

Initial Environmental Examination

November 2021

Solomon Islands: Urban Water Supply and Sanitation Sector Project

Main Report

Prepared by Solomon Island Water Authority, trading as Solomon Water, for the Asian Development Bank and World Bank. This is an updated version of the draft originally posted in September 2019 available on <https://www.adb.org/projects/documents/sol-51271-001-rrp>.

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Solomon Water

**Initial Environmental Examination
Tulagi Water Supply Components
Solomon Islands**

**Prepared by Solomon Water, Solomon Islands for the
Asian Development Bank/World Bank**

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Acronyms

ADB	Asian Development Bank
ANZEEC	Australian and New Zealand Environment Conservation Council
AP	Affected Persons
ASL	Above Sea Level
AXO	Abandoned Explosive Ordnance
BCD	Bid and contact documents
BMP	Building materials permit (issued by Dept of Minerals - Ministry of Mines, Minerals and Rural Energy)
BOQ	Bill of quantities (in the contract)
BPS	Boosting Pumping System
CAC	Community Advisory Committee
CCP	Communications and consultation plan (of the Project)
CESMP	Construction environmental and social management plan (of the contractor)
CITES	Convention on International Trade in Endangered Species
CLO	Community Liaison Officer
CSHSMP	Construction Site Health and Safety Management Plan
CSS	Country safeguard system
DC	Development Consent
DMA	District Metered Area
EARF	Environmental Assessment and Review Framework
ECD	Environment Conservation Division (in MECDM)
EDS	Environmental Impact Assessment Decision Statement
EEZ	Exclusive Economic Zone
EHSG	Environment, Health and Safety Guidelines (of World Bank Group)
EHSO	Environment, Health and Safety Officer
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement (under the CSS)
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
ENSO	El Niño–Southern Oscillation
ERW	Explosive Remnants of War
ESMP	Environmental and social management plan
ESMF	Environmental and Social Management Framework
ESO	Environmental safeguards officer (in the PMU)
FGD	Focus group discussion
GRM	Grievance Redress Mechanism
GBV	Gender Based Violence
GI	Galvanized Iron
GM	General Manager
HDPE	High Density Polyethylene
HSP	Health and Safety Plan (part of the CESMP)
IEE	Initial environmental examination
IP	Indigenous People
IPP	Indigenous Peoples Plan

IPPF	Indigenous Peoples Planning Framework
ISDS	Integrated Safeguards Data Sheet
IUCN	International Union for Conservation of Nature and Natural Resources
JICA	Japan International Coordinating Agency
MDAPC	Ministry of Development Planning and Aid Coordination
MECDM	Ministry of Environment, Climate Change, Disaster Management and Meteorology
MID	Ministry of Infrastructure Development
MI/d	Million liters per day
MMERE	Ministry of Mines, Energy and Rural Electrification
MOFT	Ministry of Finance and Treasury
NDS	National Development Strategy
NIIP	National Infrastructure Investment Plan
NRH	National Referral Hospital
NRW	Non-Revenue Water
PCCSP	Pacific Climate Change Science Program
PER	Public Environment Report (under the CSS)
PMU	Project Management Unit (in SW)
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QPR	Quarterly progress report
RAP	Resettlement Action Plan
RF	Resettlement Framework
RP	Resettlement Plan
ROW	Right of Way
SBD	Solomon Island Dollars (code)
SIPA	Solomon Island's Port Authority
SPM	Safeguards Procedural Manual
SPS	Safeguard Policy Statement 2009 (of ADB)
SW	Solomon Islands Water Authority trading as Solomon Water
TOR	Terms of Reference
USD	United States Dollar
UWSSSP	Urban Water Supply and Sanitation Sector Project
UXO	Unexploded Ordnance
WASH	Water Awareness, Sanitation and Health
WB	World Bank
WBSP	World Bank Safeguard Policies
WHO	World Health Organization
WSP	Water Safety Plan
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

- The Project.** The Asian Development Bank (ADB), World Bank (WB) and Solomon Islands Government (the government) have established the Solomon Islands Urban Water Supply and Sanitation Sector Project (UWSSSP). The Project aims to improve access to safe water and improved sanitation in urban and peri-urban areas by implementing high priority components identified in Solomon Water's 30-Year Strategic Plan and 5-Year Action Plan. The Project overall comprises capacity building, water awareness sanitation and health (WASH) component and physical works (upgrading existing water supply transmission and distribution and installing new water supply in Honiara and other provincial towns). The provincial water supply component covered in this IEE concerns the Tulagi Water Supply subprojects including (i) improvement of water intake, (ii) installation of 6 km transmission pipeline, (iii) 20 m³/h water treatment plant (WTP), (iv) 400 m³ reservoir, (v) replacement and extension of 5.4 km distribution network and (vi) non-revenue water (NRW) improvement.
- Safeguards approach.** This report gives an account of the initial environmental examination (IEE) of the proposed subprojects, conducted as part of the subproject preparation to primarily: (i) identify and assess potential impacts arising from the implementation of the proposed Subproject on the physical, biological, socio-economic and physical cultural environment; and (ii) recommend measures to avoid, mitigate, and compensate for adverse impacts. An environmental assessment and review framework (EARF) was initially prepared to guide the process for screening, assessment, review and monitoring of components.
- The IEE was carried out following (i) ADB's Safeguard Policy Statement (SPS 2009), (ii) WB Safeguards Policies (WBSP) as set out in the EARF and (iii) the requirements of the country safeguard system (CSS) as set out in the Environmental Act (1998), the Environment Regulations (2008) and the Environmental Impact Assessment (EIA) Guidelines (2010). The IEE, as per discussions with Environment and Conservation Division (ECD) is more or less equivalent to a public environment report (PER) as required for development consent application for the subprojects.
- In accordance with the ADB SPS 2009, the project was initially screened by the lenders and consequently assigned Category B, requiring preparation of an Initial Environmental Examination including an Environmental Management Plan (EMP). A screening carried out during the early phase of the Project development confirmed that environmental impacts will be mainly related to the risks of nuisances during the construction phase and controllable by appropriate construction site supervision and conventional mitigation measures. The work undertaken to prepare the present IEE has further confirmed this initial categorization as Category B Project.
- Environmental and social benefits.** The first stage of the project will improve the water supply of the entire island population estimated at 1,751 inhabitants (2018), both in terms of quantity and quality. Filtration of water will be improved through a new filtering system and a new chlorination plant will ensure safe water to 80% of the serviced population. This situation will significantly improve the public health and the well-being of the population on Tulagi Island.
- Anticipated impacts.** The IEE reviews all potential impacts from project location, construction and operation. Mitigation measures are proposed to avoid, minimize or compensate for each of the impacts identified. Most of impacts identified are related to potential temporary nuisances during construction activities, mainly noise, dust and public

safety issues particularly in relation to excavation works along public road for pipeline laying and road traffic disturbances.

7. Land acquisition and resettlement impacts have been avoided by adapting the project design where possible, using existing land owned by SW and existing pipe easements. Only 14 affected persons (APs) that have food gardens located in five clusters along the pipeline. Inventory of losses have been completed by SW and signing of agreement with the APs regarding the market valuation of the assets prior to cash payment will follow. Lastly, SW will negotiate with the leaseholders for the easement.
8. Pre-construction considerations include climate change vulnerability; updating of environmental and social management plan (ESMP) based on latest project design and components; integration of ESMP and development consent (DC) conditions in the bid and contract documents; update of the Project's communications and consultation plan (CCP); grievance redress and management; identification of materials sources, materials extraction and application for building material permit (BMP); biosecurity issues and potential introduction of alien invasive species; identification of sensitive receptors and cultural resources identification; land access arrangements; and unexploded ordnance. Actions necessary to address pre-construction considerations will be included in tender documents and construction contracts.
9. Land and Resettlement Plans (LARP) have been developed for each sub-project and discussed with Affected Persons including compensation payments for permanent and temporary impacts.
10. The construction phase considerations are site access and clearance including potential disruption of utilities (power and communication cables); soil erosion and sedimentation control; disposal of excavation spoils; oil and hazardous materials management; dust control; site waste management; construction noise and vibration; traffic management; community and occupational health and safety; potential social issues due to influx of workers; potential damage to hidden archaeological and cultural assets; impacts on rare and endangered species; and terrestrial habitat alteration. Contractors will be required to prepare Construction Environmental and Social Management Plan (CESMP) based on the ESMP included as part of the environmental and social assessment. This CESMP will reflect their construction approach and methodology to ensure appropriate environmental and social management during the construction period including COVID-19 preparedness and response.
11. Operational considerations of the water supply subprojects will include health and safety risks during operation and maintenance e.g. handling and storage of chlorine. Operational impacts will be addressed by incorporating the necessary measures, such as a water safety plan, use of appropriate operational procedures and ensure effective mitigation and monitoring plan for each subproject.
12. **Analysis of alternatives.** Analysis of alternatives include the "no project alternatives", focusing on alternative locations for the WTP and transmission line installation.
13. **Grievance redress mechanism.** A GRM consistent with the requirements of the ADB SPS (2009) will be established to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. It is based on the GRM developed by SW and already operational. SW has already established a grievance redress mechanism (GRM) and this is being applied to the project. The GRM is designed to deal with grievances from the general public in relation to SW managed projects at all stages of a project cycle.

14. **Environmental and social management plan.** Based on the Project's ESMP, contractors will be required to prepare their CESMP to ensure appropriate environmental and social management during the construction period. In responding to the Project's ESMP, the CESMP is to be site and activity specific reflecting the contractor's construction methodology and approach and include all sub-plans (health and safety plan, traffic management plan, erosion and sediment control plan, waste management plan, hazardous substances management plan) as required.
15. **Consultation, Participation and Disclosure.** SW conducted consultations during Project preparation and will continue to do so during the construction phases following the guidance set out in the Project's CCP. SW will publicly disclose any prepared project safeguard documents. During feasibility study stage, stakeholder consultations were conducted on 30 May 2019 and 25 February 2020 to provide initial information and generate community feedback about the proposed project. During detailed design stage, stakeholder consultations were conducted on 4 to 5 November 2020 to present the project scope, locations, conduct of asset inventory, community concerns and recommendations. Lastly, a public hearing was conducted on 11 February 2021 as part of the process for the approval of the PER.
16. **Conclusion and recommendations.** The findings of the IEE show that no further environmental assessment is required. The IEE has been used to support the national environmental clearance and the development consent application(s). The recommendations are:
 - The updated ESMP, IEE, and the associated PER based on the final detailed design, will be included in the bid documents along with any conditions of the development consent(s).
 - Based on the ESMP, detailed Environmental, Social, Health and Safety (ESHS) specifications will be prepared and attached as General Technical Specifications in the section 6 (Owner's Requirements) of the bidding documentation.
 - It will be a requirement of the contract that each contractor develops and submits to SW a Contractor ESMP which will describe contractor organization and methods for the implementation of all ESHS specifications in full compliance with applicable safeguards. CESMP shall be approved by SW-PMU prior to the start of any physical works on site.
 - Construction contracts will also require the contractors to respond to the Project's CCP and GRM in their CESMP.
 - ESHS training of SW personnel for operation and maintenance of water supply facilities. Improved and strengthened operation stage monitoring of health and safety is required to reduce risks to the public and SW personnel.
 - SW will continue the process of public consultation and information disclosure during detailed pre-construction, construction and operation phases as guided by the Project's CCP.

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

1. The Asian Development Bank (ADB) and World Bank (WB) are supporting the Government of Solomon Islands (the Government) to develop the Solomon Islands Urban Water Supply and Sanitation Sector Project (UWSSSP). This project aims to improve access to safe water and improved sanitation in urban and peri-urban areas by implementing high priority components of the Solomon Water (SW) 30-Year Strategic Plan and 5-Year Action Plan. Project outputs include: secure and safe urban water supplies; effective, efficient and safe urban sanitation services; enhanced awareness of hygiene and water issues and sustained improved hygiene behavior; and the financial and technical sustainability of SW, the state-owned enterprise responsible for the management and development of urban water resources and sewerage services in Solomon Islands.
2. The Ministry of Finance and Treasury (MOFT) is the Project executing agency and SW is the implementing agency, operating through a Project Management Unit (PMU). To ensure compliance with required safeguards the PMU will ensure that the Project will be implemented in accordance with the Project's Environmental Assessment and Review Framework (EARF) and resettlement framework (RF).
3. The EARF has been prepared which establishes the process and procedures that must be followed for the screening, assessment, review and monitoring of each component or subprojects that will be prepared during Project implementation. The EARF will ensure that during implementation, the components, and the Project overall, will comply with the requirements of the country safeguards system (CSS), WB's Safeguard Policies (WBSP) and the ADB's Safeguard Policy Statement 2009 (SPS).
4. In addition to the EARF, this Initial Environmental Examination (IEE) has been prepared for the provincial water supply component covering the subprojects identified for Tulagi. The IEE provides the baseline conditions at the site, an assessment of the environmental and social impacts and risks created by the subprojects during pre-construction, construction, operations, and maintenance. It is based on field visits to the proposed subprojects' areas; review of available information; and discussions with government agencies and communities in subproject areas. The IEE, as per discussions with Environment and Conservation Division (ECD) is more or less equivalent to a public environment report (PER) as required for development consent application for the subprojects.
5. Following the EARF guidelines, the Project has been screened as Category B based on the significance of its environmental and social impacts and risks which are largely site-specific, mainly related to the construction phase and many of which can be readily managed or mitigated through implementation of the measures identified in the environmental and social management plan (ESMP).

1.2 SCOPE AND OBJECTIVES OF THE STUDY

6. The main objective of this assessment is to identify potential environmental and social impacts of the water supply sub-projects and the necessary measures that will ensure the proposed project mitigates any potential adverse impacts on the environment and communities during project construction and implementation.

7. The assessment was undertaken in full compliance with the CSS including Environment Act 1998 and Regulation 2008. In addition, appropriate sectoral legal provisions relevant to such project have also been referred to for the necessary considerations during the pre-construction, construction, and operation of the project.
8. Specific objectives of the study include (but not limited to) the following:
 - Define the project area for each subproject and establish the environmental baseline conditions through review of available information and data and additional surveys/investigations where required;
 - Describe the works and activities that will be undertaken at each of the locations;
 - Based on the above identify environmental and social impacts associated with the proposed project implementation;
 - Describe the consultation activities and feedback;
 - Establish a comprehensive environmental and social management plan (ESMP) which will address the impacts expected during pre-construction, construction, and operation phases of the project.

2.0 ADMINISTRATIVE, LEGAL AND POLICY FRAMEWORK

9. The environmental safeguard requirements of the Project will be implemented to comply with Solomon Islands' laws and regulations (as comprised in the CSS), the ADB-SPS and WB-SP.

2.1 COUNTRY SAFEGUARDS SYSTEM

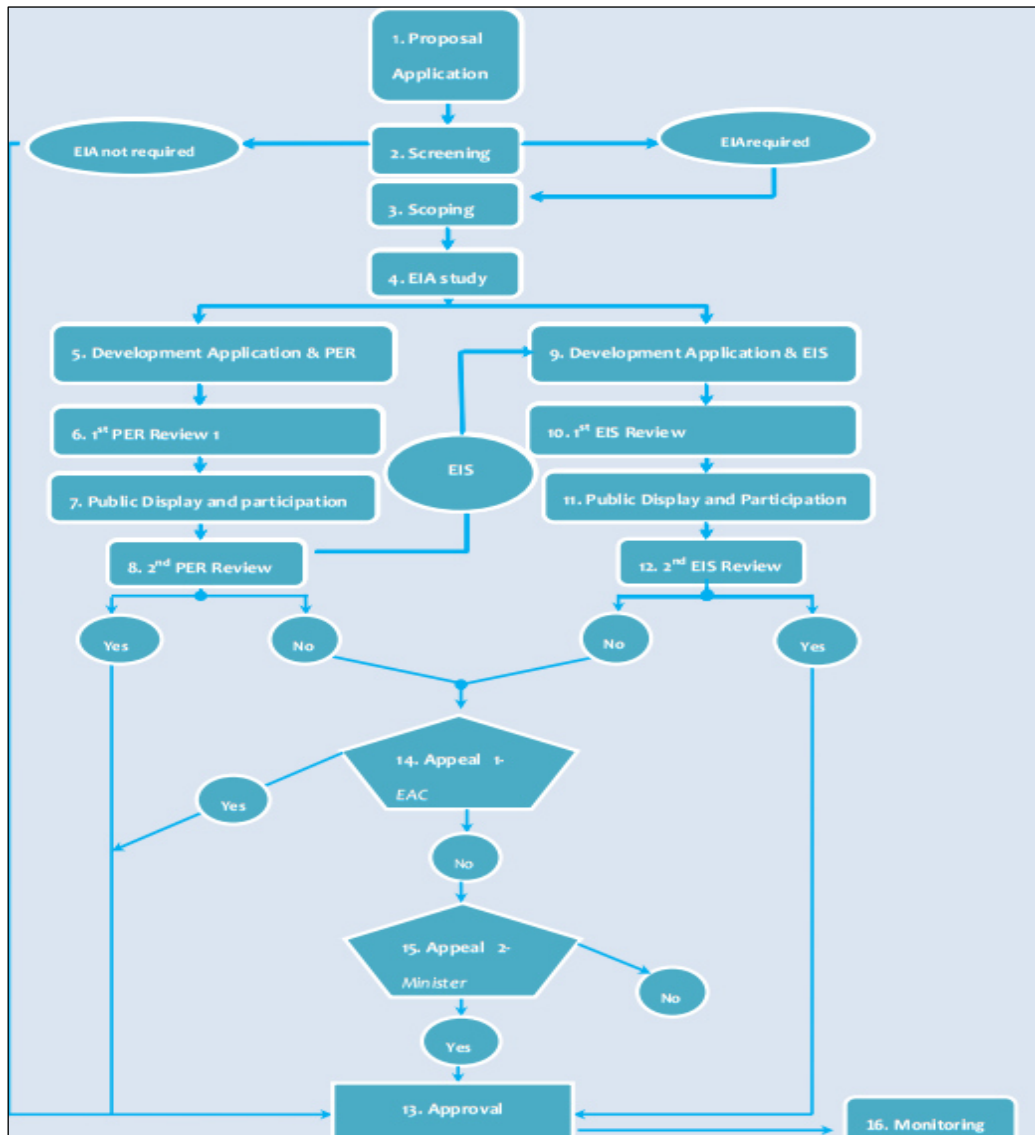
2.1.1 ENVIRONMENT ACT (1998)

10. The Environment Act (1998) provides the legal basis for environmental protection and management. It provides the foundation of the Solomon Islands' environmental impact assessment (EIA) system, under the jurisdiction of the Environment Conservation Division (ECD) of the Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM).
11. The Environment Act requires one of two levels of environmental assessment, depending on the scale and anticipated impacts of a development proposal as listed in the Second Schedule: (i) Public Environment Report (PER) or (ii) environmental impact statement (EIS) for developments which may cause more serious impacts. The Environment Regulations 2008 (see below) further defines the procedures for undertaking the environmental assessment of projects and the process of issuing development consent (DC).
12. Environmental standards for the Solomon Islands are still being developed. However, ECD generally advises project proponents to follow internationally recognized standards such as those of the World Health Organization (WHO). In addition, the Project will comply with World Bank Group's Environmental Health and Safety Guidelines (EHSG) which include standards for a range of parameters including air and water quality.

2.1.2 ENVIRONMENT REGULATION (2008)

13. The Environment Regulation was published in 2008 and enforced to effectively ensure the implementation of the Environment Act. The Environment Regulations 2008 entails detailed requirements for EIA on "prescribed" developments listed in second schedule of the Environment Act. All prescribed developments require a simple assessment through "screening" or "scoping" process, to see what form of additional assessment is required. Most development projects require a PER, while many major projects will also need a second stage of appraisal which include technical, economic, environmental, and social investigations presented in an EIA or EIS report. All types and forms of major development activities are included in the schedule as a 'prescribe development' activity and need to undergo some form of environment impact assessment as detailed in the regulation.
14. **Environment Impact Assessment Guideline, 2010:** The EIA guideline is designed to administer the schedule 16 of the Environment Act 1998. The guideline comprises of EIA procedural descriptions, stakeholders in the EIA process (see **Figure 2-1**) and fees required for development type. "The guideline was prepared by the ECD with the aim of simplifying the procedures in the Act, provide basic advice and guidance to government officers, planners, developers, resource owners on the environment impact assessment process" (MECDM, 2010).

Figure 2-1: Procedural steps of EIA



15. **Environmental Permits required for the Project:** Under the Environment Regulation (2008), any developer must submit an EIA Report to the MECDM for any prescribed development. The Ministry would also require an environmental management plan (EMP) and a corporate policy for each of the companies that involved in the project development.
16. The Director shall not issue any license under this part, if the following had occurred:
 - The PER or EIS did not support the application;
 - The discharge of waste, noise, odor, radiation, or other forms of pollution is inevitable; or
 - The discharge of waste or emission of noise, odor or electromagnetic radiation would be harmful to the environment.

17. **Environmental Impact Assessment Decision Statement (EDS):** The EDS will be issued by the Ministry of Environment upon satisfactory review of the EIA. The process is that upon receiving the PER or the EIS Report, the Director of Environment shall convene a meeting (or a Public Hearing) and the Director shall receive both oral and written submission from any person in relation to the application.
18. The Director, within 15 working days, will issue a development consent if there is no objection made on the application.
19. The Director may also amend the license, if the discharge or emission will be carried out in manner consistent with all relevant environmental policies.
20. **Application to this Sub Project:** During preliminary phases of UWSSSP an initial IEE undertook the different steps (1 to 4). Following detailed design an initial development consent application (PER) was submitted to MEDCM. Following revision of the PER submitted to the MEDCM, a Public Hearing (Step .7) was held in Tulagi. To streamline the public consultation process, the draft RP developed under the project was also disclosed and discussed at these public hearings. It was decided following this meeting that no further environmental assessment is required, and a PER is sufficient for further review. The development consent for the sub-projects has been provided.

2.1.3 WATERS RESOURCE BILL

21. **Rivers and Water Act (1996)** was enacted to administer and control developments that would impact on a river. The Act, however, only applies to rivers that have been designated under the Act. This means that all activities taking place within and around the vicinity of the declared Rivers are governed under the Rivers and Waters Act 1996.
22. **Waters Resource Bill (2006)** has been prepared to go through parliament and if approved, passed, and published, it will supersede the Rivers and Water Act (Revised edition 1996). The purpose of the Act is:
 - To provide for the integrated water resource management of Solomon Islands;
 - To promote the most efficient, fair and beneficial use of natural water;
 - To ensure the natural water resources are available for the sustainable use for the benefit of all present and future Solomon Islanders;
 - To provide for the protection of natural watercourses and water catchments;
 - To provide for the control of activities occurring over or beside waterways or watercourses.
23. The Act requires a Waters Resources Advisory Board, whose function is to advise the Minister on matters pertaining to the Act and consult with the Director of Water Resources on technical matters. The Director with his/her staff shall administer, manage, and implement the Act accordingly to achieve the purpose of the act. The Act covers all water bodies, rivers, streams whether in a registered or non-registered, public, or private or customary land in Solomon Islands.
24. The Water Resources Department is located within the Ministry of Mines, Energy & Rural Electrification (MMERE). The Ministry has the authority to control the use and development of all water catchments and riverbanks. Logging, mining and sands and gravel extraction in water catchments, riverbanks and riverbeds may be restricted by the Ministry according to the requirements of the catchment management and conservation. Section 21 of the Act provides for the Ministry to recommend to the Board to declare a water body such as a catchment, groundwater, or flood control zone as a Water Control

Area. If approved by the Minister and published, mining of sand and gravel will be prohibited. This also includes any contraction, altering, removing or in any way impede or be likely to impede flow or movement of surface water. This clause of the Act is significant as it may have a direct impact to sand and gravel extraction in the future if the current activities are not sustainably managed.

25. The Act clearly states that a development must not obstruct, divert or dam the river, if so it must make application to the Minister who upon receiving the request will direct the Director and/or his officers to assess and if agrees will issue a license accordingly.

2.2 OTHER RELEVANT LAWS

26. **Environmental Health Act 1980.** provides for the management and control of public health in the Solomon Islands. It defines local authority responsibilities in relation to the construction, operation, and management of sewerage systems, including sewage disposal works. It also provides penalties for the willful pollution of a water supply source.
27. **The Town and Country Planning Act 1997** provides for the administration of town and country planning in Solomon Islands; preparation of local planning schemes; and control and development of land. It applies to all urban areas.
28. **Mines and Minerals Act 2008.** regulates the mining and extraction of aggregate or gravels from rivers. It requires that building material permits (BMP) be applied for prior to any extraction of construction or building materials. The application for BMP may require a PER and will require preparation of an extraction plan.
29. **Mines and Minerals Regulations 1996.** complements and gives a clear detail of the Mines and Minerals Act. It further elaborates on the needs for a better step for achieving a sound minerals resource administration and management in the country. The Regulation has provisions that specify mineral rights holders which include BMP holders, to adhere to good mining practice so that their activities result in minimum ecological damage or destruction, prevent avoidable damage to trees and avoid harm to freshwater, marine and animal life.
30. **Labor Act 1978.** This act deals with protections for workers. Part IX Care of Workers requires the employer to: provide workers with rations (Article 65); protect workers and dependents from malaria (Article 66); provide workers with an accessible supply of clean, non-polluted water for drinking, washing and for other domestic purposes (Article 67); make sufficient and proper sanitary arrangements for workers (Article 68); provide accommodation for the worker and family if they are not conveniently located to the workplace (Article 69). Article 70 requires the employer to provide medical care at the workplace including: (i) treatment facilities, medicines, first aid equipment and transportation facilities; (ii) responsibility to move workers as quickly as possible either to the employer's treatment facilities or to the nearest medical facilities; (iii) treatment for workers or hospitalization; and (iv) should a worker die the employer is obliged to pay for funeral costs. Article 71 states that the employer may be required to provide medical facilities and services of a medical practitioner and the employer is to maintain a register of workers treated.
31. **Safety at Work Act 1996.** states that it is the duty of every employer to provide a safe workplace and to ensure the health and safety of employees under his control. This Act is linked to the Labor Act of 1978.

32. **Biosecurity Act 2013.** This Act is to prevent the entry of animal and plant pests and disease to Solomon Islands; to control their establishment and spread in Solomon Islands, to regulate the movement of animal, plant pest and diseases and of animals and plants and their products; to facilitate international cooperation in respect of animal and plant diseases and related matters. The Act is supported by Bio-Security Regulations 2015.
33. **Wildlife Protection and Management Act 1998.** This law provides for the protection, conservations, and management of wildlife in Solomon Islands by regulating the export and import of certain animals and plants. It is also intended to address the compliance of the obligations imposed on Solomon Islands under the Convention on International Trade in Endangered Species (CITES). It provides lists of: (i) “Prohibited or Restricted Exports” in Schedule I, (ii) and “Regulated and Controlled Species” in Schedule II. It was amended in 2017 to strengthen Solomon Islands’ compliance to the requirements of CITES.

2.2.1 INTERNATIONAL AGREEMENTS

34. Solomon Islands is a signatory to a number of international agreements (treaties and conventions) with environmental and conservation implications as well as for the protection, promotion and safeguarding of cultural heritage and traditional knowledge. These are provided as **Appendix 1** of this document.

2.3 ADB SAFEGUARD POLICY

35. Any investment funded or administered by ADB must comply with the requirements of the SPS. The SPS promotes the sustainability of project outcomes by protecting the environment and people from potential adverse impacts. The SPS comprises three safeguards—environment, involuntary resettlement, and indigenous peoples—which aim to avoid adverse impacts on the environment and people and if it is not possible to avoid then to minimize, mitigate, and/or compensate for adverse impacts; and to help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.
36. In accordance with the SPS, screening and categorization of a project (including its subprojects and/or components) is undertaken to reflect the significance of potential project impacts or risks; to identify the level of assessment and institutional resources required for the safeguard measures; and determine disclosure requirements. The water supply component has been deemed category B for environment based on the significance of its potential environmental impacts and risks. An IEE (equivalent level to a PER) is the appropriate level of assessment for a category B project.
37. An EARF has been prepared which establishes the process and procedures that must be followed for the screening, assessment, review and monitoring of each component or subprojects that will be prepared during Project implementation. The EARF will ensure that during implementation, the components will comply with the requirements of the country safeguards system CSS, WB’s Safeguard Policies (WBSP) and the ADB’s Safeguard Policy Statement 2009 (SPS). As prescribed in the EARF, the IEE was prepared for this project component.
38. The SPS requires compliance with the ADB Environment, Health and Safety Guidelines (EHSG). The EHSG requires that workers be provided with a safe and healthy working environment, considering inherent risks, any hazards in the work areas, including physical, chemical, and biological hazards. The EHSG requirements are integrated into the ESMP.

2.4 WORLD BANK SAFEGUARDS POLICIES

39. The WBSP aims to prevent and mitigate potential damage to the environment and communities generated in the development process. The WBSP provide the environmental and social safeguard requirements that must be complied with during the identification, preparation and implementation of WB-financed programs and projects.
40. The WBSP include ten safeguard policies established to inform decision making, ensuring that projects financed by the WB are environmentally and socially sustainable. The water supply subprojects may trigger the following policies: Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Indigenous Peoples (OP/BP 4.10), Physical Cultural Resources (OP/BP 4.11) and Involuntary Resettlement (OP/BP 4.12). **Table 2-1** presents these policies and their applicability to the component.
41. The EHSB are technical reference documents with general and industry-specific examples of good international industry practice. When one or more members of the World Bank Group are involved in a project, these EHSB are applied as required by their respective policies and standards. The General EHSB are designed to be used together with the relevant industry sector EHSB which provide guidance on issues in specific industry sectors. When host country regulations differ from the levels and measures presented in the EHSB, projects are expected to achieve whichever is more stringent.

The General and Industry Sector EHSB are available at the following link - <http://www.ifc.org/ehsguidelines>.

Table 2-1: World Bank Safeguard Policies: Main Objectives, Applicability and Triggered by the Sub-Projects¹

Safeguard Policies	Main Objective	Applicability	Application to Tulagi Water Supply Components
OP 4.01 Environmental Assessment	The objective of this policy is to ensure that projects financed by the World Bank are environmentally sound and sustainable, and that decision making is improved through adequate analysis of actions and their possible risks and environmental impacts in the natural environment (air, water and soils); human health & security; physical-cultural resources; and global and transboundary and global environmental aspects.	This policy is applicable when a project or sub-project has potential to cause negative environmental impacts in its area of influence.	<p>Triggered:</p> <p>Environmental risks associated with the project include temporary noise, waste and air quality impacts associated with construction, potential limited vegetation clearing for the purpose of creating access to new water supply sources or pipelines, constructing the water treatment plants, etc.</p> <p>An Initial Environmental Examination (IEE (equivalent to WB ESIA/ESMP), the EARF (equivalent to WB ESMF) and Resettlement Framework (RF) (equivalent to WB RPF) and Resettlement Plan (RP) establish the process to mitigate these impacts. Consultations with stakeholders and affected communities are used to inform the decision-making process.</p>
OP 4.04 Natural Habitats	This policy recognizes that the preservation of natural habitats is essential to protect original biodiversity, for the preservation of environmental services and products for human society and for long term sustainable development. Therefore, the Bank supports the protection, management and restoration of natural habitats by funding projects as well as via political dialogue, sector work and the economic sector. By funding projects, the Bank expects the	<p>This policy is used by any Project or sub-projects considered as potential originator of significant changes (loss) or degradation of natural habitats, be it directly (through the construction) or indirectly (with the human activities caused by the project).</p> <p>OP4.04 defines a natural habitat as land and water areas where (i) the ecosystems' biological communities are formed largely by native plant and animal species, and (ii) human activity has not</p>	<p>Triggered:</p> <p>The policy OP4.04 was triggered for the project to be consistent with the ISDS. The IEE established that the project is not located in areas where there will significant changes (loss) or degradation of natural habitats, be it directly (through the construction) or indirectly (with the human activities caused by the project).</p> <p>Construction will occur in areas of highly modified ecosystems and impacts during operations on environmental and socioeconomic values will be minor.</p>

¹ This table was taken from the EARF of the UWSSSP. The application to the Tulagi Water Supply is explained in the last column.

Safeguard Policies	Main Objective	Applicability	Application to Tulagi Water Supply Components
	<p>proponents to apply the precautionary principle in the management of natural resources, in order to ensure opportunities for sustainable environmental development.</p>	<p>essentially modified the area's primary ecological functions.</p>	
<p>OP 4.10 Indigenous Peoples</p>	<p>For all projects proposed for Bank funding that affect indigenous peoples, the Bank requires the borrower to undertake free, prior and informed consultation with affected Indigenous Peoples to ascertain their broad community support for projects affecting them. The project financed by the Bank must include measures to: (a) avoid adverse effects on indigenous populations; or (b) when it is not possible to avoid the effects, minimizes, mitigates, or compensates for such purposes. The projects financed by the Bank are designed with the assurance that indigenous people receive social and economic benefits that are culturally appropriate and adequate gender and inter-generations.</p>	<p>This policy is applied when the Project affects direct or indirectly indigenous people.</p>	<p>Triggered:</p> <p>The OP4.10 policy is triggered for the project to be consistent with the World Bank Integrated Safeguards Data Sheet (ISDS, p.16 May 2018). However, the project is located in areas where Indigenous Peoples are the sole or the overwhelming majority of direct project beneficiaries. They are not a discriminated, marginalized group, but part of the majority population, sharing the same culture, identity, and characteristics. IP aspects have been integrated into the Project Design ensuring FPIC principles, and broad community support for the project.</p> <p>The project will focus on rehabilitating failed water supply infrastructure or providing new infrastructure, this will benefit the community.</p> <p>An RF will be prepared which sets out the methodology for land acquisition / access for the project, if needed. Once land access is required, the process will include consultations with local government, local communities and various community groups (i.e. youth and women groups). The IEE/EARF will ensure free and prior informed consultation is undertaken</p>

Safeguard Policies	Main Objective	Applicability	Application to Tulagi Water Supply Components
			and broad community support is achieved for the project.
OP 4.11 Physical Cultural Resources	<p>The objective of this policy is to assist countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances.</p> <p>Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices.</p>	<p>This policy is used by any Project or sub-projects considered as potential to cause changes (loss) or degradation of physical cultural resources.</p> <p>OP 4.11 defines physical cultural resources as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance.</p> <p>Depending on the project and the nature of its impacts, various instruments can be used. An Environmental Assessment capturing impacts on physical cultural resources is required for the project and sub-projects.</p>	<p>Triggered:</p> <p>The project involves construction works in modified urban and peri-urban areas, where it is unlikely that unknown physical cultural resources will be encountered.</p> <p>However, a Chance Find procedure will be included in the CESMP to ensure appropriate measures are taken in the event cultural resources are encountered. The chance find procedure is a project-specific procedure that outlines what will happen if previously unknown heritage resources, particularly archaeological resources, are encountered during project construction or operation. The procedure includes record keeping and expert verification procedures, chain of custody instructions for movable finds, and clear criteria for potential temporary work stoppages that could be required for rapid disposition of issues related to the finds. It is important that this procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority, as well as any agreed consultation procedures.²</p>
OP 4.12 Involuntary Resettlement	The objective of this policy is to: (i) avoid or minimize involuntary resettlement, where feasible and explore all viable alternative project designs, (ii) assist displaced people	This policy does not cover only physical relocation but any loss of income sources resulting in: (i) relocation or loss of shelter, (ii) loss of assets or means of livelihood, (iii) loss of income sources or	<p>Triggered:</p> <p>The project involves the rehabilitation and expansion of failed water supply infrastructure, as well as the development of new water supply</p>

² Guidance Note 8 - International Finance Corporation

Safeguard Policies	Main Objective	Applicability	Application to Tulagi Water Supply Components
	<p>in improving their former living standards, income earning capacity, and production levels, or at let in restoring them, (iii) encourage community participation in planning and implementing resettlement; and (iv) provide assistance to affected people regardless of the legality of land tenure.</p>	<p>means of subsistence, whether or not the affected people must move to another location.</p> <p>This policy also applies to the involuntary restriction of access to legally designated parks and protected areas, resulting in adverse impacts on the livelihood of the displaced persons.</p> <p>In these cases, the World Bank requires the establishment of a Resettlement Action Plan (RAP), based on the RF for any project or sub-project.</p>	<p>infrastructure. Water networks will likely be subject to lease arrangements. Involuntary resettlements, if required, are expected to take place at a very limited scale.</p> <p>A RF has been prepared to assess potential impacts and outline measures to avoid, mitigate or manage these impacts. In the case land access is required, a Resettlement Plan (RP) will be developed. Communities will be consulted to ensure there are no pending issues. A formal grievance redress mechanism will be established to channel and manage potential grievances arising during project implementation.</p>

2.5 OTHER RELEVANT POLICIES

42. The following policies are important consideration in terms of services provided by SW in the country.

2.5.1 NATIONAL DEVELOPMENT STRATEGY (NDS)

43. The National Development Strategy (NDS) is a very comprehensive policy that strategizes ways to achieve the development aspirations of the country. The NDS focuses on two key areas: social and economic livelihoods. These two key areas are enshrined into the NDS National Vision “Improving the Social and Economic Livelihoods of all Solomon Islanders”.
44. Therefore, to achieve all those NDS Objectives, SW as one of the country’s SOE ensures that it provides access to clean water to its clients. Being an SOE, SW strives to improve the quality and accessibility of water it provides to households, government houses, business houses and industries in the urban areas. Such is important to improving the social and economic livelihoods of people and more so to support growth and economic development of the country.

2.5.2 CLIMATE CHANGE POLICY

45. The Solomon Islands Government through the MECDM launched the Climate Change Policy, highlighting steps the government would take in aiding the country and its people to exist and adapt to present imminent climate change and its impact. The Policy aims to integrate climate considerations within the framework of national policies and guiding the government and its partners so as to ensure the people, natural environment and economy of the country are resilient and able to adapt to the predicted impacts of climate change.
46. **National Climate Change Policy 2012-2017** is the guiding framework to: (a) integrate climate considerations and support the implementation and achievement of the National Development Strategy and other regional and international policies and frameworks; and (b) to guide the government and its partners’ efforts in ensuring that; (i) the people, natural environment, and economy of the country are able to adapt to the predicted impacts of climate change; and (ii) the country benefits from clean and renewable energy, energy efficiency, and mitigation technologies that improve people’s livelihoods and the national economy.

2.5.3 NATIONAL ENERGY POLICY

47. The National Energy Policy recognizes the importance of reducing dependency on imported fossil fuel. Solomon Islands have abundant of resources renewable energy source such solar, hydropower, geothermal, biomass and wind energy.

2.5.4 UNEXPLODED ORDNANCE

48. WWII ordnance found in the Pacific Islands can be defined as either unexploded ordnance (UXO) or abandoned explosive ordnance (AXO). UXO is defined as explosive ordnance that has been primed, fused, armed, or otherwise prepared for use in armed conflict but has failed to explode. AXO is defined as explosive ordnance unused during an armed conflict and subsequently abandoned or left behind. UXO and AXO are defined collectively as Explosive Remnants of War (ERW). Solomon Islands was the scene of bitter fighting during World War II. While this was over 60 years ago, UXO may still be found around Solomon Island. Should UXO be discovered at the project site, the contractor is to immediately cordon off the area, arrange the evacuation of nearby residences and inform relevant division within the Royal Solomon Island Police Force (RSIPF) to remove the UXO. Currently all UXO/AXO finds are reported to the RSIPF who arrange the pickup, transport, storage, and ultimate disposal of the finds.
49. Based on a risk assessment, construction sites will be swept for and cleared of UXOs/AXOs prior to construction by SW; it is nevertheless important that a chance find procedure for handling the UXOs/AXOs during the construction is included in the contractor's Construction Environment and Social Management Plan (CESMP). This will be the responsibility of the contractor. Ultimately, SW will be responsible for the supervision and monitoring of the contractor.

3.0 PROJECT DESCRIPTION

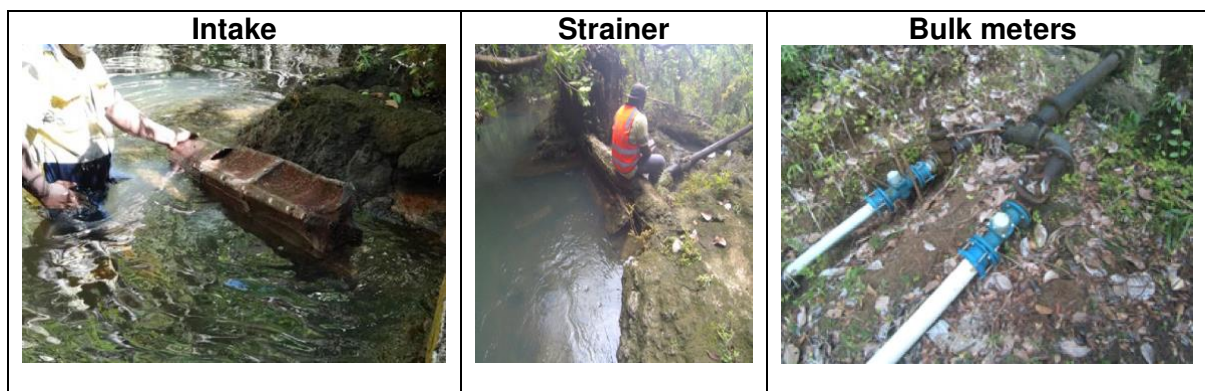
3.1 PROJECT COMPONENT'S LOCATION

50. The Project is located in Tulagi in the Province of Central Island, in the Solomon Islands. Tulagi is the current capital of Central Island Province located on the southwest part on the islands of Gela.
51. Water will be abstracted at the existing intake site, where only minor improvements will be done for access and safety. It will gravity feed to a WTP on Tulagi Island using the existing pipeline, before being boosted to a new high-level reservoir. From the high elevation reservoir, water will be distributed to two connected distribution zones. Existing reticulation will be strengthened and extended. A small booster pumping system (BPS) will be used to supply a ridge higher than the reservoir. The main components of the project are:
 - New WTP (400 m³/d) with a BPS
 - New storage tank
 - Improvement and extension of the distribution network, including a BPS at the reservoir site
52. For the replacement of the transmission line on Tulagi Island, a new pipeline will be installed from the undersea crossing to the WTP. In addition, the BPS is also relocated at the reservoir site.

3.1.1 INTAKE

53. The current water supply of Tulagi is a surface water intake at Maleali River on the larger island of Nggela Sule-immediately to the north. The water supply is taken from a small dam on a waterfall (624936.9 mE, 8998338.1 mS) on the steep slopes of Mount Pata (elevation 399 m) at an elevation of 40 m asl. The average water abstraction of SW was at 3.5 L/s in 2018 and 5.0 L/s in 2019.
54. The existing intake structure is composed by a steel strainer to initially screen large waste. The strainer is in poor condition (damaged with visible holes). Water runs through a single GI 200mm pipe which then splits into two GI 100mm pipes; a bulk meter is installed on each pipe, both of which are reported inoperative. Clogging is frequent mainly due to the inefficient upstream strainer. **Plate 3-1** shows the Maleali intake, strainer and bulk meters.

Plate 3-1: Maleali intake, strainer and bulk meters





Source: SW PRF FSR Tulagi, 07 May 2020

55. The following works will be done:

- Replacement of the strainer;
- Replacement and relocation of the gate valves and bulk meters;
- Installation of a signboard;
- Remodeling of the intake to include an overflow weir with a V-Notch to enable accurate measurement of flow not used for production purposes.

3.1.2 TRANSMISSION LINE

56. From the intake structure with a 200 mm diameter rolled steel pipe which is bifurcated into two galvanized 100 mm diameter pipes after a few meters. The two GI 100mm diameter pipes run above ground between swamp and mangroves on the coastal edge for about 4000m. The water is piped under the sea from the estuary at Maleali through a 700m PVC 200mm diameter pipe. A bulk-meter is located at the junction with Tulagi island. From the bulk meter at the junction with Tulagi island, the transmission line is once more split into two 100mm diameter pipes that supply the south-east portions of Tulagi (although there are additionally connections on the transmission main). Currently, only one of the twin GI 100mm pipeline is used.

57. Only the last 2 km of the transmission line will be replaced due to ageing facility and need for strengthening. The upstream and underwater sections will not be replaced. The summary of transmission line per section is provided in **Table 3-1**.

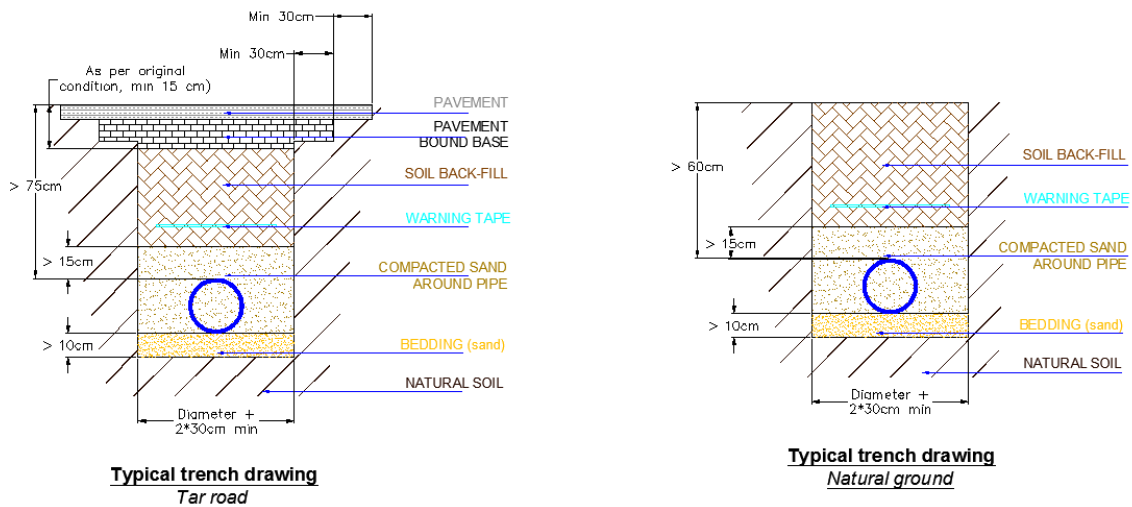
Table 3-1: Summary of Transmission Line Per Section

	Unit	Section 1	Section 2	Section3
Location	-	Nggela Sule Island	Undersea	Tulagi Island
Length	m	3,300	700	2,000
Material	-	Steel	PVC	Steel
Diameter	mm	2 x 100	200	100

Source: Detailed Design Report Tulagi Water Supply System version 2

58. **Pipe Installation.** Pipelines will generally be installed using trenching methods along roads. Wherever possible, roadsides will be favoured so as to limit formed road surface damage and reinstatement as well as potential settlement.
59. Pipes will be laid according to Solomon Water standards (cf. SIWA Construction Code). **Figure 3-1** provides general requirements for pipe trenching and installation which will depend on the type and quality the road. There is presently no tarred road in Tulagi.
60. Due to the small size of the pipeline, soil condition (rock), limited traffic in Tulagi and in order to reduce the pipe laying cost, it is suggested to adapt the standard by reducing the minimal pipe cover to 600 or 750mm, when installed respectively in natural ground or under vehicular road.

Figure 3-1: General layout for pipe trench and installation



3.1.3 WATER TREATMENT PLANT

61. The water treatment plant (WTP) will be supplied by a constant flow of 20 m³/h. Water will be boosted through the filters to supply the treated water storage. Sodium hypochlorite is injected in the pipe of filtered water. The WTP can be disconnected in case that the turbidity of raw water exceeds to 40NTU.
62. Backwashing of the filter will be triggered by:
 - Maximum pressure upstream the filter (maximum head loss of 8 m due to filter clogging);
 - Increase of turbidity in the treated water (maximum of 1 NTU);
 - Timmer (up to 48 h of filtration);
63. After backwashing, the filtration will be put back into operation. The treated water will initially be used to refill the backwash storage. Dirty water from the backwash will be stored into a sludge pond. Suspended solids settle in the pool and the clear water is discharged to the drainage by gravity.
64. The running of the plant is controlled by the level in the reservoir. It will start when water level in the reservoir is low and will stop when water level in the reservoir is high.

65. The phase 1 of the WTP will be composed of the following components:
- 2 pumps (20 m³/h, 3.8 Bars) with VFD; one stand-by unit for the phase 1 and spare space for a third pump (phase 2);
 - A bi-layer vertical pressure filter (anthracite and sand) with a capacity of 20 m³/h. Spare space for a second filter will be kept inside the treatment building;
 - Backwash storage with a 15 m³ HDPE tank located outside the main building;
 - 2 backwash pumps with VFD (45 m³/h, 10m), including one stand-by unit;
 - 2 Air boosters (110 m³/h, 600mBar);
 - 2 sets of air compressor (10 m³/h, 7 Bars), including one stand-by unit, with a 90L vessel and air dryer;
 - Chlorination room with a new chlorination dosage (the system will be the same as the existing situation with the use of liquid sodium hypochlorite);
 - Sludge pond (90 m²);
 - Electrical room;
 - Fans;
 - An electrical transformer;
 - An electrical diesel generator.
66. At a later stage, the plant can be upgraded in phase 2 by doubling the capacity and improving the treatment process if required, with the addition of:
- Second pressure filter;
 - Gas chlorine system;
 - Clarifier and chemical room for coagulation & flocculation;
 - Dirty water tank and thickener to prepare the sludge for drying beds,
 - transformation of the sludge pond into drying beds, if desired.
67. **Figure 3-2** illustrates the layout of the WTP. The site area will be approximately 1,000 m², including 100 m² for the buildings. **Plate 3-2** shows the site for WTP.
68. **Booster Pumps.** The booster pumping system will be located in the main treatment building. There will be 2 pumps: 1 duty and 1 standby. Spare space for a third pump will be kept inside the treatment building to reach a future capacity up to 40 m³/h (2 operating+ 1 stand-by).
69. **Filter and Backwash.** Filtration is carried out in closed filters (metal cans), operating at a pressure of between 5 and 6 bar. The proposed design includes a single filter (20 m³/h). Backwashing will be carried out using both air and water for an optimal functioning, using

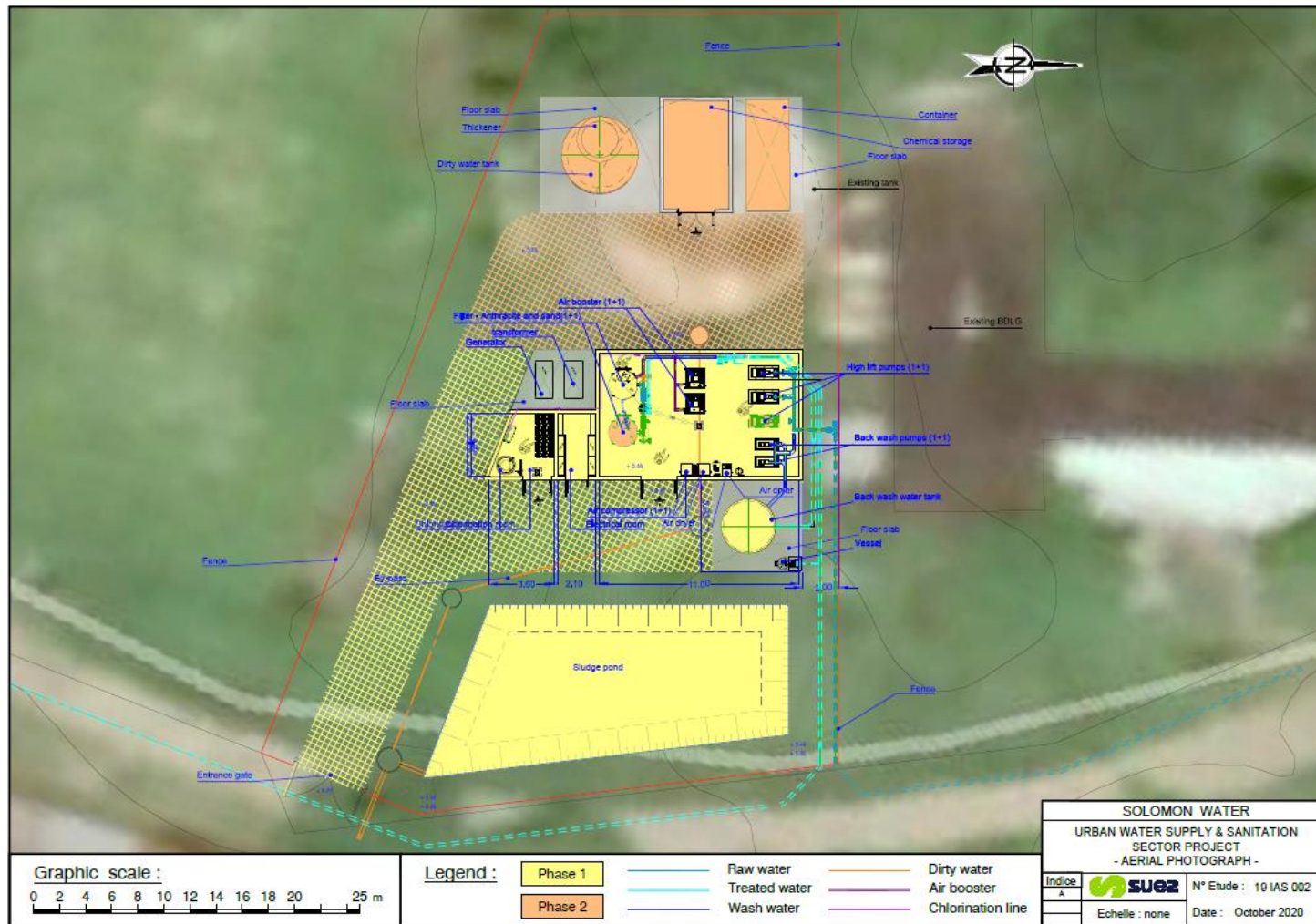
backwash pumps and an air booster. Backwash water will then be discharged to the sludge pond.

70. **Chlorination.** Chlorine solution produced from sodium hypochlorite solution will be injected in the discharge pipe at the WTP site. A dedicated room for chlorination will be installed in the existing situation, storing around 180 units per year (20 L, 13 % chlorine).
71. **Sludge Treatment.** Dirty water from the filter washes will be discharged in a sludge pond. Suspended solids settle in the pond and the clear water is discharged to the drainage system. For a production of 0.4MLD with an average raw water turbidity of 5NTU, it is estimated that 240 backwashing cycles per year will be performed, corresponding to 2,920 m³/y of dirty water and 755 kgSS/y.
72. From a concentration of suspended solid in the dirty water estimated at 0.26 g/L, the objective of the pond is to reach 20 g/L in the settled sludge and 20 mgSS/L in the clear water overflowing to the drainage.
73. Thickened sludge will be pumped from the pond with approximately 35 m³ of sludge on a yearly basis (or 70 m³ per 2 years). Sludge extracted from the pond can then be disposed in a landfill or used for agricultural purpose.
74. Hence, the sludge pond is designed to store the sludge for one year, corresponding to an area of 90 m² and a useful depth of 1.5 m. Discharge pipe for overflow will be installed on the opposite site of the inflow and will be connected to the drainage system.

Plate 3-2: Site for WTP



Figure 3-2: Layout of WTP

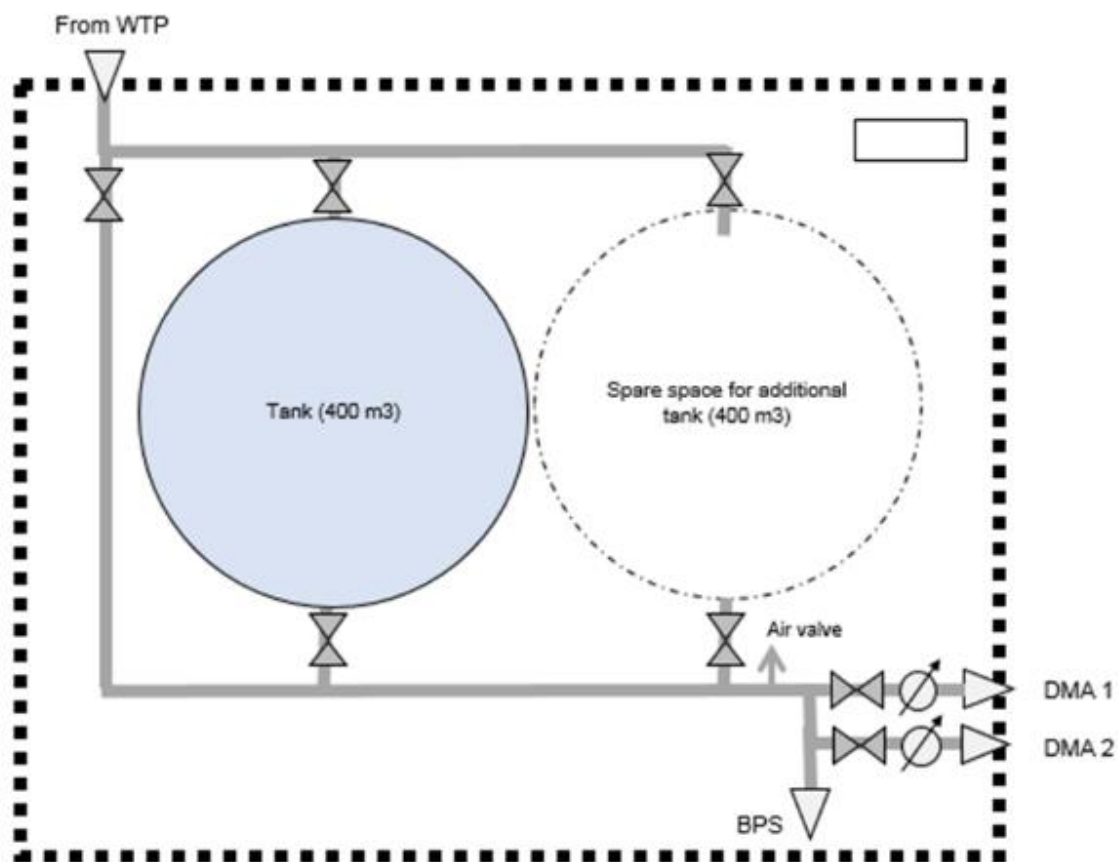


Source: Detailed Design Report Tulagi Water Supply System version 2
 Note: Integration of climate change and sea rise forecast was included in the design.

3.1.4 RESERVOIR

75. A reservoir will be built at different location at an elevation of 49 m above sea level (ASL). It will be a cylindric prefabricated steel tank of 400 m³ useful capacity (app.11m diameter for 5m height).
- It will be filled from the top and emptied from the bottom. It will have overflow and drainage pipes;
 - There will be a by-pass;
 - There will be an air valve at the outlet;
 - There will be space for a second reservoir for future extension;
 - Access road will be necessary (estimated 50 m from the existing road, 6 m wide);
 - The area will be fenced;
 - The BPS will be located within the site area;
 - Total surface of the site with the access road will be around 930 m².
76. Figure 3-3 illustrates the sketch of the reservoir. Plate 3-3 shows the site for reservoir.

Figure 3-3: Sketch of the Reservoir



Source: Detailed Design Report Tulagi Water Supply System version 2

Plate 3-3: Site for Reservoir



77. **Booster Pumping System (BPS).** The BPS will be located at the reservoir site instead of in the building currently used for chlorination. It will supply the high-level ridge via a newly installed distribution line (HDPE OD63mm) connected to existing reticulation at the outlet of the existing storage.

3.1.5 DISTRIBUTION NETWORK

78. SW currently supplies about 70% of the population of Tulagi (estimated to be about 1,200 people) with over 200 connections (22 of which are classified as commercial/ institutional). There are nearly 13.4 km of reticulation system on Tulagi Island, in addition to 8.6 km of transmission main from the source. The distribution system consists essentially of galvanized iron pipe (88%) constructed during the colonial era and therefore at least over 80 years old. The network has been extended/replaced partially by plastic pipes using predominantly PVC (11%). An overview of the water reticulation of Tulagi is provided in **Figure 3-4.**

Figure 3-4: Existing distribution network



Source: Detailed Design Report Tulagi Water Supply System version 2

79. The strategy is to both strengthen and extend the reticulation system. All works will be executed in compliance with Solomon Water - Final SIWA Water Supply Design & Construction Code. All water pipes will be HDPE PN12.5 PE100, as per SW standards.
80. **Figure 3-5** illustrates the proposed distribution network. It is proposed to divide Tulagi into 2 district metered area (DMAs) with each DMA supplied from a distribution line with a bulk meter installed on each line. Those will be linked to the existing network thereby creating a ring around the populated part of the island.

Figure 3-5: Proposed Distribution Network



Source: Detailed Design Report Tulagi Water Supply System version 2

81. Regarding the reticulation system in low elevation areas, **Table 3-2** presents the proposed replacement and extension, including 2 main distribution lines connecting the new reservoir with the existing network and connection to high ridge area. The new reticulation will be connected to the existing one. **Figure 3-6** shows the schematic for Tulagi short-term upgrading. Fire hydrants will be installed along the new structuring pipes (>OD 90mm) of the network, in the vicinity of commercial and administrative buildings.

Table 3-2: Proposed Replacement and Extension of the Existing Reticulation System

	HDPE OD 63mm	HDPE OD 110mm	HDPE OD 140mm	HDPE OD 160mm
Total length	1,350 m	3,150 m	500 m	400

Source: Detailed Design Report Tulagi Water Supply System version 2

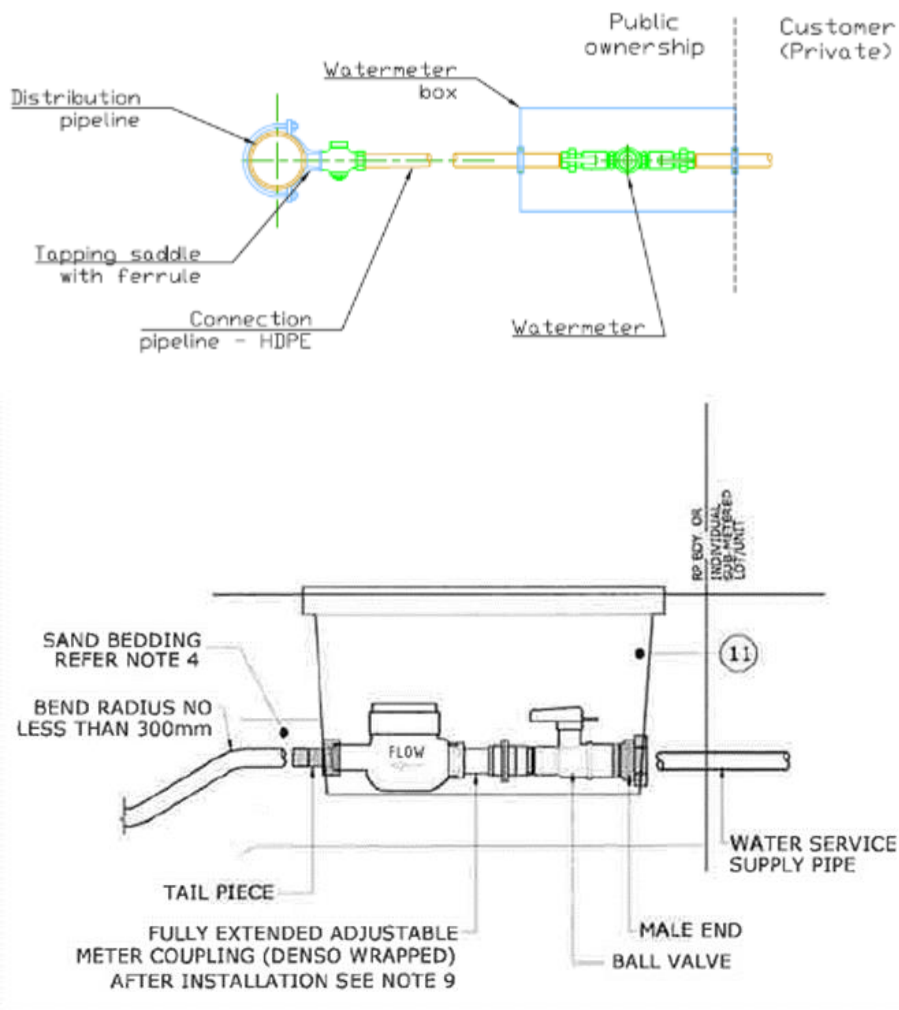
Figure 3-6: Schematic for Tulagi Short-Term Upgrading



Source: Detailed Design Report Tulagi Water Supply System version 2

82. New connections will be made where existing pipeline are replaced and where extensions are made. These customers will be connected with 20mm services connections (HDPE 25). Larger connections such as 25mm (HDPE 32), 30mm (HDPE 40) or 40mm (HDPE 50) will be used for larger establishments such as hospitals, hotels, large restaurants, schools, governments offices. It is expected to install between 50 and 150 connections as part of this project.
83. **Figure 3-7** presents the typical functioning and necessary equipment of a service connection together with the boundary between public and private ownership. Private ownership starts at the outlet of the water meter. Connection to the distribution system will be made with pipe saddles fit for the main pipe's material and external diameter, and using pipe tapping machines for under pressure drilling. The saddle will be installed on the side rather than on the top of the pipe. A lockable valve could be installed prior to the water meter, possibly inside or immediately upstream the water meter box. Installing of check valve with upstream and downstream drains downstream the water meter for commercial customers in compliance with SW standards is also considered.

Figure 3-7: Layout of Service Connection



Source: Detailed Design Report Tulagi Water Supply System version 2

3.2 SCHEDULE

84. Construction of the facilities is envisaged to take 18 to 26 months (work inputs include 350 employees for all contracts including provinces, of which 60 are foreign).

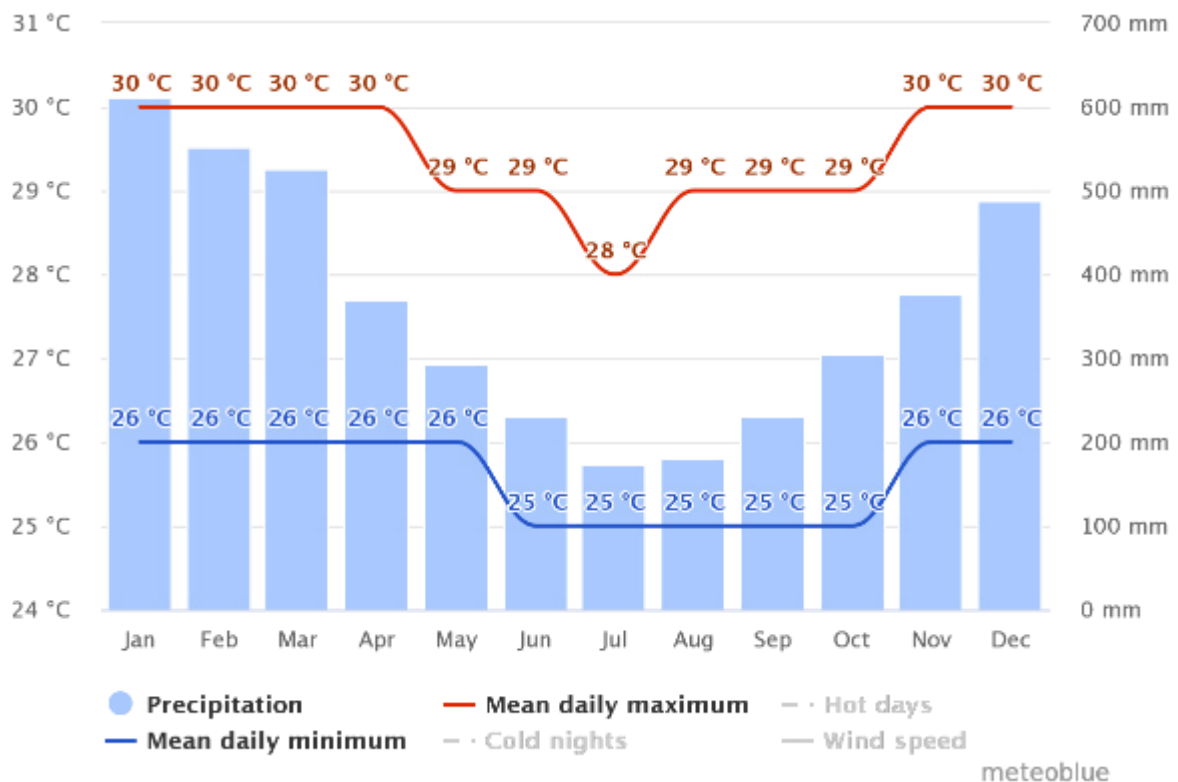
4.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

4.1.1 CLIMATE

85. As shown in the meteoblue climate diagram in **Figure 4-1** which are based on 30 years of hourly weather model simulations, the maximum and minimum temperature of an average day in Tulagi ranges from 28 °C to 30 °C and 25 °C to 26 °C, respectively. The hottest months are from November to April while the coldest months are from June to October. Lastly, the month of January has the most precipitation around 613 mm while the month of July has the least precipitation around 174 mm.

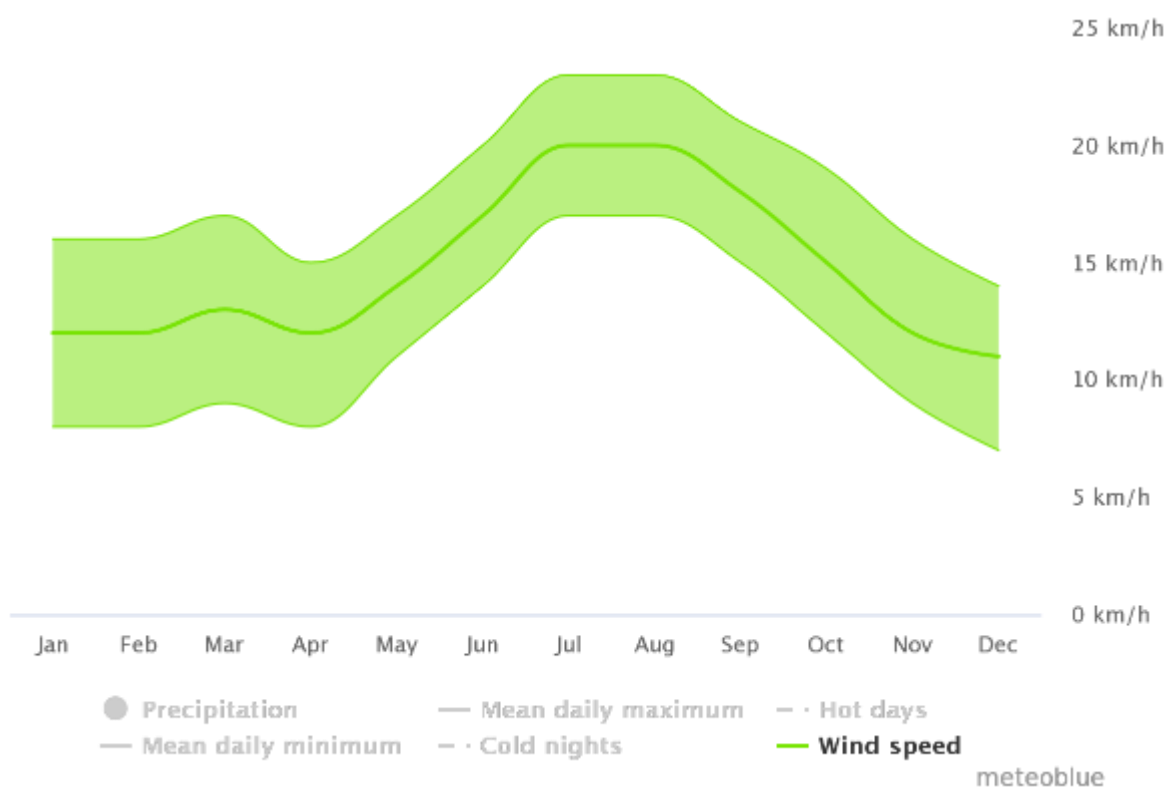
Figure 4-1: Climate in Tulagi (Modelled)



Source: Meteoblue

86. As shown in the meteoblue climate diagram in **Figure 4-2** which are based on 30 years of hourly weather model simulations, the months of July and August have the strongest wind speed of 20 km/h (minimum is 17 km/h, maximum is 23 km/h) while the month of December has the least wind speed of 11 km/h (minimum is 7 km/h, maximum is 14 km/h).

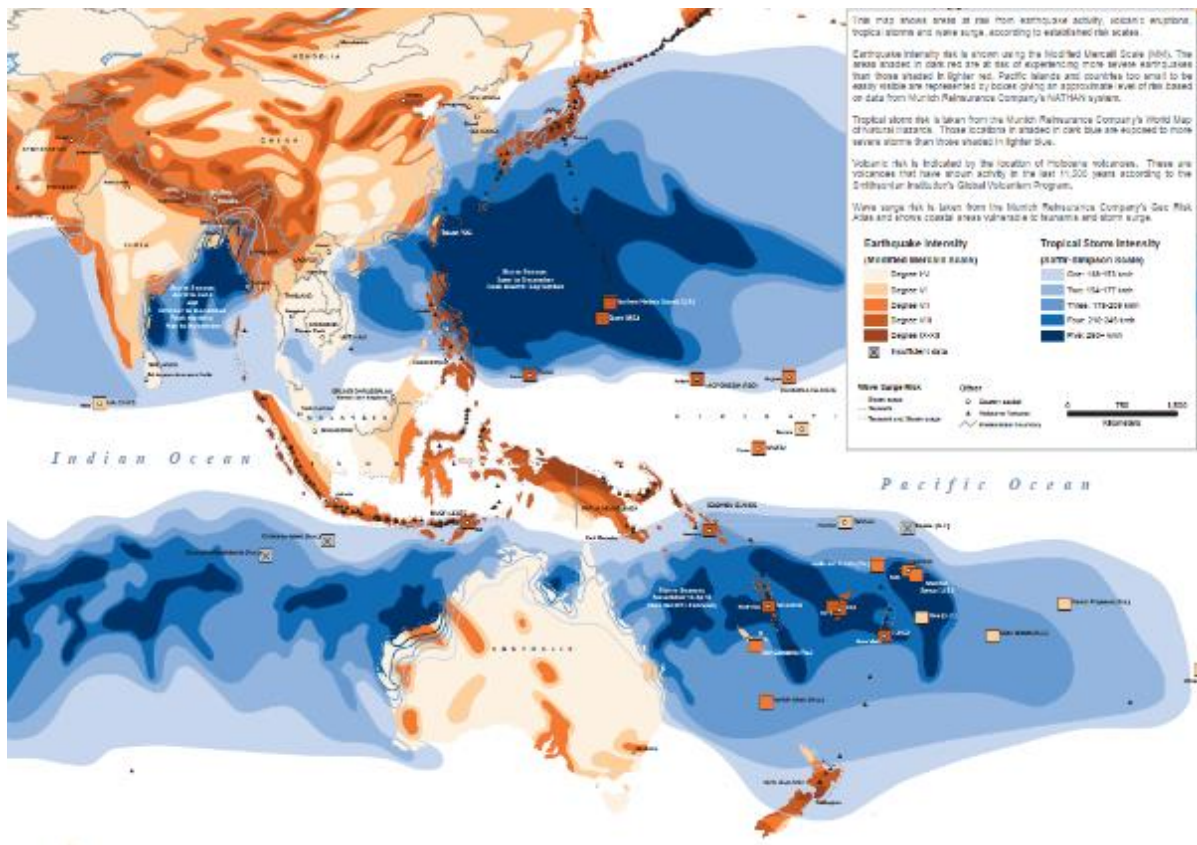
Figure 4-2: Wind Speed in Tulagi (Modelled)



Source: Meteoblue

87. The Pacific-Australia Climate Change Science Program (PCCSP) deemed the available data of cyclones as not suitable for assessing long-term trends. It however, noted that tropical cyclones were most frequent in El Niño years (39 cyclones per decade) and least frequent in La Niña and neutral years (21 cyclones per decade). It provided the following additional information: (i) tropical cyclones affect Solomon Islands mainly between November and April; (ii) an average of 29 cyclones per decade developed within or crossed the Solomon Islands Exclusive Economic Zone (EEZ) between the 1969/70 to 2010/11 seasons; and (iii) twenty-two of the 82 tropical cyclones (27%) between the 1981/82 and 2010/11 seasons were severe events (Category 3 or stronger) in the Solomon Islands EEZ. Fifteen of the 22 intense events occurred in seasons when an El Niño was present.
88. As shown in **Figure 4-3**, Tulagi is located in an area with tropical storm intensity zone 3: 178-209 km/h based on Saffir-Simpson Scale.

Figure 4-3: Major Natural Hazards in Asia and Pacific

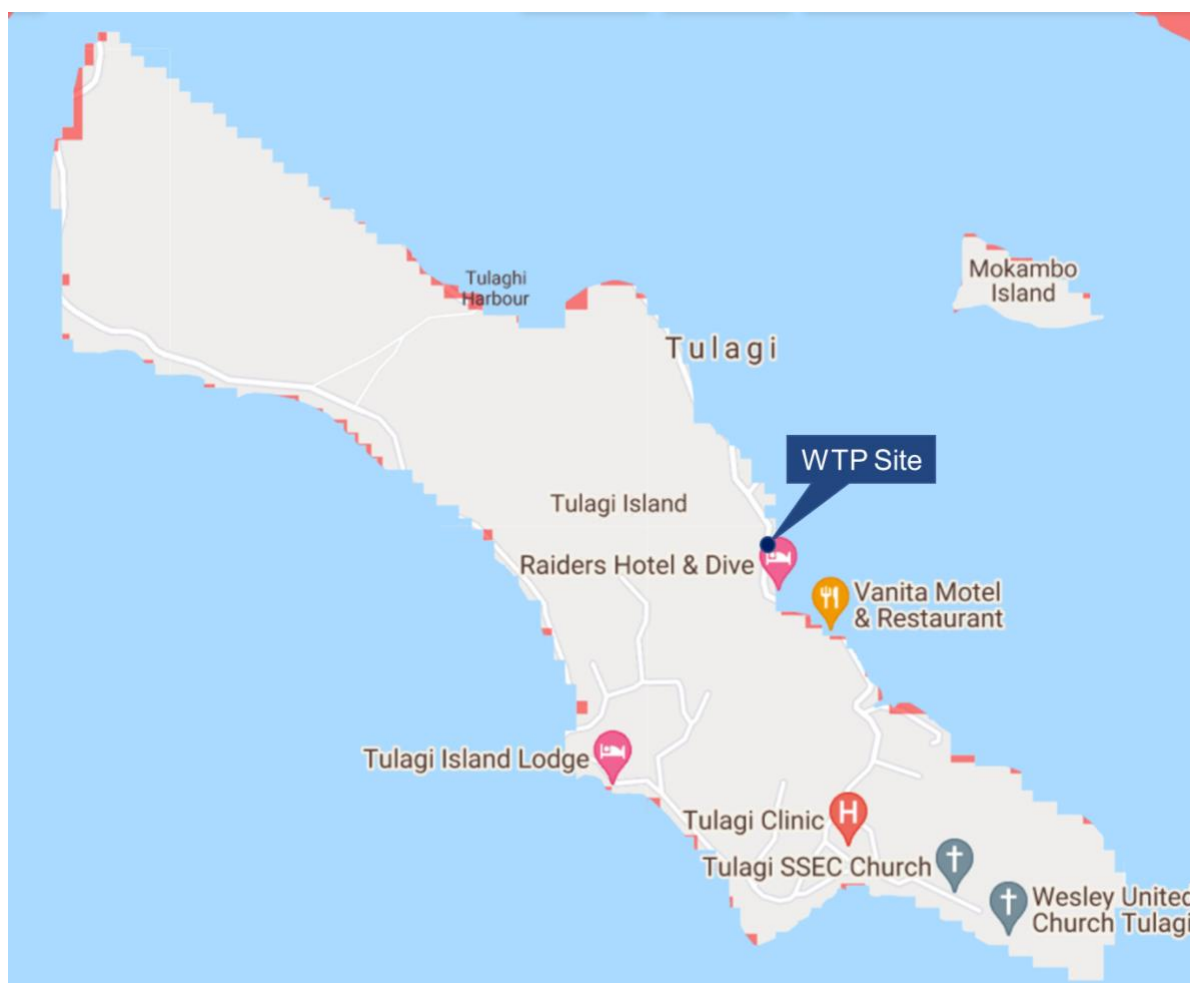


Source: Office for the Coordination of Humanitarian Affairs (OCHA). 2016.

89. For the past 20 years, the sea in Solomon Island has risen around 7-10 mm per year (three times of the global average of 3-5 mm per year) since 1993. From the study conducted in Solomon Islands, the wave energy plays an important role in the coastal erosion. Islands exposed to higher wave energy in addition to sea level rise experienced greatly accelerated loss³. As shown in **Figure 4-4**, the WTP site is not located in the land projected to be below annual flood level in 2050. Further studies, evaluating impact in relation to tides, cyclones, etc. will be conducted to provide more details.

³ The Conversation

Figure 4-4: Land Projected to be Below Annual Flood Level in 2050



Source: Climate Central

Note: Land below water level in red color.

90. PCCSP projected the changes in the annual and seasonal mean climate for Solomon Islands under four emissions scenarios and are given for 20-year periods centered on 2030, 2050, and 2070, relative to a 20-year period centered on 1995 (see **Table 4-1**).

Table 4-1: Projected Changes in Annual and Seasonal Mean Climate in Solomon Islands

Variable	Season	2030	2050	2070	Confidence (magnitude of change)
Surface air temperature (°C)	Annual	0.6 (0.4–0.9) ^a	0.8 (0.6–1.2)	0.8 (0.4–1.2)	Medium
		0.7 (0.4–1)	1 (0.7–1.4)	1.2 (0.9–1.8)	
		0.6 (0.5–0.9)	0.9 (0.7–1.4)	1.3 (1–2)	
		0.7 (0.5–1)	1.3 (1–1.9)	2.1 (1.5–3)	
Maximum temperature (°C)	1-in-20year event	0.6 (0.2–0.8)	0.7 (0.4–1)	0.7 (0.3–1)	Medium
		0.6 (0.3–0.8)	0.9 (0.4–1.3)	1.2 (0.7–1.8)	
		NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	
		0.8 (0.4–1.2)	1.4 (0.9–2.1)	2.2 (1.5–3.2)	
Minimum temperature (°C)	1-in-20year event	0.6 (0.2–0.9)	0.7 (0.4–1)	0.7 (0.3–1)	Medium
		0.6 (0.3–0.9)	0.9 (0.5–1.3)	1.1 (0.6–1.5)	
		NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	
		0.7 (0.5–1.2)	1.5 (1–2.1)	2.2 (1.5–3.3)	
	Annual	3 (-1–8)	3 (-1–7)	3 (-3–8)	

Total rainfall (%)		3 (-2-9)	3 (-4-9)	4 (-2-12)	Low
		4 (-1-9)	3 (-3-8)	5 (-3-14)	
		3 (-1-7)	3 (-3-9)	5 (-3-14)	
Total rainfall (%)	Nov-Apr	3 (-2-9)	3 (-1-9)	3 (-3-9)	Low
		2 (-2-9)	2 (-4-7)	4 (-2-13)	
		3 (-2-9)	2 (-4-9)	4 (-3-11)	
		3 (-2-9)	3 (-5-10)	5 (-4-13)	
Total rainfall (%)	May-Oct	3 (-4-8)	3 (-4-12)	3 (-5-11)	Low
		3 (-4-11)	4 (-3-11)	4 (-3-11)	
		4 (-3-13)	5 (-4-13)	5 (-8-16)	
		3 (-2-8)	3 (-6-9)	5 (-7-15)	
Mean sea level (cm)	Annual	13 (8-18)	22 (14-31)	32 (19-45)	Medium
		12 (7-17)	22 (14-31)	35 (21-48)	
		12 (7-17)	22 (14-30)	34 (21-47)	
		13 (8-18)	25 (16-35)	42 (28-58)	

Note: a - 1st line values very low emissions; 2nd line values low emissions; 3rd line values medium emissions; 4th line values very high emissions; NA = data are not available; the range of values in parenthesis.

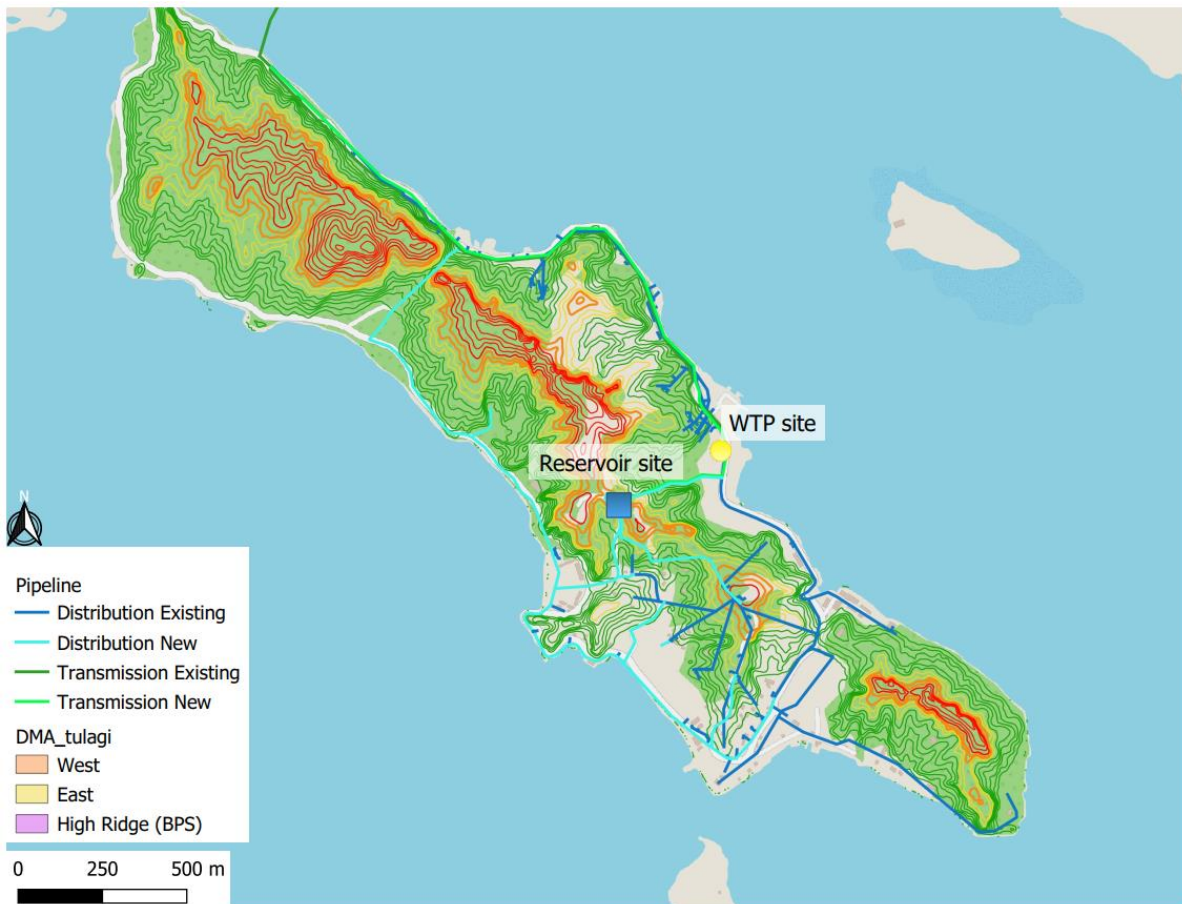
Source: SI: UWSSSP EARF, 26 March 2019

91. In the Solomon Islands, the southeast trade winds are usually established in April and continues until the end of October. During this season, more than 75% of the winds are easterly, and 60% are from east to southeast. The trade wind is steadier and stronger over the southern part of the group of islands. From November to April, the winds blow predominantly between the northeast and northwest, though great variability marks this season, and appreciable percentages of east and south winds occur (US National Geospatial-Intelligence Agency. 2017).
92. The PCCSP also concluded that the available data of wind-waves are not suitable for assessing long-term trends, however, it has noted that wind-waves around the Solomon Islands vary across the country. Seasonally, waves are influenced by the trade winds and the West Pacific Monsoon (WPM), and display variability on interannual time scales with the El Niño–Southern Oscillation (ENSO).

4.1.2 TOPOGRAPHY

93. As shown in the Tulagi water supply topographic map in **Figure 4-5**, the site for the reservoir is located in the elevated area while the site for WTP is near the coastal area and was at risk of sea-level rise.

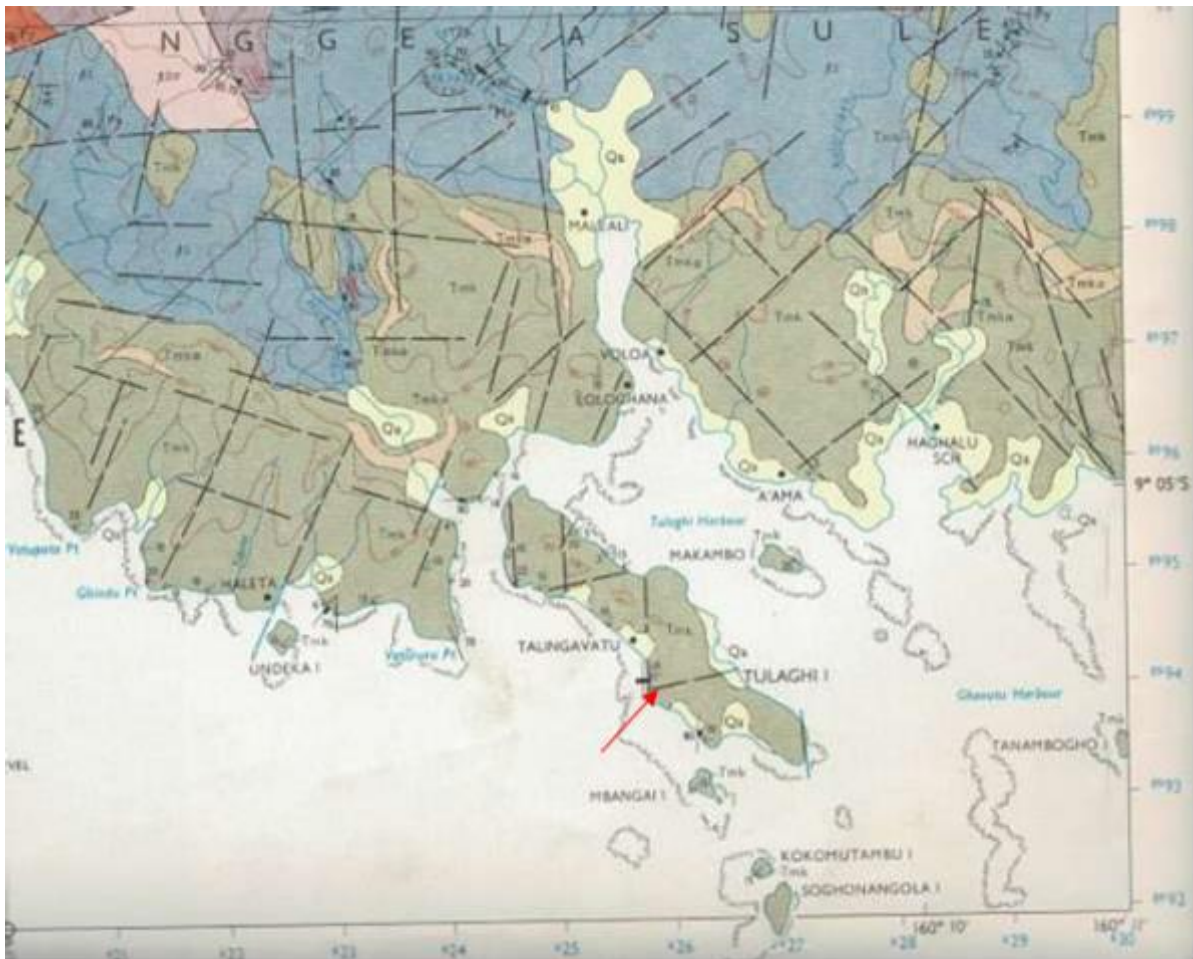
Figure 4-5: Tulagi Water Supply Topographic Map



4.1.3 GEOLOGY AND SOILS

94. There are 27 soil groups in Solomon Islands. Depending on parent material and land use, soils exhibit a range of fertility. The basalt volcanic derived soils are generally rich in nitrogen, phosphorous and organic carbon, but poor in potassium. The most fertile and agriculturally important of all soils found in Solomon Islands are the recent alluvial soils located on the northern Guadalcanal alluvial plains (Hansell & Wall, 1974).
95. The general characteristic of the Islands of Tulagi is predominantly Kombuana Sandstone with a layer of red clay covering at the top with various level of thickness.
96. Tulagi Island has several faults that cutting across the islands. The fault line that will be of interest for the implementation of this project is the fault line that shown by the red arrow on the map in **Figure 4-6**.

Figure 4-6: Geology of Part of Florida Island and Tulagi Island



Source: Geotechnical Investigation Report – Tulagi Water Supply Project

97. As shown in **Table 4-2**, two boreholes have been drilled during the geotechnical survey. The results of the geotechnical survey conducted in the site of WTP and Reservoir confirms that no geotechnical problem in WTP and possible need for engineered compacted material to avoid soil settlement for reservoir. The result of the geotechnical survey is provided as **Appendix 2** of this document.

Table 4-2: Geographic Coordinates and Depths of Each Boreholes

Description	Coordinates		Depth, m
	Easting	Northing	
Water Treatment Plant	626425.24 m E	8993646.69 m S	7
Reservoir	626275.90 m E	8993428.40 m S	10

Source: Geotechnical Investigation Report – Tulagi Water Supply Project

98. Majority of the proposed pipe network are along the existing road which are likely to be gravel material, while the pipeline between the WTP and Reservoir are likely in swampy area. Due to this reason, an excavation work was done. The result of the excavation work shows that the area is appeared to be strong and the soil is mostly gravel and sand. This is acceptable for the purpose of laying the proposed pipeline.
99. Solomon Islands has been identified by the WB study as one of the top 15 countries exposed to multiple hazards. Solomon Islands experience earthquake of magnitude 4.5 and above on average 12 times every month. In recent years, Solomon Islands experience

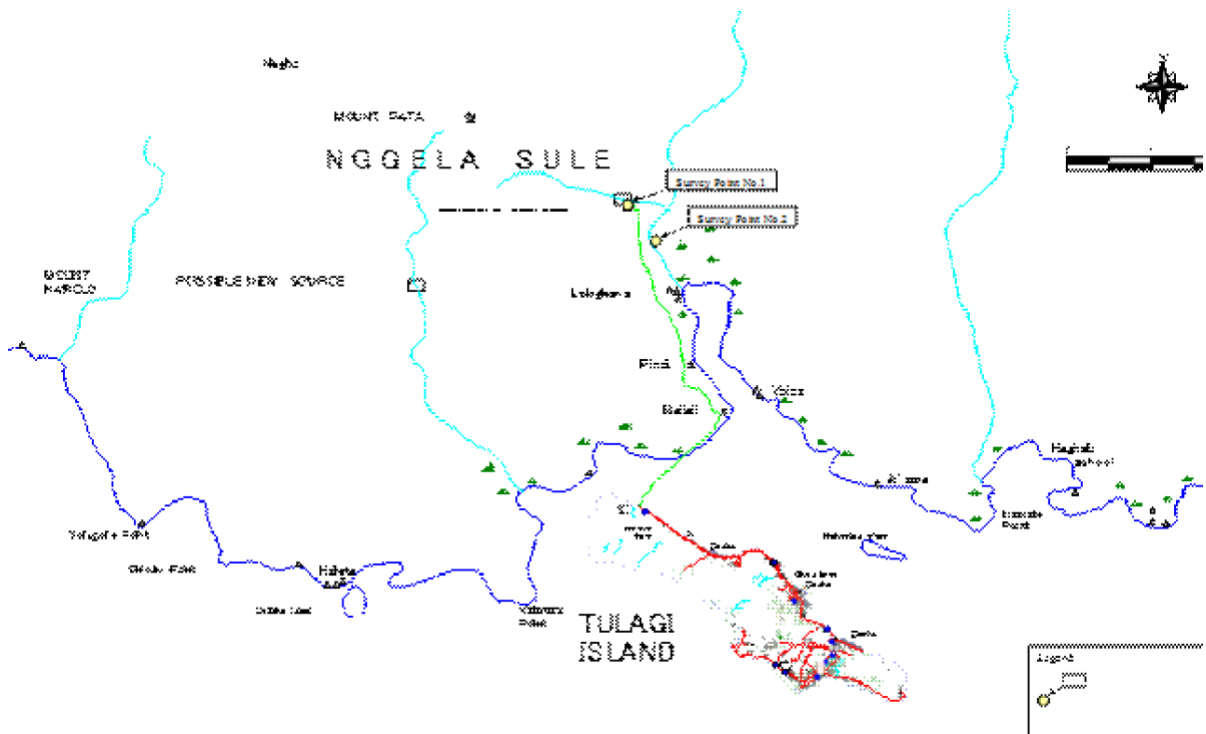
some of the most devastating earthquake in magnitude 7 & 8 in the Richter scale. The threat from tsunamis is real in Solomon Islands due to the occurrence of strong earthquakes.

100. As shown in **Figure 4-3**, Tulagi is located in an area with earthquake intensity degree VIII based on Modified Mercalli Scale. An earthquake intensity degree VIII is considered 'severe' and can cause considerable damage in ordinary substantial buildings with partial collapse; it can cause great damage to poorly built structures.

4.1.4 WATER RESOURCES

101. Groundwater is likely to be present in the Kombuana Sandstones, mainly in fractures but is likely to be brackish due to the narrow width of the island and the presence of Quaternary sediments containing some salt water. Previous test boreholes undertaken on the south of Tulagi indicated that sea water has intruded into the sand aquifer and that extensive use of the aquifer for water supply will increase salinity making use of groundwater unsuitable for water supply.
102. The only other water resource on Tulagi is rainwater, which prior to the establishment of the current water supply system was the primary source. Rainwater is still used by many residents and commercial activities as a supplement to SW water supplies. Currently around 70% of the population is connected to the network, one of the highest connections rates along with Noro. As part of the project this figure is forecasted to rise to 80% in the short term and continue to steadily increase to reach 95% by 2050.
103. As shown in **Figure 4-7**, the current water supply of Tulagi - a surface water intake at the Maleali River. As a future option (beyond 2050) an alternative water resource had been previously identified as Hughutambu Creek on Ngella Sule Island.

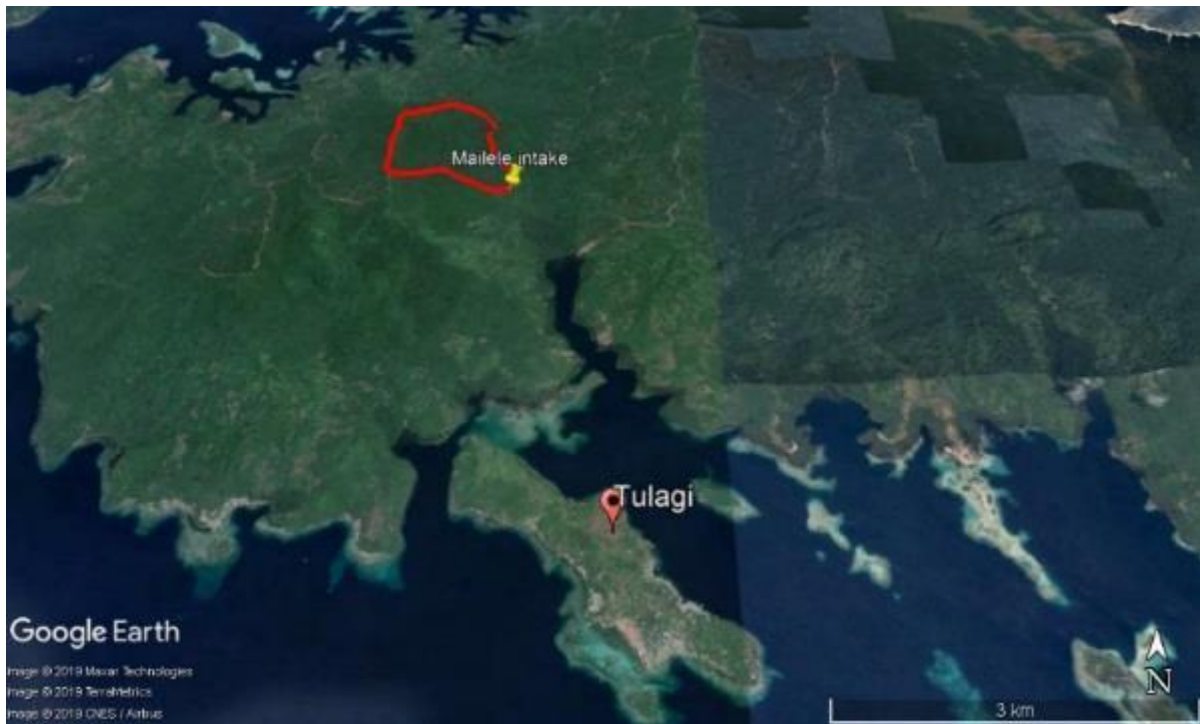
Figure 4-7: Location of current and alternative water sources in Tulagi



Source: SW PRF FSR Tulagi, 07 May 2020

104. The current water supply of Tulagi is a surface water intake at Maleali River on the larger island of Nggela Sule--immediately to the north--and transferred by undersea pipeline. The water supply is taken from a small dam on a waterfall (624936.9 mE, 8998338.1 mS) on the steep slopes of Mount Pata (elevation 399 m) at an elevation of 40 m asl. The catchment area is on steep slopes with intact rain forest with an area of 1.35 km². The average water abstraction of SW was at 3.5 L/s in 2018 and 5.0 L/s in 2019. The total yield of the catchment approaches 1 million liters per day (ML/d) which is about half of the runoff bypassing the intake. **Figure 4-8** shows the location of Maleali intake and catchment.

Figure 4-8: Location of Maleali intake and catchment



Source: SW PRF FSR Tulagi, 07 May 2020

105. In addition, there are about four surface waters on rocks found in the island of which two are at the western part of the Island and the other two are not far from the WTP site, one situated inland about 200m-300m from the solar farm and the other is at the Sasape Marina slipway area. Simple concrete structures are built to collect water and others use basins as shown in **Plate 4-1**.

Plate 4-1: Surface Water on Rocks in Tulagi



4.1.5 WATER QUALITY

106. Water samples at the source were collected and analyzed last September 2019. Although samples are only representative of the dry season, water quality is generally considered good. **Table 4-3** shows the results of laboratory analysis for Maleali River.
107. The catchment area is almost entirely covered by rainforest. It was observed that it is not yet affected by extensive logging. Nevertheless, it is recommended to undertake regular water quality monitoring to develop a database of representative measurements.

Table 4-3: Result of laboratory analysis for Maleali River

Parameter	WHO Guideline	Measurements September 2019
Temperature	-	-
Turbidity (NTU)	5.0	0.3
pH	-	7.11
DO (mg/l)	-	-
Nitrate (mg/l)	50	0.01
Nitrite (mg/l)	3	-
Nitrogen-ammonia (mg/l)	-	0.14
Mn(mg/l)	0.4	-
Fe (mg/l)	-	-
Total hardness (mg/l)	-	15
SO ₄ (mg/l)	-	-
Zn (mg/l)	-	-
Cl ₂ (mg/l)	-	-
Cl (mg/l)	5	0.013
F (mg/l)	1.5	-
Ca (mg/l)	-	6.7
Mg (mg/l)	-	-
Cu (mg/l)	2	-
Pb (mg/l)	0.01	-
P (mg/l)	-	-
Cr (mg/l)	0.05	-
I (mg/l)	-	-
Al (mg/l)	-	0.21
Phenol (mg/l)	-	-
Total Coliform (CFU/100mL)	-	62.1
E-Coli (CFU/100mL)	-	8.5

Source: SW PRF FSR Tulagi, 07 May 2020

108. Due to problem of accessibility, SW does not undertake regular water quality analysis at the source. However, turbidity is monitored daily by SW at four sampling locations as illustrated in **Figure 4-9**. The Telekom office sampling point located furthest upstream is considered as representative of the source.

Figure 4-9: Location of sampling points for turbidity

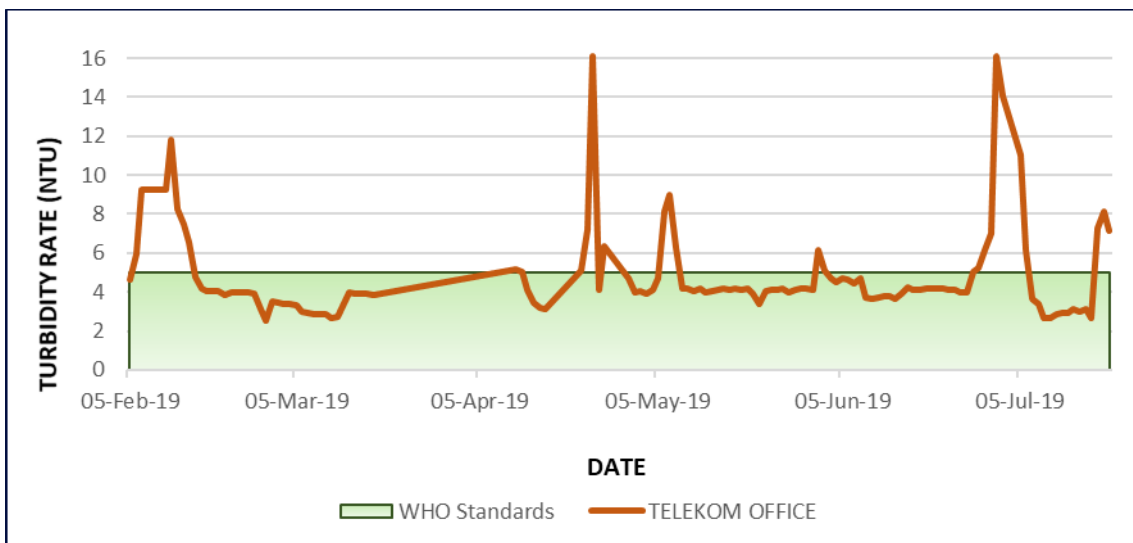


Source: SW PRF FSR Tulagi, 07 May 2020

109. As shown in **Figure 4-10**, the Tulagi source is subject to turbidity peaks (likely due to heavy rainfall as mentioned in SW field register). On a regular sampling event, water quality exceeds the WHO standard of 5 NTU. In the absence of treatment other than chlorination, turbidity levels are identical or higher at other sampling points.

110. A maximum of 22 NTU was observed at the MK sampling point. It is recommended to install wash outs to flush the system to prevent deposition of suspended particles along the network.

Figure 4-10: Tulagi turbidity peaks during rain events



Source: SW PRF FSR Tulagi, 07 May 2020

111. As part of this study, the baseline marine water quality of the receiving water body near Tulagi WTP site was analyzed last June 2021. Currently there are no guidelines for marine water quality in the Solomon Islands. The Australian and New Zealand (ANZECC) guidelines for fresh and marine waters – Aquatic Ecosystems were used in the assessment. It can be seen that the receiving water body is contaminated by *Enterococci*.

112. **Table 4-4** summarizes the results of the laboratory analysis.

Table 4-4: Result of laboratory analysis of receiving water body near Tulagi WTP site

Parameter	Guideline Values	Measurements June 2021
Turbidity (NTU)	20	0.28
pH	5.0-9.0	7.84
Electrical Conductivity (μ S/cm)	-	60,600
Nitrate, NO ₃ ⁻ (mg/L)	50	1.4
Manganese, Mn (mg/L)	-	<0.10
Chemical Oxygen Demand (mg/L)	-	>1,500
Magnesium, Mg (mg/L)	-	>75
Iron, Fe (mg/L)	-	<0.05
Aluminum, Al (mg/L)	-	<0.02
Total Suspended Solids (mg/L)	-	0.75
Chloride, Cl ⁻ (ppm)	-	>125
<i>Enterococci</i> (MPN/100mL)	35 ^a 230 ^b	488

Note:

- ^a Primary Contact, ^b Secondary Contact
- Values for pH and *Enterococci* are guideline values for recreational waters
- Values for turbidity and nitrate (oxides of nitrogen) are default trigger values for physical and chemical stressors for slightly disturbed marine ecosystems
- Heavy metal tests: Covid-19 travel restrictions are impeding heavy metal tests. Tests will be undertaken once travel restrictions are eased.

4.1.6 AIR QUALITY AND NOISE LEVEL

113. There are no available air quality and noise levels data for Tulagi. Environmental standards for air quality and noise are still under development in Solomon Islands.

114. In general, the peri-urban areas of Tulagi, where proposed components of the subproject will be located, have no major sources of anthropogenic emissions and noise generators. For these areas, it is therefore expected that the average ground level concentrations of sulfur dioxide (SO₂), nitrogen dioxide (NO₂), and particulate matter (PM₁₀) will not exceed the values in IFC's guidelines (EHS Guidelines of April 2007) which are 20 μ g/Ncm, 40 μ g/Ncm, and 20 μ g/Ncm, respectively.

4.1.7 SEAWATER SALINITY AND TEMPERATURE

115. Seawater temperature is almost constant in time and depth between the surface and at - 50 m WD around the Solomon Islands (NOAA. 2006): (i) at surface: 29°C as annual value, varying between 28.5°C (July-Sept) and 29.5°C (Jan-Mar); (ii) at -50 m: 28.5°C as annual

value, varying between 28.0°C (July-Sept) and 28.5°C; and (iii) at -100 m: 26.5°C as annual value, varying between 26.0°C (July-Sept) and 28.5°C. Similarly, seawater salinity is also almost constant in time and depth between the surface and at -50 m WD around Solomon Islands: (i) at surface: 34.6 psu with seasonal variations lower than 0.2 psu; (ii) at -50m: 34.8 psu with seasonal variations lower than 0.2 psu; and (iii) at -100m: 35.4 psu with seasonal variations lower than 0.1 psu.

4.2 BIOLOGICAL ENVIRONMENT

4.2.1 TERRESTRIAL ENVIRONMENT

Flora

116. Solomon Islands has a unique vegetation or forest types. These unique vegetation type includes lowland rainforest, hill forest, montane forests, freshwater swamps, saline swamp forests, and grassland and other non-forested areas. These vegetation types found in the islands vary in their magnitude due to their geographical location and settings, however, the range and types of plant species occurring is fairly similar between the islands.
117. The forest is characterized by a high level of biodiversity of plants of which a total of 4,500 species is occurring in the country, 3,200 are known to be native or indigenous. The plants are mostly made up of 2,763 species of angiosperms (dicots and monocots), 22 species of gymnosperms and 367 species of pteridophytes (true ferns and fern allies).
118. While diversity of plant species is high, endemism is generally low with only 57% of palms, 50% of orchids, and 75% of climbing pandanus species are considered endemic. The islands with the highest rate of endemism are Santa Cruz (Temotu) and Guadalcanal.
119. With the above, 16 species have been listed under the International Union for Conservation of Nature and Natural Resources (IUCN) Red Data List as threatened. Several other species including ebony, rosewood, rattan and some palms continue to be threatened.
120. The general forest type in the Central Island Province includes montane forest, hill forest, lowland forest, freshwater and riverine, saline swamp, grassland and other non-forest areas.
121. For the Island of Tulagi, the vegetation type is mostly associated with degraded coastal lowland forest and non-forested area inter spread with subsistence gardens. The vegetation is often with complex structure due to greater number of species from upper or hill forest and patches of freshwater swamp forest. Occasional cyclones and human activities often disturb this forest type as evident in a high incidence of re-growth and secondary species. Species predominant in this vegetation include timber species such as *Camptosperma brevipetiolata*, *Dillenia salomonensis*, *Endospermum medullosum*, *Parinari salomonensis*, *Terminalia calamansanai*, *Schizomeria serrata*, *Maranthes corymbosa*, *Pometia pinnata*, *Gmelina moluccana*, *Elaeocarpus sphaericus* and *Vitex cofasus*. Most indigenous fruit trees are also found in this forest including *Canarium spp*, *Syzygium malaccensis*, *Magnifera minor*, *Spondius dulce*, *Barringtonia procera*, *B. edulis*, *Artocarpus altilis*, *Gnetum gnemon*, and *Burkella obovata*.
122. The typical vegetation observed in Tulagi is shown in **Plate 4-2**.

Plate 4-2: Typical Vegetation Observed in Tulagi



Garden area overlooking WTP site



Casuarina equisetifolia and Mangifera indica dominating the ridge facing the mainland



The steep stony central ridge dominated by Casuarina equisetifolia, Barringtonia procera, Premna corymbosa and Terminalia complanata



Swamp area - west from WTP site dominated by Pandanus poronaliva, Cyrtosperma chamissonis and Colocasia esculenta

123. As shown in **Plate 4-3**, smaller patches of mangrove vegetation are found at the northwestern part of the Island. The common species observed during the field visit is *Rhizophora spp.*

Plate 4-3: Typical Vegetation at the Pipe Crossing Site



Mangrove strands at the pipe crossing



Mangrove and associated coastal vegetation at the pipe crossing

124. The natural vegetation associated with the WTP site area have been highly modified for urban development beginning from the time of the British Colonial Era and up until now. The site is covered with secondary growth vegetation while grasses become very common. Consequently, there is no resembles of the original natural vegetation and terrestrial ecosystem. Typical dominant vegetation present at the site include garden crops such as, *Manihot esculenta*, *Ipomoea batatas*, *Xanthosoma spp*, *Colocasia esculenta* and *Cyrtosperma chamissonis*, *Musa acuminata*, including leafy green vegetations such as *Abelmoschus manihot*, polycias, *Pseuderanthemum wharftonianum*. There are also few scattered trees including *Cocos nusifera*, *Terminalia complanata*, *Ficus benjimina* (abalolo tree), *Manifera indica* and *Premna serratifolia*.

125. **Plate 4-4** shows the typical vegetation observed at the WTP site.

Plate 4-4: Typical Vegetation at the WTP site





126. Other smaller plants, vines and creepers also dominate the area. These include *Mimosa pudica* (sensitive plant), *Mikania micrantha*, *Millettia pinnata* and *Paspalum quadrifarium*.
127. The coastal vegetation at the road corridor by which the transmission line passes through has been highly modified (cleared) previously for road and settlements. Flora includes roadside colonizing grasses, weeds, fern sp, shrubs and coastal plants including *Hibiscus tiliaceus*, *Terminalia catappa*, *Premna serratifolia*, *Casuarina equisetifolia*, *Scaevola taccada*, *Barringtonia asiatica*, *Calophyllum inophyllum*, *Morinda citrifolia*, *Pandanus tectorius sp.*, *Hibiscus rosa-sinensis*, *Pulmeria sp.* and food plants (*Musa sp.*, *Cocos nusifera*).
128. As shown in **Plate 4-5**, the corridor in which the transmission line will pass through is highly disturbed due on-going developments occurring in the Island.

Plate 4-5: Route of Transmission Line

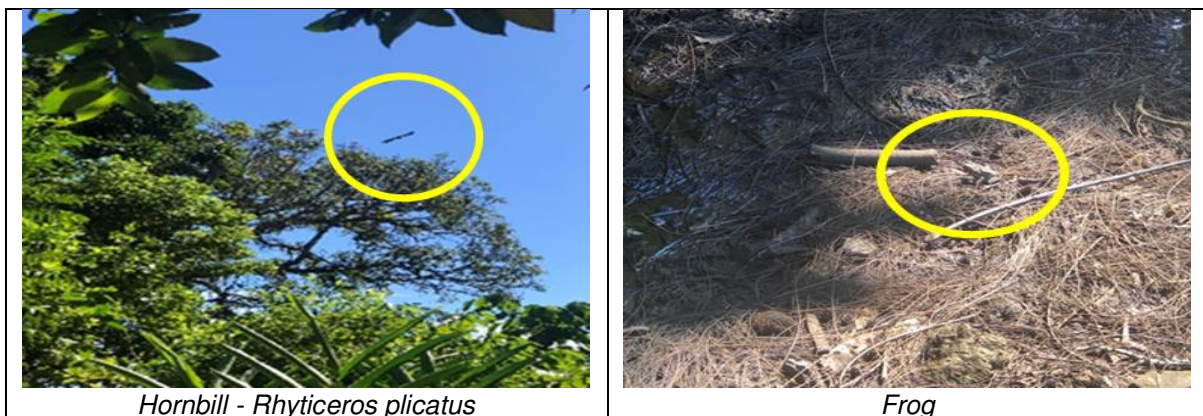


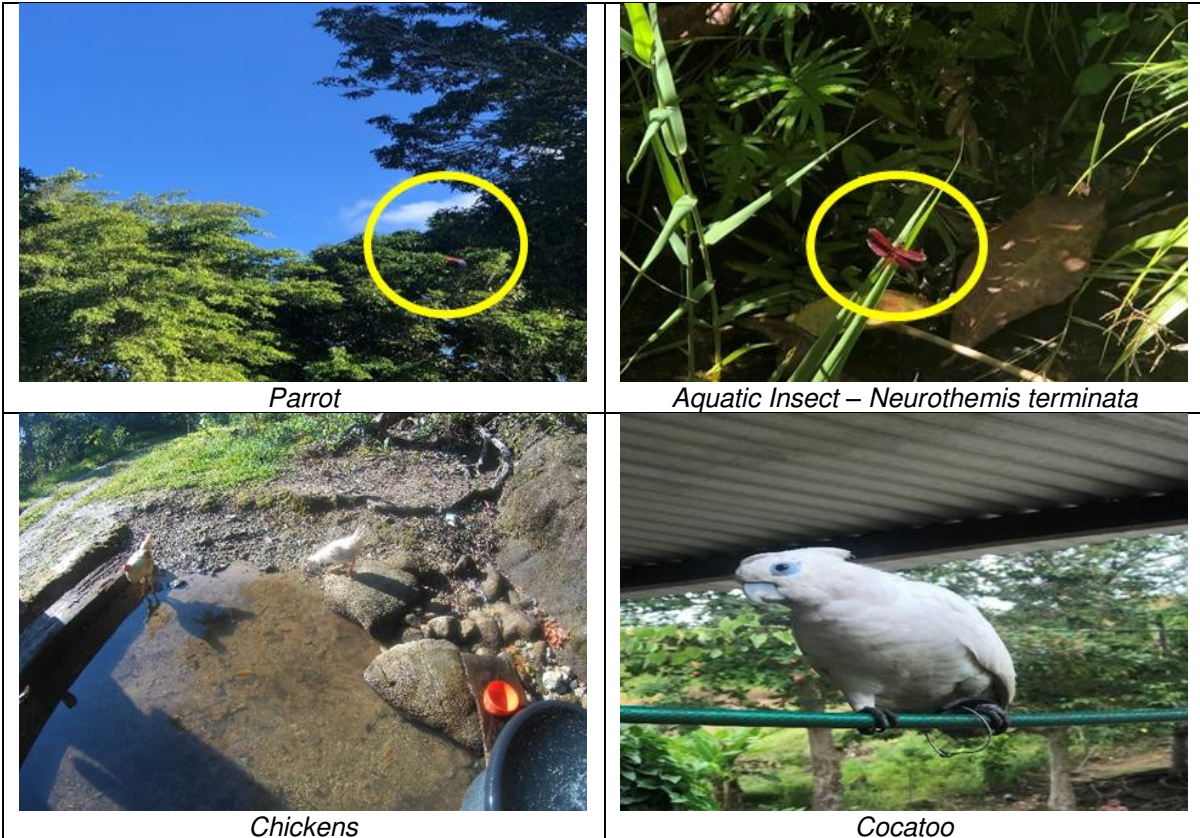
129. In general, there will be minor degradation of the local ecology where the new reservoir and WTP will be constructed as there will be clearances of small areas of vegetation (include garden land) and trees on the peripheral margins on either side of the road corridor where the transmission line will follow through.

Fauna

130. The terrestrial fauna of Solomon Islands is extremely diverse, probably with a greater diversity of land animals than any other Pacific Island country and has a high level of endemism (UNDP et al., 2002). Fauna includes 223 species of birds (173 residential terrestrial species and 50 other species of shore/sea birds and visitors) including 19 species globally threatened, 52 mammals, 61 species of reptiles (25 are endemic), and 17 species of frogs.
131. In terms of distribution, there is a relatively high level of island endemism. While Western Province records the largest number of species (41), Choiseul and Guadalcanal Provinces have the highest rate of island endemism with six species being found on only one or two islands.
132. The terrestrial ecosystem of Tulagi supports the birds and vertebrates found inhabiting the island. From field observation undertaken, birds sighted included *Rhyticeros plicatus* (Hornbill), parrot, honey eater, white cockatoo, *Rhipidura leucophrys*. Other birds and mammals sighted by residents of Tulagi include dark sheath-tailed bat, diadem leaf-nosed bat, dwarf flying fox, great bent-winged bat, island tube-nosed fruit bat, long-tongued nectar bat, Solomon's naked-backed fruit bat, woodford's fruit bat, *Halcyon leucopygia*, *Coracina lineata*. lizards, centipedes, snakes, frogs, toads are also sighted. There are also domesticated animals such as chickens (kokorako), ducks, pigs and dogs raised by residents of the Island.
133. **Plate 4-6** shows the typical fauna observed in Tulagi.

Plate 4-6: Typical Fauna Observed in Tulagi





Rare and Endangered Species

134. There is no significant wildlife species found and no endemic species or endangered species were observed during the field trip.

Protected Areas / Areas of Conservational Value & Areas of Historical Significance

135. There is no protected area or marine protected area within the project site.

136. There are no national parks or reserves found in the Island except for areas of historical significance which are found all throughout the island. As shown in **Plate 4-7**, there are numerous WW2 relics and hideouts that are protected by the Province for tourism purposes as it has historical significance. These areas will not be affected. However, care should be undertaken when working within the proximity to these areas.

Plate 4-7: WW2 Relics and Hideouts



4.2.2 MARINE ENVIRONMENT

- 137. The existing marine environment near the project area of influence is highly modified with significant alterations from past and current developments. It is evident that marine benthic biological and abiotic resources at WTP site and the surrounding area have been altered through past human activities resulting in negative impacts to these ecological systems.
- 138. Coastal foreshore and intertidal reclamation are evident and has resulted in significant benthic substrate alteration and loss of benthic habitat and resources. The physical disturbances increased the sedimentation resulting to negative impacts on benthic sessile resources and hard coral communities.
- 139. **Plate 4-8** shows the coastal alteration and reclamation near the WTP site.

Plate 4-8: Coastal Alteration and Reclamation near the WTP site.



- 140. Most of the coastal water is polluted by human induced activities and development resulting to very few marine life forms inhabiting the water. Significant wharf and community related pollution and waste (plastics, metal rubbish and sewage) was observed throughout the area near the WTP site and along the coastline. Information collected during the assessment indicates that periodic small scale petrochemical discharge from the local domestic vessels also occurs.
- 141. **Plate 4-9** shows the sources of marine environment pollution near the WTP site.

Plate 4-9: Sources of Marine Environment Pollution near the WTP site



- 142. Fauna includes various fish species, mollusks, crustaceans, sea urchins, sea stars and sea cucumbers.
- 143. The WTP site is situated on a bay and the bay is open at each end, tidally flushed and is influenced by oceanic waves and currents that enter the natural reef pass in the northeastern and western end of the bay. Towards the open sea and offshore islands, it is relatively deep and water is clean with marine life thriving.

4.2.3 FRESHWATER ECOLOGY

- 144. There is a freshwater swamp at the west of the WTP site and links to the marshy (swampy) area behind the WTP. Water from the surface runoff drains into the swamp area leaving the area to be moist and swampy. This area has high water table and during heavy rains water accumulates and floods the surrounding area. There is an existing drainage near the WTP site which collects flooded water and drains into the sea. Hence, the WTP site does not accumulate much flooded water compared to the surrounding areas.
- 145. **Plate 4-10** shows the typical vegetation observed in swam area near the WTP site.

Plate 4-10: Typical Vegetation Observed in Swamp Area near the WTP site





146. As shown in **Plate 4-11**, there are also few freshwater faunas found during the water sampling activity. This includes Goby sp, shrimps and toadpole.

Plate 4-11: Gobi Found in Surface Water

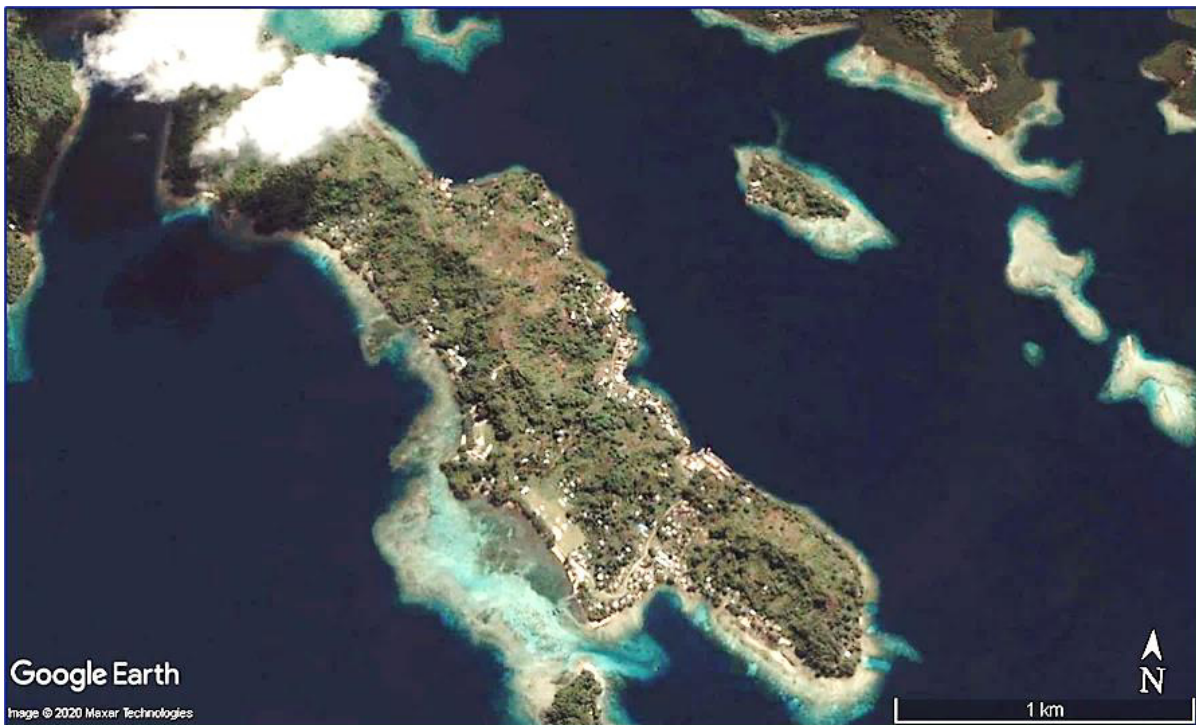


4.3 SOCIO-ECONOMIC ENVIRONMENT

4.3.1 POPULATION PROFILE

147. Currently, the population of Tulagi is mainly located in the southern side of the island, along the coastal area and the small harbor. New houses are growing on the southwest coast, notably with the increase of tourism.
148. Based on the 2009 census, 1,251 inhabitants lived in Tulagi and the 2018 population was quoted as being 1,751 inhabitants (in 2013, the Solomon Islands received some 24,000 tourists). This represents a 3.8% annual growth rate. **Figure 4-11** and **Figure 4-12** show the satellite images which illustrate the change in density particularly in the south east of Tulagi. Today the administrative and commercial center is in the middle of Tulagi Island particularly around the seafront. The 2018 population is consistent with the number of dwellings on the island and the growth since 2009.

Figure 4-11: Tulagi Development in 2009



Source: SW PRF FSR Tulagi, 07 May 2020

Figure 4-12: Tulagi Development in 2018



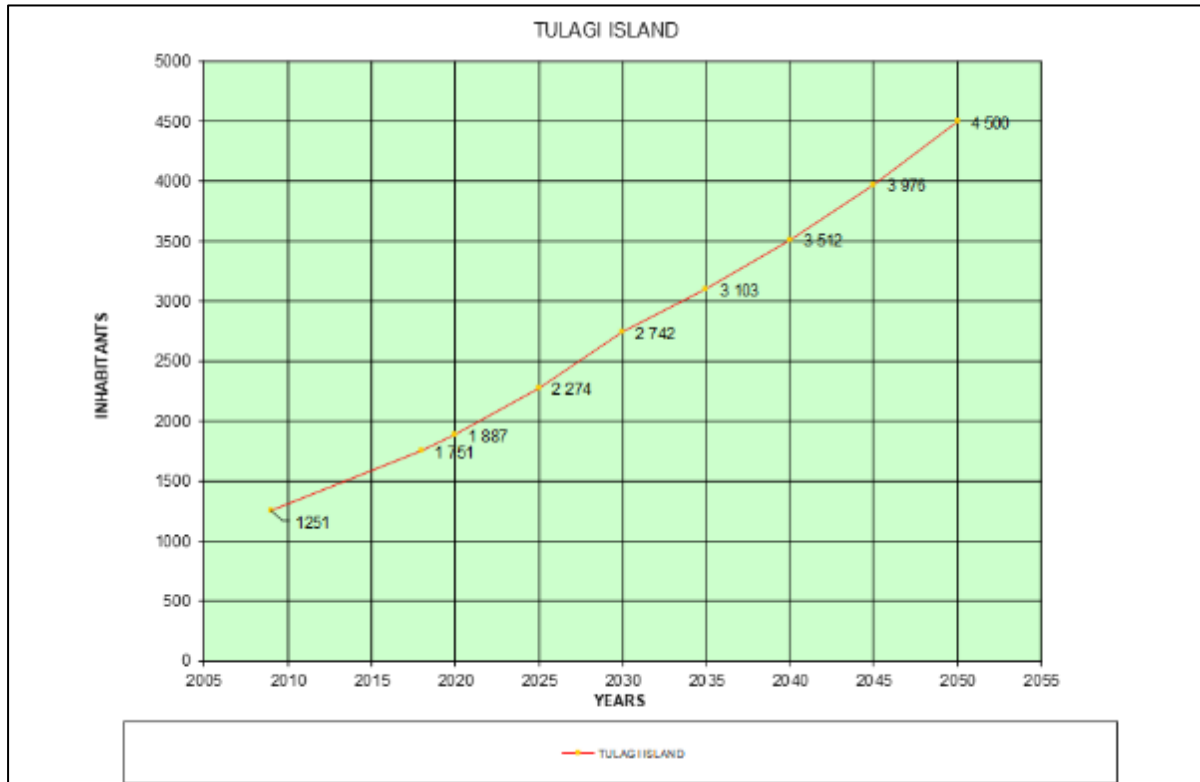
Source: SW PRF FSR Tulagi, 07 May 2020

149. In the absence of official figures, the observed growth rate over the period 2009 to 2018 (3.8%) was considered to project population to 2030 (see **Figure 4-13**). For the period of 2030 to 2050, it was assumed a lower growth rate of 2.5% per annum. These projections indicate projections of 2,742 and 4,500 by 2030 and 2050 respectively, slightly lower but

broadly consistent with the values previously indicated in interviews with consumers in the island.

150. These growth rates are higher than the projected growth rates of central province (1.3%) reflecting the inward migration from rural areas to Tulagi above and beyond natural growth rates.

Figure 4-13: Population Projection for Tulagi



Source: SW PRF FSR Tulagi, 07 May 2020

4.3.2 ECONOMIC CONTEXT

151. Tulagi is the economic, commercial, and administrative center of Central Province. Agricultural production, fisheries, individual agents for BSP and ANZ banks, retail stores, remittances, and an increasingly popular WW II-based tourism are its economic base.
152. Tulagi has a lower cost of living compared to Honiara, an hour boat ride from the province. Domestic food consumption is supported by community markets and Tulagi Market. Vendors from the surrounding communities sell their harvest and catch at Tulagi Market. Others travel to Honiara to sell fish, vegetables and fruits in the Honiara Central Market for a better price.
153. According to the World Bank, the broader impacts of COVID-19 have been felt throughout the Solomon Islands with major economic consequences. The government is projecting a -4.9% GDP growth, job losses and disruption to imports and supplies due to the lack of inbound flights. The government has responded with a US\$36.9 million stimulus relief package (309 million Solomon Islands dollars) that includes subsidies for households, loan relief for businesses, inter-island transfers and grants to provincial health authorities.

4.3.3 CULTURAL COMPONENT

154. In Solomon Islands, special, sacred, or restricted sites, or ‘tambu’ areas represent the history, lineage and society of different clans and lines. The National Solomon Islands Museum keeps a National Tambu Site Register, which records several thousand sites of Solomon Islands.
155. In addition, a number of historical sites have been identified in Tulagi dating back to the former colonial period and also WWII (see **Plate 4-12**). Of these sites, it is planned to redevelop the former Governor’s Mansion into a tourist lodge. From this site there is an existing tourist trail. **Figure 4-14** shows the Tulagi historical sites and tourist development sites. The Historical sites at the Hill top will not be impacted by the project. However, those that are immediate to the roadside may be impacted. They are estimated to be about 5 metres from the edge of the existing road. There is also a colonial graveyard but this will not be impacted. Any construction work close to these areas, any site clearance, digging and excavation activities undertaken during pre-construction and construction can unearth unknown archaeological sites/resources and UXOs. These sites are known as Change Finds. In the event this occurs, work shall cease immediately and the relevant authorities (National Museum Tabu Register, Ministry of Culture and Tourism, MECDM and RSIPF- EOD) shall be informed. Activities shall not re-commence until the authorities have signed-off that the site/resources have been dealt with appropriately and that work may continue. The Contractor will be responsible for complying with the requirements of authorities, and the SW shall monitor the same.

Plate 4-12: Tulagi Historical Sites and Tourist Development Sites



Source: Google Images

Figure 4-14: Tulagi Historical Sites and Tourist Development Sites



4.3.4 BUILT ENVIRONMENT

Transportation

156. Land transportation route is mainly served by asphalt road along its shoreline and a concrete road going up the Provincial Assembly’s Chamber. Tulagi has no airport. Small boats travel between Honiara and Tulagi daily.

Water Supply

157. SW currently operates the Tulagi water supply system. SW supplies approximately 70% of the current population of Tulagi including both domestic and commercial customers (hotels and institutions). While commercial customers represent around 10% of the number of connections, commercial consumption is approximately 25% of overall consumption. Average consumption per capita is low [less than 80 liters per capita per day (lpcd) for domestic and 100 lpcd for total consumption] testifying to the use of other sources, notably rainwater by customers. These figures are lower than similar figures for Honiara. **Table 4-5** shows the summary of Tulagi water supply consumption. The Solomon Islands room capacity is 1,556 with an estimated 141 accommodation capacity – its bed capacity estimated to be 3,076. According to the Province representatives, tourism infrastructure locations in Tulagi remain uncertain for instance a potential tourist lodge to be built at the existing reservoir location.

Table 4-5: Summary of Tulagi water supply and consumption

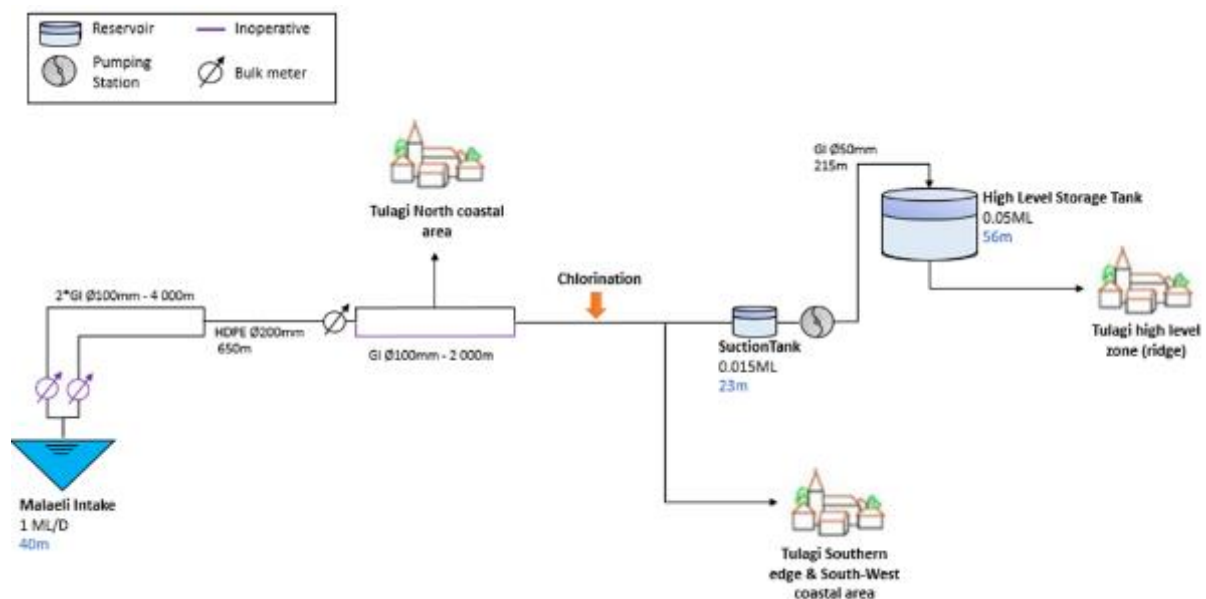
	2016	2017	2018	up to May 2019
Total Served Population	1,203	1,227	1,251	1,276
Total number of service connections	188	197	201	203
Domestic	169	178	179	181
Commercial	19	19	22	22

	2016	2017	2018	up to May 2019
Total consumption (m ³ /year)	35,760	43,431	44,287	16,869
Domestic	27,580	33,493	35,348	12,618
Commercial	8,180	9,938	8,939	4,251
LPCD (Domestic)	62.81	74.79	77.41	
LPCD Total	81.44	96.98	96.99	

Source: SW PRF FSR Tulagi, 07 May 2020

158. **Figure 4-15** shows the current Tulagi water supply system.

Figure 4-15: Tulagi water supply system



Source: SW PRF FSR Tulagi, 07 May 2020

159. **Transmission system.** From the intake structure, water flows through a 200 mm diameter rolled steel pipe which is bifurcated into two GI 100 mm diameter pipes. The two GI 100 mm diameter pipes run above ground between swamp and mangroves on the coastal edge for about 4,000 m.
160. The water is piped under the sea from the estuary at Maleali through a 650m High Density Polyethylene (HDPE) 200 mm diameter pipe. A bulk-meter is located at the junction of Tulagi Island.
161. From the bulk meter, the transmission line is once again split into two 100 mm diameter pipes that supply the south-east portions of Tulagi (although there are additional connections on the transmission main). Currently, only one of the two GI 100 mm pipeline is used.
162. Given the age and state of the two 100 mm GI intake pipes, losses along the transmission line due to leaks are expected. Besides, connection between GI and HDPE pipes can also cause significant leaks. To monitor leaks, a simple flowmeter test could be done at the

inland bulk meter through alternative closure of pipes for about 30 minutes to 1 hour. Moreover, replacement of flowmeters will ensure continuous monitoring of waterflow.

163. **Treatment and storage.** Water flows through the single operated GI 100 mm main from Tulagi harbour to the chlorination house. Treatment consists solely of chlorination which is only partial as it does not cover customers upstream of the chlorination facilities (representing about 20% of existing customers).
164. There is no significant storage on the island. The supply is directly dependent on flow from the source and subject to interruption during turbidity peaks.
165. There are two distribution zones from the chlorination house: (i) low-level zone which is supplied by gravity. This area includes the southern edge of the island and the south-west coastal area. This area is not connected to storage and directly depends on water level at source; and (ii) high-level zone which is supplied through a pumping station with a 0.015 ML suction tank and a 0.05 ML high-level storage tank.
166. In the high-level zone, the pump station has only one pump with no known spares or backup. Also, backup generator is not available in case of power fluctuation. Lastly, site security is low (no fences, building made of rusty steel plank).
167. The suction tank (elevation 23 m) in high level zone is supplied by a 50mm steel pipe. As shown in **Plate 4-13**, it is old and leaks are observed in several places.

Plate 4-13: Pumping station and 0.015 ML suction tank in Tulagi



Source: SW PRF FSR Tulagi, 07 May 2020

168. Water is also pumped to a further elevated storage (elevation 56 m) which provides water for the households on the ridge. Currently, the high-level reservoir could provide about a day of autonomy. However, the concrete tank is in poor condition and several leaks are observed. **Plate 4-14** shows the 0.05 ML high-level storage tank.

Plate 4-14: 0.05 ML high-level storage tank in Tulagi



Source: SW PRF FSR Tulagi, 07 May 2020

169. **Distribution system.** There are about 13.4 km of distribution system on Tulagi Island, in addition to 8.6 km of transmission main from the source. The distribution system consists essentially of GI pipe constructed during the colonial era and therefore at least over 80 years old. The network has been extended/replaced partially by plastic pipes in recent years, using predominantly poly vinyl chloride (PVC). **Figure 4-16** shows an overview of the water distribution in Tulagi.

Figure 4-16: Water distribution system in Tulagi



Source: SW PRF FSR Tulagi, 07 May 2020

170. **Non-Revenue Water.** Non-revenue water (NRW) for Tulagi has been calculated by SW on the basis of the difference between water production and sales. Water production is

measured at the entry point to Tulagi itself and therefore ignores potential additional water on the transmission line.

171. **Table 4-6** provides a summary of NRW between 2016 and 2019. As shown, NRW has decreased from 80% in 2016 to a little over 60% in 2018. Even though in 2019 NRW seems to be increasing this is likely due to a disparity between production and billing dates. For the later analysis, a figure of 75% has been taken as representative. At this stage, the split between physical and commercial losses is assumed to be respectively of 2/3 and 1/3 awaiting more detailed studies to develop a water balance for the Tulagi supply. The large volume of physical losses is due to the proportion of GI piping and high number of leaks observed during site visits.

Table 4-6: Estimation of NRW for Tulagi water supply

Year	Production (m ³)	Consumption (m ³)	NRW (%)
2016	171 312	35 760	80
2017	150 178	43 431	73
2018	118 092	44 287	62
2019 (partial)	70 868	16 869	75

Source: SW PRF FSR Tulagi, 07 May 2020

Energy/Power

172. Solomon Power, a state-owned electricity utility, provides electricity to the national capital (Honiara) and eight provincial centers (Auki, Buala, Gizo, Kirakira, Lata, Malu'u, Noro-Munda, and Tulagi). All grid-connected electricity generation in Solomon Islands is currently fueled by diesel⁴ and new solar power plants which are ADB funded. These projects are to be commissioned in Munda, Gizo, Malu'u, Lata, and Tulagi in early 2021 but were delayed due to the COVID-19 pandemic restrictions.

Information and Communication Technology

173. Cellular phone services are available in Tulagi and majority of the population have access to mobile services networks of either Our Telekom or Bmobile Vodafone. The networks provide calling, texting and internet signals to the people in the island. Lastly, the SIBC radio station broadcasts in Tulagi.

Health

174. The Ministry of Health and Medical Services is the key health provider in the Solomon Islands. Health services are concentrated in the urban centers with a hierarchy of facilities available ranging from nurse aide posts and rural clinics to National Referral Hospital (NRH). Of the nine provinces in the Solomon Islands, eight have a public hospital. There are approximately 22 doctors per 100,000 of population and 205 midwives and nurses per 100,000. In general, malaria and tuberculosis are the major public health concerns in Solomon Islands, along with sexually transmitted infections, acute respiratory tract infections, diarrhea, viral hepatitis, dengue fever, and measles (SINSO and MHMS, 2017).
175. In terms of coronavirus disease (COVID-19), the first case in Solomon Islands was recorded on October 3 and as of March 22, there are 18 confirmed cases with zero deaths in Solomon Islands⁵. Solomon Islands is in state of public emergency due to the pandemic.

⁴ Provincial Renewable Energy Project (RRP SOL 46014)

⁵ The Weather Channel

Social distancing and other methods to limit the possibility of transmission are encouraged but not enforced.

176. Solomon Islands has a high incidence of water-borne diseases. Diarrheal diseases are the sixth most common cause of deaths, accounting for 4% of deaths or 28 deaths per 100,000 people. The high incidence of water-borne diseases can be primarily attributed to limited access to safe water and improved sanitation and poor hygiene awareness and behaviors.⁶
177. There is a hospital in Tulagi which the facilities are very basic with all but the simplest cases being transferred to NRH. The hospital is now run by nurses with basic first aid and medical treatment including local anaesthetic.

Education

178. As per the 2009 census data (highest level of education completed), about 3% of males and 1% of females had tertiary education; 15 % of males and 9% of females attended secondary education; 59% of males and 51% of females completed only primary level, and 19% of males and 35% females had no schooling completed. Schools such as Solomon Islands National University was initiated in 2012 from the Solomon Islands College of Higher Education which was basically pooled from all the existing government schools in 1984, namely, the Solomon Islands Teachers College, Public Administration Training School, Ranadi Marine Training School, Honiara Nursing Training school, and Honiara Technical Institute. The University of the South Pacific (USP) Solomon Islands Campus at Honiara provides tertiary education to students of the South Pacific. The Woodford International School offers the International Baccalaureate Primary Program from early childhood to Year 5 and then the Cambridge International Middle Years and High School Program up to the Cambridge Advanced Level Program in Year 12.

4.4 SENSITIVE RECEPTOR

179. Sensitive receptors that have been identified along the project corridor are summarized below:
 - School - McMahon Community High and Primary School;
 - Anglican Church Diocese;
 - Police Station;
 - Accommodation,
 - Residential Areas and Buildings.

No environmental hotspot has been identified along the project corridor.

⁶ Sector Assessment (Summary): Water and Other Urban Infrastructure and Services, UWSSSP

5.0 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATING MEASURES

180. **Impact Assessment Methodology.** The potential environmental and social impacts for the project have been identified and their significance assessed. The durations of the impacts are assessed with reference to the scope of work, the physical, biological and socio-economic environment at the project site. Mitigation measures are designed to avoid and/or minimize each of the potential physical, biological and socio-economic environment impacts. Impacts may be minor, moderate, major or negligible based on the scale of impact itself and whether it is mitigated or not.
181. The subprojects will create both common and site-specific impacts. It must be noted that there are impacts that are temporary such as impacts during construction phase. This chapter provides a summary of these and measures to mitigate these impacts.

5.1 IMPACTS RELATED TO PROJECT LOCATION AND DESIGN

182. Pre-construction considerations include climate change vulnerability; updating of ESMP based on latest project design and components; integration of ESMP and development consent (DC) conditions in the bid and contract documents; update of the Project's communications and consultation plan (CCP); grievance redress and management; identification of materials sources, materials extraction and application for BMP; biosecurity issues and potential introduction of alien invasive species; identification of sensitive receptors and cultural resources identification; land access arrangements; and unexploded ordnance.

5.1.1 IMPACTS FROM CLIMATE CHANGE

183. Potential impacts of climate change and natural hazards on infrastructure were identified during the preparation in 2012 of the Solomon Islands' National Infrastructure Investment Plan (NIIP). A summary of impacts due to climate change and natural hazards and their corresponding adaptation measures were identified. These sets of information on impacts and adaptation measures were adopted in the preparation of the Solomon Water's 30-Year Strategic Plan (2017) and are the same set of information from the NIIP document.
184. A recent review by the Pacific Region Infrastructure Facility on Solomon Islands public investment management indicated that the NIIP is still being used as guide for Solomon Islands' public investment management along with other national government plans.
185. **Table 5-1** summarizes the impacts and adaptation for water infrastructure.

Table 5-1: Summary of Impacts and Adaptation for Water Infrastructure

Climate Change / Hazard	Potential Impact	Resilience Measures	Complementary Measures
Sea Level Rise	<ul style="list-style-type: none"> ▪ Rising sea levels/coastal erosion causes damage to water supply infrastructure; ▪ Saltwater intrusion into groundwater lenses 	<ul style="list-style-type: none"> ▪ Use non-corrosive materials; 	<ul style="list-style-type: none"> ▪ Demand side management; ▪ Reduce pressure on coastal groundwater sources; ▪ Undertake regular water quality assessments
Increase / Decreases in Rainfall	<ul style="list-style-type: none"> ▪ Water shortages; ▪ Water demand patterns may increase; ▪ Competition and conflict between different water users; ▪ Increased runoff can decrease water supplies by reduced infiltration into the groundwater 	<ul style="list-style-type: none"> ▪ Improved artificial water storage,; ▪ Improve water efficiency and water loss measures; 	<ul style="list-style-type: none"> ▪ Long-term demand side management; ▪ Long-term water availability studies and planning; ▪ Integrated multi-user assessment of supply needs; ▪ Ensuring groundwater recharge zones
Cyclones	<ul style="list-style-type: none"> ▪ Damage to water infrastructure could undermine the quality and quantity of water 	<ul style="list-style-type: none"> ▪ Design critical supply infrastructure for hazards 	<ul style="list-style-type: none"> ▪ Contingency planning
Earthquakes	<ul style="list-style-type: none"> ▪ Damage to water infrastructure could undermine the quality and quantity of water 	<ul style="list-style-type: none"> ▪ Design critical supply infrastructure for hazards 	<ul style="list-style-type: none"> ▪ Emergency water supplies planned

Source: SI: UWSSSP EARF, 26 March 2019

186. **Flooding considerations.** Extreme high rainfall events are expected to affect proposed subprojects in the future. While the separate climate change study prepared for this project concluded that the big flood in 2014 would still be considered an unusual event by 2050, the 1-in-70-year event could still be expected, and the flood magnitude should be considered in the planning and design of large civil engineering infrastructure. Site erosion and flooding of the facilities are therefore expected if no adaptation will be implemented. Erosion and flooding could affect the structural integrity of the proposed structures. This can result in service interruptions or total failure of the facilities with serious water shortages that may escalate into a major public health emergency.
187. **Influence of Seasonal Drought.** It is important to consider the influence of drought when selecting a suitable water source. The target is to provide uninterrupted water supply (24x7) to the customers. However, unavoidable circumstances such as occurrence of serious dry spells is also considered.
188. As part of mitigation measures, a hydrology and onsite flooding study was conducted during the design phase. The study described the nature of the flood hazard and the degree of flood risk for the specific sites. Results of the study have been considered for

the design of the proposed facilities and the preparation of engineering specifications to ensure that these facilities are less vulnerable to the predicted flood events.

189. The design capacity of the water supply system takes full consideration of the minimum discharge available at intake in Maleoli river.
190. Engineering assessment on potential site erosion has been made during the design phase for each site to determine the type of erosion protection that will be appropriate using in particular information from the site-specific geotechnical studies. This applies to the reservoir and water treatment plant sites and routes of water supply pipelines.
191. In addition, the project conceptual design fully integrates the applicable climate-proofing measures for water supply projects recommended by ADB as presented in **Table 5-2**.

Table 5-2: Climate-Proofing Measures for Water Supply Subprojects

COMPONENT	CLIMATE-PROOFING MEASURES
Water supply	<ul style="list-style-type: none"> ▪ Reduction of nonrevenue water; ▪ Water metering ▪ Enhancing storage capacity;
Water treatment and quality	<ul style="list-style-type: none"> ▪ Protection of the water source ▪ Integrated water resources management;
Water distribution	<ul style="list-style-type: none"> ▪ Adjustment to operation below design capacity

Source: EARF 2019

5.1.2 PROJECT LAND ACCESS ARRANGEMENTS

192. This impact includes permanent access to lands of the proposed subprojects either in public or private property.

Land Requirement

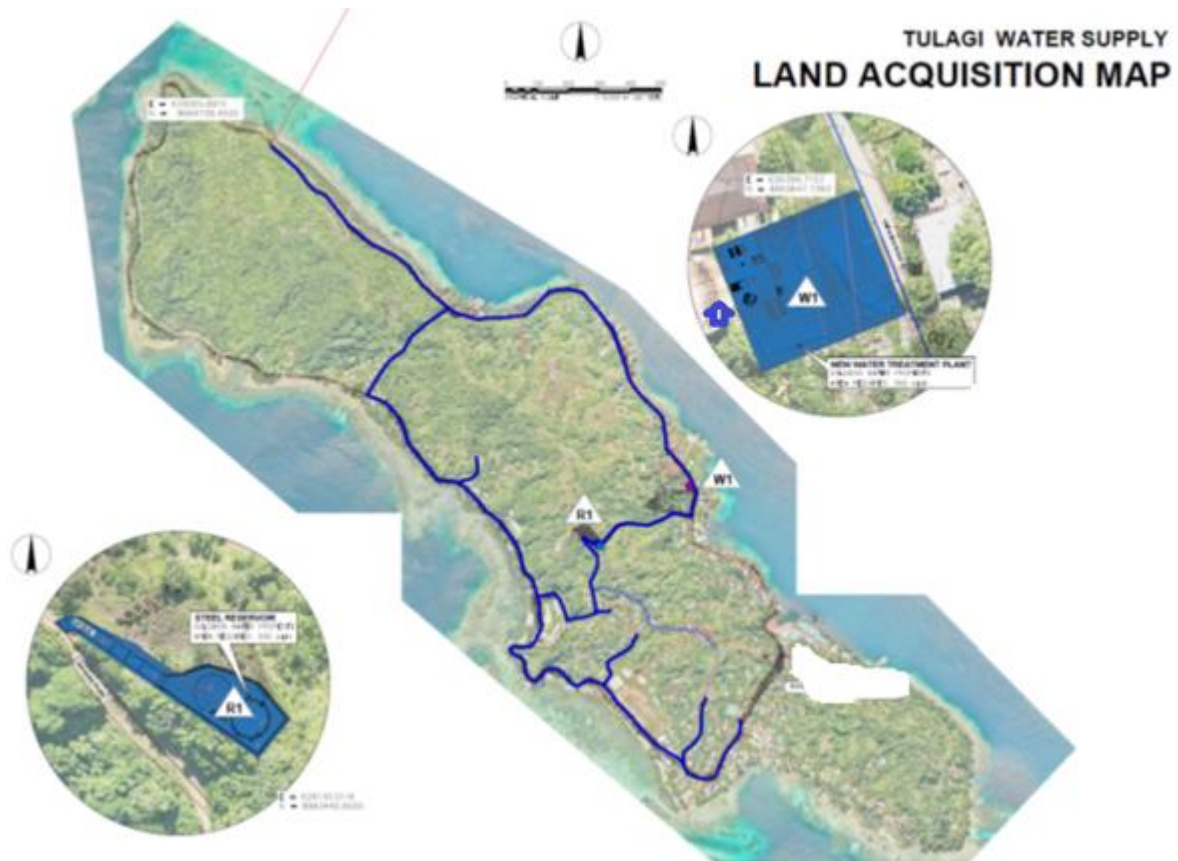
193. The WTP and reservoir will require 1,086 m² and 890 m² of land, respectively. Both the WTP and the reservoir components will be constructed on government lands. Although there will be no required private lands, there will be a need to secure easement access for the pipeline from two leaseholders on Tulagi. SW will negotiate with the leaseholders and agree on payment for the easement.
194. The sites for the proposed subproject, except for the water intake, are government-owned except for three plots that require easement access agreement from two leaseholders.
195. The chlorination house, pumping station, and existing reservoir will no longer be used and will be decommissioned. Chlorination will be transferred to the WTP at the seafront and the BPS to supply the high ridge will be transferred to the new reservoir site. The new reservoir will be built on a vacant provincial land near the existing reservoir. New pipelines will be constructed along roads, wherever possible, to limit potential involuntary resettlement impacts.
196. **Table 5-3** summarizes the land requirement per project component. **Figure 5-1** shows the land acquisition map for Tulagi water supply.

Table 5-3: Summary of Land Requirement per Project Component

Component	Proposed Works	Location/Description	Land Purchase Requirement	Land Ownership
Reservoir	A new reservoir and an extra space for future extension.	Located on Tulagi Island. A new reservoir will be constructed at an elevation of 49m ASL. It will be a cylindrical prefabricated steel tank of 400 m ³ useful capacity (app.11m diameter for 5m height).	None	Government
	Access road and fencing.		None	Government
	The BPS will be located within the site area.		None	Government
Water Treatment Plant	The site will be fenced using SW standard fencing with a gate for vehicular access.	A new WTP will be constructed on site (Tulagi seafront) with allowance for extension	None	Government (Expired lease from a former cannery)
Pipeline	Replacement and extension of pipeline network on Tulagi Island.	Replacement and extension of pipelines on Tulagi Island.	No land purchase, easement of access only	4 government & 3 private-owned land plots (from 2 leaseholders)
Intake	Strainer replacement, relocation and replacement of gate valves and bulk meters, weir intake, access improvement.	On the mainland, outside Tulagi Island.	None	Government

Source: Land Acquisition and Resettlement Plan, Tulagi Water Supply Subproject

Figure 5-1: Land Acquisition Map for Tulagi Water Supply



Source: Detailed Design Report Tulagi Water Supply System version 2

Affected Persons

197. All the 14 affected people (AP) have food gardens located in five clusters along the pipeline: (i) two (2) at the end of the pipeline on the hill, (ii) two (2) near the reservoir or R1, (iii) two (2) on the ridge towards the proposed WTP site, (iv) three (3) next to the WTP, and (v) five (5) next to the old reservoir. **Table 5-4** provides the list of affected persons and impacts on their assets along the water pipeline easement.

Table 5-4: List of APs and Summary of Affected Non-Land Assets

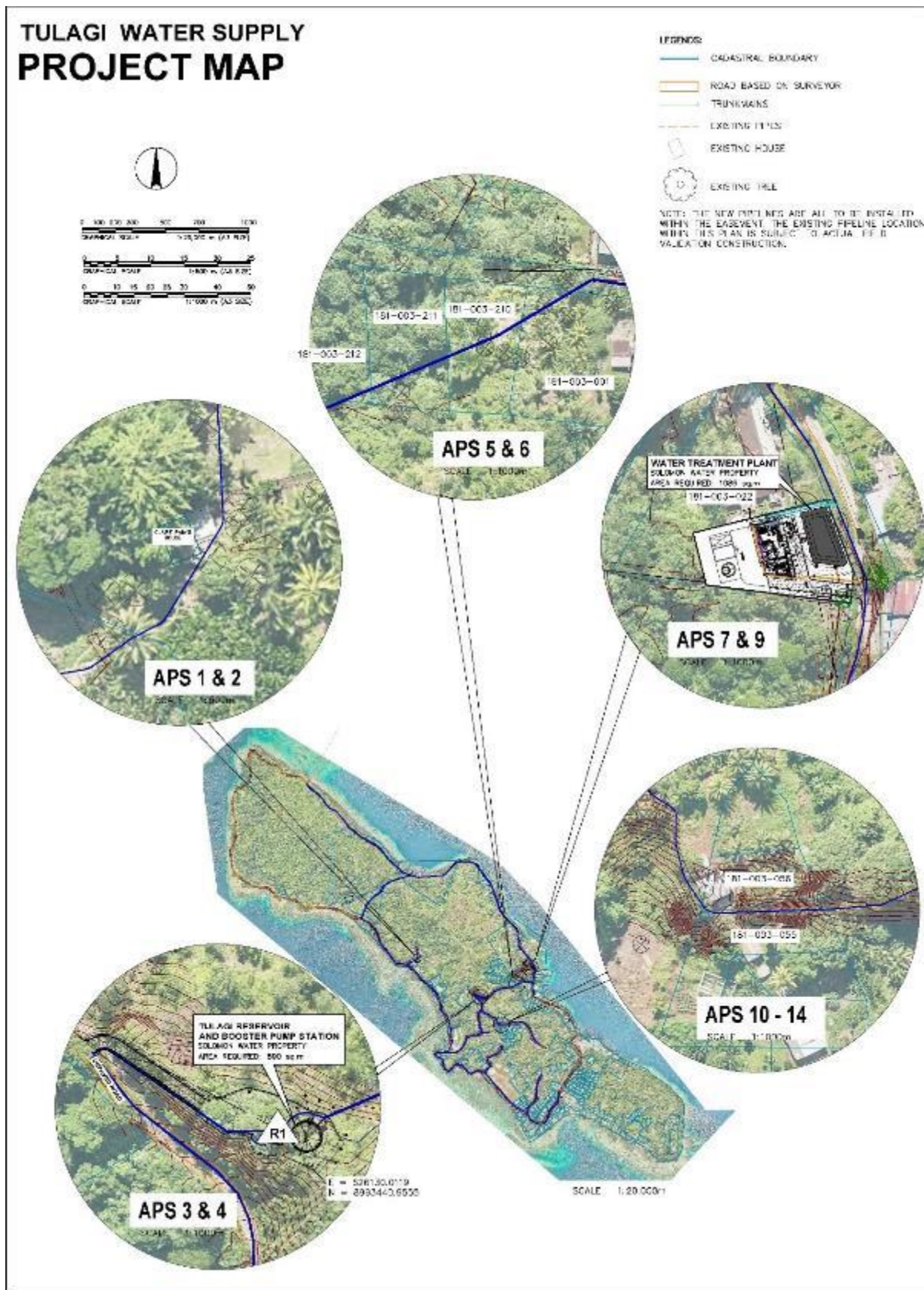
AP No.	Name of Landowner/Occupant	Status of Landownership	Location	Impact
			End of pipeline	
1	Clare Paia	Land Occupier	Lives at the end of pipeline behind the Premier's residence	Loss of crops.
2	Regina Manetiva	Government	End of pipeline	Loss of crops
			Reservoir	
3	Frank Vulebura	Land Occupier	Reservoir	Loss of crops
4	Joseph Manele	Land Occupier	Reservoir	Loss of crops
			Ridge	

5	Doreen Lagi	land Occupier	Ridge- on the way down to the WTP location.	Loss of crops
6	Fred Samora (Anna Samora)	land Occupier	Ridge- Going to the flat ground for the new pipeline. Near Doreen/R1 new water tank.	Loss of crops
Water Treatment Plant				
7	Janet Sade	land Occupier	WTP	
8	Anna Malakai	land Occupier	WTP	Loss of crops
9	Anna Lee	land Occupier	WTP- garden and house next to the old reservoir(Ex- NFD).	Loss of crops
Near Old Reservoir				
10	Lylah Tokasi (widow)	land Occupier	Old reservoir	Loss of crops
11	Mrs Madeline Alalo (only AP with land document) retired nurse	Leaseholder	Old reservoir. Next to Lyla Tokasi.	Loss of crops and easement for pipeline (parcels 181-003-055 and 56)
12	Ms Meldah Raka	Land Occupier	Old reservoir; after Lyla Tokasi	Loss of crops
13	James Sale	Land Occupier	Old reservoir; after Melda Raka, bush area	Loss of crops
14	James Macleen	Land Occupier	Old reservoir; after Melda Raka, bush area	Loss of crops

Source: Land Acquisition and Resettlement Plan, Tulagi Water Supply Subprojects

198. Inventory of losses had been completed by SW with assistance from the Ministry of Agriculture. SW will follow this up with signing of agreement with the APs regarding the market valuation of their assets prior to cash payment. **Figure 5-2** shows the location of APs.
199. As part of mitigating measures, PMU will monitor and manage the process to ensure that potential land acquisition and physical displacement is considered on site selection and facility design. The approach is to use the existing SW and government lands including road right-of-way to avoid or minimize land impacts to the extent possible.
200. SW will negotiate for water pipeline easement access rather than acquiring leasehold lands. All payments for access easement and crop loss compensation will have to be completed before SW gives access to site to the Contractor.

Figure 5-2: Location of Affected People



Source: Land Acquisition and Resettlement Plan, Tulagi Water Supply Subprojects

5.1.3 EXTRACTION OF LOCAL CONSTRUCTION MATERIALS AND ENVIRONMENTALLY RESPONSIBLE PROCUREMENT

201. Construction activities are expected to use local construction materials such as soil, sand, gravel, and rocks. The contractor will be required to obtain the local materials only from sources that have the required government environmental approvals.
202. Estimated amounts associated with each component are provided in **Table 5-5**.

Table 5-5: Estimated amount of local construction materials

Construction Materials	Quantities	Unit of Measure
Sand	700	m ³
Gravel	125	m ³
Aggregates	1,500	m ³
Portland cement	180	bag
M40 Ready Mix Concrete	2,760	m ³
Reinforcing Steel Bars	485,560	kg
Backfill from Excavation	3,260	m ³
Imported Backfill	490	m ³
32MPa Concrete	75	m ³

Note: These quantities include the facilities, site drainage, trenches, fence, roads

203. Before the start of activities, the contractor will provide the PMU with a Materials Procurement Plan providing information on the sources of materials, transporting modes to sites, stockpiling schemes, and schedules of deliveries. The information will include locations, scale of operations, method of transport of materials, schedule of use relative to the overall construction schedule, and the associated environmental mitigation measures to be instituted in those locations. This will be included in CESMP.

5.1.4 UNEXPLODED ORDNANCE (UXO)

204. During WWII, the project site was subjected to intense battles and while this occurred over 60 years ago, it is possible that a chance discovery of UXO may occur. Prior to construction, a UXO survey (and subsequent UXO clearance if necessary) will be undertaken by a specialized company mandated by SW. SW will appoint specialist for UXO survey/clearance before the start of construction.
205. The contractor will present a chance find procedure as part of the CESMP. Should UXO be discovered, the contractor is to immediately cordon off the area and arrange the evacuation of nearby residences and inform the Royal Solomon Islands Police Force of the find.

5.2 POTENTIAL CONSTRUCTION IMPACTS AND MITIGATING MEASURES

206. The construction phase considerations are site access and clearance including potential disruption of utilities (power and communication cables); soil erosion and sedimentation control; disposal of excavation spoils; oil and hazardous materials management; dust control; site waste management; construction noise and vibration; traffic management; community and occupational health and safety; potential social issues due to influx of workers; potential damage to hidden archaeological and cultural assets; impacts on rare and endangered species; and terrestrial habitat alteration. Contractors will be required to prepare Construction Environmental and Social Management Plan (CESMP) based on the ESMP included as part of the environmental and social assessment. This CESMP will

reflect their commitments and construction methodologies to ensure appropriate environmental and social management on the project sites including COVID-19 preparedness and response.

5.2.1 POTENTIAL CONSTRUCTION IMPACTS AND MITIGATING MEASURES ON PHYSICAL RESOURCES

Soil Erosion and Sedimentation Control

207. Potential sources of sediment runoffs are site clearing, ground leveling, excavations for structures' foundation, and pipe-laying. Soil materials can be carried by runoff to the natural drainage system or to adjacent lots during rainy periods.
208. The contractor will be required to install small interceptor dikes, pipe slope drains, grass bale barriers, silt fence, sediment traps, and temporary sediment basins to divert surface runoffs away from the exposed areas, prevent sediments from moving offsite, and reduce the erosive forces of runoff waters.
209. For all subprojects, the contractor will be required to prepare an erosion and sediment control plan as part of their CESMP. The geotechnical report will be provided as part of the contract documentation. This includes investigation and interpretation of onsite geology, allowing potential contractors to consider their proposed methods and the suitability of site for erosion control.

Disposal of Excavation Spoils

210. Construction activities of subprojects have the potential to generate excess excavation materials for the installation of water supply facilities and other structures.
211. Improper disposal of excavation spoils can be avoided by addressing the issue prior to the start of construction activities. The PMU will:
 - Require the contractors to submit a plan for the disposal of excess excavation spoils, and;
 - Undertake inspection and approval of the contractors' suggested disposal sites prior to actual construction.

Storage, Use and Transportation of Hazardous Materials

212. The use of oil products and other hazardous materials will be required for the construction activities. Fuel, oil, grease, paints, and solvents associated with the operation of heavy equipment and vehicles will be handled on site. Maintenance of equipment will generate hazardous waste such as used engine oil, oil filters, empty containers of hazardous products (paints, solvents). All these products may accidentally be released to the environment and adversely affect water quality and aquatic life. Mitigation measures, where required, include:
 - Prepare a hazardous materials and waste management plan and an emergency response plan as part of the CESMP;
 - ensure all storage containers are in good condition with proper labeling; and

- store diesel fuel, waste oil, used lubricant and other hazardous materials in tightly sealed containers located in dedicated storage facility providing retention capacity (secondary containment to 100% of the tank capacity) in case of leakages.

213. Measures for clean-up and handling of contaminated materials will include:

- immediate clean-up of spills,
- oil-stained wastes and used oil to be collected and disposed of through recyclers / authorized waste handlers and disposal in authorized waste facilities,
- ensure availability of spill cleanup materials such as absorbent pads, spill kits, etc.,
- restoration of temporary work sites will include removal, treatment, and proper disposal of oil contaminated soils,
- discharge of oil contaminated water into the environment to be prohibited; and
- construction personnel designated to handle fuels/hazardous substances to be trained particularly in spill control procedures.

Dust and On-site Air pollution

214. On-site air pollution from dust generation and use of vehicles and equipment can be expected during dry periods from activities associated with site clearing, ground leveling, and excavations for pipe laying. Intermittent episodes of localized air pollution from smoke emitting equipment may also occur as well as wind blowing on large stockpiles of construction materials such as soil and aggregates.

215. Contractors will be required to:

- conduct regular water spraying of roads, work areas and other construction-related facilities to minimize dust generation;
- ensure construction materials stockpiles are covered or sprayed with water, as appropriate, to prevent fine materials from being blown;
- prohibit use of equipment and vehicles that emit dark sooty emissions;
- provide trucks transporting loose construction materials such as sand, gravel, and spoils with tight tarpaulin cover or other suitable materials to avoid spills and dust emission; and
- prohibit burning of all types of wastes generated at the construction sites, workers' camps as well as other project-related facilities and activities.

Generation of Solid Waste

216. Construction activities are expected to generate solid wastes including used wood materials, steel works cuttings, paint, and solvents containers, used packaging materials, on-site office solid wastes, used oil from equipment, unused aggregates, and surplus earth materials. These solid wastes may cause aesthetic problems and be potential sources of contaminants for surface runoff and pollution of nearby water bodies. In addition, improper closure of temporary work sites may create impacts following subproject completion.

217. Contractors will be required to:

- Prepare a waste management plan as part of the CESMP;

- provide garbage bins and facilities within the project site for temporary storage of construction waste and domestic solid waste;
 - separate solid waste into hazardous, non-hazardous and reusable waste streams and store temporarily on-site in secure facilities with weatherproof flooring and roofing;
 - ensure that wastes are not haphazardly dumped within the subproject site and adjacent areas;
 - encourage re-use of excavated excess soil;
 - regularly dispose of wastes to an accepted disposal site as approved by SW-PMU; and
 - prohibit burning of all types of wastes.
218. After completion of work activities, contractors will be required to remove construction wastes from sites, implement the required restoration of disturbed sites and ensure the proper closure of construction sites.
219. All these will be reflected in the CESMP which will contain a subproject specific waste management plan and describing all waste types, amounts, disposal method, transport documentation requirements, and details of licensed waste treatment/recycling facilities for each waste stream.

Decommissioning of Chlorine House, Pump Station and Existing Reservoir

220. In Tulagi, the existing 0.05 ML reservoir, pump station and chlorination house will be decommissioned.
221. To mitigate or avoid risks to operation during decommissioning of existing reservoir, the following measures will be implemented:
- Ensure that the structures to be decommissioned are physically disconnected from the operating structures;
 - Ensure that there will be no stagnant water that will support the growth of biofilms.

5.2.2 POTENTIAL CONSTRUCTION IMPACTS AND MITIGATING MEASURES ON BIOLOGICAL RESOURCES

Impacts on biodiversity

222. Construction impacts on biodiversity are anticipated to be very limited. The small scale of the project and its implementation in sub-urban areas (reservoir and WTP sites), already modified by human occupation and use, will minimize impacts. The pipeline and the secondary mains will be laid along the road, within the right-of-way of the previous installations.
223. Only 1,086 m² and 890 m² will be required for the construction of the WTP and reservoir, respectively. Minimum vegetation clearing will occur of mainly grass and shrubs. Few secondary vegetation trees either of natural or planted origin (palm tree) will be removed.
224. Clearing of vegetation along the pipeline route will be for a distance of 2 km and 5.4 km for the transmission line and distribution network, respectively. After the pipeline has been laid and backfilled, the site will be regularly maintained for access.
225. The removal of a small number of trees from land plots or adjacent road trees should not significantly affect local biodiversity. Trees in such sub-urban areas are generally not

sheltering significant fauna because of the disturbance created by the road traffic and the presence of residences below.

226. Mitigation measures include:

- Strictly limiting vegetation clearing to areas necessary for construction activities;
- Provide immediate fencing of project sites to protect external areas from accidental vegetation clearing.

5.2.3 POTENTIAL CONSTRUCTION IMPACTS AND MITIGATING MEASURES ON SOCIO-ECONOMIC RESOURCES

Disruption of Utilities and Services

227. Proposed subprojects may disrupt existing built environment during construction since water supply pipelines will be generally installed along roads in the urban area. Construction activities may affect existing transportation, water supply system, solid waste management, electricity and communication lines, health services and building infrastructures.

228. Prior to construction activities, SW and the contractors will:

- SW will coordinate with utility providers to obtain information about locations of built environment;
- Coordinate with the other utility companies regarding potential disruptions;
- Make provisions to preserve the operation of current facilities; and
- Notify affected households and establishments well in advance of disruptions.

Construction Noise and Vibration

229. Trucks and construction equipment may significantly increase noise level and create a nuisance for nearby residential areas. The issue is mostly applicable along the roads where water supply pipelines will be installed and the sites for reservoirs. Reference noise levels of various construction equipment (in dBA) are provided in **Table 5-6**.

Table 5-6: Noise Levels of Various Construction Equipment (in dBA)

Equipment Type	15 m	30 m	50 m	100 m	200 m
Excavator / Backhoe	78	72	67	61	53
Bulldozer	78	72	67	61	53
Jackhammer	89	83	78	72	66
Air compressor	75	69	64	58	52
Vibrator	76	70	65	59	53
Mixer	75	69	64	58	52
Truck	76	70	65	59	53

230. In terms of standard applicable for monitoring of noise level at different receptor, the guidelines from International Finance Corporation – Environmental, Health and Safety (IFC-EHS) can be followed. From the guideline, noise impacts should not exceed the

levels presented in **Table 5-7** or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 5-7: Noise Level Guidelines in Different Receptors

Receptor	One Hour L_{Aeq} (dBA)	
	Daytime (07:00 – 22:00)	Nighttime (22:00 – 07:00)
Residential; institutional; educational	55	45
Industrial; commercial	70	70
Source: IFC-EHS Guidelines		

231. Significant vibration from construction activities is not expected in pipeline route since pipeline installation will not involve heavy compaction activities. For the reservoir site, method to lessen vibration may be required due to consolidation and compaction to strengthen reservoir foundations.

232. Contractors will be required to:

- Before site works commence, a Noise and Vibration Control Plan shall be prepared by the Contractor as part of CESMP. The plan shall provide details of mitigation measures, specific locations and schedule where such measures shall be implemented to minimize impacts to sensitive receptors (residential areas, schools, hospitals, etc.) due to construction works, transport of construction materials and other project-related activities;
- Restrict noisy activities to daytime (6:00-19:00) and avoid nighttime activities;
- provide prior notification to the community on schedule of construction activities;
- whenever applicable, provide noisy equipment with noise reduction covers; all construction equipment and vehicles shall be well maintained, regularly inspected for noise emissions, and shall be fitted with appropriate noise suppression equipment consistent with applicable national regulations;
- position stationary equipment that produce elevated noise levels, such as diesel generators and air compressors, as far as practicable from houses and other receptors;
- prohibit operation of noisy equipment and construction works in populated areas and where sensitive receptors are found during nighttime (19:00 – 06:00);
- if nighttime operation, ensure prior notification and consultation will be made with affected people and local officials, and implement suitable noise reduction measures;

233. The contractor will be required to reduce the noise generation from their activities near residential areas and other sensitive receptors.

Vehicular Traffic Congestion Hindrance to Public Access

234. Construction activities and any temporary or partial road closures may cause traffic congestion and hinder public access.

235. Contractors will be required to:

- prepare a traffic management and control plan as part of the CESMP and provide traffic management personnel to direct the flow of traffic in the vicinity of the construction sites and construction-related facilities;
- closely coordinate with local authorities for any closure of roads or rerouting of vehicular traffic;

- provide prior notification to the community on schedule of construction activities;
- provide traffic signs in the vicinity of the construction sites to direct motorists and pedestrians;
- schedule construction activities with consideration to periods of heavy presence of people such as festivities, processions, parades, etc. to minimize disruption to local activities.

Occupational Health and Safety

236. Hazards to construction workers include sharp edges, falling objects, flying sparks, chemicals, noise, and various potentially dangerous situations. It is contractors' duty to protect their employees from workplace hazards that can cause injury. A clean environment is also necessary to enable the workers to maintain good health and hygiene.
237. Health and safety will be managed in accordance with the Safety at Work Act 1987 and best practice will be employed where gaps exist. This specifically refers to the use of Australian and New Zealand standards, guidelines and codes of practice.
238. The contractor is required to have a full-time health and safety representative that will be responsible for ongoing compliance including regular auditing and updates to project specific health and safety documentation. The contractor will prepare the health and safety plan to include the following procedures listed below.
239. Contractors will be required to:
- prepare and implement a health and safety plan (HSP) as part of their CESMP;
 - ensure that a properly equipped and resourced first aid station is available at all times;
 - provide potable water and adequate sanitation facilities including several hand washing stations to comply with Covid 19 obligations;
 - if required, provide adequate and well-ventilated camps and clean eating areas;
 - provide separate sleeping quarters for male and female workers;
 - provide PPE suitable to tasks and activities undertaken to minimize exposure to a variety of hazards;
 - provide fire-fighting equipment and fire extinguishers in workshops, fuel storage facilities, construction camps, and any sites where fire hazard and risk are present;
 - ensure that all workers are aware of emergency response and medical evacuation procedures.
240. The contractor's health and safety plan (HSP) will provide guidance to its staff on how good work practices can be carried out on every activity in the construction site to prevent accidents to the workers and the general public. This will include emergency procedures and the required resources, clear description of responsibilities and management, specific requirements of occupational health and safety policies and regulations, training requirements, and site safety rules. The HSP is one of the inputs to the contractor's CESMP.
241. Considering the most recent COVID-19 threat, the following measures will be implemented to manage risks on construction sites and in workers' housing. The detailed guidance is provided as **Appendix 3** and **Appendix 4** of this document.
- Avoid physical interaction and maintain physical distancing requirements;
 - Limit the capacity of common areas;

- Regular cleaning and disinfection particularly heavily trafficked areas and common areas;
- Promote good personal hygiene such as frequent hand washing with soap and water or alcoholic gel;
- Provide appropriate personal protective equipment (PPE) such as face mask, face shield, etc;
- Monitoring of health status of workers and visitors before entering the site and housing

Community Health and Safety

242. The movement of construction vehicles, trench excavations, and various activities may pose hazards to the public. Any deep excavations may also pose hazards to the public.
243. Many of the measures to manage occupational health and safety will help mitigate the risk to the community. Contractors will be required to:
- implement the various plans to minimize health and safety risks to the public;
 - use barriers and install signage to keep the public away from constructions sites and excavation sites;
 - provide prior notification to the community on schedule of construction activities;
 - provide security personnel in hazardous areas to restrict public access;
 - operate construction night light in the vicinity of construction sites;
 - provide adequate safe passage for public, as necessary, across construction sites; and
 - ensure that any access to properties or establishments that have been disrupted or blocked by the ongoing construction activities, are reinstated as quickly as possible or alternative access is provided.

Potential Social Issues Due to Influx of Workers

244. Presence of workers from outside the Project area may cause some social issues such as potential for conflict with local residents, risk spread of communicable diseases including STIs and HIV and potential gender-based violence (GBV) related concerns. However, due to the small scale of the project, only a limited number of workers will be required, most probably in the range of maximum 50-60 as observed on similar scale projects, part of which could potentially be recruited on site as unskilled workforce.
245. Measures to mitigate such risks and impacts will include:
- Induction of all workers on Project requirements regarding safeguards (including child protection), GRM and CCP;
 - Agreement to and implementation of protocols (including code of conduct) concerning the workers contact with the local communities;
 - Contractor(s) to engage an approved service provider implementation a communicable disease awareness and prevention program;
 - Construction of camp specific for workers;

- No child labor will be employed in the project. The contractor must ensure that all workers are adults above the age of 18 years. The PMU will require the contractor to provide records of workers by age. The PMU will monitor risks of child labour and raise community awareness of the harm caused by children dropping out of school to work;
- Ensuring that sufficient water supply and temporary sanitation facilities including handwashing facilities are provided for workers at work sites in order that community infrastructure is not over-burdened;
- Security at contractor's camp and yard to control access and prevent entry of the public (especially children);
- Workers' participation in addressing GBV issues will be set in an environment where women can openly converse with about these concerns.
- Implementation of GBV awareness training program for contractors (including subcontractors) site personnel

Impacts on Cultural Heritage Resources

246. Available information did not identify any archaeological or cultural assets within the subproject construction areas. This was confirmed on the field and during public consultations held on site. However, precautions will be taken to avoid potential damage to any archaeological and cultural assets discovered during works. The contractor will be requested to develop and implement a "chance to find" procedure throughout the construction works to account for any undiscovered items identified during construction/excavation works. The procedure will include workers training, stop of works, preservation of discovered item, information chain, visit of a specialist if required (Solomon Island National Museum).

Potential Introduction of Alien Species

247. This impact includes the materials such as imported plant and equipment and vessels that import them. All construction equipment i.e., bulldozers, excavators, backhoes will be sourced locally i.e., from Tulagi or nearby areas and as such will limit any bio-security concerns focusing on plant invasive species/disease control.
248. To prevent spread of alien and/or invasive species, imported plant, equipment and materials and the vessels that import them will be subject to clearance procedures under the Bio-Security Act and Regulations and may require issue of phytosanitary certificates from Biosecurity Solomon Islands. It is the importer's responsibility to ensure all machinery that arrives in the Solomon Islands to be free from biosecurity risk material, such as soil, seeds, plant and animal material.

5.3 POTENTIAL OPERATIONAL IMPACTS AND MITIGATING MEASURES

249. Operational considerations of the water supply subprojects will include health and safety risks during operation and maintenance e.g. handling and storage of chlorine. Operational impacts will be addressed by incorporating the necessary measures, such as a water safety plan, use of appropriate operational procedures and ensure effective mitigation and monitoring plan for each subproject.

5.3.1 POTENTIAL OPERATION IMPACTS AND MITIGATING MEASURES ON PHYSICAL RESOURCES

Natural Disaster Impacts

250. It is anticipated that there are unforeseen events in the future due to extreme weather events.
251. SW will develop an emergency response plan in response to natural disasters. SW's staff including communities nearby will be trained on all SOPs associated with disaster management and implementation of the plan.

Generation of Site Waste

252. During operation, it is anticipated to generate solid and liquid waste from storage and office.
253. All solid and liquid waste generated from storage and office will be collected and disposed of in an approved manner and in an approved location.
254. Discharge of backwash water
255. During treatment, solids entrap in the filter media increases which makes the bed less porous thus decreasing the filtration efficiency. Filters will be cleaned regularly in order to remove entrap solids.

5.3.2 POTENTIAL OPERATION IMPACTS AND MITIGATING MEASURES ON SOCIO-ECONOMIC RESOURCES

Health and Safety Risks during Operation and Maintenance

256. Intake structure, WTP, reservoir and transmission and distribution pipeline do not inherently pose significant risk to workers. It must also be noted that the infrastructures are being designed following the ANZ standards.
257. The use of chlorine as a disinfectant may pose safety risks particularly in the new disinfection facility to treat the incoming water. In addition, noise and transportation during operation and maintenance may pose safety risks not only to workers but also to nearby community.
258. To reduce the operational health and safety risk of water supply facilities, the following measures must be implemented:
 - Workers will be trained on health and safety aspects of operating a water supply facilities;
 - A facility health and safety manual will be prepared. An eyewash and shower system will be installed inside the chlorine room.
 - A system will be established for safe use and handling of chlorine materials in the workplace;
 - Workers will be provided with the appropriate PPE for chlorine use and handling; and

- A five-foot-high fence will be erected to control access and avoid exposing the public to any hazard due to the presence of the water supply facilities.

Health Hazard Due to Unplanned Delivery of Poor Water Quality

259. Contamination in water sources may be due to the presence of bacteria, viruses, protozoa, or chemicals. It will result to unplanned delivery to customers of poor water quality from Project facilities.
260. The unplanned delivery to customers of poor water quality from Project facilities can be prevented in a broader scale by:
- Implementing SW's water safety plan as advocated by the WHO. The water safety plan enables SW to (i) prevent contamination of its water sources thru provision of protection zones to prevent pollution from encroachment, logging, etc., (ii) treat the water to reduce or remove contamination that could be present to the extent necessary to meet the water quality targets and ensure water quality monitoring is conducted as indicated in the Environmental Monitoring Plan, and (iii) prevent re-contamination during storage, distribution and handling of drinking water. It is a best practice approach in ensuring delivery of potable water to consumers. SW has updated its water safety plan to conform with WHO requirements.
 - SW will continue to practice water chlorination and ensure that adequate residual disinfection will be maintained to control microbial contamination.

Unplanned Outages and Emergencies

261. Unplanned outages and emergencies in the water supply system will cause loss of adequate water pressure in the network or in worst cases will result to no water being delivered to customers. This may affect public health due to the lack of potable water. There is also the risk of bacterial contamination of the water supply network from contaminated seepages when water pressure is low or no water at all in the pipelines. Seepages may enter the water supply network through leaks, cracks, faulty seals, and other openings. When significant quantity of pathogens has entered the water supply network, chlorine residual normally sustained in the water supply network may not be enough to maintain the necessary water disinfection level. This will have adverse health effects to the consumers and in worst cases will result to outbreak of waterborne disease. Most common causes of unplanned outages and emergencies are lack of adequate backup power supplies, equipment failure, damage to WTP, reservoirs, water pipelines and appurtenances, and accidents.
262. To address the unplanned outages and emergencies of the water supply system:
- Identification of potential causes of unplanned outages and emergencies will be conducted during operation of the water supply system and updated as necessary.
 - Written management procedures for unplanned outages and emergencies as required by the water safety plan implementation (advocated by WHO).
 - Regular inspection and maintenance of the backup power supplies and the associated automatic transfer switch of the backup power at the water treatment plant and water pumping stations to ensure uninterrupted operation during power failure.
 - Regular inspection and maintenance of pumping systems and emergency backup systems to ensure that these are in good working conditions.
 - Implement flushing and disinfection, as necessary, during unplanned outages and emergencies to prevent microbial contamination of the water supply system.

- Written standard operating procedures manual to be available at the facilities to provide guidance to the water supply system's staff on how to handle unplanned outages and emergencies.
- Regular training of water supply system's staff on how to handle unplanned outages and emergencies.

6.0 ANALYSIS OF ALTERNATIVES

6.1 NO PROJECT ALTERNATIVE

263. Due to its resources that are limited consisting of rainwater, which is used to supplement existing sources, and also groundwater which is known to be of limited extent and subject to salinity, Tulagi Island will experience water scarcity in the coming years when it is expected to increase with population.
264. The NRW is still high approaching 75% due to the nature of the network which is primarily galvanized iron dating back to colonial times (at least 80 years old). There will be problems with the distribution due to undersized networks and lack of storage.

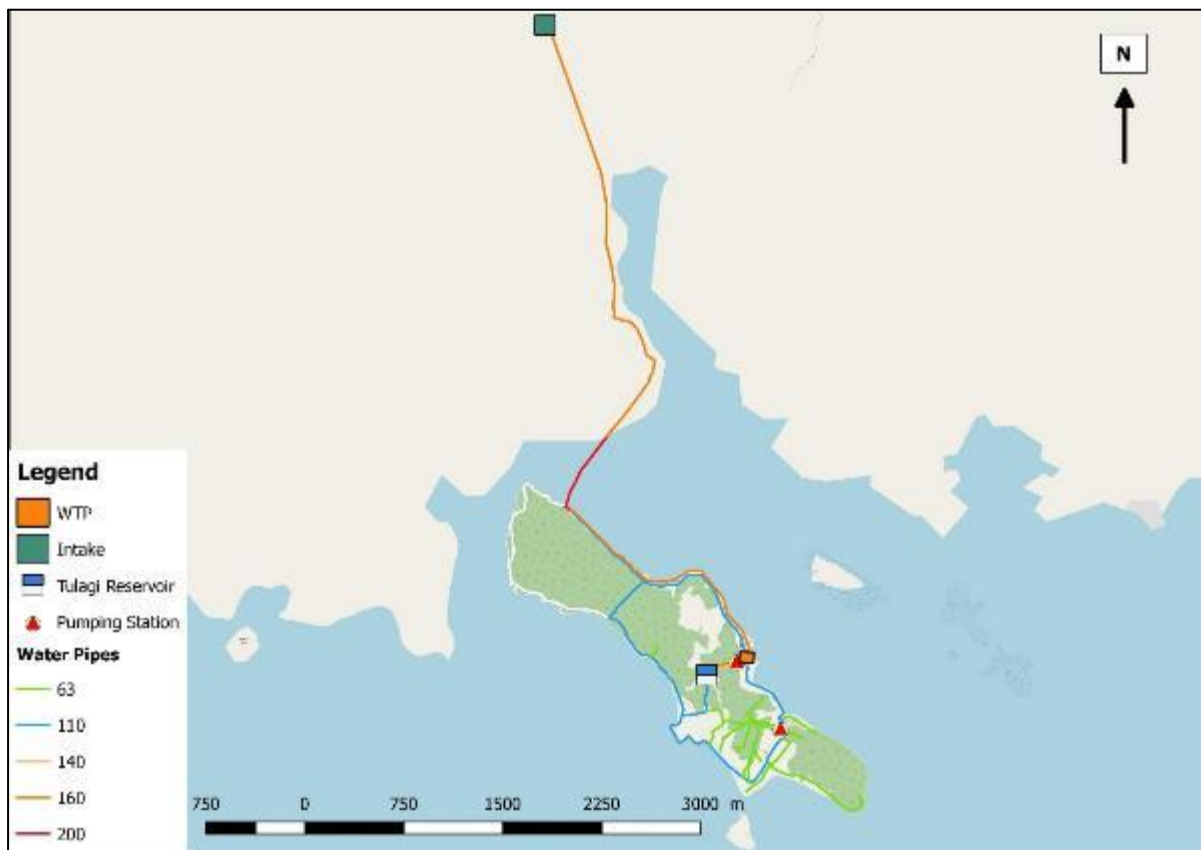
6.2 ALTERNATIVE FOR LOCATION OF WATER TREATMENT PLANT (WTP) AND INSTALLATION OF TRANSMISSION LINE

265. Two different scenarios are studied, the major differences being the location of the treatment plant and the associated transmission line. Both include treatment of the source water at a location on the island and pumping to the centralized reservoir location previously identified with provincial authorities.

6.2.1 SCENARIO 1

266. This scenario involves the following improvements in the short-term:
- Installation of new strainer at the intake, fencing with signage to avoid encroachment, relocation of intake bulk meters to a lower area facilitating reading and ensuring a full section of water (no air) together with monitoring of the source in terms of quantity and quality;
 - Reuse of one of the parallel GI 100 mm inland as dedicated raw water transmission line to the WTP;
 - New WTP (0.4 MLD capacity) using bilayer (sand & anthracite) pressure filter and chlorination located along the main road, next to the solar power plant;
 - New booster pumps at the outlet of the WTP and treated water line to supply high level reservoir;
 - New 0.4 ML steel reservoir located at high level at the center of the island;
 - Creation of two distribution lines and two DMAs for monitoring and NRW reduction;
 - Extension of the distribution system;
 - Installation of a new pumping station with booster pumps from existing chlorine house to supply high level zone with decommissioning of existing high level reservoir.
267. By 2050, the WTP will be extended to 0.8 MLD with an additional filter and a new 0.4 ML reservoir. Strengthening of the transmission line from the source to the WTP will also be necessary to increase the transfer capacity. To reduce the high rate of NRW, complete replacement of GI pipes (about 8 km) is recommended in the short term.
268. A schematic for the long-term configuration is provided in **Figure 6-1**.

Figure 6-1: Schematic for the Long-term Configuration for Scenario 1



Source: SW PRF FSR Tulagi, 07 May 2020

6.2.2 SCENARIO 2

269. Scenario 2 differs from Scenario 1 regarding the WTP location as well as the installation of a raw water transmission line crossing the island to the WTP site.

270. This scenario involves the following improvements in the short term:

- Installation of new strainer at the intake, fencing with signage to avoid encroachment, relocation of intake bulk meters to a lower area facilitating reading and avoiding air issues;
- New raw water line crossing the island plus a pumping station (0.4 MLD capacity). Available head being insufficient, pumping is necessary to supply raw water to the WTP and storage site.
- First phase water treatment including rapid sand/anthracite filtration and chlorination along with steel reservoir (0.4MLD capacity) on the ridge, at the center of the island;
- Creation of two distribution lines and two DMAs for monitoring and NRW reduction;
- New small booster pumps from proposed reservoir to supply high level zone;

271. As per the previous scenario, the WTP will be extended to 0.8 MLD with an additional filter and a new 0.4 ML storage tank to meet long term requirements. To reduce the high rate

of NRW, complete replacement of GI pipes (about 8 km) is recommended in the short term.

272. A schematic for the long-term configuration is provided in **Figure 6-2**.

Figure 6-2: Schematic of the Long-term Configuration for Scenario 2



Source: SW PRF FSR Tulagi, 07 May 2020

273. A final alternative based upon Scenario 1 assumes that no pipe replacement is undertaken. In this instance, the size of treatment, pumping and storage facilities will need to be increased (in fact almost doubled in the short term) and operational costs will increase due to the need to treat and pump more water to provide the same supply.

7.0 GRIEVANCE REDRESS MECHANISM

7.1 PURPOSE

274. This Grievance Redress Mechanism (GRM) is designed to deal with grievances from the public in relation to Solomon Water managed projects at all stages of the project cycle. To date, the GRM has been delivered in English. Awareness of the GRM has been made through consultations in English and Pidgin. Documentation is currently in English but can be provided in Pidgin in future.
275. The mechanism allows for affected parties to make known grievances as they arise and aims to provide a predictable, transparent, timely and credible process to all parties, resulting in outcomes that are fair, effective, and lasting.
276. Inward communications to SW will be filtered at the initial query stage as being project specific or general enquiries by the customer relations team within SW. All external project communications and sites have project identifiers and unique names that allow customers to identify the potential project. Project specific queries will be dealt with confidentially by the Community Liaison Officer (CLO) and a determination made as to the nature and whether a grievance need be raised. Generally, this will involve contacting the requestor.
277. The Grievance redress shall be highlighted to all employees of the contractor and shall be included in the site induction. Where 3rd party agreements are struck with groups or individuals the GRM shall be highlighted, and the contact details of the Project Manager shall be communicated. It shall be noted that this is in addition to their rights under Solomon Islands Law which is applicable in all senses.
278. The Project Managers, as the delegated authority on the contracts will be responsible for managing grievances within the PMU.

7.2 PROCESS

279. The SW GRM is a three-stage process during any stage of which the grievance may be considered, by both parties, to have been resolved and closed off. The Grievance Log Information Sheet associated with the GRM is listed in **Appendix 5**.

7.2.1 STAGE 1

280. Any grievance should first be made known to Solomon Water Project Manager (PM) in charge of the project being implemented. This may initially be verbally however a monitoring form must be prepared and signed off by the party raising the grievance – support to filling in the form can be provided by Solomon Water to the aggrieved party.
281. On receipt of the Grievance Monitoring form the PM will hold a meeting with the aggrieved party in an attempt to resolve the grievance within 5 working days of the grievance being raised. Following the discussion, the grievance may either be resolved or need to be escalated to Stage 2.
282. A Stage 1 Grievance Outcome form should be prepared by the PM confirming either:
- The grievance has been resolved and the means of resolution;
 - The grievance has not been resolved; and outlining Solomon Water Projects Team position on the grievance.

283. The Stage 1 Grievance Outcome form should be signed by both parties and a copy provided to the party raising the grievance. This form should include next steps in the process if they consider the issue not resolved.

7.2.2 STAGE 2

284. If the grievance is not resolved under Stage 1, the grievance should then be referred to the General Manager (GM) of SW.

285. The GM will be provided with the Stage 1 Grievance Outcome form and a meeting arranged with the aggrieved party within 10 working days of issue of the form to discuss and try to resolve the grievance.

286. Based on the discussion the GM will issue a Stage 2 Grievance Outcome form confirming either:

- The grievance has been resolved and the means of resolution;
- The grievance has not been resolved and outlining SW GM position on the grievance.

287. The Stage 2 Grievance Outcome form should be signed by both parties and a copy provided to the party raising the grievance. This should include next steps in the process if the issue has not been resolved.

7.2.3 STAGE 3

288. If the grievance is not resolved under Stage 2 the grievance should then be referred to a three-member Grievance Tribunal⁷ comprised of:

- A member of the Board of SW;
- The PS (or designate) of the MMERE;
- independent member selected by GM SW and Board Chairman.

289. All prior Grievance Outcome reports will be made available to the Tribunal; A meeting with the aggrieved party shall be held within 10 working days of issue of the Stage 2 Grievance Outcome Form.

290. Within 5 working days of the Tribunal meeting a formal response will be issued to the aggrieved party outlining the Tribunal's decision on the grievance raised.

291. The Tribunal's decision will be final.

7.3 MISCELLANEOUS

292. Whenever a grievance is resolved to the satisfaction of both parties, at whichever Stage this is achieved a written record of the agreement must be made and signed by both parties.

⁷ The composition of the Grievance Tribunal should always ensure at least one female member and where the complainant is female should consist of two female members and one male member.

293. At all stages of the process the aggrieved party has the right to be represented by a third party at their own cost. The GRM nor its final decision does not affect the legal rights of the individual.
294. Provisions can be made for persons who cannot read, may have a learning disability, and/or need the written record provided in a written language other than English e.g. having it read to them, translated to a different language etc. when there is a need recognized by local community feedback.
295. SW are responsible to maintain an accurate register of grievances and the way they are dealt with.
296. SW Staff are all familiar with the GRM process and how to raise a grievance. As grievances require close out, a plaintiff must be identified. This preserves the ability to clarify and follow up grievances and agree outcomes. A SW staff member or any person may raise a grievance on behalf of someone but there must be a contact available for correspondence and close out. SW keeps private details of peoples raising grievances, the specific details of, and any details of settlements on a separate drive on their server which is accessible only to executive staff. Absolute confidentiality cannot be assured as SW encourages raising of grievances to any officer or contract staff regardless of station.
297. Each stage in the process allows an appeal through escalation. After the SW Grievance Redress process has been completed to Stage 3, if the plaintiff is still not satisfied, they will be advised that they have legal measures available to them including the right to appeal through the Solomon Islands judicial system.
298. SW Projects Team must hold a grievance review meeting at least once every 6 months to report on all grievances received and in process.
299. A Grievance Log must be maintained by the SW Projects Team and an annual report provided to the GM of SW – this should identify grievances raised (month and to date), grievances resolved (month and to date) and balance of grievances outstanding with specific actions pending. Key information to be included in the grievance log can be found in **Appendix 5**, and includes the type of problem or grievance:
- land related
 - compensation
 - construction
 - resettlement site
 - other (specify)

8.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 INTRODUCTION

300. The role of ESMP is to outline the mitigation measures to be considered during project implementation and operation to avoid or control adverse environmental and social impacts and the actions deemed necessary to implement these measures.
301. It has determined on environmental assessment that the Project will have low significant impacts on the environment. Social impacts are not expected to be significant with land acquisition and resettlement impacts generally avoided and residual impacts mitigated as detailed in the LARP report. The Project can be implemented in an environmentally acceptable manner provided that the mitigation measures to avoid or reduce the environmental and social impacts will be provided. This ESMP includes: (i) implementation arrangement, (ii) mitigating measures to be implemented; (iii) required monitoring and reporting associated with the mitigating measures. It also describes the institutional roles and responsibilities during pre-construction, construction, and operation phases.

8.2 INSTITUTIONAL ARRANGEMENT

302. **MOFT & SW:** The MOFT is the Project executing agency and SW is the implementing agency, operating through a PMU including in particular specialists associated with environmental and social safeguards.
303. **Project Management Unit:** SW has established a PMU to prepare and implement the Project. The PMU will include an environment safeguards officer (ESO) and Resettlement Specialist who will receive training and capacity building from the international environmental specialist (IES) and international social specialist (ISS). Together the ESO, IES and ISS will ensure that all subprojects are implemented in accordance with the Project's EARF, RP and environmental assessments are prepared, and development consents are obtained, and compliance with each subproject ESMP and development consent conditions is monitored and reported.
304. **Construction Contractors:** The contractors undertaking the works will be responsible for ensuring that their activities comply with the environmental and social safeguard requirements of the contract including the ESHS technical specifications. The contractor will prepare a CESMP for review and approval by the PMU prior to any physical works. The CESMP will be activity, site and project-specific and detail how the contractor intends to meet the environmental and social management requirements identified in the ESMP. It will be designed to ensure that appropriate environmental and social management practices are applied throughout the construction period. The CESMP will include all the site-specific and sub-plans necessary to meet the standards and targets set out in the ESMP. The contractor will be required to employ a full-time health and safety officer and an environmental officer as necessary to ensure compliance with all requirements concerning environmental, health, safety, social and labor regulations during construction.
305. **Environmental Conservation Department:** The ECD will review the development consent applications and issue the consents, either with or without conditions. The ECD will be invited to participate in joint inspections and audits during construction activities.
306. A summary of the environmental and social management responsibilities for the Project is presented in **Table 8-1**.

Table 8-1: Summary of Environmental and Social Management Responsibilities in the Project

Project Implementation Organization	Management Roles and Responsibilities
Asian Development Bank / World Bank	<ul style="list-style-type: none"> ▪ Review and clear IEEs/ESMPs ▪ Review bidding documents and clear CESMPs ▪ Review executing agency and implementing agency's submissions for procurement of goods, equipment, works and services ▪ Conducts project review missions, midterm review mission and project completion review mission to assess project implementation progress of all outputs, compliance of project to covenants including safeguards requirements ▪ Provide environmental and social safeguards capacity building to the PMU during missions and remotely as required. ▪ Review semi-annual and annual environmental and social monitoring report
Ministry of Finance and Treasury (executing agency)	<ul style="list-style-type: none"> ▪ Guide and monitor overall project execution ▪ Financial and procurement oversight ▪ Ensure flow of funds to the implementing agency and the timely availability of counterpart funding
Project Steering Committee (PSC)	<ul style="list-style-type: none"> ▪ Responsible for oversight and providing guidance and strategic direction to SW with respect to project implementation ▪ Ensure that the PMU is provided with the necessary resources to effectively carry out its duties and responsibilities.
Solomon Islands Water Authority (implementing agency)	<ul style="list-style-type: none"> ▪ Responsible for overall project implementation and monitoring at the implementing agency level ▪ Ensure adequate funding available for the PMU ▪ Submit semi-annual and annual monitoring reports to ADB and WB ▪ Assist in resolving complaints brought through the Grievance Redress Mechanism (GRM) that have not been resolved at lower levels
SW Project Management Unit	<ul style="list-style-type: none"> ▪ Responsible for overall project management, implementation and monitoring ▪ Responsible for SW's application for a Development Consent ▪ Update the IEE and ESMPs based on the detailed design and submit to ADB and WB for clearance ▪ Ensure environmental safeguard concerns are incorporated in the detailed engineering design ▪ Disclose safeguard documents, as appropriate ▪ Conduct awareness and consultations as per the CCP ▪ Submit monthly, quarterly, semi-annual, and annual monitoring report to SW Management ▪ Review and clear the CESMP of contractors ▪ Review contractor's monthly reports ▪ Implement the GRM and maintain records of complaints/grievances ▪ Ensure the contractor observes the GRM requirements ▪ Ensure contractor compliance with required resources for mitigation measures as reflected in the CESMP ▪ Issue the Community Advisory Committee guidelines to the contractor at Bid Award

Project Implementation Organization	Management Roles and Responsibilities
PMU Environment/Social Officer	<ul style="list-style-type: none"> ▪ Ensure IEE/ESMPs are updated based on the final detailed designs and their disclosure in locations and form accessible to the public ▪ Coordinate with the preparer of bid documents for the inclusion of IEE/ESMPs and CESMP frameworks in the bidding documents and civil works contracts ▪ Ensure required government permits and clearances acquired by SW prior to actual construction activities ▪ Establish system for monitoring environmental and social safeguards of the Project as described in the IEE/ESMPs ▪ Review, monitor, and evaluate the effectiveness of implemented mitigation measures and recommend corrective actions whenever necessary ▪ Prepare monthly environmental monitoring reports for consolidation to the semi-annual monitoring reports for SW and ADB ▪ Ensure GRM is activated prior to the start of construction ▪ During construction, conduct quarterly and additional <i>ad hoc</i> site visits as necessary and coordinate with the project engineers to ensure that required environmental and social mitigation measures are implemented at the construction sites, ▪ Provide training for contractors' environment and safety officers to ensure they understand the ESMP requirements; and ▪ Coordinate with the contractors' EHSO to ensure that environmental and social awareness trainings for workers are done.
PMU Land Officer	<ul style="list-style-type: none"> ▪ Responsible in dealing with land acquisition issues as detailed in LARP
Owner Engineer (OE) or Supervision Engineer (SE) or Project Implementation and Supervision Consultant (PISC) safeguard specialist	<ul style="list-style-type: none"> ▪ Assist PMU in supervising environmental implementation of the project in compliance with safeguards and contract terms ▪ Supervision, monitoring and reporting of CESMP implementation ▪ Provide appropriate action/plan to PMU to correct any non-compliance issue ▪ Assist PMU in preparing of the environmental safeguards monitoring reports for ADB/WB ▪ Assist PMU in organization of training and capacity development
Contractor	<ul style="list-style-type: none"> ▪ Prepare and submit the CESMP prior to construction for review and approval of PMU ▪ Understand the ESMP requirements and allocate necessary resources for implementation ▪ Employ a full-time health and safety officer and an environmental officer as necessary to ensure compliance with all requirements concerning environmental, health, safety, social and labor regulations during construction. In addition, the archaeological findings will be handled by environmental officer in consultation with PMU land officer. ▪ EHSO also provides capacity building and training for workers on CESMP requirements as needed ▪ Implement construction activities with the required mitigation measures ▪ Conduct environmental and social monitoring as required by ESMP

Project Implementation Organization	Management Roles and Responsibilities
	<ul style="list-style-type: none"> ▪ Act promptly on complaints and grievances concerning the construction activities in accordance with the project's GRM ▪ Submit monthly progress reports on CESMP/ESMP implementation to PMU ▪ Publish a construction notice in local media and distribute the notice to affected community members prior to the commencement of construction on-site. ▪ Establish a Community Advisory Committee (CAC) within 4 weeks of the publication of the construction notice. ▪ Hold a minimum of three (3) CAC meetings at the start, during and at the completion of construction works. ▪ Contractor's Terms of Reference for the EHSO (Secretary for the CAC) will include the role, tasks and activities described in the CAC Guidelines.
Environment Conservation Division (ECD)	<ul style="list-style-type: none"> ▪ Responsible for processing of SW's application for a Development Consent ▪ Monitors construction progress for compliance with the terms of the issued Development Consent ▪ Monitors implementation of the mitigation measures and the ESMP in general
Ministry of Mines, Energy and Rural Electrification (MMERE)	<ul style="list-style-type: none"> ▪ Responsible for processing of contractor's application for a BMP regarding mining and extraction of aggregates or gravel from rivers ▪ Monitors contractor's compliance with the terms of the issued BMP

Source: Adapted from EARF, 2019.

8.3 INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

307. In Solomon Islands, complaints about environmental performance of projects issued a Development Consent may also be brought to the attention of ECD of the MECDM. ECD is mandated by law (Environment Act of 1998 and the Environment Regulations of 2008) to monitor the projects issued with a development consent and address concerns, complaints, and grievances of the public regarding project performance.
308. The PER documenting the mitigation measures and consultation process will be submitted to MECDM and will be available for public review. The PER Report will be available to the public from SW website.
309. The Stakeholder Engagement Plan (SEP) for the project documents the information disclosure, consultation and public participation measures to meet ADB and World Bank standards for ongoing and meaningful consultation during construction and operational works.

8.4 ENVIRONMENTAL MANAGEMENT SYSTEM

310. Throughout the Project, for implementation of environmental safeguards to be effective, a robust environmental management and monitoring system will need to be established. The PMU will ensure that the ESMP is updated, as required, based on detailed design, and incorporated into the bid documents. The bid documents will also specify other environmental management requirements such as: (i) requirements to comply with applicable standards; (ii) the contractor designating a full-time environmental, health and safety officer (EHSO) and deputy EHSO and recruiting a community liaison officer (CLO) from the local community and the reporting/communication lines and channels; (iii) the

monitoring and reporting requirements; and (iv) delivery of induction, training and awareness sessions for workers and the community. Prior to works commencing at each subproject site, the contractor will prepare and submit a site-specific construction ESMP (CESMP) to the PMU, the CESMP will be based on the project ESMP and detail the construction methodology and program to be undertaken at each site, identify the risks associated with that construction methodology and detail mitigation measures to avoid or reduce the risks. The PMU will review and clear the CESMP and advise the supervising engineer that the CESMP may be approved and no objection to commencement of works given.

311. Once works commence, the EHSO will conduct monitoring of compliance of activities with the approved CESMP and the PMU will undertake inspections and audits of the effectiveness of the contractor's implementation of the approved CESMP. The PMU will devise the checklist to be used for the inspections and audits and will consolidate the inspection/audit findings along with summaries of the contractor's monthly reporting. WB and ADB will undertake review missions which will report on, inter alia, overall implementation of environmental safeguard requirements.
312. As early as practicable after commencement, the project will operate a grievance redress mechanism (GRM) to address concerns and resolve complaints and issues raised on any aspect of Project and subproject implementation. Safeguards concerns will be addressed through the GRM.
313. The CESMP will outline how the contractor will implement the relevant elements of the GRM and how and when they will provide information about construction activities and timing to the community. The contractor will be expected to provide information about the works, impacts and mitigation/control measures to the community in a timely and effective manner. The contractor's liaison and communication with the community, managed by the CLO, will be guided by the Project's CCP.
314. Workers and sub-contractors will be inducted to the site and this will include awareness and training on the provisions and requirements of the CESMP and how it is to be implemented.

8.5 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

315. The ESMP (including monitoring requirements) for Tulagi water supply system subprojects are presented from **Table 8-2** to **Table 8-4**.

Table 8-2: Environmental and Social Management Plan for Laying of Water Supply Pipelines

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
PRE-CONSTRUCTION							
Climate change vulnerability	Climate change adaptation measures are: i. engineering assessment on potential site erosion ii. appropriate erosion protection for the trunk mains will be determined	Part of detailed design cost	Design Consultant	SW's PMU	Engineering drawings and specifications	Verification of engineering drawings and specifications Once	Minimal cost to SW (verification of documents only)
Improper implementation of ESMP	Tender documents and construction contract will require the following: i. issuance of Contractor's Environmental Management Plan (CESMP) framework to bidders ii. preparation of CESMP prior to construction activities iii. review and approval of CESMP by the Owner's Engineer prior to site mobilization	Part of contractors' bid cost	Design Consultant and Contractor	PMU	CESMP	CESMP submission prior to commencement of site works	Minimal cost to SW (part of consultant's task)
Complaints due to project-related impacts	SW's PMU and the contractors will: i. establish the approved project's grievance redress mechanism (GRM) ii. publicize the existence of the project's GRM through campaigns,	Part of contractors' bid cost	Contractor	PMU	<ul style="list-style-type: none"> ▪ Consultation meetings ▪ Tender documents ▪ GRM activated with community advisory 	Verification of meeting documents, tender documents and in placed CACs After completion of meetings	Minimal cost to SW (part of consultant's task)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<p>website, billboards, etc.</p> <p>iii. ensure that the contact details are placed on notice boards and/or website.</p>				committees (CACs)	Once after preparation of tender documents prepared	
Extraction of local construction materials and environmentally responsible procurement	<p>The contractor will provide sufficient information about the source of construction materials to be used in the project. Sources such as quarries and borrow pits should be:</p> <p>i. Licensed</p> <p>ii. Covered by required government permits</p> <p>iii. Not located within 300 meters of any urban sensitive receptors</p> <p>iv. Provided with drainage and sediment flow controls</p> <p>v. Provided with abandonment plan such as rehabilitation using topsoil and fencing and placing of warning sign</p>	Part of contractors' bid cost	Contractor	PMU	<p>Government permits, license of quarries and borrow pits</p> <p>Operational and abandonment plan</p>	<p>Visual inspection of source</p> <p>Verification of operational and abandonment plan</p> <p>Weekly</p>	Minimal cost to SW (visual inspection of source and verification of plans only)
Land Access Arrangements	SW will use existing road carriage way/easement for the water supply pipeline. The land is government owned. Arrangement for SW's use will be facilitated by their land acquisition specialist	To be part of the project cost.	SW	SW land acquisition specialist	Detail design minimizes relocation	Avoid any need for relocation. Need is not foreseen. In event of a possibility then this will be managed closely by the SW land	Minimal cost to SW (relocation will be managed by SW land acquisition specialist)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
						acquisition specialist	
UXO Survey	i. To be managed by SW	Part of SW cost	SW	PMU Land Officer	Survey has been carried out by approved personals	Certificate showing the project area is UXO free	SW costs
Environmental Capacity Development	The contractor prior to mobilization will conduct orientation for its workers and subcontractors on the provisions of the CESMPs focusing of the mitigating measures to minimize impact of construction.	Part of contractors' bid cost	Contractor	PMU	Number of training conducted and workers trained	Attendance sheets	Part of contractors cost
CONSTRUCTION							
Disruption of utilities and services	SW's PMU and the contractors will: i. coordinate with the other utility companies regarding the potential disruptions ii. make provisions to preserve the operation of current facilities; and iii. provide prior notification to affected households and establishments; iv. re-establish water services once old networks are disconnected.	Part of contractors' bid cost	Contractor	PMU	Coordination with the other utility companies Notification of affected households and establishments	Verification of coordination meetings and notifications After completion of meetings and notifications	Minimal cost to SW (verification of documents only)
Soil erosion and sedimentation control	Earthworks and area to be exposed carefully planned; Measures to divert surface runoffs away from the exposed	Part of contractors' bid cost	Contractor	PMU	<ul style="list-style-type: none"> ▪ Disturbed sites ▪ Use of appropriate 	Visual inspection of sites Verification of plans	Minimal cost to SW (visual inspection of sites and

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<p>areas and to prevent sediments from moving offsite may include</p> <ol style="list-style-type: none"> i. small interceptor dikes, ii. pipe slope drains, iii. grass bale barriers, iv. silt fence, v. sediment traps, and vi. temporary sediment basins; vii. replanting disturbed areas 				sediment controls	Daily during rainy periods	verification of plans only)
Loss of vegetation	<p>SW's PMU and the contractors will:</p> <ol style="list-style-type: none"> i. Conduct bio-physical assessments ii. Limiting vegetation clearing iii. Provide temporary fencing to retained vegetation iv. Promote restoration by planting trees near the project site 	Part of contractors' bid cost	Contractor	PMU	<ul style="list-style-type: none"> ▪ Disturbed sites 	Visual inspection of sites	Minimal cost to SW (visual inspection of sites and verification of plans and permitting only)
Disposal of excavation spoils	<p>The Owner's Engineer will:</p> <ol style="list-style-type: none"> i. Require the contractor's disposal plan i. Inspect the disposal site prior to construction 	Part of contractor bid cost	Contractor	PMU	Contractor's disposal plan	<p>Inspection of disposal site</p> <p>After submission of disposal plan</p>	Minimal cost to SW (visual inspection of sites and verification of plans only)
Oil and hazardous materials management	<p>Measures for clean-up and handling of contaminated materials:</p> <ol style="list-style-type: none"> i. Training on how to handle fuels/hazardous 	Part of contractors' bid cost	Contractor	PMU	Measures required to prevent accidental releases	<p>Visual inspection of storage area;</p> <p>Verification of records</p>	Minimal cost to SW (visual inspection of storage area and

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<ul style="list-style-type: none"> substances and how to contain spills ii. Provision of spill cleanup materials such as absorbent pads, spill kit, etc., iii. Immediate clean-up of spills iv. Collection and disposal of oil-stained wastes and used oil through authorized waste handlers and waste facilities v. Restoration of temporary work sites will include removal, treatment, and proper disposal of oil contaminated soils, 				<ul style="list-style-type: none"> Records of accidental releases Measures for clean-up and handling of contaminated materials Training records of personnel for hazardous materials; 	Daily and as necessary	verification of records only)
Dust control and on-site air pollution due to construction activities	Measures for air pollution due to construction activities: <ul style="list-style-type: none"> i. regular water spraying of roads, work areas and other construction-related facilities to minimize dust generation ii. provision of cover in storage area of construction materials, stockpiles and spoils to prevent fine materials from being blown iii. Prohibit use of equipment and vehicles that emit dark sooty emissions 	Part of contractors' bid cost	Contractor	PMU	<ul style="list-style-type: none"> Dust generation Smoke emitting equipment, Open burning of materials 	Visual inspection of sites Daily	Minimal cost to SW (visual inspection of sites only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<ul style="list-style-type: none"> iv. Provision of tight tarpaulin cover on delivery trucks to avoid spills and dust emission; and v. Prohibit burning of all types of wastes generated 						
Improper solid waste management	<p>Measures for solid waste management:</p> <ul style="list-style-type: none"> i. Provision of garbage bins for domestic solid waste and temporary storage area for construction and demolition waste ii. Segregation of solid waste into hazardous, non-hazardous and reusable waste iii. Storage area should be secured and has weatherproof flooring iv. Regular disposal of wastes to the Ranadi Landfill v. Prohibit burning of all types of wastes generated vi. Removal of construction and demolition wastes from the sites after work completion, and vii. Restoration of disturbed sites. 	Part of contractor bid cost	Contractor	PMU	Contractor's disposal plan	<p>Inspection of disposal site</p> <p>After submission of disposal plan</p>	Minimal cost to SW (visual inspection of site and verification of plans only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
Construction noise and vibration	Measures for construction noise and vibration: <ol style="list-style-type: none"> <li data-bbox="489 337 770 500">i. Prior notification to the community on schedule of construction activities especially nighttime activities <li data-bbox="489 505 770 581">ii. Provision of noisy equipment with noise reduction covers <li data-bbox="489 586 770 800">iii. Position stationary noisy equipment (genset, compressors, batching and rock crushing plant, etc.) away from houses and other receptors <li data-bbox="489 805 770 914">iv. If possible, avoid working during nighttime (19:00-06:00) <li data-bbox="489 919 770 1133">v. Conduct regular noise level monitoring (the limits near residential area are 55 and 45 dB(A) during daytime and nighttime, respectively) 	Part of contractors' bid cost	Contractor	PMU	Noise level Normal operation schedule	Noise meter Daily / as necessary	Minimal cost to SW after purchasing of noise meter reader
Hindrances to public access	Measures for accessibility: <ol style="list-style-type: none"> <li data-bbox="489 1198 770 1328">i. Coordinate with local authorities for any closure of roads or rerouting of vehicular traffic 	Part of contractors' bid cost	Contractor	PMU	Traffic signs in vicinity of construction sites Schedule of festivities, processions, parades, etc.	Verification of traffic management plan Visual inspection of sites Daily	Minimal cost to SW (visual inspection of site and verification of plans only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<ul style="list-style-type: none"> ii. Provision of traffic signs in the vicinity of the construction sites iii. Consideration on schedules of festivities, processions, parades, etc. 						
Community health and safety	<p>Measures for community health and safety:</p> <ul style="list-style-type: none"> i. Use barriers and install signage ii. Provision of security personnel in hazardous areas to restrict public access iii. Operate construction night light at the vicinity of construction sites; and iv. Provision of adequate safe passageways for the public crossing the construction sites v. Refer to Appendix for COVID measures vi. Advise local community of site health and safety site plans and seek feedback on appropriate mitigation measures via Community Advisory Committee meetings. 	Part of contractors' bid cost	Contractor	PMU	<p>Construction safety policy</p> <p>Hazards in the area</p> <p>Safety control such as signages, lightings, and barriers</p> <p>Health and safety records (near miss, first aide, lost time accident)</p> <p>Adherence to measures and ADB/WG COVID-19 guidelines</p>	<p>Verification of construction safety policy and health and safety record</p> <p>Visual inspection of site</p> <p>Daily</p>	Minimal cost to SW (visual inspection of site and verification of plans only)
Occupational health and safety at work sites	<p>Measures include:</p> <ul style="list-style-type: none"> i. Implementation of construction site 	Part of contractors' bid cost	Contractor	PMU	Construction of health and safety plan	Verification of health and safety plan	Minimal cost to SW (visual

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<ul style="list-style-type: none"> health and safety management plan (CSHSMP), ii. Ensure that first aid station is always available iii. Provision of appropriate personal protective equipment (PPE), iv. Providing of emergency response equipment such as fire-fighting equipment, fire extinguishers, etc. v. Provision of potable water and adequate sanitation facilities, vi. Provision of workers with adequate and well-ventilated camps, clean eating areas, and separate sleeping quarters for male and female workers. vii. Refer to Appendix for COVID measures 				<p>First aid station, PPE, emergency response equipment and sanitation facilities</p> <p>Health and safety records (near miss, first aide, lost time accident)</p>	<p>Verification of health and safety record Visual inspection of site</p> <p>Daily</p>	<p>inspection of site and verification of plans and records only)</p>
Potential social issues due to influx of workers	<p>Measures include:</p> <ul style="list-style-type: none"> i. Induction of all workers on Project requirements regarding safeguards (including child protection), GRM and CCP; ii. Agreement to and implementation of 	Part of contractors' bid cost	Contractor	SW's PMU	Implementation of workers induction, required protocols, and disease awareness and prevention program	<p>Verification of records</p> <p>Visual inspection of site</p> <p>At start of work Monthly</p>	Minimal cost to SW (visual inspection of site and verification of records only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<p>protocols (including code of conduct) concerning the workers contact with the local communities;</p> <p>iii. Implementation of a communicable disease awareness and prevention program;</p> <p>iv. Construction of camp specific for workers;</p> <p>v. No child labor will be employed in the project;</p> <p>vi. Ensuring that sufficient water supply and temporary sanitation facilities including handwashing facilities are provided for workers at work sites;</p> <p>vii. Security at contractor's camp and yard to control access and prevent entry of the public (especially children);</p> <p>viii. Workers' participation in addressing GBV issues will be set in an environment where women can openly converse with about these concerns; and</p>				Administrative signages		

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	ix. Implementation of GBV awareness training program for contractors (including subcontractors) site personnel						
Potential damage to hidden archaeological and cultural assets	Tender documents and construction contract will require the following: i. Cultural heritage impact assessment will be done prior to construction to identify any cultural or archaeological assets ii. Immediate stoppage upon discovery of archaeological and cultural assets iii. Inform the local authorities and the Solomon Island National Museum about the presence	Part of specs preparation cost	Design Consultant	PMU	Tender documents	Verification of tender documents Once after preparation of tender documents	Minimal cost (part of consultant's task)
Potential Introduction of Alien Species	The imported plant, equipment and materials and the vessels that import them will be subject to clearance procedures under the Bio-Security Act and Regulations and may require issue of phytosanitary certificates from Biosecurity Solomon Islands.	Part of importation cost	Contractor /Importer	PMU	Certificates from Biosecurity Solomon Islands	Verification of certificates Once after acquisition of certificates	Minimal cost (part of consultant's task)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
Improper closure of construction sites after subproject completion.	Site restoration and removal of all temporary facilities, excess materials, equipment, plant and excavated materials on site; all dumping will be to approved locations. Replanting of disturbed sites in accordance with replanting plan.	Part of contractors' bid cost	Contractor	PMU	Disturbed sites, staging areas and workers camps.	Visual inspection of sites Review and "clear" site remediation through issue of certificate Once when all site work is complete	Minimal cost to SW (visual inspection of site only)
OPERATIONS							
Health and safety risks during operation and maintenance	Mitigating measures include: i. Identification of potential causes ii. Provision of written management procedures iii. Provision of written standard operating procedures (SOPs)	Part of SW's operational cost	SW's Operations Dept.	SW's Operations Dept. Mgt	Written management procedures SOPs	Verification of management procedures, SOPs and records Weekly verification Implementation of SOPs	Minimal cost (verification of documents only)
Health hazard due to unplanned delivery of poor water quality	Implementation of WSP to: i. prevent contamination of the water sources, ii. treat the water to meet the water quality targets, and iii. prevent re-contamination during storage, distribution and handling of drinking water	Part of SW's operational cost	SW's Operations Department	SW's Operations Dept. Mgt.	WSP Physical, Chemical and Biological parameters	Verification of WSP implementation Water sampling and laboratory test Monthly for plan and for bacteria; Annual for physical & chemical	Part of SW's operational cost

Table 8-3: Environmental and Social Management Plan for Construction of Reservoir

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
PRECONSTRUCTION							
Climate change vulnerability	Climate change adaptation measures are: i. engineering assessment on potential site erosion ii. appropriate erosion protection for the trunk mains will be determined	Part of detailed design cost	Design Consultant	PMU	Engineering drawings and specifications	Verification of engineering drawings and specifications Once	Minimal cost to SW (verification of documents only)
Improper implementation of ESMP	Tender documents and construction contract will require the following: i. issuance of Contractor's Environmental and Social Management Plan (CESMP) framework to bidders ii. preparation of CESMP prior to construction activities iii. review and approval of CESMP by the Owner's Engineer prior to site mobilization	Part of contractors' bid cost	Design Consultant and Contractor	PMU	CESMP	CESMP submission prior to commencement of site works	Minimal cost to SW (part of consultant's task)
Complaints due to project-related impacts	SW's PMU and the contractors will: i. establish the approved project's grievance redress mechanism (GRM) ii. publicize the existence of the project's GRM through campaigns,	Part of contractors' bid cost	Contractor and SW's PMU	PMU	<ul style="list-style-type: none"> ▪ Consultation meetings ▪ Tender documents ▪ GRM activated with community advisory committees (CACs) 	Verification of meeting documents, tender documents and in placed CACs After completion of meetings	Minimal cost to SW (part of consultant's task)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
	<p>website, billboards, etc.</p> <p>iii. ensure that the contact details are placed on notice boards and/or website.</p>					Once after preparation of tender documents prepared	
Extraction of local construction materials and environmentally responsible procurement	<p>The contractor will provide sufficient information about the source of construction materials to be used in the project. Sources such as quarries and borrow pits should be:</p> <p>i. Licensed</p> <p>ii. Covered by required government permits</p> <p>iii. Not located within 300 meters of any urban sensitive receptors</p> <p>iv. Provided with drainage and sediment flow controls</p> <p>v. Provided with abandonment plan such as rehabilitation using topsoil and fencing and placing of warning sign</p>	Part of contractors' bid cost	Contractor	PMU	<p>Government permits, license of quarries and borrow pits</p> <p>Operational and abandonment plan</p>	<p>Visual inspection of source</p> <p>Verification of operational and abandonment plan</p> <p>Weekly</p>	Minimal cost to SW (visual inspection of source and verification of plans only)
Land Access Arrangements	The land is government owned. Arrangement for SW's use will be facilitated by their land acquisition specialist	To be part of the project cost.	SW	PMU Land Officer	Detail design minimizes relocation	Avoid any need for relocation. Need is not foreseen. In event of a possibility then this will be managed closely by the SW land acquisition specialist.	Minimal cost to SW (relocation will be managed by SW land acquisition specialist)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
UXO Survey	<ul style="list-style-type: none"> ▪ Provision to carry out UXO survey; and ▪ Provision in the contract 	Part of contractors' bid cost	Contractor	PMU	Survey has been carried out by approved personals	Certificate showing the project area is UXO free	Minimal cost to SW (verification of UXO survey certificate only)
Environmental Capacity Development	The contractor prior to mobilization will conduct orientation for its workers and subcontractors on the provisions of the CESMPs focusing of the mitigating measures to minimize impact of construction.	Part of contractors' bid cost	Contractor	PMU	Number of training conducted and workers trained	Attendance sheets	Part of contractors cost
CONSTRUCTION							
Soil erosion and sedimentation control	<p>Earthworks and are to be exposed carefully planned.</p> <p>Measures to divert surface runoffs away from the exposed areas and to prevent sediments from moving offsite may include</p> <ol style="list-style-type: none"> i. small interceptor dikes, ii. pipe slope drains, iii. grass bale barriers, iv. silt fence, v. sediment traps, and temporary sediment basins; vi. Replanting disturbed areas 	Part of contractors' bid cost	Contractor	PMU	<p>Disturbed sites</p> <p>Use of appropriate sediment controls</p>	<p>Visual inspection of sites</p> <p>Verification of plans</p> <p>Daily during rainy periods</p>	Minimal cost to SW (visual inspection of sites and verification of plans only)
Loss of vegetation	<p>SW's PMU and the contractors will:</p> <ol style="list-style-type: none"> i. Conduct bio-physical assessments 	Part of contractors' bid cost	Contractor	PMU	<ul style="list-style-type: none"> ▪ Disturbed sites ▪ Plans and permits and 	Visual inspection of sites	Minimal cost to SW (visual inspection of sites and

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
	<ul style="list-style-type: none"> ii. Limiting vegetation clearing iii. Provide temporary fencing to retained vegetation iv. Securing tree cutting permit v. Promote restoration by planting trees near the project site 				clearances from relevant government agencies	Verification of plans and permitting requirements	verification of plans and permitting only)
Disposal of excavation spoils	<p>The Owner's Engineer will:</p> <ul style="list-style-type: none"> ii. Require the contractor's disposal plan iii. Inspect the disposal site prior to construction 	Part of contractor bid cost	Contractor	PMU	Contractor's disposal plan	<p>Inspection of disposal site</p> <p>After submission of disposal plan</p>	Minimal cost to SW (visual inspection of sites and verification of plans only)
Oil and hazardous materials management	<p>Measures for clean-up and handling of contaminated materials:</p> <ul style="list-style-type: none"> i. Training on how to handle fuels/hazardous substances and how to contain spills ii. Provision of spill cleanup materials such as absorbent pads, iii. Immediate clean-up of spills iv. Collection and disposal of oil-stained wastes and used oil through authorized waste handlers and waste facilities 	Part of contractors' bid cost	Contractor	PMU	<p>Measures required to prevent accidental releases</p> <p>Records of accidental releases</p> <p>Measures for clean-up and handling of contaminated materials</p> <p>Training records of personnel for hazardous materials;</p>	<p>Visual inspection of storage area;</p> <p>Verification of records</p> <p>Daily and as necessary</p>	Minimal cost to SW (visual inspection of storage area and verification of records only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
	v. Restoration of temporary work sites will include removal, treatment, and proper disposal of oil contaminated soils,						
Dust control and on-site air pollution due to construction activities	Measures for air pollution due to construction activities: i. regular water spraying of roads, work areas and other construction-related facilities to minimize dust generation ii. provision of cover in storage area of construction materials, stockpiles and spoils to prevent fine materials from being blown iii. Prohibit use of equipment and vehicles that emit dark sooty emissions iv. Provision of tight tarpaulin cover on delivery trucks to avoid spills and dust emission; and v. Prohibit burning of all types of wastes generated	Part of contractors' bid cost	Contractor	PMU	Dust generation Smoke emitting equipment, ▪ Open burning of materials	Visual inspection of sites Daily	Minimal cost to SW (visual inspection of sites only)
Improper solid waste management	Measures for solid waste management: i. Provision of garbage bins for domestic solid waste and	Part of contractor bid cost	Contractor	PMU	Contractor's disposal plan	Inspection of disposal site After submission of disposal plan	Minimal cost to SW (visual inspection of site and verification of plans only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<ul style="list-style-type: none"> temporary storage area for construction and demolition waste ii. Segregation of solid waste into hazardous, non- hazardous and reusable waste iii. Storage area should be secured and has weatherproof flooring iv. Regular disposal of wastes to the Ranadi Landfill v. Prohibit burning of all types of wastes generated vi. Removal of construction and demolition wastes from the sites after work completion, and vii. Restoration of disturbed sites. 						
Construction noise and vibration	Measures for construction noise and vibration: <ul style="list-style-type: none"> i. Prior notification to the community on schedule of construction activities specially nighttime activities ii. Provision of noisy equipment with noise reduction covers iii. Position stationary noisy equipment (genset, compressors, batching and rock 	Part of contractors' bid cost	Contractor	PMU	Noise level Normal operation schedule	Noise meter Daily / as necessary	Minimal cost to SW after purchasing of noise meter reader

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
	crushing plant, etc.) away from houses and other receptors iv. If possible, avoid working during nighttime (19:00-06:00) v. Conduct regular noise level monitoring (the limits near residential area are 55 and 45 dB(A) during daytime and nighttime, respectively)						
Community health and safety	Measures for community health and safety: i. Use barriers and install signage ii. Provision of security personnel in hazardous areas to restrict public access iii. Operate construction night light at the vicinity of construction sites; and iv. Provision of adequate safe passageways for the public crossing the construction sites v. Refer to Appendix for COVID measures vi. Advise local community of site health and safety site plans and seek feedback on appropriate mitigation measures via	Part of contractors' bid cost	Contractor	PMU	Construction safety policy Hazards in the area Safety control such as signages, lightings, and barriers Health and safety records (near miss, first aide, lost time accident) Adherence to measures and ADB/WG COVID-19 guidelines	Verification of construction safety policy and health and safety record Visual inspection of site Daily	Minimal cost to SW (visual inspection of site and verification of plans only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
	Community Advisory Committee meetings.						
Occupational health and safety at work sites	Measures include: i. Implementation of construction site health and safety management plan (CSHSMP), ii. Ensure that first aid station is always available iii. Provision of appropriate personal protective equipment (PPE), iv. Providing of emergency response equipment such as fire-fighting equipment, fire extinguishers, etc. v. Provision of potable water and adequate sanitation facilities, vi. Provision of workers with adequate and well-ventilated camps, clean eating areas, and separate sleeping quarters for male and female workers vii. Refer to Appendix for COVID measures	Part of contractors' bid cost	Contractor	PMU	Construction of health and safety plan First aid station, PPE, emergency response equipment and sanitation facilities Health and safety records (near miss, first aide, lost time accident)	Verification of health and safety plan Verification of health and safety record Visual inspection of site Daily	Minimal cost to SW (visual inspection of site and verification of plans and records only)
Potential social issues due to influx of workers	Measures include: i. Induction of all workers on Project requirements regarding safeguards (including child	Part of contractors' bid cost	Contractor	SW's PMU	Implementation of workers induction, required protocols, and disease awareness and	Verification of records Visual inspection of site	Minimal cost to SW (visual inspection of site and verification of records only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
	<ul style="list-style-type: none"> protection), GRM and CCP; ii. Agreement to and implementation of protocols (including code of conduct) concerning the workers contact with the local communities; iii. Implementation of a communicable disease awareness and prevention program; iv. Construction of camp specific for workers; v. No child labor will be employed in the project; vi. Ensuring that sufficient water supply and temporary sanitation facilities including handwashing facilities are provided for workers at work sites; vii. Security at contractor's camp and yard to control access and prevent entry of the public (especially children); viii. Workers' participation in addressing GBV issues will be set in an environment where women can openly converse with 				<ul style="list-style-type: none"> prevention program Administrative signages 	<ul style="list-style-type: none"> At start of work Monthly 	

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
	<p>about these concerns; and</p> <p>ix. Implementation of GBV awareness training program for contractors (including subcontractors) site personnel</p>						
Potential damage to hidden archaeological and cultural assets	<p>Tender documents and construction contract will require the following:</p> <p>i. Cultural heritage impact assessment will be done prior to construction to identify any cultural or archaeological assets</p> <p>ii. Immediate stoppage upon discovery of archaeological and cultural assets</p> <p>iii. Inform the local authorities and the Solomon Island National Museum about the presence</p>	Part of specs preparation cost	Design Consultant	PMU	Tender documents	<p>Verification of tender documents</p> <p>Once after preparation of tender documents</p>	Minimal cost (part of consultant's task)
Potential Introduction of Alien Species	The imported plant, equipment and materials and the vessels that import them will be subject to clearance procedures under the Bio-Security Act and Regulations and may require issue of phytosanitary certificates from Biosecurity Solomon Islands.	Part of importation cost	Contractor /Importer	PMU	Certificates from Biosecurity Solomon Islands	<p>Verification of certificates</p> <p>Once after acquisition of certificates</p>	Minimal cost (part of consultant's task)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/ Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
Improper closure of construction sites after subproject completion.	Site restoration and removal of all temporary facilities, excess materials, equipment, plant and excavated materials on site; all dumping will be to approved locations. Replanting of disturbed sites in accordance with replanting plan.	Part of contractors' bid cost	Contractor	PMU	Disturbed sites, staging areas and workers camps.	Visual inspection of sites Review and "clear" site remediation through issue of certificate Once when all site work is complete	Minimal cost to SW (visual inspection of site only)
OPERATIONS							
Health and safety risks during operation and maintenance	Mitigating measures include: i. Identification of potential causes ii. Provision of written management procedures iii. Provision of written standard operating procedures (SOPs) iv. Controlling the access of unauthorized personnel in the reservoir by providing fence around the perimeter v. Regular training of workers on health and safety aspects of operating how to operate a water supply tank vi. Chlorine gas cylinders will be kept in separate safety rooms	Part of SW's operational cost	SW's Operations Dept.	SW's Operations Dept. Mgt	Written management procedures SOPs Facility fence	Verification of management procedures, SOPs and records Weekly verification Implementation of SOPs	Minimal cost (verification of documents only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
	<ul style="list-style-type: none"> vii. Provision of safety control for chlorine gas cylinders like automated shutoff system viii. Preparation of SOPs for chlorine handling ix. Provision appropriate PPE for chlorine use and handling 						
Health hazard due to unplanned delivery of poor water quality	<p>Implementation of WSP to:</p> <ul style="list-style-type: none"> i. prevent contamination of its water sources thru provision of protection zones to prevent pollution from encroachment, logging, etc., ii. treat the water to meet the water quality targets, ensure water quality monitoring is conducted as indicated in the Environmental Monitoring Plan, and prevent re-contamination during storage, distribution and handling of drinking water 	Part of SW's operational cost	SW's Operations Department	SW's Operations Dept. Mgt.	WSP Physical, Chemical and Biological parameters	<p>Verification of WSP implementation</p> <p>Water sampling and laboratory test</p> <p>Monthly for plan and for bacteria;</p> <p>Annual for physical & chemical</p>	Part of SW's operational cost
Unplanned outages and emergencies	<p>Mitigating measures include:</p> <ul style="list-style-type: none"> i. Regular inspection and maintenance of pumping systems and emergency backup systems 	Part of SW's operational cost	SW's Operations Dept.	SW's Operations Dept. Mgt	Records of inspection and maintenance of backup power and pumping systems,	<p>Weekly verification of records of inspection and maintenance</p> <p>Verification of records on flashing</p>	Minimal cost (verification of documents only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision/Monitoring	Aspects/Parameters to be monitored	Means of Monitoring/Frequency	Monitoring Cost
	<ul style="list-style-type: none"> ii. Ensure that disinfection system is working iii. Regular training of water supply system staffs on how to handle unplanned outages and emergencies 				<p>Records on flushing and disinfection during unplanned outages and emergencies</p> <p>Records on training of water supply system staffs</p>	and disinfection after incidents	

Table 8-4: Environmental and Social Management Plan for Construction of Water Treatment Plant

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
PRECONSTRUCTION							
Climate change vulnerability	Climate change adaptation measures are: i. engineering assessment on potential site erosion ii. appropriate erosion protection for the trunk mains will be determined	Part of detailed design cost	Design Consultant	PMU	Engineering drawings and specifications	Verification of engineering drawings and specifications Once	Minimal cost to SW (verification of documents only)
Improper implementation of ESMP	Tender documents and construction contract will require the following: i. issuance of CESMP framework to bidders ii. preparation of CESMP prior to construction activities iii. review and approval of CESMP by the Owner's Engineer prior to site mobilization	Part of contractors ' bid cost	Design Consultant and Contractor	PMU	CESMP	CESMP submission prior to commencement of site works	Minimal cost (part of consultant's task)
Complaints due to project-related impacts	SW's PMU and the contractors will: i. establish the approved project's GRM ii. publicize the existence of the project's GRM through campaigns, website, billboards, etc. iii. ensure that the contact details are	Part of contractors ' bid cost	Contractor	PMU	Consultation meetings Tender documents GRM activated with CACs	Verification of meeting documents, tender documents and in placed CACs After completion of meetings Once after preparation of tender documents prepared	Minimal cost (part of consultant's task)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	placed on notice boards and/or website.						
Extraction of local construction materials and environmentally responsible procurement	The contractor will provide sufficient information about the source of construction materials to be used in the project. Sources such as quarries and borrow pits should be: vi. Licensed vii. Covered by required government permits viii. Not located within 300 meters of any urban sensitive receptors ix. Provided with drainage and sediment flow controls i. Provided with abandonment plan such as rehabilitation using topsoil and fencing and placing of warning sign	Part of contractors ' bid cost	Contractor	PMU	Government permits, license of quarries and borrow pits Operational and abandonment plan	Visual inspection of source Verification of operational and abandonment plan Weekly	Minimal cost to SW (visual inspection of source and verification of plans only)
Land Access Arrangements	The land is government owned. Arrangement for SW's use will be facilitated by their land acquisition specialist	To be part of the project cost.	SW	SW	Detail design within allocated site	No relocation	Minimal cost to SW (relocation will be managed by SW land acquisition specialist)
UXO Survey	<ul style="list-style-type: none"> ▪ To be managed by SW 	Part of SW cost	SW	PMU officer	Survey has been carried out by	Certificate showing the project area is UXO free	SW cost

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
					approved personals		
Environmental Capacity Development	The contractor prior to mobilization will conduct orientation for its workers and subcontractors on the provisions of the CESMPs focusing of the mitigating measures to minimize impact of construction.	Part of contractors ' bid cost	Contractor	PMU	Number of training conducted and workers trained	Attendance sheets	Part of contractors cost
CONSTRUCTION							
Soil erosion and sedimentation control	Measures to divert surface runoffs away from the exposed areas and to prevent sediments from moving offsite may include <ul style="list-style-type: none"> i. small interceptor dikes, ii. pipe slope drains, iii. grass bale barriers, iv. silt fence, v. sediment traps, and temporary sediment basins; vi. Replanting disturbed areas 	Part of contractors ' bid cost	Contractor	PMU	Disturbed sites Use of appropriate sediment controls	Visual inspection of sites Verification of plans Daily during rainy periods	Minimal cost to SW (visual inspection of sites and verification of plans only)
Loss of vegetation	SW's PMU and the contractors will: <ul style="list-style-type: none"> i. Conduct bio-physical assessments ii. Limiting vegetation clearing iii. Provide temporary fencing to retained vegetation 	Part of contractors ' bid cost	Contractor	PMU	▪ Disturbed sites	Visual inspection of sites	Minimal cost to SW (visual inspection of sites and verification of plans and permitting only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	iv. Promote restoration by planting trees near the project site						
Disposal of excavation spoils	The Owner's Engineer will: i. Require the contractor's disposal plan ii. Inspect the disposal site prior to construction	Part of contractor bid cost	Contractor	PMU	<ul style="list-style-type: none"> ▪ Contractor's disposal plan 	<p>Inspection of disposal site</p> <p>After submission of disposal plan</p>	Minimal cost to SW (visual inspection of sites and verification of plans only)
Oil and hazardous materials management	Measures for clean-up and handling of contaminated materials: i. Training on how to handle fuels/hazardous substances and how to contain spills ii. Provision of spill cleanup materials such as absorbent pads, iii. Immediate clean-up of spills iv. Collection and disposal of oil-stained wastes and used oil through authorized waste handlers and waste facilities v. Restoration of temporary work sites will include removal, treatment, and proper disposal of oil contaminated soils,	Part of contractors ' bid cost	Contractor	PMU	<p>Measures required to prevent accidental releases</p> <p>Records of accidental releases</p> <p>Measures for clean-up and handling of contaminated materials</p> <p>Training records of personnel for hazardous materials;</p>	<p>Visual inspection of storage area;</p> <p>Verification of records</p> <p>Daily and as necessary</p>	Minimal cost to SW (visual inspection of storage area and verification of records only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
Dust control and on-site air pollution due to construction activities	Measures for air pollution due to construction activities: <ol style="list-style-type: none"> i. regular water spraying of roads, work areas and other construction-related facilities to minimize dust generation ii. provision of cover in storage area of construction materials, stockpiles and spoils to prevent fine materials from being blown iii. Prohibit use of equipment and vehicles that emit dark sooty emissions iv. Provision of tight tarpaulin cover on delivery trucks to avoid spills and dust emission; and v. Prohibit burning of all types of wastes generated 	Part of contractors' bid cost	Contractor	PMU	Dust generation Smoke emitting equipment, Open burning of materials	Visual inspection of sites Daily	Minimal cost to SW (visual inspection of sites only)
Improper solid waste management	Measures for solid waste management: <ol style="list-style-type: none"> i. Provision of garbage bins for domestic solid waste and temporary storage area for construction and demolition waste ii. Segregation of solid waste into hazardous, non- 	Part of contractor bid cost	Contractor	PMU	Contractor's disposal plan	Inspection of disposal site After submission of disposal plan	Minimal cost to SW (visual inspection of site and verification of plans only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	hazardous and reusable waste iii. Storage area should be secured and has weatherproof flooring iv. Regular disposal of wastes to the Ranadi Landfill v. Prohibit burning of all types of wastes generated vi. Removal of construction and demolition wastes from the sites after work completion, and vii. Restoration of disturbed sites.						
Construction noise and vibration	Measures for construction noise and vibration: i. Prior notification to the community on schedule of construction activities especially nighttime activities ii. Provision of noisy equipment with noise reduction covers iii. Position stationary noisy equipment (genset, compressors, batching and rock crushing plant, etc.) away from houses and other receptors	Part of contractors' bid cost	Contractor	PMU	Noise level Normal operation schedule	Noise meter Daily / as necessary	Minimal cost to SW after purchasing of noise meter reader

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<ul style="list-style-type: none"> iv. If possible, avoid working during nighttime (19:00-06:00) v. Conduct regular noise level monitoring (the limits near residential area are 55 and 45 dB(A) during daytime and nighttime, respectively) 						
Community health and safety	<p>Measures for community health and safety:</p> <ul style="list-style-type: none"> i. Use barriers and install signage ii. Provision of security personnel in hazardous areas to restrict public access iii. Operate construction night light at the vicinity of construction sites; and iv. Provision of adequate safe passageways for the public crossing the construction sites v. Refer to Appendix for COVID measures vi. Advise local community of site health and safety site plans and seek feedback on appropriate mitigation measures 	Part of contractors' bid cost	Contractor	PMU	<p>Construction safety policy</p> <p>Hazards in the area</p> <p>Safety control such as signages, lightings, and barriers</p> <p>Health and safety records (near miss, first aide, lost time accident)</p> <p>Adherence to measures and ADB/WB COVID-19 guidelines</p>	<p>Verification of construction safety policy and health and safety record</p> <p>Visual inspection of site</p> <p>Daily</p>	Minimal cost to SW (visual inspection of site and verification of plans only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	via Community Advisory Committee meetings.						
Occupational health and safety at work sites	Measures include: i. Implementation of construction site health and safety management plan (CSHSMP), ii. Ensure that first aid station is always available iii. Provision of appropriate personal protective equipment (PPE), iv. Providing of emergency response equipment such as fire-fighting equipment, fire extinguishers, etc. v. Provision of potable water and adequate sanitation facilities, vi. Provision of workers with adequate and well-ventilated camps, clean eating areas, and separate toileting and sleeping quarters for male and female workers. vii. Refer to Appendix for COVID measures	Part of contractors ' bid cost	Contractor	PMU	Construction of health and safety plan First aid station, PPE, emergency response equipment and sanitation facilities Health and safety records (near miss, first aide, lost time accident)	Verification of health and safety plan Verification of health and safety record Visual inspection of site Daily	Minimal cost to SW (visual inspection of site and verification of plans and records only)
Potential social issues due to influx of workers	Measures include: i. Induction of all workers on Project requirements	Part of contractors ' bid cost	Contractor	SW's PMU	Implementation of workers induction, required protocols, and disease	Verification of records	Minimal cost to SW (visual inspection)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<p>regarding safeguards (including child protection), GRM and CCP;</p> <p>ii. Agreement to and implementation of protocols (including code of conduct) concerning the workers contact with the local communities;</p> <p>iii. Implementation of a communicable disease awareness and prevention program;</p> <p>iv. Construction of camp specific for workers;</p> <p>v. No child labor will be employed in the project;</p> <p>vi. Ensuring that sufficient water supply and temporary sanitation facilities including handwashing facilities are provided for workers at work sites;</p> <p>vii. Security at contractor's camp and yard to control access and prevent entry of the public (especially children);</p>				<p>awareness and prevention program</p> <p>Administrative signages</p>	<p>Visual inspection of site</p> <p>At start of work Monthly</p>	<p>of site and verification of records only)</p>

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<ul style="list-style-type: none"> viii. Workers' participation in addressing GBV issues will be set in an environment where women can openly converse with about these concerns; and ix. Implementation of GBV awareness training program for contractors (including subcontractors) site personnel 						
Potential damage to hidden archaeological and cultural assets	<p>Tender documents and construction contract will require the following:</p> <ul style="list-style-type: none"> i. Immediate stoppage upon discovery of archaeological and cultural assets ii. Inform the local authorities and the Solomon Island National Museum about the presence 	Part of specs preparation cost	Design Consultant	PMU	Tender documents	<p>Verification of tender documents</p> <p>Once after preparation of tender documents</p>	Minimal cost (part of consultant's task)
Potential Introduction of Alien Species	The imported plant, equipment and materials and the vessels that import them will be subject to clearance procedures under the Bio-Security Act and Regulations and may require issue of phytosanitary certificates from	Part of importation cost	Contractor /Importer	PMU	Certificates from Biosecurity Solomon Islands	<p>Verification of certificates</p> <p>Once after acquisition of certificates</p>	Minimal cost (part of consultant's task)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	Biosecurity Solomon Islands.						
Improper closure of construction sites after subproject completion.	Site restoration and removal of all temporary facilities, excess materials, equipment, plant and excavated materials on site; all dumping will be to approved locations. Replanting of disturbed sites in accordance with replanting plan.	Part of contractors ' bid cost	Contractor	PMU	Disturbed sites, staging areas and workers camps.	Visual inspection of sites Review and "clear" site remediation through issue of certificate Once when all site work is complete	Minimal cost to SW (visual inspection of site only)
OPERATIONS							
Health and safety risks during operation and maintenance	Mitigating measures include: i. Identification of potential causes ii. Provision of written management procedures iii. Provision of written standard operating procedures (SOPs) iv. Controlling the access of unauthorized personnel in the reservoir by providing fence around the perimeter v. Regular training of workers on health and safety aspects of operating how to operate a water supply tank	Part of SW's operational cost	SW's Operations Dept.	SW's Operations Dept. Mgt	Written management procedures SOPs Facility fence	Verification of management procedures, SOPs and records Weekly verification Implementation of SOPs	Minimal cost (verification of documents only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	<ul style="list-style-type: none"> vi. Chlorine gas cylinders will be kept in separate safety rooms vii. Provision of safety control for chlorine gas cylinders like automated shutoff system viii. Preparation of SOPs for chlorine handling ix. Provision appropriate PPE for chlorine use and handling 						
Health hazard due to unplanned delivery of poor water quality	Implementation of WSP to: <ul style="list-style-type: none"> i. prevent contamination of the water sources, ii. treat the water to meet the water quality targets, and iii. prevent re-contamination during storage, distribution and handling of drinking water 	Part of SW's operational cost	SW's Operations Department	SW's Operations Dept. Mgt.	WSP Physical, Chemical and Biological parameters	Verification of WSP implementation Water sampling and laboratory test Monthly for plan and for bacteria; Annual for physical & chemical	Part of SW's operational cost
Unplanned outages and emergencies	Mitigating measures include: <ul style="list-style-type: none"> i. Regular inspection and maintenance of pumping systems and emergency backup systems ii. Ensure that disinfection system is working 	Part of SW's operational cost	SW's Operations Dept.	SW's Operations Dept. Mgt	Records of inspection and maintenance of backup power and pumping systems, Records on flushing and disinfection during unplanned outages and emergencies	Weekly verification of records of inspection and maintenance Verification of records on flashing and disinfection after incidents	Minimal cost (verification of documents only)

Activity/Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Mitigation Cost	Implementation	Supervision / Monitoring	Aspects/ Parameters to be monitored	Means of Monitoring/ Frequency	Monitoring Cost
	iii. Regular training of water supply system staffs on how to handle unplanned outages and emergencies				Records on training of water supply system staffs		

8.6 ENVIRONMENTAL AND SOCIAL MONITORING PLAN

316. The Environmental and Social Monitoring Plan (ESMoP) presents a set of critical environmental parameters that will allow SW to ensure environmental compliance and sustainability of the project operations.
317. Environmental monitoring is required across all phases of subproject implementation. The monitoring meets two objectives to ensure: (i) that mitigation measures are effective in reducing/managing impacts, and identify corrective actions as required; and (ii) that safeguard requirements are being complied with by the contractor and the implementing agency (on behalf of government).
318. The ESMoP for Tulagi water supply system subprojects are presented from **Table 8-5** to

319. **Table 8-7.**

320. **Pre-construction monitoring.** Details are in the ESHS specifications which are part of the bidding documentation and which form part of the contract. Relevant aspects of the ESMP shall be incorporated in these documents. The PMU shall verify if these aspects are incorporated in the said documents first during submission of the draft documents and later during submission of the draft final documents.
321. **Construction monitoring.** Contractors are expected to implement the relevant aspects of each project's ESMP as per their approved CESMP during execution of the construction activities as stipulated in their contracts. The contractors' CESMP will detail the monitoring plan (based on the subproject ESMP and the attached monitoring plans) with details on staff, resources, implementation schedules, and monitoring procedures (parameters, frequency etc.).
322. Compliance with the approved CESMP will be the basis for inspections and audits by PMU and the ADB and WB. The bidding document will include provisions requiring the contractor to submit their CESMP which will include a section on monitoring which should be linked to allocation of budget and staff for implementation.
323. **Reporting.** Overall, the Project will establish a system of reporting. The contractor will prepare monthly reports which will include a section on compliance with the approved CESMP, corrective actions, training and the like. This will also record any grievances lodged and project communications undertaken by the contractor. The PMU will review and consolidate information from the monthly reports of all subprojects. The quarterly progress report (QPR) prepared by the PMU will include a section on safeguards implementation summarizing the monthly reports (including training and capacity development activities).
324. A semi-annual safeguard monitoring report will be submitted to ADB and WB. This report will be based on the QPR and will include the environmental performance of each subproject/component.

Table 8-5: Environmental and Social Monitoring Plan for Laying of Water Supply Pipelines

Concern	Parameter to be Monitored		Sampling & Measurement Plan			Responsible	Annual Estimated Cost
			Method	Frequency	Location		
Pre-construction and construction phase							
Solid and hazardous waste generation	<ul style="list-style-type: none"> Weight or volume of wastes generated 		Weighing/log-book recording	Daily	Construction areas	Contractor; PMU	Minimal cost (verification of documents only)
Siltation of nearby surface water	Parameter	Acceptable Limits	Grab sampling and use of turbidity tube	Monthly	Surface water upstream and downstream near project site	Contractor; PMU	\$50 per event per station
	<ul style="list-style-type: none"> Turbidity (to be calibrated against TSS for initial measurements) 	<ul style="list-style-type: none"> 20 NTU (default trigger values for slightly disturbed marine ecosystems) 					
Air quality and noise	Parameter	Acceptable Limits	Noise meter and handheld PM ₁₀ dust meter	Monthly	Project Site	Contractor; PMU	Minimal cost to SW after purchasing of meter reader
	<ul style="list-style-type: none"> Dust Noise 	<ul style="list-style-type: none"> 20 µg/Ncm (IFC Guideline for PM₁₀) 55 dBA (Daytime), 45 dBA (Nighttime) (IFC-EHS Guidelines for residential, institutional, educational) 70 dBA (Daytime and Nighttime) (IFC-EHS Guidelines for industrial, commercial) 					

Concern	Parameter to be Monitored		Sampling & Measurement Plan			Responsible	Annual Estimated Cost
			Method	Frequency	Location		
Pre-construction and construction phase							
Employment	<ul style="list-style-type: none"> Number of locally employed personnel No workers are underage 		Logbook/ database registration	Daily	Administration office of the project site	Contractor; PMU	Minimal cost (verification of documents only)
Occupational health and safety	<ul style="list-style-type: none"> No. of work-related illnesses/injuries No. of safety man-hours Worker training records 		Logbook/ database registration	Daily	Administration office of the project site	Contractor; PMU	Minimal cost (verification of documents only)
Relation with local communities and authorities	<ul style="list-style-type: none"> Complaints from nearby community 		Logbook/ database registration	Daily	Administration office of the project site	Contractor; PMU	Minimal cost (verification of documents only)
Operation Phase							
Solid waste generation	<ul style="list-style-type: none"> Weight or volume of wastes generated 		Weighing/log- book recording	Daily/Weekly	Project Site	SW's Operations Department	Minimal cost (verification of documents only)
Water Quality	Parameter	Acceptable Limits	Grab sampling and laboratory analysis	Monthly for bacteria; Annually for physical & chemical	Identified sampling locations	SW's Operations Department	Part of SW's operational cost
	<ul style="list-style-type: none"> Bacteria, Physical, Chemical Parameters 	<ul style="list-style-type: none"> Refer to WHO Guideline in Table 4-3 					
Occupational health and safety	<ul style="list-style-type: none"> No. of work-related illnesses/injuries No. of safety man-hours Worker training records 		Logbook/database registration	Daily	Administration Office of the Project	SW's Operations Department	Minimal cost (verification of documents only)

Table 8-6: Environmental and Social Monitoring Plan for Construction of Reservoir

Concern	Parameter To Be Monitored		Sampling & Measurement Plan			Responsible	Annual Estimated Cost
			Method	Frequency	Location		
Pre-construction and construction phase							
Solid and hazardous waste generation	<ul style="list-style-type: none"> Weight or volume of wastes generated 		Weighing/log-book recording	Daily	Construction areas	Contractor; PMU	Minimal cost (verification of documents only)
Siltation of nearby surface water	Parameter	Acceptable Limits	Grab sampling and use of turbidity tube	Monthly	Surface water upstream and downstream near project site	Contractor; PMU	\$50 per event per station
	<ul style="list-style-type: none"> Turbidity (to be calibrated against TSS for initial measurements) 	<ul style="list-style-type: none"> 20 NTU (default trigger values for slightly disturbed marine ecosystems) 					
Air quality and noise	Parameter	Acceptable Limits	Noise meter and handheld PM ₁₀ dust meter	Monthly	Project Site	Contractor; PMU	Minimal cost to SW after purchasing of meter reader
	<ul style="list-style-type: none"> Dust Noise 	<ul style="list-style-type: none"> 20 µg/Ncm (IFC Guideline for PM₁₀) 55 dBA (Daytime), 45 dBA (Nighttime) (IFC-EHS Guidelines for residential, institutional, educational) 70 dBA (Daytime and Nighttime) (IFC-EHS Guidelines for industrial, commercial) 					

Concern	Parameter To Be Monitored	Sampling & Measurement Plan			Responsible	Annual Estimated Cost	
		Method	Frequency	Location			
Pre-construction and construction phase							
Employment	<ul style="list-style-type: none"> Number of locally employed personnel No workers are underage 	Logbook/ database registration	Daily	Administration office of the project site	Contractor; PMU	Minimal cost (verification of documents only)	
Occupational health and safety	<ul style="list-style-type: none"> No. of work-related illnesses/injuries No. of safety man-hours Worker training records 	Logbook/ database registration	Daily	Administration office of the project site	Contractor; PMU	Minimal cost (verification of documents only)	
Relation with local communities and authorities	<ul style="list-style-type: none"> Complaints from nearby community 	Logbook/ database registration	Daily	Administration office of the project site	Contractor; PMU	Minimal cost (verification of documents only)	
Verification of ownership or formal lease arrangement	<ul style="list-style-type: none"> Records of consultations Contracts for local materials 	Database registration	Once	Administration office of the project site	Contractor; PMU	Minimal cost (verification of documents only)	
Storage of hazardous materials (diesel, chlorine, etc.)	<ul style="list-style-type: none"> Weight or volume of hazardous materials 	Weighing/log- book recording	Daily	Construction areas	Contractor; PMU	Minimal cost (verification of documents only)	
Operation Phase							
Solid and hazardous waste generation	<ul style="list-style-type: none"> Weight or volume of wastes generated 	Weighing/log- book recording	Daily/Weekly	Project Site	SW's Operations Department	Minimal cost (verification of documents only)	
Contamination of water sources	<ul style="list-style-type: none"> Water source protection measures e.g., fencing, signage, zoning, etc. 	Water Safety Plan	Once	Project Site	SW's Operations Department	Part of SW's operational cost	
Water Quality	Parameter	Acceptable Limits	Grab sampling and laboratory analysis	Monthly for bacteria; Annually for physical & chemical	Identified sampling locations	SW's Operations Department	Part of SW's operational cost
	<ul style="list-style-type: none"> Bacteria, Physical, Chemical Parameters, Chlorine Residual 	<ul style="list-style-type: none"> Refer to WHO Guideline in Table 4-3 					
Occupational health and safety	<ul style="list-style-type: none"> No. of work-related illnesses/injuries No. of safety man-hours Worker training records 	Logbook/database registration	Daily	Administration Office of the Project	SW's Operations Department	Minimal cost (verification of documents only)	
Storage of hazardous materials (diesel, chlorine, etc.)	<ul style="list-style-type: none"> Weight or volume of hazardous materials 	Weighing/log- book recording	Daily	Project Site	SW's Operations Department	Minimal cost (verification of documents only)	

Table 8-7: Environmental and Social Monitoring Plan for Construction of Water Treatment Plant

Concern	Parameter To Be Monitored		Sampling & Measurement Plan			Responsible	Annual Estimated Cost
			Method	Frequency	Location		
Pre-construction and construction phase							
Solid and hazardous waste generation	<ul style="list-style-type: none"> Weight or volume of wastes generated 		Weighing/log-book recording	Daily	Construction areas	Contractor; PMU	Minimal cost (verification of documents only)
Siltation of nearby surface water	Parameter	Acceptable Limits	Grab sampling and use of turbidity tube	Monthly	Surface water upstream and downstream near project site	Contractor; PMU	\$50 per event per station
	<ul style="list-style-type: none"> Turbidity (to be calibrated against TSS for initial measurements) 	<ul style="list-style-type: none"> 20 NTU (default trigger values for slightly disturbed marine ecosystems) 					
Air quality and noise	Parameter	Acceptable Limits	Noise meter and handheld PM ₁₀ dust meter	Monthly	Project Site	Contractor; PMU	2,000 SID per event per station
	<ul style="list-style-type: none"> Dust Noise 	<ul style="list-style-type: none"> 20 µg/Ncm (IFC Guideline for PM₁₀) 55 dBA (Daytime), 45 dBA (Nighttime) (IFC-EHS Guidelines for residential, institutional, educational) 70 dBA (Daytime and Nighttime) (IFC-EHS Guidelines for industrial, commercial) 					
Employment	<ul style="list-style-type: none"> Number of locally employed personnel No workers are underage 		Logbook/database registration	Daily	Administration office of the project site	Contractor; PMU	Minimal cost (verification of documents only)

Concern	Parameter To Be Monitored		Sampling & Measurement Plan			Responsible	Annual Estimated Cost
			Method	Frequency	Location		
Pre-construction and construction phase							
Occupational health and safety	<ul style="list-style-type: none"> No. of work-related illnesses/injuries No. of safety man-hours Worker training records 		Logbook/database registration	Daily	Administratio n office of the project site	Contractor; PMU	Minimal cost (verification of documents only)
Relation with local communities and authorities	<ul style="list-style-type: none"> Complaints from nearby community 		Logbook/database registration	Daily	Administratio n office of the project site	Contractor; PMU	Minimal cost (verification of documents only)
Verification of ownership or formal lease arrangement	<ul style="list-style-type: none"> Records of consultations Contracts for local materials 		Database registration	Once	Administratio n office of the project site	Contractor; PMU	Minimal cost (verification of documents only)
Storage of hazardous materials (diesel, chlorine, etc.)	<ul style="list-style-type: none"> Weight or volume of hazardous materials 		Weighing/log-book recording	Daily	Construction areas	Contractor; PMU	Minimal cost (verification of documents only)
Operation Phase							
Solid and hazardous waste generation	<ul style="list-style-type: none"> Weight or volume of wastes generated 		Weighing/log-book recording	Daily/Weekly	Project Site	SW's Operations Department	Minimal cost (verification of documents only)
Water Quality	Parameter	Acceptable Limits	Grab sampling and laboratory analysis	Monthly for bacteria; Annually for physical & chemical	Identified sampling locations	SW's Operations Department	Part of SW's operational cost
	<ul style="list-style-type: none"> Bacteria, Physical, Chemical Parameters, Chlorine Residual 	<ul style="list-style-type: none"> Refer to WHO Guideline in Table 4-3 					
Discharge of backwash water	Parameter	Acceptable Limits	Grab sampling and use of turbidity tube	Monthly	Discharge Point	SW's Operations Department	Part of SW's operational cost \$50 per event per station
	<ul style="list-style-type: none"> Turbidity (to be calibrated against TSS for initial measurements) 	<ul style="list-style-type: none"> 20 NTU (default trigger values for slightly disturbed marine ecosystems) 					
Occupational health and safety	<ul style="list-style-type: none"> No. of work-related illnesses/injuries No. of safety man-hours Worker training records 		Logbook/database registration	Daily	Administratio n Office of the Project	SW's Operations Department	Minimal cost (verification of documents only)
Storage of hazardous materials (diesel, chlorine, etc.)	<ul style="list-style-type: none"> Weight or volume of hazardous materials 		Weighing/log-book recording	Daily	Project Site	SW's Operations Department	Minimal cost (verification of documents only)

9.0 PUBLIC CONSULTATION AND PARTICIPATION

9.1 CONSULTATION ACTIVITIES

325. Information disclosure, public consultation, and public participation are part of the overall planning, design, and construction of the proposed subprojects.

9.1.1 DURING FEASIBILITY STUDY STAGE

326. During the feasibility study stage, a series of stakeholder consultations and focus group discussions (FGD) were held on 30 May 2019 and on 25 February 2020 in Tulagi. The 2019 consultation was attended by 40 participants while the 2020 consultations were attended by 53 participants. The first consultation was held to provide initial information and generate community feedback about the proposed water supply improvement project. The follow-up consultation provided updated information about the project, confirm support, and identify any stakeholder concerns and recommendations. These consultations confirmed continued high-level support for the project by Tulagi communities including possible APs. The minutes of meetings are provided as **Appendix 6** of this document.

9.1.2 DURING DETAILED DESIGN STAGE

327. During detailed design stage, follow-up community consultations were conducted by SW in Tulagi from 4 to 5 November 2020 to present the project scope, locations, conduct of asset inventory, community concerns and recommendations. The participants of the consultation include men, women, youth leaders and members, potential APs, and health officials. A short presentation about the project was also held with the Provincial Premier and the Provincial Assembly during the Assembly session. Lastly, a joint consultation with sub-tribes who are claiming ownership of the catchment area around the intake was also held in Tulagi. The minutes of meetings are provided in **Appendix 7**.

328. Public hearing was conducted on 11 February 2021 as part of the process for the approval of the PER (national environment process) and to disclose and consult further on the RP. Comments from this consultation have been considered in this IEE. The minutes of meeting is provided in **Appendix 8**.

9.2 CONSULTATIONS DURING PROJECT IMPLEMENTATION

329. Due to the changes on project components, it is recommended for SW to update the stakeholders with the changes through consultation activities. In line with this, the Project's CCP will be updated early in Project implementation. The CCP will guide the future consultation and participation activities to be facilitated and undertaken by SW. Whenever necessary, stakeholder consultations will be conducted for specific issues that may arise during the design phase. Stakeholder consultations will be continued throughout the construction phase on an area by area basis to address any potential problems particularly in resolving and mitigating project impact affecting any sector of the community. These will be conducted by SW's PMU, contractors, and implementation consultants prior to commencement of construction activities. The construction consultations will address stakeholders' specific concerns related to construction activities in their area, including the scheduling of activities and the potential nuisances to the public. Records of environmental and social complaints, received during consultations, field visits, informal discussions, and/or formal letters, together with the subsequent follow-up and resolutions of issues will be kept by SW's PMU.

330. Community based information, education activities will be undertaken to increase community awareness and participation in water catchment protection. Community of elders, women and youth can be organized into a local management group that will lead in the community based -protection activities.

10.0 CONCLUSION

331. The subprojects covered in this assessment will offer benefits to Tulagi by ensuring adequate supply of potable water and delivering high priority elements of SW's 30-Year Strategic Plan and 5-Year Action Plan.
332. The environmental and social screening process has highlighted the environmental and social issues and concerns of the proposed subprojects. Based on the screening for potential environmental and social impacts and risks of the proposed subprojects, there are no significant negative environmental and social impacts or risks that cannot be mitigated or managed. The ESMP prepared for each subproject will be updated and used as the basis for preparation of the CESMP to be prepared by the contractor. Monitoring and reporting of the approved CESMP will ensure that each subproject can be implemented in an environmentally acceptable manner. There is no need for further environmental assessment. This IEE will accompany the development consent application for each component.
333. Concerning identified social impacts, detailed LARP have been developed for each subproject and consultations have been undertaken with the communities, of which PER hearings and RP disclosure have been completed.
334. In addition, each subproject is hereby recommended with emphasis on the following:
 - Tendering process will advocate environmentally responsible procurement by ensuring the inclusion of ESMP provisions in the bidding and construction contract documents.
 - Contractor's submission of a CESMP will be included in the construction contract.
 - Contract provisions on the creation and operation of the community advisory committees.
 - Training of SW's personnel on operation and maintenance before actual operation.
 - Monitoring of health and safety requirements will be given more importance during implementation to reduce risks to the public and to SW's personnel; and
 - SW will continue the process of public consultation and information disclosure during detailed design and construction phases.
 - The existence of the Project's GRM will be publicized through public awareness campaigns, billboards, public notifications, etc. GRM procedures will be disclosed to the public in consultation meetings.

11.0 REFERENCES

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