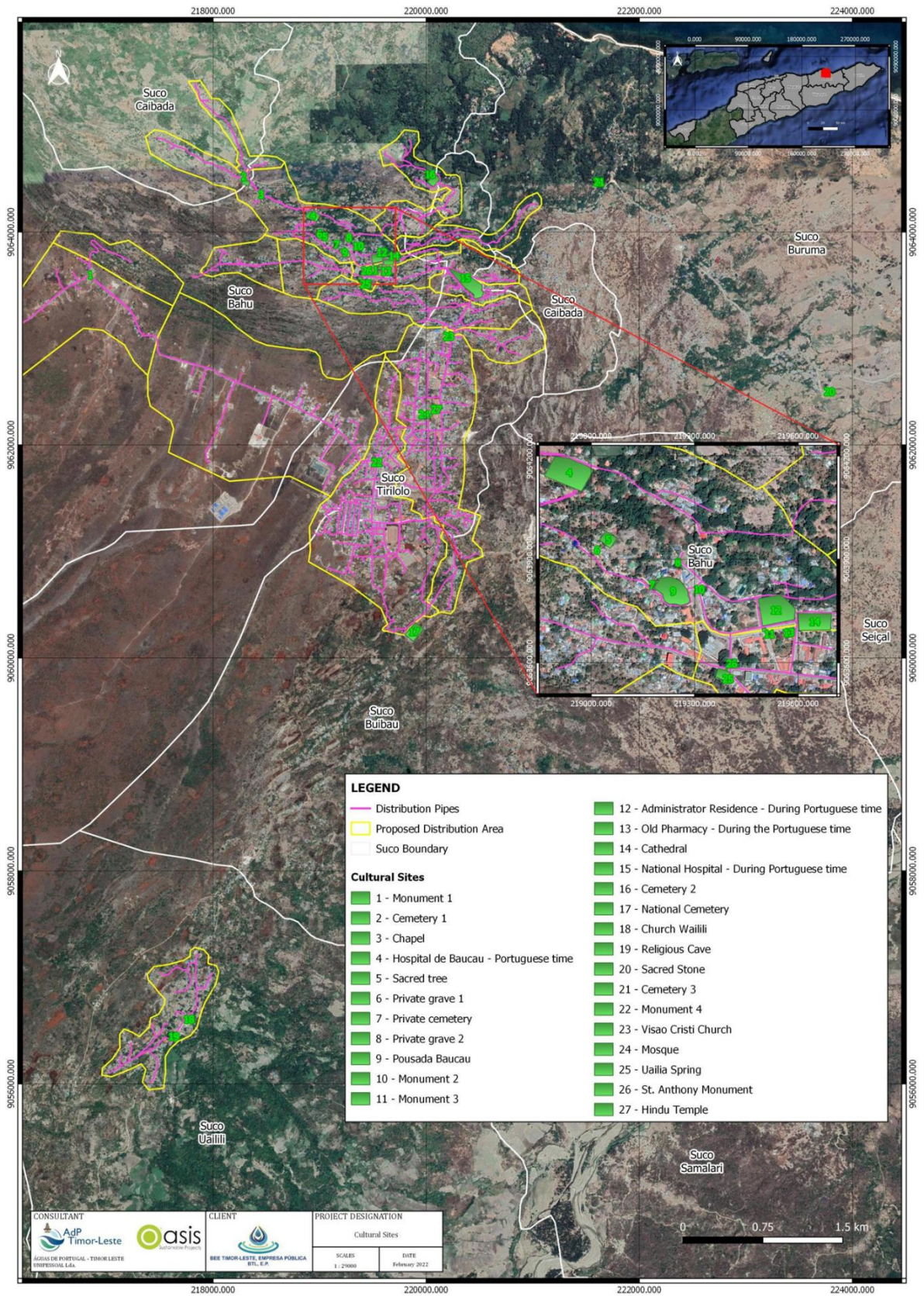
No.	Places	Type	Coordinates
16.	Cemetery 2	Socio-cultural	8° 27.313'S / 126° 27.476'E
17.	National Cemetery	Socio-cultural, Heritage	8° 29.596'S / 126° 27.335'E
18.	Church Wailili	Socio-cultural	8° 31.560'S / 126° 26.175'E
19.	Religious Cave - Wailili	Socio-cultural, Heritage, Touristic	8° 31.652'S / 126° 26.106'E
20.	Sacred Stone	Socio-cultural	8° 28.391'S / 126° 269.478'E
21.	Cemetery 3	Socio-cultural	8° 27.328'S / 126° 28.334'E
22.	Monument 4	Heritage	8° 28.735'S / 126° 27.161'E
23.	Visão Cristão Church	Socio-cultural	8° 28'6.06"S / 126° 27'32.99"E
24.	Mosque	Socio-cultural	8° 28'29.72"S / 126° 27'25.24"E
25.	Uailia Spring Altar Cultural	Socio-cultural	8° 27'47.87"S / 126° 27'4.62"E
26.	St. Anthony Monument	Heritage	8° 27'47.23"S / 126° 27'05.36"E
27.	Hindu Temple	Heritage, Socio-cultural	8° 28'29.29"S / 126° 27'25.31"E

6.6.2 Archaeological and Sacred Sites, and Unique Landscape

The Secretary of State of Arts and Culture (SEAC) of Timor-Leste had been procuring data collection of all districts physical and immobile materials objects that are considered valuable for their historical background. The said activity aims on conservation and guaranteeing the sites from external activities that may jeopardize the objects. According to the information that SEAC provided to the consultant team and sites visit, it is concluded that there are no particular historic or archaeological sites identified in the project area, albeit only immaterial objects were confirmed as sensitive or sacred, as explained in the next sub-chapter.

Most of the water spring in the territory are considered sacred is Uailia Spring and currently not used due to a very significant difference of flow during seasonal change; however, the community still carries out yearly cultural ceremony as a form of gratitude to the nature until now.

Figure 6.5. Cultural Sites Identified within the Project Area



7 PROJECT ALTERNATIVES

7.1 'Do-Nothing' Option

The citizens of Baucau municipality currently consumes untreated or partially treated water from the existing water supply systems operated by BTL Baucau and primarily sourced from the spring system. This situation has the potential for increasing the possibility of water-borne related diseases due to poor access to safe and potable water supply and resulting. This may pose increase in the risk of the incidence of diseases such as Typhoid, Cholera, Dysentery, or increase stunting and in turn result in the environmental problems.

The existing water supply in the project area is intermittent, not able to meet the increasing demands of the increasing population of Baucau. Limited water supply will compel customers to control the use of water for various purposes, including sanitation practices, such as flushing after use of latrine, bathing, washing clothes etc. influencing negatively on the personal hygiene of the project area.

The 'Do-Nothing' alternative reduces substantially the chance of people in the project area to combat diseases such as these because they continue to consume untreated water, increasing the risk of infections that will obviously have an impact on public health, animal health and the health of the ecosystems. It may also be an impediment to the development of Baucau City, hindering further social and economic development of the municipality and, indirectly, the Government of Timor-Leste's commitment to SDG-6 to increase the percentage of the population with access to sustainable, safe drinking water and basic sanitation.

7.2 Alternatives of Water Sources

Several spring water sources have been assessed to ascertain feasibility for the water supply system on 24/7 basis throughout the year. The Consultant/DED team has evaluated water sources, particularly the maximum yield during dry season condition and hence concluded that the water supply demand up to 2040 can be met while still providing a buffer for community (social) needs and ecological flows.

Alternative of the sources depends on the provision from the Uailia Mata spring which naturally naturally accumulate with the Uailewa Spring. If those 2 springs are still in deficit to meet the water demand of 123.5 L/s, thus Uailia Bere spring will need to be reactivated as the probability of its potential may be adequate considering that this spring provides water supply for nearby communities. The Uailili spring was previously chosen, however, considering that this place is a local tourist spot, this option was not progressed further. a spring is a contact spring downstream of Uailili was previously considered as potential water source of the project, but then was not selected as the access to this spring is difficult and it has a relatively high risk of contamination due to the significant community activities upstream of this spring.

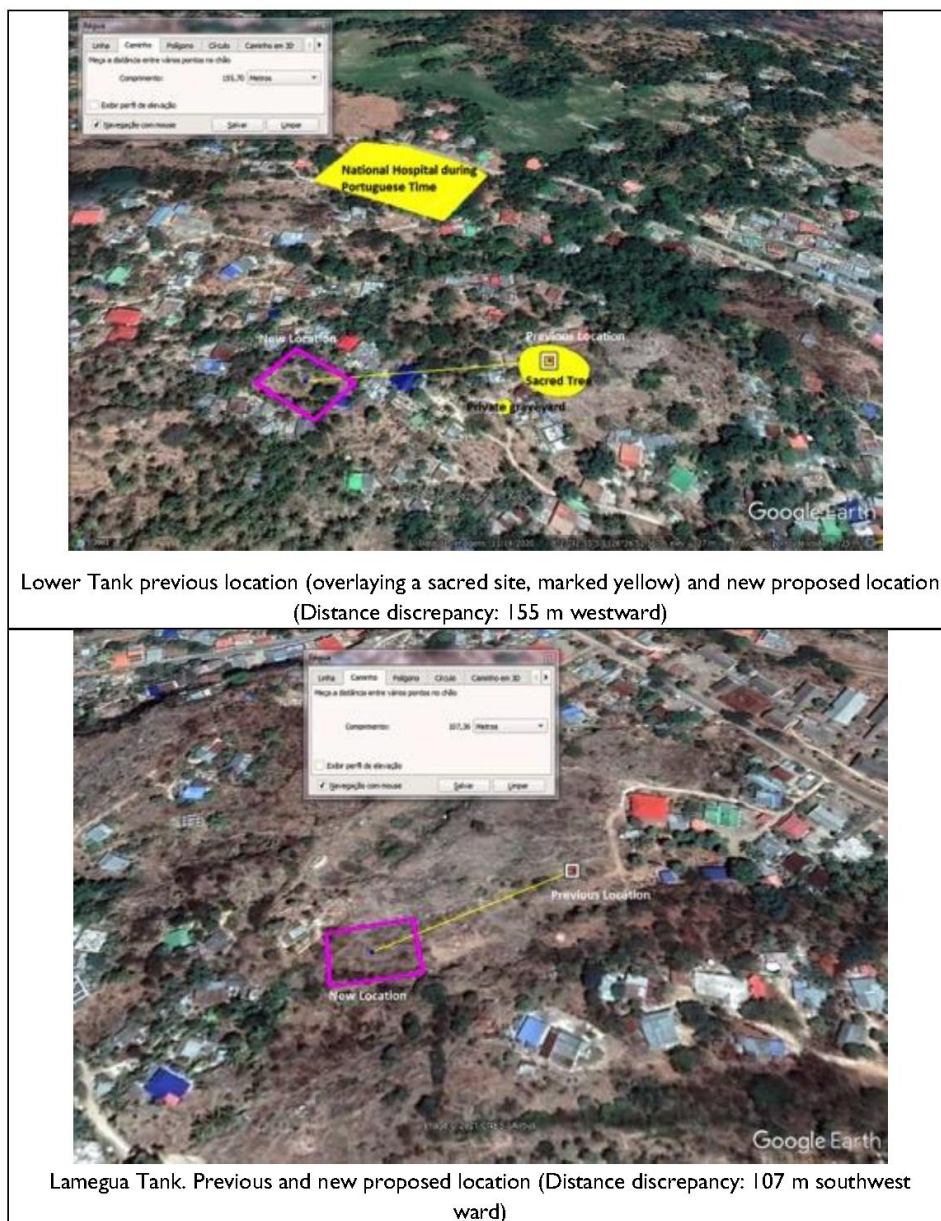
7.3 Alternatives of Water Tank Locations

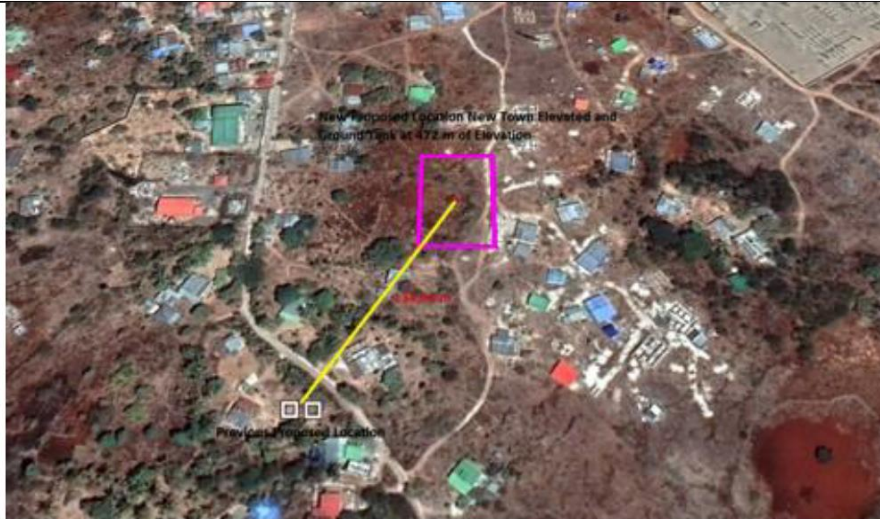
The layout of the proposed transmission and distribution mains follows previous design with some adjustments and improvements i.e., network supply expansion. The pipelines are also linked to the proposed water storages aimed on distributing treated water to subsequent distribution tanks and/or eventually to the community's households. All tanks will be made of concrete.

The current capacity of the water storage tanks in Baucau cannot meet the projected water demand for 2040 including the incompatibility between the tanks due to poor infrastructure. Therefore, this project has proposed up to a total of 9 water tanks of the project including rehabilitation of three existing tanks and construction of six new tanks.

Baucau city is one of the vastest urban areas with rich cultural and historical values, and various land use activities are mobilized by the state for urban planning and private community for housings, lease, agricultural and commercial purposes. According to the DED, several water tanks happen to be located exactly in a particular sensitive area and several plots of land that are still under tribunal process in terms of proprietary. In this case, finding alternative solution to place the water tanks will minimize social and environmental disruptions that may hinder the implementation of this project as shown in the following figures.

Figure 7.1. Water Tanks Alternative Locations

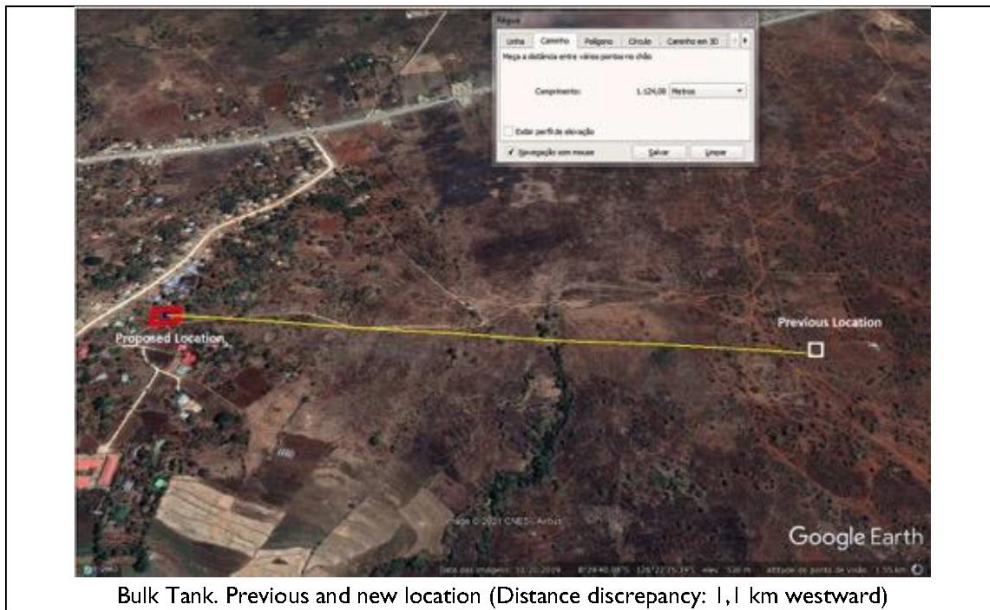






New Town Tank (Elevated and Ground). Previous and new proposed location (Distance discrepancy: 134 m north-eastward)



Aderai Tank. Previous and new location (Distance discrepancy: 30 m north-westward)



Components and Site Salient Features	
A. Bulk Water Tank	
<ul style="list-style-type: none"> • Previous location (Opt. 1): <ul style="list-style-type: none"> - Encompassed with empty plots with no activities found - No specific sensitive area was identified nearby the said location - Transmission line connecting to the water tank is to be traversing very vast agriculture farms, thus socio-economic impacts will be high - Distance to the closest dwellings 1,1 km • New proposed location (Opt.2): <ul style="list-style-type: none"> - Encompassed with numerous dwellings and existing access road - Land status is government's property - Further study needed for more feasible of the new location - Transmission main will be aligned along the road corridor; thus, the socio-economic aspect will have less impact - Water treatment will be attributed, although will not consume more land space 	
 <p>Previous Location (Eastward)</p>	 <p>New Proposed Location</p>
B. Aderai Tank	
Existing tank: <ul style="list-style-type: none"> - Disputed land - The selected area is adjacent to RoW - Very close to Telkomcel tower (unknown distance) 	



Aderai Tank to be moved and newly constructed due to land issue



Front view (north-eastward) from the RoW

New proposed location:

- Presumably a private land. Clearance required from the landlord (to be confirmed);
- Next to national road and NW is a land use for small industrial activity;
- Distance discrepancy from the old location is only 30 m NW;
- No human activities identified;
- No land use activities. Generally grazing land and topography is relatively flat.



New proposed Location. Northeast view.



National road eastward from the proposed location

C. Lamegua Tank

Opt 2:

- Moved 107 m SW from previous option
- Elevation 6 m higher than the previous site
- Hard limestone surface, close to a natural gully
- 105 m from access road and settlements
- Complemented with water treatment facility although it will not consume additional space



Current condition of the Lamegua tank where it's located 520 m SW towards the Opt. 2 location



Limestone ground. 40 m south-westward towards the new location with alike environmental condition



Actual condition of the new location (South west view)

Opt. 1:

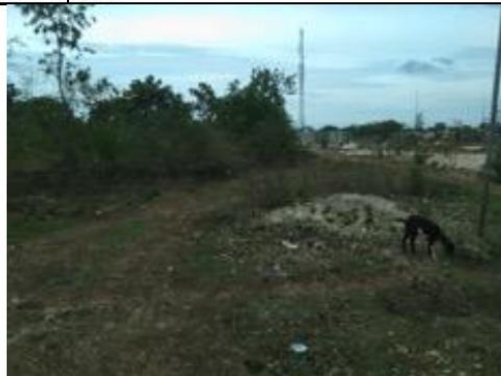
Locations is beneficial to the proponent because it is adjacent to the road access, although the land happens to be in dispute, hence to be recommended to the second option.



D. New Town Tank (Elevated and Ground)

New proposed location:

- 130 m North from the previous site
- Adjacent to existing the road
- Empty plot and relatively flat topography with no activities on the land use
- Land status to be confirmed
- Treatment facility will be installed if Uailili spring is to be selected, although the attribute will not consume anymore space



Northeast view of the final proposed location

7.4 Transmission Main and Distribution Pipes Alternative

The previous design in the DED demonstrated water abstraction through a transmission reticulation that will traverse large agricultural farms heading to the water tank prior delivering the treated water to the city. This has come to an issue to making a few adjustments on alternating the layout including the location of the water storage i.e., bulk tank aiming to avoid conspicuous and adverse socio-economic impacts towards the surrounding community particularly the farmers.

The layout of the water conveyance is hence altered by proposing the transmission main to be installed via road corridor and the bulk tank adjacent to the national road which is 1,100 meters southwest from the previous location as in addition to minimize unwanted impacts, such as illegal connection as the pipes is will be buried under the road.

The project has been designed as a totally gravity surface water system with a distribution system comprising a bulk water system and household distribution system. In this way the whole of the service area will be divided into a number of service areas with dedicated storage tanks located on the basis of elevation differences and proximity to the beneficiaries. However, these subsystems of water distribution can be operated independently as they are also inter-linked, enabling water from neighbouring subsystems can be supplied to another adjacent subsystem in case of maintenance and other unforeseen events.

7.5 The Selected, Final Option

Overall, the proposed project and its components, as the 'with project alternative' will be the best solution to overcome the aforementioned threats that are likely to occur in its absence and a whole city will have convenient access to reliable, adequate, safe, potable water supply and a sanitation system that extends from the domestic area to public spaces and thus, good hygiene and sanitation practices will be promoted and the consequent reduction of possible health and safety risks. It will bring about improved public health and a living environment that will contribute to improved quality of life in the municipality and create an enabling environment for local economic development and improved social services that communities within the project area will benefit from.

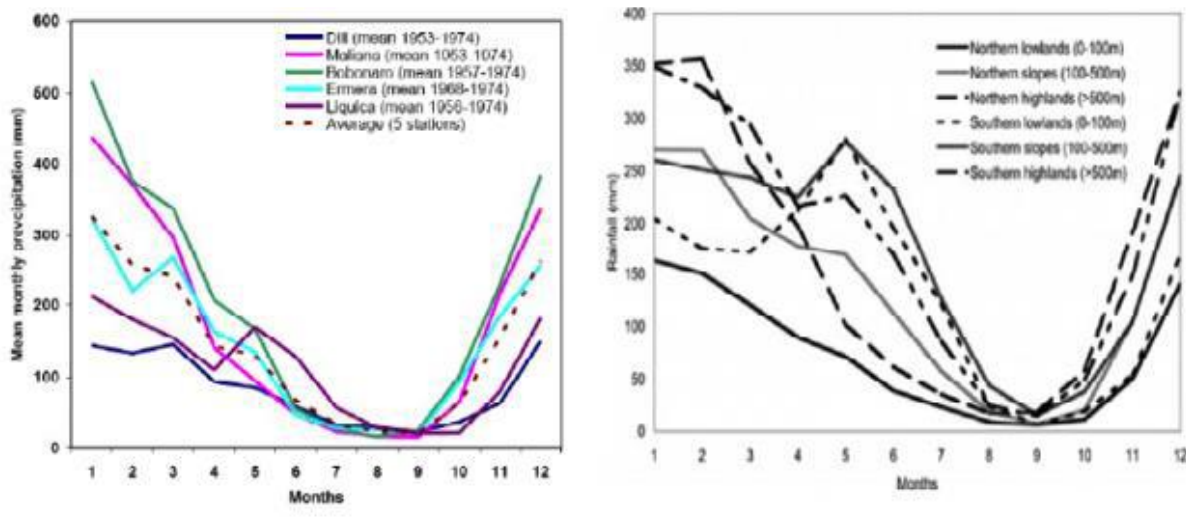
8 CLIMATE CHANGE

8.1 Historic Weather Observation and Trends

Timor-Leste's climate follows the trend of tropical countries, characterized by intense monsoon rain followed by a pronounced dry season. Its climate is affected by the West Pacific Monsoon, moving north to mainland Asia during the Southern Hemisphere winter and south to Australia in the Southern Hemisphere summer, usually bringing a switch from very dry to very wet conditions.

Rainfall is mainly due to northwest monsoon coming from the south China Sea, while the dry southeast trade winds come from the Australian Continent (AusBM/CSIRO, 2014). Recent study shows that by comparing historical weather data from the middle of the 20th century with recent data, it's possible to observe an increase in temperature of 0.16°C per decade since 1950 and decrease of 19% in average annual rainfall (More weather data needs to be collected in order to establish a real trend, specially concerning to the rainfall decrease) (Seeds of life, 2010).

Figure 8.1. Average Precipitation Rate



8.2 Climate Change Projections

The projected increase in temperature for Baucau (increase of approximately 1.0-1.3 °C across the project sucos, based on 2050 IPCC4 CSIRO A2A Projection) may come to cause the farmers to i.e., suffer from production yields decline of 10% for every 1°C increase in temperature (GovTL, 2010). Based on 2050 IPCC4 CSIRO A2A Projection (GovTL, 2010) from 2000 - 2050, there is an estimated of 3.84% decrease in average annual rainfall (1276 mm to 1227 mm) and a 5.07% increase in average annual temperature (24.30 °C to 25,60 °C) in Baucau (GovTL, 2010).

The increasing temperature that occurs worldwide is gradually increasing the sea level to rise and is affecting small islands including Timor-Leste. Under the SRES A1B scenario, it is projected that the sea level surrounding Timor-Leste is expected to increase around 0.76 meters by 2100 (SEA, 2014).

8.3 Implications for the Proposed Project

Climate change is expected to have negative impact on water and wastewater management in the project area, due to projected air temperature increase and rainfall decrease, particular to drought conditions with less rain in short period of time. The impacts to the water supply and sanitation system in the project areas including:

Water Source. The projected increase in air temperature in Baucau will induce higher rates of evaporation and plant transpiration, thereby speeding up water loss from the soil and plants. Moreover, rising air temperature will cause surface water temperatures to increase which are expected to result in the following issues to water quality:

- Increase of algal blooms that impair water quality through undesirable colour, odour and taste; and
- Enhance the transfer of volatile and semi-volatile pollutants such as ammonia, mercury, PCBs (polychlorinated biphenyls), dioxins, pesticides) from water and waste water to the atmosphere (IPCC, 2008).

On the other hand, extreme changes in precipitation and characteristic due to climate change will continue to trigger flood and landslide hazards in the project areas. The consequences of these hazards towards water sources may include:

- Sedimentation, resulting in silting up of water bodies;
- Total or partial destruction of intakes located in rivers or ravines;
- Loss of intakes because of changes in the course of rivers;
- Contamination of surface water due to excessive increase in the turbidity of water, or pollution from other types of contaminants;
- Flood levels that surpass the height of well head walls, or waters that flow directly over wells and other intakes;
- Total or partial destruction in intakes located on or in the main path of active slides, especially in unstable mountainous zones with steep slopes or in slopes with steep grades that are susceptible to slides; and
- Contamination of water in surface intakes in mountainous areas;

Furthermore, the climate change and climate variability-induced drought will also affect the water sources in the project areas. The main effects of the droughts on water sources are the following:

- Decrease in the flow of surface or ground water;
- Rationing and suspension of service;
- Reliance on water from tank trucks, with the consequent loss of water quality and increase in costs and;
- Abandonment of the system.

Transmission and Distribution Mains. The climate change also will affect the transmission and distribution lines in the project areas. Due to the increase in temperature and decrease in rainfall which intercalate with higher intensities of rainfall in short period of time may trigger several issues include:

- Failures on steel pipes;
- Breaks where exposed pipe crosses ravines and/or rivers;
- Total or partial destruction of the installations, in particular the transmission and distribution structures, located on or in the main path of active slides, especially

in unstable mountainous zones with steep slopes or in slopes with steep grades that are susceptible to slides and;

A statical analysis performed in Netherland identified that due to increase in air temperature causes failures in steel pipes. This failure is doubled during warm periods, which often simultaneously occurred when water consumptions were high. The study also suggests that no effect of weather conditions on pipe failure were observed for polyvinyl chloride and polyethylene pipes (Wols & Thienen, 2014).

Water Treatment Plant (WTP) and Storage Tanks. The natural hazard induced by climate change will influence water quality and compromise the integrity of water storage facility in the project areas. The increase in surface water temperature will affect the efficiency of chlorination. Moreover, the contamination of surface water due to excessive increase in the turbidity of water will reduce the concentration of chlorine residual, hence it will influence on the chlorine demand.

On the other hand, studies suggest that increase in water temperature will result in the loss of disinfectant residual and the increase in the activity of ammonia-oxidizing bacteria (Kimbrough, 2019). Furthermore, statical analysis performed in Netherland on concrete cement water tanks identified failures in concrete cement due to the increase air and water temperatures. These failures doubled during warm periods, which often simultaneously occurred when water consumptions were high (Wols & Thienen, 2014).

As the project areas are prone to natural hazards, the planning design when selecting the sites for water treatment plant (WTP) facilities and tanks should consider topography and atmospheric factors as well. The location of WTP should be relatively high for the rest of land to protect them from floods and adequate soil exploration is essential in site selection to guard against structural failure and functional damage due to landslides.

8.4 Adaptation Measures

To mitigate decreasing in water availability, it is necessary to protect the water sources and its surrounding area from illegal logging. On the other hand, it is important to implement the reforestation program to help in the improvement of water cycle thus increases the amount of rain and reduces the lack of water due to increase in temperature. Shade provided by riparian forest can help reduce the evaporation and can protect soils and reduce erosion rates and sediment delivery to water sources.

The design of the project will need to adapt to the implication of climate change, including climate consideration and environmentally friendly infrastructure to protect water sources to provide safe water supply during climate change extreme event periods and creating/enhancing water harvesting model and water distribution system as well as management system at all levels to avoid water shortage, particularly due to prolonged dry periods, due to climate change risk.

9 IMPACT ASSESSMENT AND MITIGATION MEASURES

9.1 Risk and Impact Assessment Method

An impact evaluation was carried out for all project components and activities by applying an evaluation matrix (see example in Figure 9.1) and impact assessment rating applied for the Pre-construction, Construction, Operation and Decommissioning Phases of the Project. The significance of the impacts was assessed according to the condition of the affected environmental and social component's present condition and the scale of impact should the impact persist, at the time of evaluation.

- S (+/-) denotes significant impact either positive or negative
- MS (+/-) denotes moderately significance impact either positive or negatice
- IS (+/-) denotes insignificant impact either positive or negative.

These classifications are the result of the product between “Scale of Present Condition” and “Scale of Impact”, based on the criteria below where present condition has three classifications, treated independently from the scale of impact, according to the present condition of the affected component. On the other hand, the scale of impact accounts for the nature of the impact whether it will have a minor, moderate or strong impact and whether the impact would be temporary or permanent.

Table 9.1. Scales Assigned for Present Conditions and Impacts

Scale	Remarks
Scale of Present Condition	
3 - Good	Sensitive E&S conditions of the location and surrounding area, with little to no impact sources
2 - Moderate	Moderate E&S conditions and with pre-existing sporadic (temporary or permanent) impact sources not related to the project
1 - Bad	Deteriorated E&S conditions and with large numbers of pre-existing (temporary or permanent) impact sources (other than the project).
Scale of Impact	
1 - Minor, temporary	Inside project boundary - zero or minor E&S impact/damage, temporary Outside the project boundary - No E&S impact
2 - Moderate, temporary	Inside project boundary - release/impact with limited E&S damage/impact, temporary Outside the project boundary - Minor E&S impact/damage, temporary
3 - Strong temporary	Inside project boundary - release/impact with major damage, temporary Outside the project boundary - Strong E&S impact/damage, temporary
4 - Minor, permanent	Inside project boundary - release/impact with minor E&S damage/impact, permanent Outside the project boundary - minor E&S damage/impact, permanent
5 - Moderate, permanent	Inside project boundary - release/impact with limited E&S damage/impact, temporary Outside the project boundary - moderate E&S damage/impact, permanent

Scale	Remarks
6 - Strong, permanent	Inside project boundary - major E&S impact/damage, permanent Outside the project boundary - major E&S impact/damage, permanent
Conclusion	
S	Significant Impact
MS	Moderate Significant Impact
IS	Insignificant Impact

The product of the scale of present condition and the scale of impact is used to assess whether the impact is ‘significant (S), moderately Significant (MS) or insignificant (IS). This figure presents the matrix for the impact assessment based on the product of values for the scale of importance and the scale of impact.

Figure 9.1. Impact Assessment Rating.

		Scale of Impact					
		1	2	3	4	5	6
Scale of presenting condition	1	1	2	3	4	5	6
	2	2	4	6	8	10	12
	3	3	6	9	12	15	18

	Insignificant Impact (+/-)	IS
	Moderately Significant Impact (+/-)	MS
	Significant Impact (+/-)	S

Several codes are used in this sub-chapter and are related according to the Project Phases as shown in the Summary of EMP, for instance ‘PC’ (Pre-Construction Phase), ‘C’ (Construction Phase), or ‘O’ (Operational and Maintenance Phase)’. Each phase is also numbered based on the type of the components and possible generated impacts, starting from water abstraction up to water distribution.

9.2 Overall Beneficial Impacts

Clean, adequate drinking water is a basic human need and developing drinking water supply facilities has numerous beneficial impacts to individuals and communities. Furthermore, when coupled to sanitation improvement, there is a substantial increase in the quality of life within the project area. Some of the major beneficial impacts of the proposed project and suggestions to achieve these benefits are described below and the numbering is related to the EMP.

Construction Impact Coded C3.2.1. Local Employment Generation (Component: Social and Economic). This project will directly generate employment opportunities (although it may be in limited number) either skilled or non-skilled works for the local people. Their earnings will consequently affect the local economy, given the worker recruitment will prioritize local people, reducing the need for in-migration, and therefore, the impact is Positive Significant (S+).

The various construction operations are potentially job generators due to the need to hire labour, in addition to those that the construction companies already have in their staff. The estimated duration of the construction works is four years. The works are carried out in stages in that part of the labour force may shift from the construction of one infrastructure to another and from year to year.

The volume of unemployment of Baucau Municipality is within the annual national rate in the order of 5%. This means there is a need for working opportunity for the unemployed sector of the active population. Considering the estimates of several hundred direct jobs, the impact will be a positive significant impact (S+).

Recruitment of unskilled workers from affected community within the project area, in coordination with local authorities i.e., municipality and sucos, and in accordance with Timor-Leste Law, will be the most effective mitigation measure. From a perspective of sustainability and social responsibility, the tender documents for the construction work should establish the obligation for construction companies to give priority to hiring local labour and, as far as necessary and possible, to promote training and qualification initiatives in order to maximise the volume of labour that can be hired in the families, villages and Sucos affected by the project including employment of women.

The implementing agencies and the future construction companies must articulate with the Suco Chiefs and the Villa Chiefs the plan for labour hiring including the requirements and priority for vulnerable people to apply for the job.

In order to maximise the positive effects, the following measures are proposed:

- Where feasible and safer to do so, the use of manual labour should be preferred to the use of machinery in order to create more employment.
- Carry out, whenever possible and if the necessary skills are available, the hiring of local labour, following the following priorities: i) affected families; ii) affected villages; iii) affected Sucos; iv) Baucau Administrative Post; v) Baucau Municipality; and vi) other locations outside Baucau Municipality.
- The hiring of local workers should be planned and implemented in articulation between the construction companies, the promoter, the Suco chiefs and the Aldeia chiefs.
- A communication plan should be implemented in good time, in liaison with the local authorities, with a precise indication of the number of jobs made available and the necessary requirements to fill them.
- When hiring, give priority to the most deprived and vulnerable people.
- Not discriminate against women, who should receive a salary equivalent to that of men performing the same functions.
- In the performance of equivalent functions, locally hired workers should not receive a lower salary than workers integrated into the staff of construction companies.
- Do not employ child and forced-labour.
- Assign fair wages and respect working hours; and overtime work, when performed at the request of construction companies, must be remunerated adequately.
- Companies responsible for the construction works should promote the implementation of vocational training initiatives to increase the skills of as many locally hired workers as possible.

Construction Impact Coded as C3.2.2. Skill Enhancement (Component: Social and Economic). Employment opportunities will increase the skill of the workforce in terms of

technical proficiency. This kind of enhancement will be an investment for individuals to implement in the future, as well as to augment incomes and improve their economic status, which is a Positive Significant impact (S+). The contractor must prepare a training program i.e., “on-the-job” for all workers and, equally important, training on the E&S management plan (ESMP) and its Mitigation Measures, particularly to create the competency, skills and abilities of all the relevant staff to ensure they are aware of the obligation and apply the provisions of the ESMP effectively.

Operation Impact Coded O3.1.1. Improved Health and Hygiene (Component: Social). This project is aimed at improving water supply and sanitation to the community, improving people’s hygiene and public health and consequently reduce waterborne disease occurrence. A regular maintenance of the project’s components will provide continuous benefits to the local people which is a Positive Significant impact (S+).

Operation Impact Coded O3.1.2. Women Empowerment (Component: Social). Women play an important role in the family: they manage the household, bear children and expect to live a healthy menstrual cycle. Having good access to improved water and sanitation will result in a significant health improvement, reduce mortality and balance family and at an individual level, it will improve their working performance which will lead to a more advanced economic condition in the household daily life which is Positive Significant impact (S+).

Key E&S significant impacts anticipated from the project, from pre-construction to operation stages, are elaborated in Section 9 and summarized in the following table.

Table 9.2. Summary of Potential Significant Impacts

E&S Components	Potential Significant Impacts		
	Pre-Construction	Construction	Operation and Maintenance
Water source quality (spring/sink hole)	Water pollution due to inadequate protection Drying up of the boreholes & private wells due to over extraction	Silt runoffs and soil wastes without final disposal site will trigger underground water contamination	Expansion of housing in the upstream with inadequate sanitation facilities that may lead into deterioration of the water sources.
Noise	-	Increase in noise level from construction works, particularly nearby the affected households	-
Air Quality	-	Increasing dust concentration	-
Socio-economic	Water conflicts between communities	Job opportunities and skill enhancement for local communities	Increasing life quality in health and hygiene sector due to the depleting rate of mortality and waterborne diseases. The community will be able to be more productive.

E&S Components	Potential Significant Impacts		
	Pre-Construction	Construction	Operation and Maintenance
Odour	-	Construction materials mixed-up with household-typed wastes from construction sites without proper handling and disposal	Irregular maintenance e.g., cleaning and treated sludge kept in an open space for certain period of time.
Soil	-	Silt runoffs can cause traffic accident and increasing volume of soil wastes (spoils, spare materials, etc) can lead to possible soil contamination, attract pests and serve as vectors for disease carrying insects, and negative visual impact	Runoff from the construction sites
Traffic Management		Heavy load trucks mobilization and construction sites without barriers, signages and velocity limit that may cause traffic accident towards the affected community	-
Occupational and Community Health & Safety	Health hazard arising from inadequate design and/or handling of facilities for receiving, storing and handling of chlorine and other hazardous chemicals	Accidents and even mortality for the worst scenario towards the workforces without utilizing proper PPE	Health hazards due to chlorine exposure

9.3 Pre-Construction Phase Impacts

The pre-construction (PC) works involve field survey and investigation, development of design and detailed drawings, carrying out cost estimate etc, as well as the evaluation of water availability and competing uses. A characterization study of existing origins and pilot well testing area was conducted during site visit (15 to 18 June 2020) for the preliminary design, aiming to identify specific protected biodiversity, sacred sites, water usage, land status, and competing activities downstream and upstream.

9.3.1 PC1. Water Sources

PC1.1. Location and Sensitive Areas (Component: Biodiversity and Water Resources)

1.1.1. Nuisance to the biodiversity (flora, fauna, water ecosystem)

The Uailewa and Uailia Mata springs and intake are all located in a sensitive area, more on cultural aspect than environmental one. The Uailewa spring has been supplying water for

Baucau city for quite a long time, through a poor and old water distribution infrastructure, and, surrounding the spring, there are dwellings and housing with agricultural activities. Meanwhile, Uailia Mata is far from community's households and very dispersed agriculture activities. Site visits also concluded that there are no specific endangered species and vegetations, nor it is located in a protected area. The spring is however considered sacred and requires cultural ceremony. The environmental assessment of these components shows that it is not likely the project activities have significant adverse environmental impacts that are irreversible, diverse, or unprecedented and unlikely to affect areas larger than the sites or facilities subject to physical works. These impacts are site-specific and few if any of them are irreversible and in significant (IS-).

Irrespective of this situation, it is important to apply more stringent forms of implementing the mitigation measures identified in C3 that may prevent and manage the activities of the project when working in the ROW and accessory areas of the rehabilitation of the Uailewa and Uailia Mata springs.

While there are no official lists of mitigation measures to be applied by the project in culturally sensitive areas, the following measures could be applied:

- a) The contractor, his employees or subcontractors are prohibited to carry out the following activities;
 - Kill, injure, damage, remove, handle, disturb or interfere with any endangered species or existing animals under any circumstances;
 - Bring domesticated animals on-site
 - Poaching on-site or the surrounding forests
 - sell endangered species or derivatives of these species; and
 - export endangered or derivatives of these species;
- b) Trees that will be cleared should be inspected for nesting birds prior to cutting. The nest will be transferred carefully to another tree safe from project activities. Trees with nesting birds near the trees to be cut will be marked and the direction of fall should be inclined away from the trees with nests. If chicks are already present felling must take place, where possible, > 50 m distance from the nest. All activities must be supervised and decided upon by a Forest Guard or representative of the National Directorate for Protected Areas (DNAP);
- c) A detailed layout of vegetation clearing will be presented by the contractor before is carried out. Clearing will be limited in accordance to the project layout/design and the extent will be limited with relevance to the project. The Contractor is prohibited to deface, paint, mark natural and pre-existing vegetation even if of no relevance to the project.
- d) All tree species will not be harmed and will be protected throughout the lifespan of the project. If an endangered tree is to be cut, under special circumstances and technically justified, DNAP must approve the felling and guarantee that the planting of the similar tree species at a quantity to be determined will be conducted at pre -defined and approved site.

PC1.2. Use of Existing and Proposed Springs (Component: Water Resources and Social)

1.2.1 Available water for all users

Consumers in Baucau have received insufficient water supply due to an increasing urban water demand and degradation of the existing water infrastructures over time, hindering optimal operation and distribution of water from a limited number of natural water sources available. The high incidence of illegal connections in the system also results in interrupted water supply distribution to consumer which is a Negative Significant impact (S-).

The potential sources were identified to be used in the supply system are Uailewa, Uailia Mata, and Uaisarake. In addition to these, Uailia Bere source was also selected to be integrated into the system. In terms of quantity, based on Baucau Plateau size, the aquifer can preserve a large volume of water. The primary water sources in this region are contact springs, where the limestone contacts impermeable formations. The Uailewa spring is in the centre of Baucau, making it vulnerable to contamination resulting from lack of sanitation services. A critical point is a hospital upstream from the source with an open septic tank system where it leads to a risk of groundwater contamination by pharmaceuticals released from hospital wastewater. The water quality tested was carried out on 4 - 5 October 2021 by the ADP team. The Uailia Mata spring is generally good but will probably have bacteriological contamination and suffers from high total hardness, therefore, the water treatment facility will include calgon dosing (water softener) and disinfection. The Uailewa spring also supplies other communities downstream, including irrigation. Therefore, the overall impact is considered as Negative Significant (S-).

The water demands versus estimate water flow, suggest that, under these numbers, and pending a long-term monitoring program, Uailewa and Uailia Mata sources are expected to have enough flow to contribute to the requirements of the distribution system for the bigger part of the Dry Season. The overflow of the said springs should also be substantial for social use (agriculture and other) and especially an ecological flow suggested at 30% of the wet season spring flow (November to May) and 10% of dry season spring flow (June to October).

Uailewa Spring is estimated to have a flow rate of 120 L/s with the water supply to community is 83 L/s (69%) and 37 L/s (31%) of water remains as social and ecological flow. Giving that Uailewa Spring also produces surplus surface water from additional untapped sources in the Uailewa Spring system which are not extracted and the amount is unidentified, and the water flowing through drainage and being used for several activities to the community downstream, such as agricultural and household activities. The Uailia Mata has a flow rate of 40 L/s was tested during dry summer and without underground tested which means is not even 100% to the represented the total extraction of Uailia Mata Spring, thus, in 2040 it will be sufficient to supply the water need by the system as well as covering the flow required by community, social and ecological outside the distribution network.

Therefore, the increase in supply will be obtained from the refurbishment of the distribution network (which will significantly reduce system losses from leakage), and the installation of a new metering system (which will improve leak detection and cost recovery). This is expected to both improve the supply of water to the consumer and reduce the decline in groundwater from over-abstraction.

However, if the dry season spring flow reduces naturally, to guarantee the distribution system maintains service to Baucau consumers throughout its lifetime, it is necessary that a monitoring system is put in place to monitor daily flow in all operational sources and help estimate water production variability and decreases that may require other sources i.e., north and south system boreholes, to come online to support the water distribution, especially in the dry season. These boreholes systems must also have a well monitoring program to be able to track aquifer performance.

1.2.2. Water user needs between the environment, communities and water distribution system on water consumption

The issue of water benefits with source area communities has been raised by local authorities and Chefes de Suco during the Public Consultation. This, together with a mixed urban/rural setting that has several different water consumptions beyond human consumption alone i.e., agriculture and rice fields, etc, downstream of nearly all the existing and future sources, has brought discussions regarding source sustainability for all users, not only for the targeted urban areas, although no indications were given that water was scarce to the point of depletion which is Negative Significant impact (S-). With this deficit, water resource is one of the major public assets, which is a vital need for human well-being, animals, plants, environments and ecosystems.

For Baucau, mitigation measures must be the definition of a sustainable water balance and feasible/fair environmental a flow for shared sources that takes into account the seasonal variability of the project area i.e., abstraction in wet season is about 30% of average monthly flow and that in dry season is about 10% of average monthly flow.

1.2.3. Social and cultural disruption due to ‘Tara Bandu’ and ‘Lulik’/sacred areas

Several national laws i.e., Cultural Framework, Base Law for Environment, etc, as well as the requirements of the WB ESF (2018) are the project guidelines to protect and mitigate impacts to related cultural segments, as a project that involves, exploits, or associates with any type of natural resource use. However, the project also needs to follow customary Law regarding localised cultural customs applied by the community, aiming at the natural preservation, sustainability of the natural elements and social balance.

It is important to understand that almost all springs, new and currently in use i.e., Uailewa and Uailia Mata springs, are and have always been involved in and have a spiritual importance to the community, under cultural/animistic protection and therefore the impact on these is considered Negative Significant impact (S-). Therefore, it is imperative to involve the lia na’in i.e., cultural leader, and communities to lead in the preparation of cultural ceremony preparation i.e., “opening” and Tara Bandu for authorization to i.e. yearly ceremonies at Uailewa springs or while conducting investigations for existing and proposed water sources, their use, continuance of use and/or cultural/natural protection of the source water resource, to avoid conflicts and distribution interruptions.

Project activities during construction phase will be monitored by assigned personnel from the Culture Department. The springs will be demarcated with tapes to limit construction works outside the area and restrict access to the springs unless authorized by relevant authority. Precautionary measures will be taken by all construction workers to prevent damage to the Lulik springs. After construction operations, the contractor shall seek clearance from relevant authorities that the springs are in its natural state prior to departure.

PC 1.3. Protection of the Water Source and Distribution (Component: Social)

1.3.1. Illegal connection of BTL water spring

There may be the risk of the BTL boreholes and adjacent private wells drying up due to over extraction of the water sources

1.3.1.1. BTL protection area

In areas where the project has been successful in testing and sourcing water for the system i.e., Uailia Mata source, dwellers in the immediate area may now be prepared to make

illegal connection to the spring drill, which may diminish the available water yield for distribution and hinder the Government's investment and considerable budget for the project's water sourcing, treatment and distribution (Ind S- = Indirect Negative Significant).

It is important that BTL initiated Land Use planning reclassification of the area around and upstream of the spring as "no abstraction" zones and implement a Water Resource Management regulations to manage these areas and guarantee the present investment.

9.3.2 PC2. Water Treatment and Storage

PC 2.1. New Disinfectant and Storage Systems (Component: Social and Water Resources)

The storage and treatment of the water predicted activities encompasses generalised impacts, especially those related to the Water Distribution Network i.e., minor civil construction works of Water Reservoirs. However, there are a few design phases impacts and mitigation measures worth noting for this project component.

2.1.1. Waterborne diseases towards consumers; and 2.2.1. Insufficient treated water due to poor infrastructure and lesser capacity of the water tanks

In general, the upgrade of the design of new treatment plant and storage facilities that apply a disinfection, chlorination or Calgon dosing system to the Water sources with lower quality and which are not in compliance with WHO standards, becomes the necessary mitigation measure to avoid waterborne disease towards consumers (S- = Negative Significant).

PC 2.2. Remodelling/Rehabilitation of Existing Water Tanks (Component: Water Resources)

2.2.1. Insufficient treated water due to leakages (poor infrastructure) and lesser capacity of the water tanks

Insufficient water storage capacity and increasing water demand due to population increase and requirements for 2040 supply levels has pushed this project to upgrade the proposed storage infrastructure in order to avoid interruption of quality water distribution to the current and future registered consumers (MS- = Moderately Negative Significant)

9.3.3 PC3. Water Distribution Network

PC 3.1. Identification of Cultural Heritage sites (Component: Cultural)

3.1.1. Impairment of Cultural heritage properties

Cultural heritage refers to sites, structures, and remains of archaeological, historical, religious, cultural, and aesthetic value. Its identification and examination clarify the significance of a site, according to its aesthetic, historic, scientific, and social value. Several cultural heritages, touristic and other sensitive sites have been identified and mapped within the Project Area (19 in total) during the field visits in the Inception and Preliminary Design Phase, which are within <20m from and may be impacted by the construction activities, if precautions are not taken (S- = Negative Significant)

Preparation of the rehabilitation activity must be done together with the Directorate that represents the Secretariat of State for Culture at the Municipal level. Pre-construction, the contractor must review these immovable asset locations and request approval of a Safeguard Plan for each of the assets, making sure that during the Construction activities, those sensitive heritage sites within 50 m radius of the construction activities should not be interfered with or impacted on, and the rules as mentioned in Decree Law No. 33 /2017 for

Cultural Patrimony Protection are followed, with the request, by the contractor, of a license /authorisation for intervention in the area. In case a new cultural/historical heritage site is identified during the construction, the Contractor will notify the BTL-Baucau and follow the same procedure regarding these sites.

PC 3.2. Preparation of Project for Health & Safety and Operation & Maintenance (Component: Social)

3.2.1. Occupational Health & Safety Risk

3.2.1.1. Health & Safety Plan

Project workers will be exposed to many threats during construction works such a range of accidents in site due to earthwork activities, dehydration, communicable and transmittable diseases, exposure to hazardous substances, poor sanitation, poor handling and/or operation of the equipment, and these are evaluated as Negative Significant impact (S-).

There must be a requirement in the Bid Contract that compromises the contractor to develop a Health and Safety Plan, taking into account all occupational health and safety requirements, such as: installation of warning signs and symbols; ensure sufficient visibility and safety instructions in the work areas; the construction site free of drugs and alcohol; and the use of personal protection equipment (PPE) by all workers. It is also fundamental that the contractor provides the name, details of qualifications and experience of the person on the contractor's team who will be responsible for implementing the C-ESMP.

The Health and Safety Plan must be in accordance with National Law, IFC EHS General Guidelines (2007) to ensure the following:

- a. Train all site personnel on environmental health and safety;
- b. Provision of PPE and proper utilization;
- c. Health and safety training and toolbox meeting, including the communicable diseases and operational system of the equipment;
- d. Maintain records of reports and complaints concerning health & safety occurrences
- e. Installation of sick bay in the base campsite including recruitment of medical staff (intermittent, on-call) for primary response prior delivering to the hospital or closest clinic; and
- f. Emergency plan and collection of all contacts in Baucau-city related to accident response.

The contractor will provide all safety equipment to all his/her staff to ensure their safety during construction works. The employer shall permit only those employees qualified by training or experience to operate equipment and machinery.

3.2.1.2. HSE manuals and documentation in Tetum language

This project is concentrated on rehabilitation of existing structures only and therefore there are minimal projected negative effects on construction, which will only occur as a result of the proposed activities, since improvement works are generally aimed at improving benefits to surrounding communities.

However, workers and communities will be moderately exposed to impacts on air and water quality, ambient noise level; mobility of people, goods, and services; accesses to properties, economic activities, and social services; service disruptions, etc. and this impact may be

enhanced if manuals and signage are not properly prepared and understood (S- = Negative Significant).

Catalogues, manuals and signage shall be prepared in Timorese language (Tetum) with sketches on community health and safety and potential occupational health and safety impacts to help explain and avoid occurrence of said impacts.

3.2.2. Risk to community health & safety

While the volume of vehicles that will be operated from the simultaneous construction fronts at project component sites may not be very large, the condition and characteristics of the roads in Baucau City i.e. narrow access roads, poor road condition and high intensity of activities particularly in market areas, can create traffic jams and hinder the mobility of people, good, and services and people may be exposed to safety hazards from the constricted road space. Communities are also a potential actor in the spreading of communicable diseases which is Negative Significant (S-).

Apart from the applicable mitigation measures, proper coordination with relevant local authorities, social service institutions and businesses should help mitigate these impacts. Therefore, mitigation measures to be taken are as:

- a. Prepare a Traffic Management Plan;
- b. Proper traffic or road signage and warning signs with good quality of shining barriers to restrict access to the site and minimize road accidents to the local community;
- c. The Contractor to ensure that all vehicles that may be required to pass through villages and transport equipment and materials are operated safely without endangering these communities;
- d. Protect the community by applying the H&S Plan and distancing them from physical, chemical or other hazards associated with sites under construction and decommissioning; and
- e. Disseminating information through flyers or others regarding communicable and transmittable diseases.

9.4 Impacts in the Construction Phase

As mentioned previously, the construction (“C”)activities will likely produce more negative impacts towards environmental stability and the local community. Other than the pipe laying works (new and/or rehabilitation), the rest of the construction activities will be restricted to their respective confined area, thus the interference with the public and surrounding community should be minimal. Negative impacts to be generated are predicted as mostly temporary, such as noise and air pollution (that causes disturbance to the nearby dwellings and commercial buildings), construction waste (solid and liquid), increased traffic (especially in narrow roads), as well as health and safety risk to workers, declining of water quality, soil erosion, etc.

These are all general impacts of construction in urban areas, but it is important to remember there may be serious impacts that jeopardize private and public properties if the contractor does not implement the proposed mitigation measures. Therefore, methods of mitigation have been developed and suggested, adapted to Baucau city, in order to prevent negative impacts, and are all established in the EMP.

The above-mentioned impacts, albeit in different scales, are common to all four project components i.e., water a) sources; b) treatment and storage; c) distribution; and d)

sanitation, in regards to the construction of all these infrastructures. Therefore, in this subchapter (and in the EMP), they are described in general in Section C3. Water Distribution, since this component is the most significant regarding the construction phase, while only the specific impacts to the other components will be described in each of their subchapters.

9.4.1 C1. Water Sources

C1.1. Inadequate Protection off Water Intake Structures (Component: Water Resources and Cultural)

1.1.1. Intake overflow to cause erosion

The spring intake will require some physical protection during their rehabilitation as to avoid any overflow into unplanned areas, and possible erosion of adjacent areas and these impacts are evaluated as Moderate Negative Significant (MS-).

It is important that the intake has adequate land for perimeter fencing and connect to a temporary drainage that shares the overflow with pre-existing neighbours, thus avoiding any unnecessary erosion or impact to adjacent communities.

1.1.2. Socio-Cultural Impact

Just as in PC 1.2.3, the spiritual opening of the construction activity is extremely important to avoid conflicts with the local communities, particularly in locations as sacred as the springs (S- or Negative Significant). Thus, it is important to involve the lia na'in i.e., cultural leader, and communities to lead in the of cultural ceremony of i.e., "opening" for the continuance of use and/or cultural/natural protection of the source water resource, to avoid conflicts and distribution interruptions.

9.4.2 C2. Water Treatment and Storage

C2.1 Upgrading of Water Treatment System and Storage (Component: Social)

2.1.1. Worker exposure to disinfection chemicals during installation

During construction there may be some risk of contact with the disinfection chemicals, on the part of the workers that are installing and/or storing the first batch of disinfection equipment and materials, and this is assessed as Negative Significant impact (S-). For this activity, it is fundamental that the contractor provides and obligates the use of PPE to handle these substances, such as i.e., mask, gloves, and safety boots and restrict access to a minimal number of authorised persons.

C3. Water Distribution

C3.1 Induction of Contractor (Component: Social)

3.1.1. Enhanced impacts because of lack of knowledge of the EMP

Clear understanding of the C-ESMP by the Contractor is paramount to avoid enhancement of potentially adverse impacts in the project area (S- = Negative Significant). Therefore, after selection of the Contractor, the PMU will meet the Contractor's HSE responsible staff prior to contract commencement and on-site to explain and confirm understanding of the C-ESMP conditions. After the PMU is confident that the contractor understands and can comply with the C-ESMP, the "go-ahead" for the Contractor to commence work will be formally announced.

C3.2. Construction Activities - Macro Benefits

See 5.2.1 Overall Beneficial Benefits

C3.3. Construction Campsite (Component: Social and Economic)

3.3.1. Campsite Location, Community and Landslide Risk

Typical construction camps cannot be established on the sides of the roads of the alignments as most of the sites are surrounded by housing, private property or buildings and therefore there is not sufficient space to accommodate the campsite (MS- = Moderate Negative Significant).

Thus, basecamp and work site camps sites are proposed to be established in central locations, preferably in Government land that are flat and landslide and floodplain risk free and shall not be located near settlements, water supply intakes or sites that affect local access to drinking water.

Thus, basecamp and work site camps sites are proposed to be established in central locations, preferably in Government land that are flat and landslide and floodplain risk free and shall not be located near settlements, water supply intakes or sites that affect local access to drinking water.

The Contractor shall make his own arrangements for all land, yards, stores, workshops, offices, etc. required by him for the purposes of the Contract and for all services in connection therewith. All sites must apply mitigation measures to prevent impacts to surrounding community and environment i.e., wastewater, waste, dust, noise, etc. After use, sites shall be cleared and restored to status as they were and, if required due to their surroundings, to near natural or stable conditions with vegetative cover.

The locations of all yards, stores, workshops, offices, etc., shall follow the CEMP specifications for location, etc and be agreed beforehand with PMU and the Engineer shall be such as to minimize obstruction and nuisance to the public. In particular, the Contractor shall demonstrate that he will take such measures to prevent pollution of the environment from fuel and oil spillages, washing of concrete mixers and the following measures:

- The Contractor shall provide, maintain suitable and sufficient shelters and mess rooms for his workmen and supervisory staff as are customary and necessary.
- The Contractor shall provide sufficient closets or latrines to the satisfaction of the Engineer and the relevant authority, for the use of his personnel. They shall be properly screened and maintained in clean and sanitary state at all times.
- The mess rooms, closets and latrines shall be located in positions to be approved by the Engineer. The Contractor shall be responsible for making all arrangements for the disposal of waste from mess rooms, closets and latrines.

3.3.2. Wastewater and soil/water contamination

Throughout the duration of the project, the campsite will house many personnel and facilities in the campsite will need to be available for those who do not lodge in the area. A suitable latrine is a primary facility for a construction camp, which also brings wastewater issues and the anticipated impacts of poor campsite operation is assessed as Negative Significant (S-).

Good housekeeping practices, maintenance of latrines, and protection from surface runoff provides favourable hygienic conditions for the workers. This will also prevent the accumulation of flies in the area, which are vectors for transferring food-borne illnesses. Further, the latrines must include a proper septic tank design (at a minimum) and should be located in an area at least 30 m from any domestic well, to minimize the risk of

contamination or downhill of wells within 30 m distance. It will be elevated to prevent surface water from flooding the sanitation facility especially during rainy season.

3.3.3. Competing water use between campsite and the community

While some water distribution exists currently in Baucau, the campsite may require to be established in an area where the distribution system does not exist yet. The communities in Baucau, under these conditions, may experiencing shortages in water supply during the dry season and thus sourcing water for the campsite locally from tap water/pipe line/boreholes may create conflict with the adjacent community and this impact is assessed as Moderate Negative Significant (MS-)

The campsite should establish a water tank large enough to provide for the campsite requirements, to be filled with water purchased from BTL. Also, purchasing sufficient potable water supply in the form of water litre bottles and/or gallon containers will ensure the health safety of the workers and prevent disturbances to the communities in their utilization of public water from taps.

3.3.4. Storage of hazardous chemicals, waste and construction materials may bring spills, fire hazards and H&S problems

Improper storage and handling of construction materials may have the potential impact to the surrounding areas that could be Negative Significant impact (S-). Properly stored chemicals will minimize human contact, thus providing a healthy environment for the workers. Fuel and lubricants for construction machinery will be stored as delivered in steel drums in the work areas and properly handled to prevent contamination of nearby water bodies. Allocating appropriate containment for hazardous materials will reduce vulnerability to fires and health effects of exposure to chemicals like cement and hydrocarbon-based products.

In the event of conflagration, fire protection facilities such as fire extinguishers, water tanks with available buckets and stock of sand to cover fuel spill will be provided. Also, containing flammable materials in a fire-resistant enclosure will prevent the spread of fire and provides additional fire safety measures for the workers and the public.

If present, Asbestos Containing Materials (ACMs) i.e., used pipes must be handled under controlled conditions (with gloves, mouth and eye protection and under moist conditions so as to not break the materials and risk inhalation. Contractor HSE representative must train/inform/draft guideline for workers on identifying and the dangers of mishandling this material and prepare special team to handle these materials if they are found during construction and coordinate with the DNCP on solution for deposition of these materials.

Materials for the works i.e., sand, gravel and cement, fuel and lubricants, will be planned duly to be hauled directly into the work sites and utilized as work progresses, with all haul trucks covered with tarpaulin, especially when hauling aggregates and sand.

3.3.5. Improper handling of non-hazardous solid wastes

Implementation of a Solid Waste Management System throughout the duration of the project will improve hygienic conditions of the workers. A clean environment is less vulnerable to disease carrying insects and less likely to be a source of health complication and therefore, the impact is assessed as Moderate Negative Significant (MS-).

Minimisation and proper handling/storage of solid waste in the campsite will maintain a pleasant environment for the workers and the local communities. Keeping non-hazardous waste in closed bins will prevent luring in scavengers such as rats, dogs, pigs and wild

animals that could displace waste in the campsite. Further, proper disposal of solid waste to authorized dump sites/landfills, referred and identified by the Baucau Municipality that will ensure that waste is not disposed in random areas of the forest where it may have implications to wildlife and local communities.

Minimize single use plastic by adapting 4R concepts (Reduce, Reuse, Recycle and Refuse):

1. Reduce

- Reduce plastic supply through minimising procurement for plastic
- Decrease excessive packaging of materials
- Replacing plastic straws, plastic cutlery and plastic cups with paper, glass, metal or biodegradable alternatives;

2. Reuse

- Use the reusable bags food, cups and drinks bottles instead of using the disposable bags;
- Providing the workforce with re-usable PPE including re-usable eyewear and overshoes;
- Providing the workforce with re-usable bags in order that operatives do not bring their own single- use plastic bags onto site.

3. Recycle

- Use eco-friendly products or use the products that are made up of recycled materials

4. Refuse

- Avoid unnecessary product packaging
- Use water Gallon instead of single-use plastic water bottles

The single use plastic also can be used as aggregate and mix with hot bitumen which the result can be used for backfilling trenches during the construction phase. Based on the laboratory studies conducted in countries in Europe and Africa suggest 5-10 % by weight of plastic can be incorporated in bituminous mixes (asphalt). The results of that shown in improving pavement stability, strength and durability. Types of plastic materials that are recommended to use including, waste package PVC and Organic montmorillonite (OMMT), polypropylene and polyester fibres, plastic bottle wastes, and High-Density Polyethylene (HDPE) and Low-Density Polyethylene (Sasidharan, Torbaghan, & Burrow, 2019).

3.3.6. Food for construction personnel may compete with food supply for the local communities

To ensure that workers do not interfere with local food supply, adequate food supply will be provided by the contractor, sourced from local vendors. This will also discourage poaching of wild animals and of communities' livestock grazing freely in the forest. In addition, prohibiting poaching will protect local fauna and livestock of the communities. However, the impacts, if occurred, are considered Negative Significant (S-).

C3.4. Construction Materials (Component: Social and Ecological)

3.4.1. Sand and stone extraction and disturbances to environment

Although most of the trenching upon completion will mbe backfilled the excavated soil from pre-existing alignments, there is still a need for a percentage of the trench to in-fill with sand and gravel for the cushioning of the pipe bed and support the top layer asphalt. This

extraction activity can disrupt natural land contour, soil erosion, loss of vegetation, scouring of riverbeds, ponding, water logging or water pollution and these impacts are assessed as Negative Significant impact (S-).

The Contractor will request licensing/authorisation for all extraction sites from the necessary authorities (ANPM), under BTL-Baucau supervision. The extraction activities for these materials must be done to the quantities required by the project only. The PMU supervision will allow regulating the extent and volume of extraction based on the current conditions of the quarries and/or rivers (sand extraction) and allow authorities to monitor and ensure the quality and good condition of the extraction sites, ensuring that extraction activities will not have social or ecological disturbances, and that the quantities of extracted sand and stone conform to the project specifications, which will also reduce the generation of spoils in the construction site.

In such instance where additional sand and stone will be required, it should be based on technical reasoning, intended solely for the development of the project components. All non-established extraction sites/borrow pits must be restored maintaining natural contours and vegetation.

C3.5. Construction Work Front: all Infrastructure (Inlet / Tank / WTP / Water pipes) (Component: Ecological Resources and Social)

3.5.1. Servicing and fuelling of construction equipment

Hydrocarbon based products are toxic to humans and straying wildlife upon prolonged exposure and exposure to high quantities. It is also a possible source of fire (S- = Negative Significant). Define rules from using unmaintained vehicles and ensuring that all equipment is in good condition prior to operation minimizes the likelihood of leaks and accidental spills. Prohibiting equipment and vehicle with leaks and causing spills prevents the accumulation of toxic contaminants in the forest, and minimize the probability of bush fires, thereby maintaining a safe environment for wildlife and local communities.

Maintenance and repair of vehicles such as washing, repairing leaks, changing parts etc. should be done in the central base camp site, confined within a designated area. This area should have a concrete surface or lined with an impermeable surface (ex. plastic) with built drainage to contain wastewater contaminants. The drainage may be built as a subsurface drainage for direct treatment. Otherwise, the drainage should channel wastewater to an infiltration trench system for treatment of wastewater constituents (hydrocarbon and metals) prior to infiltration to the subsoil. A fuel secondary containment must be available in the event of fuel spills and Removable Well Cap for monitoring and sampling purposes.

3.5.2. Excavation, cut and fill hazards to the public and workers

Construction sites, especially those with trenching, have a high risk for workers and the community assessed as Negative Significant impact (S-). Placing adequate visual signage in excavated, cut and filled areas will reduce safety risk of the workers and the public. Installation of light reflecting road signs will provide safety measures for people and vehicles accessing the road during night-time. Vivid and readable Warning signs maintained on sites of construction, especially haphazard zones will inform public of danger sites and caution to take precautions. This will reduce the likelihood of construction and road accidents.

3.5.3. Storage and handling of construction materials, water runoff damage to existing utilities, buildings and drainage blockage

Improper storage and handling of construction materials may have the potential to contaminate the surrounding areas assessed as Negative Significant impact (S-). Periods of high wind events may disperse stockpiles, generating airborne dust particulates, particularly during dry season.

Covering stockpiles with impermeable material will minimize the generation of fugitive dust or wastewater runoff in the surrounding areas. Where possible, it should be stored in the campsite, otherwise utilized at once when stored on-site. Easily accessible storage areas will minimize interferences to water runoff into drainage and the movement of vehicles and personnel in the campsite and will allow fast transport of materials.

3.5.4. Excavation, Cut & Fill, Soil Erosion and Land Disturbance

Excavation activities have the potential to cause soil instability, erosion and silt runoff especially during wet season, and spoil materials from earthwork activities that are not being managed properly can disturb the construction work and/or traffic, and decrease the aesthetic and economic values of the area. This resulting activity may also impede the access to the community's houses and other buildings assessed as Moderate Negative Significant impact (MS-).

Mitigation measures to be taken should be: a) Proper backfilling trenches; b) Earthworks targeted for dry season as soil erosion vulnerability is high during wet season, thus, stockpiles (sand, cement and aggregates) will not be situated at or near steep areas; c) Exposed soil will be stabilized and re-vegetated to prevent further soil erosion; d) Provide for temporary access and diversion to dwellings and buildings where these are impeded, to avoid traffic accident or others.

3.5.5. Construction and noise disturbance to communities and sensitive areas

The project will include heavy machinery and vehicles activity during this phase, such as demolition works, movement of trucks and equipment, earthworks, concrete mixing, loading and unloading construction materials. These types of activities may have a potential impact in noise-sensitive areas i.e., residential or buildings such as government, health care or educational facilities assessed as Negative Significant impact (S-).

The Contractor must implement a Noise Management System with the following Mitigation measures: a) Limit and/or no unnecessary engine idling duration in construction area, as well as use of power horns; b) Reduce speed limit in the work site and all road-worthy project equipment must not circulate above 40 km/h in residential areas and 50 km/h in urban areas; c) Construction Monday to Friday (7:00 AM to 7:00 PM), Saturday (7:00 AM to 1:00 PM if inaudible at residential premises), No construction works during night-time (7 PM to 7 AM), Sundays and Holidays; d) No construction works on a particular time wherein cultural and religious practices are carried out.

3.5.6. Construction and airborne dust to the community

No major air quality concerns are projected to occur during the project implementation as the planned works require small scale and not much equipment, confined excavation to be undertaken and it is not projected to result in a significant increase in particulates matter in the area, only dust generation which can affect the respiratory and eye systems assessed as Negative Significant impact (S-).

The Contractor must apply an Air Quality and Dust Management System with mitigation/control measures such as watering and sprinkling of the excavated ground surface, to suppress dust from becoming airborne (at least twice a day), especially required

frequently during dry season. Covering stockpiles will protect them from wind and will contain light particulates to the surface. Limiting the movement of vehicles to 40 km/h in residential and 50 km/h maximum in urban area will also reduce the generation of fugitive dust.

3.5.7. Construction and impact on ecological resources

During the implementation for the rehabilitation project, attention must be given to protect and minimize negative impacts on environmental sensitive areas and ecosystems, or the natural environment. Overall, the project area is in urban area and the trenches and trenchless works will not have direct impacts since the work will be done within the ground adjacent to the road (RoW) or confined to the planned area of construction. Nevertheless, the project only has one (1) location that is deemed sensitive (see PC1.1.1.) and should other areas be encountered during the construction activities, the contractors must ensure to establish a Sensitive Areas Management Plan to make sure no impacts occur in this regard, which could be Negative Significant impact (S-), namely vegetation and trees removal are avoided and no fauna is destroyed.

However, if some of the construction works must forcefully remove roadside trees under the supervision of the NDPA and BTL-Baucau, the contractor is required to compensate with trees replanting and re-vegetation. It is also important to limit noisy activities within these areas, in order to stabilize the fauna's mobility, and restrict permanent campsite location, clearing, parking, and movement of heavy vehicles and equipment stockpiling.

3.5.8. Impacts on socioeconomic resources, infrastructure, utilities and cultural sites

3.5.8.1. Reducing impact on established businesses activities and others

Large numbers of shops, businesses, industries, and other economic activities may be affected by the network improvement works, as most of the components are located in an urban area, with ROWs in roadways, although the work will be carried out on individual short lengths of the network, thus the period of construction in each section area will not last long.

No major impacts will be expected on the economy of the city or its citizens given the installation of distribution pipes will be conducted by trenchless methods as much as possible, which require small-scale excavation, conducted the road in right-of-way (RoW), not requiring land from private owners.

Nevertheless, there can be economic impacts if roads have to be closed for short periods and customers are unable to gain access to shops, or if trenches are constructed near the sides of roads, and customers are impeded by the presence of trenches, excavation, workers and machineries. Resulting losses in income are expected to be small (or in-existent) and short-lived (S- = Negative Significant).

Applicable mitigation measures would be planning and making available temporary access ways to all businesses and activities affected and, in extreme cases, determine compensation to the affected business that have justifiably been impacted and demonstrate reduction of income due to the project's direct construction activities.

Cultural sites and infrastructure can be impacted if the constructor does not apply caution to the construction ROW (S- = Negative Significant).

Construction must follow the precautionary measures and rules in the Construction Protection License (see PC 0.5.2) and his/her own Safeguard Plan (see PC3.2.1) for each site, in order to avoid any impact and/or degradation of these sites.

C3.6. Site Clean-up and Rehabilitation (Component: Social)

3.6.1. Unattended construction materials left on site may pose health and safety hazards to the public

3.6.1.1 Site Clean-up Plan

The project should endeavour to return the project sites to their original state, where possible, in order to guarantee the constructed infrastructure blends with its surroundings and does not impact communities or the environment (MS- = Moderate Negative Significant).

The contractor must remove all his/her materials, facilities, etc, as the completion of the project components occur. Excess rocks and sand as a result of excavation activities are not to be dumped next to surface waters and left prior to departure and proper coordination with local authorities must be done of appropriate sites where mass load is needed. This had to be spread in natural looking manner and left in a stable state.

At campsites, besides all equipment, all evidence of the project being there must be retrieved and the latrines and septic tanks must be filled with a soil mixed of dry plant matter soil prior to departure. If the latrines is full, cover with 30 cm of soil mixed with dry plant matter.

9.5 Impacts In the Operation and Maintenance Phase

The operation and maintenance (“O”) phase are a stage where the constructed facilities are ready to be used and how BTL, as the responsible agent, is going to manage them properly so that they can function accordingly with the O&M manual as a foundation for all the related procedures. The EMP will guide BTL with some provided mitigation measures aiming to minimize or inhibit possible impacts from occurring. This too, enables BTL to resolve the anticipated issues as fast as possible.

Various activities in this phase generate both positive and negative impacts originally come from each component of water sources, treatment and storage, distribution up to sanitation which are described below.

9.5.1 O1. Water Sources (Component: Water Resources and Cultural)

O1.1. Protection of the Water Source Quality

The existing condition in the Uailewa, Uailili, and Uailia Mata water sources in Baucau are concluded as not well protected and according to the field observation, the upstream and surrounding area of Uailewa and Uailia Mata systems have intensive human activities such as agriculture or housing areas with no proper sanitary infrastructure, as previously cited in Chapter 3.2.3. along with figures of existing private toilet.

Given the circumstance that the existing conditions needed to be upgraded with more advance designs and programs to maintain a good quality of potable water for the community’s consumption, therefore, it is mandatory for the BTL operators to be duly consistent on implementing programs as mentioned below as part of mitigating such impacts.

1.1.1. Declining of the spring water quality

As the population number ascends, there will be more houses built adjacent to where the water sources are located (upstream) as the community’s main target, especially when the sanitation facilities in each household are built inadequately. The more intense human

activities intervention in that specific area, the more polluted the water quality will be. The said impact is likely to be indirect significant (Ind S-).

1.1.1.1. Implementation of upstream watershed protection programs

Protecting the upstream zones and area encompassing the water source such as restriction to slash and burn activity, animal husbandry, other typical deforestation activity, irresponsibly disposing household chemicals, etc. Information also needs to be disseminated to the community regarding to watershed protection in order to expand awareness which can thus trigger them for the implementation, promptly as possible. The responsible agent i.e., BTL and Municipality should be able to encourage the local leaders such as Suco Chiefs, Aldeia Chiefs, and also the community to take part in this program.

1.1.1.2. Improvement program for existing and future dwelling

Community in the district either in the urban, semi-urban, or rural areas, particularly the low-income family, are proven to scarcely own sanitation infrastructure of septic tanks with any further preliminary treatment process and desludging activity. It is considered very crucial because the untreated sewage that's being generated from the households would flow directly to the water bodies and even to the ground, which can then cause water and soil contamination. The presence of water stored in the ground is easily to be impacted with this sort of condition mentioned above.

Improving the existing and future private sanitary facility is also part of the Watershed protection program aiming to conserve the underground water volume and its quality. The such program that can be offered and applied for is to promote the BTL septic tank design template to the community in a comprehensive way, but also to mainly focus on the community surrounding the water source and other upstream watershed area.

1.1.1.3. Involve the Lia Na'in and Communities for Cultural Ceremony Preparation and Tara Bandu Protection of the Source

The programs mentioned above will not be successfully attained if they are not fortified by the establishment of Tara Bandu (local regulation) and the cooperation and involvement between the local Lia Na'in with the community. The local community and its culture play important contribution on managing the resources, although BTL will be the one responsible for all the requirements to prepare for the Cultural Ceremony.

9.5.1.1 O2. Water Treatment and Proposed Storage

O2.1 Mishandling of Chlorine (Component: Social)

Water quality tests to Uailewa and Uailili Sources water have shown that some intakes are commonly contaminated by E. Coli and Total Coliform contamination. To ensure the potable water conveyance to the consumers and due to the design analysis, 3 out of 8 water tanks in total to be reconstructed will be designed with treatment facility i.e., disinfection type by injecting Sodium Hypochlorite into the proposed tanks with stored water.

After the construction phase, the operators will still have to encounter some risky tasks e.g., dealing with operating chemical hazards which subsequently may threaten the workers' health and safety. The impact of chemical exposure is adverse and negative significant (S-) towards the workers and some mitigation measures should be seriously taken into account, as described below.

2.1.1 Health hazards towards the operators

When it comes to mishandling of hazardous substance, the impact will directly and solely effect on the workers. Chlorine, hypochlorous acid and hypochlorite ion exposures can result in irritation of the oesophagus, a burning sensation in the mouth and throat, and spontaneous vomiting.

2.1.1.1. Proper storage and handling of water treatment chemicals

Chemicals either they are imported or not, should be placed properly in an indoor warehouse, avoidance of sun exposure and room temperature control, in order to maintain the chemical composition in its original state, and diverting fire and explosion from occurring.

2.1.1.2. Ensure knowledgeable/skilled personnel are in charge of chlorine handling

Operators still need to be provided with training skills with simulation performances and equipment if any, in order to improve their capacity in the working field especially on handling the Chlorine.

2.1.1.3. Ensure use of PPE while Using Chemicals

Workers or operators are obligated to use PPE as part of HSE procedures during working hours. Face masks, safety boots & jackets, gloves and goggles are examples of equipment that workers must wear to protect themselves from any undesirable accidents.

Supervisor needs to do monitoring in each of the water storage location and do registry of workers who are or are not in compliance with the usage of PPE, as a mechanism for the workers working performance and their consistency.

9.5.2 O3. Proposed Distribution Network

O3.1. Sound Operation of Clean Water Distribution System (Component: Social)

3.1.1. Improved Health and Hygiene

This project is aimed to improve water supply and sanitation sectors to the community. This project will result in improvement of local people's hygiene and public health and thereby reduce the waterborne disease. A regular maintenance of the project's components will provide continuous benefits to the local people. The impact is therefore direct in nature, local in extent, high in magnitude and long-term in duration and therefore assessed as Positive Significant impact(S+).

3.1.1.1. Proper operation of the water distribution system

This mitigation measure is aimed on providing an adequate and reliable supply of safe water to its users. Operation includes monitoring the system state, running the system and enforcing policies and procedures.

O3.2. Drinking Water Supply System (Component: Water Resources and Social)

Monitoring activity conducted by operators is to ensure the water distribution components are operating properly and consequently can guarantee the necessity to the users in terms of quantity and quality of water. Although, there will be certain impacts expected to occur, similar as other water supply projects e.g., pipe leaks and bursts, and changes in the water quality due to natural phenomena, inadvertent negligence or non- compliance of O&M manual.

Nevertheless, this phase will not anticipate any illegal connections in the sources and other locations because mitigation measures are already established previously in the design

phase in terms of water sources protection of the rehabilitated intakes and boreholes area, and additionally water pipelines are designed to be implanted under the ground. However, impacts that are constituted in the EMP matrix particularly on water delivery system are described below along with their mitigation measures.

3.2.1. Delivery of unsafe water

This refers on the diminishing of the water quality and volume with a rating impact of moderate significant (MS -) because they can be quickly mitigated and somehow the duration will only be temporary without causing any acute effect on the environment and public health.

The water quality that is affected depends on the activities upstream contaminating the immediate area of the sources and also pipe leaks along the distribution line.

3.2.1.1. Prepare Operations and Maintenance Plan

The referred manual is prepared by the selected Contractor for this project and should provide detailed information on the related matter. The O&M manual will then be used by the BTL as a guideline during operating and maintaining the quality of the facilities from impairments.

3.2.1.2. Implement a Water Quality Control Program (WQCP)

The WQCP should be drafted based on the requirements of Decree-Law no. 31/2020 - Water Quality, in order to ensure the system monitors and distributes safe drinking-water to prevent contamination of water sources, to treat water, to reduce or remove contamination that could be present to the extent necessary to meet the water quality targets in Timor-Leste, and to prevent re-contamination during storage, distribution and handling of drinking-water.

3.2.1.3. Monitor Water Quality

The BTL as the responsible agent should plan its sampling schedule for water quality testing as per Decree-Law no. 31/2020 - Water Quality, specifically under the requirements of Annex II of said regulation, daily at each WTP exit and monthly in all sampling points defined in the WQCP.

3.2.2. Detection and repair of leak and pipe bursts

Pipe bursts are commonly happened in the water distribution systems. Detection of pipe burst events usually comes from direct visual observation or customer report, although this sort of method is not efficient and time - consuming. Leaks and pipe bursts should be solved accurately and quickly to reduce water loss and further damages to the pipes (MS-).

3.2.2.1. Ensure leak detection and restoration time is minimized to the extent possible

To mitigate leaks and pipe bursts, there should be an advance design with time-efficient method for burst detection techniques either equipment-based method or software-based methods. Not to mention that giving trainings to the workers in regards to implement those methods is also essential.

3.2.3. Excessive algal growth in tanks

The presence of algal in reservoir can affect in deteriorating water quality because it releases toxins that often lead to several disruptions e.g., health concerns, water taste and odour problems. Water that is contaminated with algae can endanger the whole water

supply system, since not all water tanks or reservoirs will be installed with treatment facilities. This kind of impact is likely to be moderately significant (MS-).

3.2.3.1. Water tank maintenance and cleaning schedule

Mitigation measures to be taken: a) Close Water Tanks All the Time; b) Clean Reservoirs as per the O&M Schedule.

10 SUMMARY OF ENVIRONMENTAL MANAGEMENT PLAN AND INSTITUTIONAL RESPONSIBILITY

10.1 Summarized Environmental Management Plan

An Environmental Management Plan (EMP) of the Baucau project is prepared as stand-alone document to meet the provision of the Decree Law No. 5/2011 on Environmental Licensing. Therefore, the EMP should be read together with the related SEIS. The EMP details measures and monitoring program that should be implemented during project implementation to mitigate anticipated E&S risks and impacts, from pre-construction through to operation stages. This sub-section is not intended to duplicate the contents of the project's EMP, instead, it provides a summary of mitigation measures that should be implemented to minimize E&S impacts, among others:

Ambient air quality

- All stockpiles will be situated within the campsite or designated areas on-site that can easily be accessed by equipment and personnel and will cause minimal interference to the movements of vehicle and personnel At public space.
- Watering of surface through water trucks, sprinklers or hoses, say 2 - 3 times a day.

Noise

- Implement the works only within working hours of 7 AM to 7 PM when considered appropriate
- Queuing and idling of construction vehicles outside the premises of the camp site and outside operating hours specified is prohibited

Soil Works and Land Access

- Excavations, cuttings and fillings will be carried out in a manner to reduce soil erosion
- Provide for temporary passageways and communicate/inform dwellers and institutions
- Restrict haphazard site clearing, parking, and movement of heavy vehicles and equipment stockpiling

Groundwater and Surface Water

- Temporary drainage provision that links to safe surface water drainage
- Installation of appropriate latrine with septic tanks for construction camps
- Establish a water supply system for construction purposes based on the approval from BTL
- Waste bins will be kept closed to prevent the accumulation of water during rain events
- Regular emptying of waste bins and transport to approved disposal sites, with coordination with local authorities of appropriate dumpsites.

Community and Occupational Health & Safety

- Preparation of a Health and Safety Plan for subsequent implementation
- Allocation of proper containments and labelled, suited for the nature of chemicals and/or wastes

- Refuelling of project vehicles and equipment only in designated areas which are to be 50 m from a water course and drip trays to be used when refuelling
- Materials hauled directly to work front, minimizing storage at campsite
- Asbestos containing material i.e. used pipes to be confined covered, unbroken and with limited access from people
- Ensure proper storage and handling practices for chemicals Ensure the knowledgeable and skilled person is in charge of chlorine handling
- Ensure the use of PPE while performing the works and when using chemicals

Cultural Aspect

- Involvement of ‘lia nain’ for cultural ceremony preparation
- Follow the Heritage License rules for each site, defined by the SS Culture and apply measures

Socio-economics

- Make available temporary access ways to all businesses and activities affected
- Determine compensation to business justifiably affected and demonstrate reduction of income due to project
- Recruitment of skilled and unskilled workers from affected peoples and households, including the opportunity for women in coordination with the local authorities and promote on-the-job trainings
- Assign fair wages and respect working hours. Overtime work, when performed at the request of construction companies, must be remunerated

10.2 Institutional Roles and Responsibility

The EMP will be primarily implemented by the the civil work contractors (to be appointed) with the overall accountability reside with a dedicated PMU of the project reporting to the MPW. The project supervision consultant (PSC) to be appointed by the MPW will assist PMU in supervising the civil works including EMP implementation. A summary of the key functions for project implementation and environmental safeguards and detail on the responsibilities of each function in the following table.

Table 10.1 Roles and Responsibilities on EMP Implementation

Pre-Construction Phase	Construction Phase	Operation Phase
Ministry of Public Works/Project Management Unit (Implementing Agency)		
<ul style="list-style-type: none"> • Overall responsibility for project design and implementation • Provide support and operating budget to the PMU • Ensure that sufficient funds are available to properly implement all agreed environmental safeguards measures 	Supervision of implementation and management of all activities under the project according to the SEIS and EMP, Timor-Leste laws and regulations, and good international industry practices	Oversee environmental regulatory compliance and reporting requirements by BTL/PMU, to ANLA.

Pre-Construction Phase	Construction Phase	Operation Phase
<ul style="list-style-type: none"> On behalf of the GOTL, ensure that the project, regardless of financing source, complies with the Bank's E&S requirements 		
Project Management Unit (PMU)		
<ul style="list-style-type: none"> Include EMP and related clauses are incorporated in bidding documents, contracts Ensure that all necessary approvals (e.g.: Environmental License from ANLA, Culture Licenses, construction permits) are secured prior to civil work contract award Review/endorse final CEMP of the winning or selected Contractor. Conduct affected people consultation. Establish a functional GRM and making affected persons aware of GRM focal points, contacts and procedures 	<ul style="list-style-type: none"> Conduct inspections and spot checks to monitor performance of the Contractors in implementing the C-ESMP Collect and review monthly EMRs from the Contractors Prepare and submit semi-annual E&S monitoring report to the Bank Oversee management and resolution of grievances as well as effectiveness of the established GRM Conduct appropriate consultation and monitoring of effect of construction on affected people 	<ul style="list-style-type: none"> Conduct water quality tests for baseline data BTL/PMU shall be responsible for: i) setting up a team to manage EMP implementation and reporting; and ii) implementing mitigation and protection measures specified in the Component's EMP, O&M Manuals and other relevant documents Ensure all GRM complaints are closed out to affected person's satisfaction.
The Contractor		
<ul style="list-style-type: none"> Appoint a HSE Manager/supervisor for the project Finalize C-ESMP with inputs/comments from PMU and WB clearance Organize disclosure of the relevant project's information before commencement of civil works. 	<ul style="list-style-type: none"> Engage or mobilize engineers to manage the C-ESMP's implementation and reporting Implement all environmental mitigation and protection measures, conduct environmental monitoring activities and ensure preparedness for emergency responses Observe the GRM in addressing complaints Prepare monthly reports including summary of E&S aspects 	-
Construction Supervision Consultants (CSC)		
<ul style="list-style-type: none"> Provide technical advice/ assistance on C-ESMP implementation. Provide E&S related training for PMU, contractors and stakeholders Assist the PMU in reviewing the bidding documents and C-ESMP 	<ul style="list-style-type: none"> Conduct monitoring performance of the Contractor in implementing the C-ESMP Collect monthly progress report from the Contractors, and prepare and submitting semi-annual E&S monitoring report to 	<ul style="list-style-type: none"> Conduct inspections to monitor performance of the ESMP implementation. Conduct a periodic water quality monitoring and review the associated analytical results

Pre-Construction Phase	Construction Phase	Operation Phase
	<p>the Bank, PMU and related agencies.</p> <ul style="list-style-type: none"> • Oversee/monitor the management/ resolution of grievances logged and effectiveness of the GRM 	
Local and National Authorities		
<ul style="list-style-type: none"> • ANLA to review, comment and approve the updated SEIS and EMP; Issue and renew environmental license as required by GoTL during the life of the project; • Concerned Chefes de Suco and Aldeia shall be involved in: <ol style="list-style-type: none"> 1) public disclosure of the IEEs and EMPs; 2) Contractor employment mechanism (local contracting numbers); 3) community awareness program on health and safety impacts of the EMP implementation; 	<ul style="list-style-type: none"> • ANLA to monitor compliance with SEIS and EMP; • Municipality and Suco Council to participate in the monitoring of the Contractor performance in EMP implementation; • Chefes de Suco and Aldeia shall be involved in grievance resolution pursuant to grievance redress mechanism. 	<ul style="list-style-type: none"> • ANLA shall review EMRs and results of environmental monitoring; • ANLA shall conduct validation and provide technical guidance on environmental effects and quality monitoring, when necessary.

11 PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

11.1 Public Consultation Conducted to Date

The Public Consultation of the Baucau project was first undertaken in the Assembly Room of the Baucau Municipality Administration Office on 3 October 2020, participated by local government agencies and authorities (Chiefs of Suco/Village), and representative members of the communities within the project area. This consultation was undertaken as part of the SEIS and EMP preparation in alignment with the ADB Safeguard Policy Statement (2009) in which this MDB provided assistance to the government in preparing the Master Plan/DED of Timor-Leste Four Municipal Capitals Water Supply and Sanitation Project including for Baucau. Subsequently, the World Bank participated in the Baucau project.

BTL, as the project proponent at that time, presented the arrangement of the proposed project, predicted environmental and social impacts, and proposed mitigation measures in order to collect all useful and relevant inputs from the stakeholders attending the event in readiness for the project construction phase. The stakeholders presented their concerns, suggestions and recommendations for the project implementation, focussing mainly on issues regarding the beneficial of the existing water source for agriculture, sucos that are not included in supply zone, possibility of extracting water from Uailia Mata spring, possibility to identify another water source and measurement for structural preservation of cultural and religious assets within the project area.

No issues of significant social concern or objections about the proposed project were raised and the stakeholders were positive about it, expecting for this project to be implemented as soon as possible, since they are facing crucial water issues for daily consumption and do not want to repeat uncertainty over the schedule for water delivery into the households in the future.

Figure 11.1. Public Consultation in Baucau City (2020)



The Consultant Team also engaged with several local and national level institutions that supported the study, in particular during the field study and data collection, namely:

- Baucau Directorate of Water and Sanitation (Mr. Pedro Alexandre Guterres and technician staff Mr. Natalino);
- Chief Department of the Environment for Baucau BTL, Mrs. Adriana;

- Ministry of Agriculture and Fisheries: General Director from Forestry, Coffee and Industrial Plants, (Mr.Raimundo Mau) and Chief of Department of Conservation (Mr. Joao Antalmo);
- Secretary of State for Arts and Culture: General Director from Secretary of State for Arts and Culture (Mr. Manuel Ximenes Smith), National Director of Cultural Patrimony (Mr. Gil Paulino dos Santos Oliveira) and Chief of Department of Archaeology (Mrs. Irene dos Reis Goncalves);
- Local authorities: Chief of Suco Bahu, Caibada, Buibau, Tirilolo, Uailili, Samalari, Triloca, and Buruma.

11.2 Public Consultation at Village (Suco) Level

In addition, seven (7) other Public Consultations were carried out under the social component, on the 4th February 2021 in Suco Caibada, Suco Bahu and Suco Tirilolo, on the 5th February 2021 in Suco Gariuai, Suco Tiriloca, on the 6th February 2021 in Suco Buibau, and lastly on the 9th February 2021 in Suco Uailili. These Consultations aimed at confirming the expectations and worries in the previous Public Consultation and reassured the team that there is very little risk of any water conflicts or impacts felt by the community during implementation and operation of the future system.

During the consultations as shown in the following photos, the Suco's communities acknowledged about the lack of proper water and sanitation system. Most of the questions were technical matters and the majority concerns from the community are the water sharing to other villages that are not mentioned in the design and water payments during operational and maintenance phase if water meters are to be installed in the future. However, the community is supportive, is willing to pay for water supply in their households and does not have any objection for future Public Toilets to be installed. Most women in all 7 Sucos do not have their own organizations or groups, but they are encouraged by the recognition of this project and will involve fully in the implementation of this project aiming to improve the quality of life through clean water and sanitary services.

Figure 11.2. Public Consultation at Suco Caibada (2021)



Figure 11.3. Suco Bahu Public Consultation



Figure 11.4. Suco Tirilolo Public Consultation



Figure 11.5. Suco Gariuai Public Consultation



Figure 11.6. Suco Triloca Public Consultation



Figure 11.7. Suco Buibau Public Consultation



Figure 11.8. Suco Uailili Public Consultation



11.3 Public Consultation Undertaken for the SEIS Process

To follow ANLA's request for Public Consultation under the Environmental Licensing process, two (2) other Public Consultations were carried out on the 1st and 2nd of June 2022 in Suco Bahu and Suco Tirilolo, with a total 156 participants. These consultations aimed at reviewing the expectations and concerns stated in the previous consultation events and reassured that there is a low risk of any water conflicts or impacts felt by the community during implementation and operation of the future project.

In general, during the consultations, several issues were raised and the consultant managed to clarify and inform the community members regarding their worries, where they were informed that most issues were already thought of, analysed and covered under the SEIS and the EMP.

Suco's communities acknowledged about the lack of proper water and sanitation system and voiced that they were positive about the proposed project, voicing their support and willingness to pay for water supply in their households, with no objection for future Public Toilets to be installed.

Women in particular were encouraged by their recognition in this project and will involve fully in the implementation of this project aiming to improve the quality of life through clean water and sanitary services.

The communities supported to the project implementation, thanking the consultants for the designs and the strategy to supply them with water on 24/7 basis. They expect this project to be implemented as soon as possible, with better coordination with local administration and Suco and Aldeia leadership, and printed project information i.e. brochures, since they are facing crucial issues with water for daily consumption and don't want to repeat uncertain schedules for water delivery into their households, as have occurred in the past.

Figure 11.9. Suco Bahu Pulic Consultation



In this regard, the DED consultant emphasized the importance of the EMP as the rules to safeguard these concerns, for the future contractor to follow during construction and the need to draft project-specific Construction-ESMP, adapted to the contractor's project scope and area, based on the current EMP requirements. It was further explained that there are indirect impacts issues that fall under the general responsibilities and coordinated effort of the Local Authorities and the community, such as: adaptation to urban planning; improving domestic and building sanitation installations to avoid contamination of sources; or control of illegal connections.

Figure 11.10. Suco Tirilolo Public Consultation



However, a few issues and concerns were discussed further during the public consultation, due to their significance, namely:

- *Downstream water uses and potential for water conflict* - the community are concerned of reduction of water due to extraction for water distribution. This is particularly relevant for the Uailewa and Sirimanana sources. However, while Sirimanana has a Non-objection letter from the community, the consultant explained that the Project has calculated the water use in Uailewa based on the existing and future water needs and the volume of extracted water now and in 2040 is a small percentage of the whole of the Uailewa system and the current Uailewa water users within the proposed water distribution areas downstream will become BTL clients so the water they use today will be the same volume in the future but potable and safe to drink, and the extra water will continue to flow to non-BTL surface water users.
- *Cultural and Heritage issues* - any issues in this regard within the project ROW must be managed locally: Suco Bahu voiced their concern about the need for local management of these issues. The Consultant informed that the SEIS has already identified several important cultural and architectural heritage sites for the project area and has included rules for the contractor to follow in his/her contract, especially to review the conditions of each component before construction and together with the 'Chefe de Suco' and 'Lia Nain'. These components are as follows:
 - All water sources are defined as "sacred" even if they are not, because of their importance and opening and yearly ceremonies will be done according to the Lia Nain of each project component area.
 - The transmission lines and distribution network are to be placed under the road to minimize impacts to persons and physical assets. Contractor to request a license to the Secretariat of State for Culture (in coordination with Chefe de Suco and Lia Nain) regarding Heritage sites that are within 50m of the project components, as demanded by the Cultural Laws in effect.
 - Tirilolo Tank location to be changed: the Land and Property Representative advised that this land was already earmarked for a Municipality project. The team advised they would coordinate again with Land and Property and Municipality to confirm the location.

11.4 Stakeholder Engagement and Information Disclosure during Construction

Prior to the start of construction, the appointed contractor and PMU will conduct information dissemination sessions and request support of the local community leaders to encourage the participation of the people to discuss the E&S concerns they may have on the project during construction. At each Aldeia/Suco, focus group meetings in appropriate format/scale would be conducted to discuss the construction plan with local communities and thus reduce disturbance and other impacts, as well as provide a mechanism through which stakeholders can participate in project monitoring and evaluation. Constant communication will be established with the residents to address E&S issues likely to surface during construction and operational phases and also regarding the grievance redress mechanism, and overall EMP implementation. Meetings will also be organized at potential hotspots/sensitive locations before and during the construction i.e., water Sources and/or close to cultural sites where considered appropriate.

For disclosure and information purposes, a copy of the SEIS and EMP with the Executive summary translated into Tetum (local language) will be distributed to each of the Chiefs of

Aldeia, for local public access to information, creating wider public awareness. An electronic version of the SEIS and EMP in English and Executive Summary in Tetum will be placed in a website indicated by the MPW, BTL, WB, Consultant or other, and the stakeholders will be made aware of the grievance redress mechanism.

Public disclosure meetings will be conducted at key project stages to inform the public of progress and future plans. A board showing the details of the project will be displayed at the construction site for general public information.

12 DIFFICULTIES ENCOUNTERED

The preparation of the SEIS and EMP commenced in 2020 with water supply and sanitation components as the scope of the Baucau project, and this process has been challenging for the Consultant Team as Covid-19 pandemic had been affecting nationwide with the establishment regulations during the State of Emergency enforced by the Government of Timor-Leste starting early 2020 up to June 2021. In the earlier 2020, the Consultant Team had to postpone the second field visits after carrying out preliminary site visits for the Inception Report due to quarantine restrictions to leave the Capital city, which led the Team to depend temporarily on the available information from desktop research and previous collected data. In addition, during the State of Emergency, Government services, working hours and conducting physical meetings were limited or not possible to carry out, thus only long-distance communication i.e., phone or video calls, were the preferential method of communication to continue the project to where possible.

After the restrictions were relieved in the middle year of 2020, the Consultant Team managed to collect necessary information through site visits, under compliance with the Covid-19 protocol. During the visit, it was quite difficult to propose future infrastructure location, given it somehow coincided in or adjacent to a sensitive area, private land status, or was environmentally incompatible, or was even earmarked for municipal development expansion. To accelerate the working progress, the Consultant Team was able to get help from the Baucau BTL technicians to undertake due diligence of the final project locations.

The water quality sampling and testing had also been hindered due to another total lockdown since March until October 2021, forbidding again citizens to travel to districts. After the abolishment of lockdown in June 2021 and in adherence to a new regulation, technical members will started the related activity in the project area once they were all vaccinated.

The Consultant team also felt considerable difficulties in procuring existing secondary data sources for components such as air quality and noise level, essential to complement the field surveys and characterisation visits. The repository of existing Environmental Reports (e.g., EIA and IEE) in the country is not available to be consulted and those reports that are available, mostly through entities such as the ADB and/or the World Bank, in their websites. Therefore, the team relied on the on-site review and experience of the technicians and the perception of the stakeholder interviewed during said surveys.

The SEIS and EMP prepared since 2020 was finalized in 2022 and related environmental license granted by ANLA in October 2024, but the project was then postponed by the Government. In early 2026, the project was reactivated with amendment on the scope and therefore the SEIS and EMP has been updated to reflect it and improve the overall contents.

13 CONCLUSIONS AND RECOMMENDATIONS

The original SEIS and EMP of the project (i.e., water supply and sanitation components) was prepared at the planning stage of the project since 2020, where primary and secondary data have been used to assess the potential E&S impacts in a comprehensive manner. These documents have been evaluated by ANLA and subsequently the Environmental License granted in October 2024. Subsequent to the amendment of the project scope to focus on water supply only with new water sources and storage tank locations, these documents have been reviewed in March - April 2026.

The updated SEIS (this report) provides assessment of key potential environmental and social impacts associated with the Project when implemented and operated, and recommend suitable mitigation and monitoring measures to minimise such impacts. Assessment of the project characteristic and details with the existing conditions revealed that, although the project footprint may traverse in the proximity of the residences, the anticipated E&S impacts could be quite adverse, but would be temporary and of short duration as well as reversible upon completion of the project implementation.

The EMP prepared and updated as a standalone document, if implemented as directed, will mitigate impacts on the natural environment and affected people to an acceptable level. The extent of adverse impacts is expected to be localised, confined within the project's main areas of influence, including the access routes to and from these sites. With mitigation measures in place and ensuring that the bulk of earthworks are completed before the onset of the rainy season, the potential adverse impacts during construction would be site-specific.

Few adverse impacts of moderate magnitude during construction will be temporary and short-term (i.e., most likely to occur only during peak construction activities). Noise, dust/fugitive emission impacts are anticipated for human receptor but not on ecological aspects, considering that the project's area in Baucau is an urban- and semi-urban landscape that have been quite heavily modified. Anticipated impacts on the natural hydrology e.g., the water from intake may overflow which cause soil/silt erosion due to inadequate protection off spring intake, and all the predicted impacts that have been identified can be mitigated and managed to a minimal level. The mitigation measures, integral to socially and environmentally responsible construction practices, are commonly used at construction sites and are well known to Contractors. Hence, they will not be difficult to implement, depending upon willingness of the contractor and quality of the supervision works to be undertaken.

During operation, the spring water resource sustainability is fundamental and the setup of a monitoring system for all water resources is essential to maintain the safely managed (potable) water supply rate as per the DED, and for maintaining the water flow outside the distribution networks for social use ecological flows in the related water bodies. The potential delivery of unsafely treated water can be mitigated with good operation and maintenance, prompt action on leaks, and complying with the required quality monitoring of supplied water as prescribed in the National Drinking Water Quality Standards Legislation.

The key parties for mitigation measure during operation of the project would be the BTL of Baucau and to be accompanied by competent parties to provide on the job trainings and effective standard operating procedures.

14 NON-TECHNICAL SUMMARY

Context of the Project. The Baucau Municipal Capital Water Supply Project is a continuation of the Second District Capitals Water Supply Project of Asian Development Bank (ADB), which then proceeds into the Detailed Engineering Design (DED) phase. Its main objective is to provide improved water supply and sanitation services to Baucau city community, rehabilitating the existing infrastructures that are currently in a very poor condition, and to provide technical trainings to members of related stakeholders in maintaining the sustainability of the future facilities. The World Bank was engaged in the project preparation since 2020, but the project was cancelled in 2025. At the request of the Government of Timor-Leste, the project was reactivated in early 2026 with the focus to implement only the water supply component and exclude the sanitation component.

E&S Impact Assessment According to the Decree Law 05/2011. According to the Decree Law 5/2011 on Environmental Licensing, the Ministry of Public Works (MPW) submitted a Project Document as a scoping document for the National Authority for Environmental Licensing (ANLA) to determine the category for the Baucau project. ANLA determines that the project is classified as Category B, and therefore, the SEIS and EMP has been prepared by the consortium of Endidro/Agua de Portugal/OASIS to obtain the required environmental license. The work undertaken in preparing this report was based on the information collected by the Environmental Consultant during the preliminary meetings with the proponent and project site visits. The SEIS comprises several key chapters that provide information on, among others:

- Project Proponent; and the Consultant who prepared the SEIS and EMP.
- Key Regulatory Framework of the Country and International Standards
- Description of the Project and the Environment; Alternatives;
- Impacts, Mitigation Measures and Monitoring;
- Public Consultation;
- Issues occurred in the SEIS;
- Conclusions and Recommendations.

General Environmental and Social Setting of the Project Area. The project is situated in the Baucau Municipality, covering selected Sucos (villages), namely Bahu, Buibau, Buruma, Caibada (Makasae), Caibada (Uaimoa), Gariuai, Seical, Tiriloca, Tirilolo and Uailili. These Sucos population is the primary receptor of the water supply services from this project, which in 2018, counted 7,350 persons, therefore, water quality particularly Uailia Mata should also be the main focus for its treatment, given that in the future the Uailia Mata will probably have bacteriological contamination and suffers from high total hardness even though the current result is generally good, thus it is important that the water treatment facility will include the following treatment lines: Soften (calgon dosing) and disinfection.

The Uailia Mata spring is located in the plateau of Baucau, precisely in Suco Gariuai with high potential of aquifer and according to the BTL Baucau technician, the said spring currently serves to only certain groups or community in Suco Triloca and Gariuai, which is outside the urban area and proposed supply zone. The region of Baucau is formed of recent sedimentary materials, aged of the Pleistocene (Qpb) named Baucau Formation. The flat lying Baucau limestone consists of grey, hard, cavernous, massive white coral-reef limestone well developed around Baucau city. The topography of the project area is quite flat in the upper plateaus and landslide risk is unlikely and so location and routing of the water infrastructure is not considered to be a substantial problem.

Scope of the Project. It is expected to produce several outputs, as described in the following below:

- To rehabilitate and expanding the Baucau municipal capital urban water supply system in order to cover the potable water demand;
- Establish fully functioning water supply in Baucau Municipality and selected Sucos;
- Influence and facilitate achieving new or improved households' sanitation in all served households in the Baucau municipal capital and selected Sucos.

The Project scope includes all the areas that will be required to implement the Abstraction, Treatment and Distribution of Water for Human Consumption, as well as provide designs and solutions for Sanitation infrastructures encompassing 15-km diameter urban area of Baucau Municipal Capital. The existing water distribution system and future expansion on to new households in Baucau city will serve the following Sucos: Bahu, Buibau, Buruma, Caibada (Makasae), Caibada (Uaimoa), Gariuai, Triloca, Tirilolo and Uailili.

Why Do We Need the Project? The Project will contribute into enhancing the quality life of the local people in health and hygiene sector particularly on women. The future significant improvement in women's health will lead to low rate of mortality, balance family and individual level. Other than that, shaping the local economy and boosting the livelihood of the community are anticipated as job opportunities will be available once the Project is implemented.

What are the Anticipated Project Impacts? The implementation of the project is associated according to the cycle, which comprises of 4 phases, commencing from the design activity, aiming to meet the project's needs. The subsequent phases are the construction activities of infrastructures, following the operational and maintenances of the facilities, and the decommissioning. All possible adverse impacts associated with the respective activities have been identified and evaluated thoroughly in the SEIS. Based on the activities identified, the possible impacts are considered significant and mitigation measures for each of them as elaborated in the EMP are needed to mitigate the impacts on site.

Have Stakeholder Consultation been Conducted for the Project? The Public Consultation of the Baucau project was conducted at the Baucau Municipality Administration Office on the 3 October 2020, participated by local government agencies and authorities (Chief of Suco and Village), and representative members of the communities within the project area. In addition, 7 other Public Consultations were carried out on the 4 February 2021 in Suco Caibada, Suco Bahu and Suco Tirilolo; on 5 February 2021 in Suco Gariuai, Suco Tiriloca; on the 6 February 2021 in Suco Buibau, and lastly on the 9th February 2021 in Suco Uailili.

All PCs registered a significant attendance especially with a strong female participation. After the non-technical presentation of the project, the floor was given to the attendees to discuss water supply and sanitation issues related to the project. At the request of ANLA, two additional public consultations were undertaken in Suco Bahu and Suco Tirilolo on 1 - 2 June 2022 as part of the SEIS preparation and to better address expectations and concerns stated in the previous consultation events related to potential conflict between water users downstream of the proposed springs and potential disturbance to the spring considered sacred and culturally sensitive sites.

Conclusions. The SEIS concludes that the adverse impacts due to project implementation will be anticipated predominantly during the construction phases, but these are temporary, localised and reversible upon project completions. The affected community will have to

endure temporary disturbances and interferences from the project activities; however, mitigation measures for the impacts are set in the EMP and based on this, the Contractor will be required to prepare a construction environmental and social management plan (C-ESMP) for endorsement by PMU that will served as a guidance to mitigate impacts and conduct monitoring program during construction. The positive or beneficial impacts will likely occur during the Operation and Maintenance phase as the socioeconomic sector will grow significantly, for instance the livelihood, health and hygiene of the community are anticipated to improve through provision of a safely managed (potable) water supply on 24-hour/7-days per week.

15 NON-TECHNICAL SUMMARY IN 'TETUM' LANGUAGE

Resumo Não Technical

Kontestu Projetu nian. *Baucau Municipal Capital Water Supply Project* mak kontinuasaun ida husi Segundu Projetu Abastesimentu Bee ba Kapitál Distritu husi Banku Dezenvolvimentu Aziátiku (ADB), ne'ebé kontinua ona ba faze Dezeñu Enjeñaria Detalladu (DED). Ninia objetivu prinsipál mak atu fornese servisu abastesimentu bee no saneamentu ne'ebé di'ak liután ba comunidade sidade Baucau, reabilita infraestrutura ezistente sira ne'ebé atualmente iha kondisaun att nia laran, no atu fornese treinamentu tékniku sira ba membru parte interesada sira hodi mantein sustentabilidade ba facilidade futuru sira. Banku Mundiál envolvidu iha preparasaun projetu ne'e dezde tinan 2020, maibé projetu ne'e kansela tiha iha tinan 2025. Ho pedidu husi Governu Timor-Leste, projetu ne'e reativa fial fali iha inísiu 2026 ho foku atu implementa de'it komponente abastesimentu bee nian no esklui tiha komponente saneamentu nian.

Avaliasaun Impaktu E&S Tuir Dekretu-Lei 05/2011. Tuir Dekretu-Lei 5/2011 kona-ba Lisensiamentu Ambientál, Ministériu das Obras Públikas (MOP) submete ona Dokumentu Projetu nian nu'udar dokumentu eskopu ba Autoridade Nasionál Lisensiamentu Ambientál (ANLA) atu determina kategoria ba projetu Baucau nian. ANLA determina katak projetu ne'e kalsifikadu nu'udar Kategoria B, tan ne'e, konsórsiu Endidro/Aguas de Portugal/OASIS prepara ona Deklarasaun Impaktu Ambiental Simplifikada (DIAS) no Planu Jestaun Ambiental (PJA) atu hetan lisensa ambientál ne'ebé presiza. Servisu preparasaun relatóriu ne'e bazeia ba informasaun ne'ebé Konsultór Ambientál sira halibur durante enkontru preliminaríu ho proponente no vizita sira ba fatin projetu nian. DIAS ne'e kompostu husi kapitulu xave sira ne'ebé fó informasaun kona-ba, inklui mos:

- Proponente Projetu; no Konsultór ne'ebé prepara DIAS no PJA.
- Kuadru Regulamentu Xave Nasaun nian no Padraun Internasionál sira.
- Deskrisaun Projetu no Ambiente; Alternativa sira.
- Impaktu sira, Medida Mitigasaun sira no Monitorizasaun.
- Konsultasaun Públika.
- Kestaun sira ne'ebé mosu iha DIAS laran.
- Konkluzsaun no Rekomendasaun sira.

Kondisaun Jerál Ambientál no Sosiál iha Área Projetu. Projetu ne'e situa iha Munisípiu Baucau, kobre Suku selesionadu sira, hanesan: Bahu, Buibau, Buruma, Caibada (Makasae), Caibada (Uaimoa), Gariuai, Seical, Tiriloca, Tirilolo no Uailili. Populasaun iha Suku sira-ne'e mak benefisiariu primáriu ba servisu abastesimentu bee husi projetu ne'e, ne'ebé iha tinan 2018 konta hamutuk ema na'in 7.350, tan ne'e, qualidade bee, liuliu iha be'e matan Uailia Mata mós tenke sai foku prinsipál ba nia tratamentu, konsidera katak iha futuru be'e matan Uailia Mata karik bele hetan kontaminaun bakteriolójiku no husi nivel *hardness* (dureza) ne'ebé aas, maski rezultadu atual jerálmente di'ak, tan ne'e importante tebes ba facilidade tratamentu bee nian sei liu husi liña tratamentu sira hanesan: hamihis (doze calgon) no dezinfesaun.

Bee-matan Uailia Mata situa iha planaltu Baucau nian, iha Suku Gariuai ho potenciá akuíferu ne'ebé aas tuir tékniku BTL Baucau, bee-matan ne'e atualmente fornese de'it ba grupu ka comunidade balu iha Suku Triloca no Gariuai, ne'ebé sai husi área urbana no zona

abastesimentu ne'ebé proposta ba. Rejiaun Baucau formadu husi materiál sedimentáriu foun husi kapa Pleistoseinu (Qpb) ne'ebé hanaran Formasaun Baucau. Fatuk-ahu ruin (limestone) Baucau nian kompostu husi fatuk-mutin ahu ruin nian ho kór-sinzentu, to'os, no kaverno zu ne'ebé dezenvolve tebes iha sidade Baucau laran. Topografia área projetu nian tetuk ituan iha planaltu leten nian, no laiha risku rai-halai, tan ne'e fatin no lalaok ba infraestruturá bee nian la konsidera nu'udar problema substansial.

Eskopu Projetu nian. Projetu ne'e hein katak sei prodús rezultadu lubuk ida, hanesan deskreve iha kraik ne'e:

- Reabilita no loke-luan sistema abastesimentu bee urbana kapitál munisípiu Baucau nian atu kobre nesesidade bee moos;
- Estabelese abastesimentu bee ne'ebé funksiona kompletamente iha Munisípiu Baucau no Suku selezionadu sira;
- Influénsia no fasilita hodi atinji saneamentu uma kain nian ne'ebe foun ou diak ba uma-kain hotu ne'ebé fornese iha kapitál munisípiu Baucau no Suku selezionadu sira.

Eskopu Projetu inklui área hotu ne'ebé presiza atu implementa Kaptasaun, Tratamentu no Distribuisaun Bee ba Konsumu Umanu, nune'e mós fornese dezeńu no solusaun ba infraestruturá Saneamentu nian kobre diâmetru 15-km iha área urbana Kapitál Munisípiu Baucau. Sistema distribuisaun bee ezistente no espansaun iha futuru ba uma-kain foun sira iha sidade Baucau sei serve ba Suku sira tuirmai: Bahu, Buibau, Buruma, Caibada (Makasae), Caibada (Uaimoa), Gariuai, Triloca, Tirilolo no Uailili.

Tanba Sá Ita Presiza Projetu Ne'e? Projetu ne'e sei kontribui hodi hasa'e kualidade moris komunidadade lokál iha sektór saúde no ijiene, liuliu ba fetu sira. Saúde fetu nian ne'ebe diak signifikativu iha futuru sei hatun taxa mortalidade, no ekilibriu iha nivel família no individuál. Iha sorin seluk, bele forma ekonomia lokál hodi haforsa komunidadade nia moris ho oportunidade ba empregu wainhira projetu ne'e implementa ona.

Saida deit mak Impaktu Projetu ne'ebé prevee ona? Implementasaun projetu ne'e asosiadu tuir siklu ne'ebé kompostu husi faze 4, hahú husi atividade dezeńu ho objetivu atu kumpri nesesidade projetu nian. Faze sira tuirmai mak atividade konstrusaun infraestruturá, tuir kedas ho operasaun no manutensaun ba facilidade sira, no desmantelamentu. Posibilidade husi impaktu negativu bo'ot sira ne'ebe asosiadu ho atividade sira-ne'e identifika no avalia ona ho didi'ak iha DIAS. Bazeia ba atividade sira ne'ebé identifika ona, impaktu sira ne'ebé sei mosu konsidera signifikativu, no presiza medida mitigasaun iha PJA ba kada impaktu sira-ne'e hodi mitiga impaktu iha terenu.

Konsultasaun ho Parte Interesada sira Hala'o Ona ka Lae? Konsultasaun ba projetu Baucau hala'o ona iha Edifísiu Administrasaun Munisípiu Baucau iha lora 3 Outubru 2020, ne'ebé partisipa husi ajénsia governu lokál no autoridade sira (Xefe de Suku no Aldeia), hamutuk ho representante komunidadade sira iha área projetu. Aleinde ne'e, Konsultasaun Públika 7 seluk mós hala'o ona iha lora 4 Feveireiru 2021 iha Suku Caibada, Suku Bahu no Suku Tirilolo; 5 Feveireiru 2021 halao iha Suku Gariuai no Suku Tiriloca; 6 Feveireiru 2021 iha Suku Buibau; no ikus liu 9 Feveireiru 2021 iha Suku Uailili.

Konsulta Públika hotu-hotu rejista partisipasaun ne'ebé signifikativu, liuliu ho partisipasaun fetu ne'ebé as. Depois de apresentasaun non-tékniku projetu nian, fó oportunidade ba partisipante sira atu diskute kestaun abastesimentu bee no saneamentu ne'ebé relasiona ho projetu. Ho pedidu husi ANLA, hala'o mós konsultasaun públika adisionál rua iha Suku Bahu

no Suku Tirilolo iha loron 1 - 2 Juñu 2022 nu'udar parte husi preparasaun DIAS nian, hodi responde di'ak liután ba espetativa no preokupasaun sira ne'ebé hato'o iha eventu konsultasaun sira anterior kona-ba potenciá konfliktu entre utilizadór bee iha parte mota-ain husi bee-matan sira ne'ebé propoza, no mós potenciá distúrbu ba bee-matan ne'ebé konsidera hanesan fatin lulik no area sensível kulturá sira nian.

Konkluzau. DIAS ne'e konklui katak impaktu negativu sira tanba implementasaun projetu sei predominante mosu liuliu durante faze konstrusaun, maibé sira-ne'e temporáriu, lokalizadu no bele fila fali ba kondisaun normál bainhira projetu remata. Komunidade afetadu sira sei sente no hasoru distúrbio no interferé temporaria husi atividade sira projetu nian; maski nune'e, medidas mitigasaun sira ba impaktu sira-ne'e kolokadu ona iha PJA no bazeia ba ida-ne'e, Kontrator sei rekere atu prepara Planu Jestaun Ambientál no Sosiál ba Konstrusaun (C-ESMP) hodi hetan aprovasaun husi PMU, ne'ebé sei serbí nu'udar matadalan hodi mitiga impaktu sira no hodi hala'o programa monitorizasaun durante konstrusaun. Impaktu pozitivu ka benefisiál sira karik sei mosu durante faze Operasaun no Manutensaun, tanba sektór sosioekonómiku sei dezenvolve signifikativu, hanesan lalaok moris, saúde no ijiene komunidade nian ne'ebé hein katak sei sai diak liuhusi provizaun abastesimentu bee moos (potável) ne'ebé seguru durante oras 24 no loron 7 iha semana laran.

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APPENDICES