AFB/PPRC.36/Inf.16
15 September 2025

Adaptation Fund Board
Project and Programme Review Committee
Thirty-sixth Meeting
Bonn, Germany, 7-8 October 2025

PROPOSAL FOR TUVALU

ADAPTATION FUND BOARD SECRETARIAT TECHNICAL REVIEW OF PROJECT/PROGRAMME PROPOSAL

PROJECT/PROGRAMME CATEGORY: Regular-sized Project Concept

Country/Region: Tuvalu
Project Title: Reducing the vulnerability of the people of Tuvalu to the impacts of climate change by enhancing water security
Thematic Focal Area: Water Management
Implementing Entity: United Nations Environment Programme
Executing Entities: Climate Change Department, Tuvalu Government
AF Project ID:
IE Project ID: **Requested Financing from Adaptation Fund (US Dollars):** 10,000,000
Reviewer and contact person: Mahamat Assouyouti **Co-reviewer(s):** Markus Johannesson
IE Contact Person:

Technical Summary	The project "Reducing the vulnerability of the people of Tuvalu to the impacts of climate change by enhancing water security" aims to increase the resilience of the people of Tuvalu to the impacts of climate change by enhancing their water security. This will be done through the two components below: Component 1: Strengthening community-level water security and sanitation infrastructure: USD 7,341,014 Component 2: Enhancing institutional capacity for climate resilient water governance: USD 1,000,000 Requested financing overview: Project/Programme Execution Cost: USD 875,576 Total Project/Programme Cost: USD 9,216,590 Implementing Fee: USD 783,410 Financing Requested: USD 10,000,000 The initial technical review raises several issues, such as the lack of both an initial gender analysis and initial stakeholder's consultations, unclarity of the ESP principles and their related risk, as well as the lack of detail to explain the project's benefits sustainability and replicability, as is discussed in the number of Clarification Requests (CRs) and Corrective Action Requests (CARs) raised in the review.

Date:	August 21, 2025

Review Criteria	Questions	First Technical Review Comments August 14, 2025
Country Eligibility	1. Is the country party to the Kyoto Protocol, and/or the Paris Agreement?	**Yes.** The country has signed and ratified both the Kyoto Protocol and the Paris Agreement.
	2. Is the country a developing country particularly vulnerable to the adverse effects of climate change?	**Yes.** With intensifying climate change, Tuvalu is expected to experience higher annual-average air temperatures and more hot days; a rise in sea levels and more frequent and intense inundation events; and more extreme rainfall events. While droughts are heavily influenced by the El Niño-Southern Oscillation (ENSO) and their future intensity, frequency, and duration are difficult to predict, the significant reliance on rainwater harvesting and limited storage capacity already exposes Tuvaluans to regular recurring droughts. Coupled with socio-economic and geographic factors these climate hazards make Tuvalu highly vulnerable to climate change impacts threatening the availability and quality of water.
Project Eligibility	1. Has the designated government authority for the Adaptation Fund endorsed the project/programme?	**Yes.** As per the Endorsement letter dated August 7th, 2025.
	2. Does the length of the proposal amount to no more than Fifty pages for the project/programme concept, including its annexes?	**Yes.** The concept note is 50 pages long, including its annexes.
	3. Does the project / programme support concrete adaptation actions to assist the country in addressing adaptive capacity to the adverse effects of climate change and build in climate resilience?	**Yes, but further information is needed.** The concept note outlines a relevant set of activities for the water sector in Tuvalu, including among others Conduct custom-made water and sanitation training and awareness campaigns on installation and

		maintenance of rainwater harvesting systems, infiltration galleries, sustainable sanitation and hygiene, demonstration projects for high school students, and new WASH and/or water conservation material, establishment of locally managed groundwater protection zones, conduct groundwater resource and water need assessments, construct and/or restore infiltration galleries, groundwater wells and accompanying water infrastructure, new or upgrade existing water infrastructure such as rainwater harvesting tanks, cisterns, catchment systems, and water filters in vulnerable communities, etc. However, more details are needed on how these activities translate into concrete and measurable adaptation benefits for the vulnerable communities. It is not clear how these actions would lead to substantial tangible outcomes, or which Adaptation Fund Strategic Objectives are supported. **CR1:** Please outline clearly the specific adaptation benefits related to livelihood improvement and people centered resilience that the project will lead to, including their tangible outcomes and measurable impact, in particular any concrete adaptation benefit for the vulnerable communities. **CR2:** Please consider expanding the projects onto more than 2 components to include (1) community resilience component with few concrete actions leading to livelihood improvement in the productive sector, for example the agriculture sector and (2) a dedicated knowledge management component to capture and disseminate lessons learnt throughout the project implementation.

		CAR1: Considering that some of the proposed activities are yet to be designed or identified, kindly confirm if this project will be implemented through an approach of unidentified sub-project (USP) and briefly elaborate what is the main reason that requires the inclusion of USPs under the project (e.g., project approach etc). Please also comply with USP guidelines at https://www.adaptation-fund.org/wp-content/uploads/2021/05/Updated-guidance-on-USPs-.pdf for identifying the type of USPs etc.
	4. Does the project / programme provide economic, social and environmental benefits, particularly to vulnerable communities, including gender considerations, while avoiding or mitigating negative impacts, in compliance with the Environmental and Social Policy and Gender Policy of the Fund?	**Not Clear.** The proposal broadly outlines expected benefits under Part II.C, including a gender and diversity perspective. It provides a logical explanation of the relationships between objectives and activities. The document also provides a quantitative estimate of the beneficiaries including women and youth. However, it does not clearly describe how the project adaptation benefits will be equitably distributed among the vulnerable groups operating in the water sector including farmers and other indigenous people. **CR3:** Please identify the additional specific vulnerable groups (e.g., smallholder farmers, indigenous peoples) who will benefit from the proposed project and describe how benefits will be equitably distributed. **CR4:** Under table 4, kindly provide quantification estimates of the expected economic, environmental, and social benefits for all identified sub-category, i.e. agriculture. **CAR2:** Please include an Initial Gender Analysis under Part II, that describes the different needs, roles and knowledge sources of women and men in the areas of intervention, clearly stating how the proposed change

		in gender dynamics under the project might drive lasting changes. The gender analysis should inform and recommend how gender considerations are mainstreamed throughout the project's activities.
	5. Is the project / programme cost effective?	**Unsure.** The proposal provides a logical explanation of the cost-effectiveness of the proposed project; however, it does not provide a comparison of other cost-effective options and alternative solutions, or a justification of the cost-efficiency for all proposed infrastructures and/or measures. **CAR3:** 1. In addition to the "ground water development" measures, kindly update table 5 and related information under section C Part II and provide a sound justification for the cost-effectiveness for all proposed measures, including scope, approach, alternative options to the proposed measures, and estimates of the evaluation whenever possible. 2. Additionally, please highlight the cost effectiveness from a sustainability point of view of the proposed interventions.
	6. Is the project / programme consistent with national or sub-national sustainable development strategies, national or sub-national development plans, poverty reduction strategies, national communications and adaptation programs of action and other relevant instruments?	**Yes.** The proposed project outlines the project alignment with key national related strategies in Tuvalu. An exhaustive list of related plans and strategies such as the National Adaptation Plan or education- and building-related is also included.
	7. Does the project / programme meet the relevant national technical standards, where applicable, in compliance with the Environmental and Social Policy of the Fund?	**Unsure.** The concept note does not provide a comprehensive list of all key national technical standards to compliance

		with the proposed project, nor does it outline a plan for ensuring compliance. **CAR4:** Under Part II.E, please specify all applicable national technical standards and regulations in Tuvalu that are relevant to the proposed project. Please present this information in table format. This should include, but is not limited to: • Water use regulations • Building construction code standards • Green building standards if any • Minimum energy efficiency standards if any For each identified standard, include: • A brief description • A statement confirming the project's compliance
	8. Is there duplication of project / programme with other funding sources?	**Yes.** The proposal includes a list of all related projects/programmes to this proposed project. Part II.F states that the project complements initiatives.
	9. Does the project / programme have a learning and knowledge management component to capture and feedback lessons?	**Yes. However, additional information is required.** While the proposed project includes learning and knowledge management activities under outcomes 3, it does not clearly specify the mechanisms for tracking experiences, learning and disseminating lessons learned to enrich the adaptation community with new knowledge including what kind of interventions works. Please consider expanding the project onto more than 2 components and outline KM activities under a new component. **CR5:** Kindly elaborate in section II.G, how, who and when the project will be tracking the experiences gained as well as for the periodical analysis.

		CAR5: Please consider a new component with more detailed KM activities to track experiences and learning and disseminate lessons and results of the project. .
	10. Has a consultative process taken place, and has it involved all key stakeholders, and vulnerable groups, including gender considerations in compliance with the Environmental and Social Policy and Gender Policy of the Fund?	**Yes. However, additional information is required.** The concept note outlines that a consultative process have been undertaken during the project preparation phase. However, it does not specify whether it included perspectives from vulnerable groups, women, and marginalized communities. **CR6:** Kindly include, under Part II.H, a more detailed information on the initial consultative process with key stakeholders of the proposed project, including gender and diversity considerations. Where marginalized and vulnerable groups are identified, clearly describe how their concerns have been considered in the design of the proposal. **CAR6**: Please attach the list of stakeholders that have been consulted as part of CN annexes including location and group of people/institutions consulted.
	11. Is the requested financing justified on the basis of full cost of adaptation reasoning?	**Unsure.** The proposal mentions adaptation objectives and describes the contribution of the proposed project to them. However, the demonstration of how the project will address and achieve its adaptation objective solely without adding any additional sources of funding is not fully clear and justified. **CAR7:** **1.** Please confirm whether or not co-financing is being/has been mobilized for project implementation and present

		information to indicate how this project will meet its objectives solely with the resources of the adaptation fund. **2.** IN the PFG please remove reference to UNCCD in the budget notes section and remove the proposed co-finance amount from the PFG budget. **3.** Please also clarify if the PFG will be able to be effectively implemented without the UNCCD resources.
	12. Is the project / program aligned with AF's results framework?	**Yes. However further clarification is needed.** As per information provided in section III.A, page 41 The concept note includes a mapping of the proposed project's results and products (under the Adaptation Fund financing request) to the Adaptation Fund Strategic Results Framework. **CAR8**: 1. However, please update the Table "Project Alignment with the Results Framework of the Adaptation Fund" and provide a breakdown of grant amount for each Fund outcome instead of bulk amount as currently presented. 2. Please ensure that the upper part of the table (outcoems and outcome indicators) identified corresponds to the bottom of the table outputs and output indicators. 3. The grant amounts in the top and the bottom part of the table should also be the same, with both up and bottom totaling to the components costs of the project.

	13. Has the sustainability of the project/programme outcomes been taken into account when designing the project?	**Yes. However, further information is needed.** The proposed project outlines project long-term sustainability by "leveraging existing government structures and programs rather than relying on temporary, project-specific processes". It also references the inclusion of local communities and participation in governance and decision-making throughout the project implementation. However, the proposal lacks a detailed explanation of the full range of arrangements required to ensure the sustainability of proposed project benefits. **CR7:** Kindly describe all the arrangements required for the project's benefits sustainability, including regulatory, managerial, environmental, institutional, and financial resources. **CR8**: Please explain briefly if there is any funding mechanism for operation and maintenance of proposed measures and whether a local committee be established to manage the proposed "infrastructures" post project. **CR9**: Please explain clearly how replication and scaling up of the proposed project benefits will be assured and achieved after its end.
	14. Does the project / programme provide an overview of environmental and social impacts / risks identified, in compliance with the Environmental and Social Policy and Gender Policy of the Fund?	**Not Clear.** The concept note assesses all 15 principles from the Adaptation Fund ESP in section II.K. From them, 9 out of 15 principles are marked as "no further assessment required for compliance", while the remaining 6 declared the existence of a potential impact and risk.

		However, the information on the management required for compliance is very broad. In addition, an Initial Gender Assessment is not included. Further, ESP Principles 1, 4 and 6 always apply. Please, also note that to state that "no further assessment required for compliance" **should only be done if there is beyond all doubt that no risk whatsoever is present, i**.e., an ESP Principle with "low risk" must be further assessed. The development of good preventative/mitigation measures is not a justified reason to not conduct further assessments for an ESP principle continuously throughout the project cycle. **CAR9:** Please state and describe in the table in section II.K, the following: a. In consideration of above guidance, and as needed, please adjust the table's "middle column" for the various ESPs. b. All risks identified against each of the 15 ESP principles, including all potential impacts (direct, indirect, transboundary and cumulative) and how it is planned to mitigate and manage each of them. c. All impacts and risks should be described in the third column called "Potential impacts and risks – further assessment and management required for compliance". Please strengthen the information in the third column on the proposed management for compliance.

		CR10: Please provide an Initial Gender Assessment, including details about gender-specific cultural and legal context in which the proposed project will operate in Tuvalu. The outcome could inform the design of the project's activities in terms of the inclusion of gender considerations and responsiveness.
Resource Availability	1. Is the requested project / programme funding within the cap of the country?	**Yes.**
	2. Is the Implementing Entity Management Fee at or below 8.5 per cent of the total project/programme budget before the fee?	**Yes.**
	3. Are the Project/Programme Execution Costs at or below 9.5 per cent of the total project/programme budget (including the fee)?	**Yes.**
Eligibility of IE	1. Is the project/programme submitted through an eligible Implementing Entity that has been accredited by the Board?	**Yes.** UNEP is accredited until November 2025.
Implementation Arrangements	1. Is there adequate arrangement for project / programme management, in compliance with the Gender Policy of the Fund?	n/a at concept stage
	2. Are there measures for financial and project/programme risk management?	n/a at concept stage
	3. Are there measures in place for the management of for environmental and social risks, in line with the Environmental and Social Policy and Gender Policy of the Fund?	n/a at concept stage

	4. Is a budget on the Implementing Entity Management Fee use included?	n/a at concept stage
	5. Is an explanation and a breakdown of the execution costs included?	n/a at concept stage
	6. Is a detailed budget including budget notes included?	n/a at concept stage
	7. Are arrangements for monitoring and evaluation clearly defined, including budgeted M&E plans and sex-disaggregated data, targets and indicators, in compliance with the Gender Policy of the Fund?	n/a at concept stage
	8. Does the M&E Framework include a break-down of how implementing entity IE fees will be utilized in the supervision of the M&E function?	n/a at concept stage
	9. Does the project/programme's results framework align with the AF's results framework? Does it include at least one core outcome indicator from the Fund's results framework?	n/a at concept stage
	10. Is a disbursement schedule with time-bound milestones included?	n/a at concept stage

ADAPTATION FUND

CONCEPT NOTE PROPOSAL FOR SINGLE COUNTRY

PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme:	Reducing the vulnerability of the people of Tuvalu to the impacts of climate change by enhancing water security
Country:	Tuvalu
Thematic Focal Area:	Water Management
Type of Implementing Entity:	Multilateral Implementing Entity
Implementing Entity:	United Nations Environment Programme
Executing Entities:	Climate Change Department, Tuvalu Government
Amount of Financing Requested:	10,000,000 (in U.S Dollars Equivalent)

Project Formulation Grant Request (available to NIEs only): Yes ☒ No ☐

Amount of Requested financing for PFG: 150,000 (in U.S Dollars Equivalent)

Letter of Endorsement (LOE) signed: Yes ☒ No ☐

NOTE: LOEs should be signed by the Designated Authority (DA). The signatory DA must be on file with the Adaptation Fund. To find the DA currently on file check this page: https://www.adaptation-fund.org/apply-funding/designated-authorities

Stage of Submission:

☐ This concept has been submitted before

☒ This is the first submission ever of the concept proposal

In case of a resubmission, please indicate the last submission date: Click or tap to enter a date.

Please note that concept note documents should not exceed 50 pages, including annexes

Content

List of Figures

List of tables

Abbreviations and Acronyms

AF	-	Adaptation Fund
ARI	-	Average Return Interval
CCD	-	Climate Change Department of Tuvalu
CSIRO	-	Commonwealth Scientific and Industrial Research Organisation
CSO	-	Civil society organization
EEZ	-	Exclusive Economic Zone
EIA	-	Environmental Impact Assessments
ENSO	-	El Niño-Southern Oscillation
ESA	-	Environmental and Social Assessment
ESMS	-	Environmental and Social Management System
GDP	-	Gross Domestic Product
IE	-	Implementing Entity
IMF	-	International Monetary Fund
LLMA	-	Locally Managed Marine Areas
M&E	-	Monitoring and Evaluation
MLS	-	Mean Sea Level
NDA	-	National Designated Authority
NDMO	-	National Disaster Management Office of Tuvalu
NGO	-	Non-governmental organization
PMU	-	Project Management Unit
PWD	-	Public Work Departments of Tuvalu
SPCZ	-	South Pacific Convergence Zone
SSD	-	Solar Still Distillation
SPI	-	Standardized Precipitation Index
TTF	-	Tuvalu Trust Fund
UNEP	-	United Nations Environment Programme
WASH	-	Water, sanitation, and hygiene

Project Background and Context

Tuvalu is frequently highlighted as a key example of the unique susceptibility of small island nations to climate change, often emphasizing the risks associated with rising sea levels. Tuvalu lacks surface freshwater resources such as rivers or lakes and faces significant risks from climate change, with multiple hazards—sea level rise, saltwater intrusion, drought, higher air temperatures, flooding, and cyclones—interacting and compounding each other. Rising sea levels drive saltwater intrusion into groundwater, reducing freshwater availability, particularly during high spring tides. Droughts and higher air temperatures further deplete water supplies while increasing demand for domestic and agricultural use, intensifying pressure on already limited resources. Flooding and coastal inundation worsen water quality by contaminating both surface and groundwater with pollutants, including untreated wastewater from compromised septic systems. Inadequate water storage and supply increasingly affect food security, public health, livelihoods and ecosystems. Without integrated adaptation measures, these interconnected vulnerabilities will continue to escalate, threatening long-term water security in Tuvalu.

With intensifying climate change, Tuvalu is expected to experience higher annual-average air temperatures and more hot days; a rise in sea levels and more frequent and intense inundation events; and more extreme rainfall events. While droughts are heavily influenced by the El Niño-Southern Oscillation (ENSO) and their future intensity, frequency, and duration are difficult to predict, the significant reliance on rainwater harvesting and limited storage capacity already exposes Tuvaluans to regular recurring droughts. Coupled with socio-economic and geographic factors these climate hazards make Tuvalu highly vulnerable to climate change impacts threatening the availability and quality of water.

Tuvalu acknowledges this vulnerability and identifies water security as key adaptation priority for the country. Several water projects have attempted to support Tuvalu in the past to address this vulnerability, but limited community awareness and skills, lack of monitoring including on groundwater quantity and quality, insufficient climate resilient water and sanitation infrastructure, financial constraints, inadequate institutional capacities, and absence of data sharing mechanisms for integrated and climate-resilient water management are preventing climate resilient water and sanitation in Tuvalu.

Recognizing the adaptation urgency of the issue, this concept note outlines a comprehensive project focused on adapting Tuvalu’s water sector to the impacts of climate change. The project aims to enhance water security and sanitation infrastructure in Tuvalu’s vulnerable island communities by strengthening groundwater management, improving water harvesting systems, and expanding sanitation facilities. It promotes long-term sustainability by establishing community-led water monitoring teams, integrating ecosystem-based approaches, and developing data-driven governance frameworks. Capacity-building initiatives, including training, policy strengthening, and knowledge-sharing platforms, ensure that local institutions and communities will be empowered to manage climate risks effectively. By improving water resilience through climate-responsive infrastructure and sustainable governance, the project fosters long-term environmental and social sustainability, protecting both water resources and livelihoods for future generations. The overarching goal of the project is to reduce the vulnerability of the people of Tuvalu to the impacts of climate change by enhancing water security. The project is expected to directly benefit 4,030 people (2,060male / 1,970 female) including 1,383 children (age 0-14 years) and 950 people with disabilities.

A. Geography

1.Tuvalu, a Polynesian island nation located in the Pacific Ocean, comprises nine atoll islands: Six of Tuvalu's islands—Nanumea, Nui, Nukufetau, Funafuti, Nukulaelae, and Vaitupu—are low-lying atolls made up of *motu* (islets) that encircle lagoons. The remaining three islands—Nanumaga, Niutao, and Niulakita—are raised limestone reef formations. Consisting of predominantly carbonate reef-borne material, Tuvalu’s islands have low fresh water-holding capacity.

2. Tuvalu’s total landmass is 25.3 km² (as measured above mean high-water spring), spread across an Exclusive Economic Zone (EEZ) of 749,790 km². All of Tuvalu's islands are low-lying, with the highest natural elevation reaching only 6.5 meters above mean sea level (MSL) on Niulakita and Nanumaga which

is associated with the ocean-side storm berm landforms characteristic of these islands.[1]

B. Demographic and social trends

3. Tuvalu's population, estimated at 10,876, predominantly resides in coastal zones due to the limited land area and access to resources. 48.7% of its population is under 25 years of age. 48.3% of the population are females and 51.7% males. Future water demand will be strongly influenced by population growth, which is expected to rise to over 14,000 by 2065, leading to a substantial increase in the need for freshwater resources.[2] Migration is increasingly driven by the combined pressures of climate change and socio-economic challenges, which undermine livelihoods and living conditions in the outer islands. Migration from the outer islands to Funafuti is placing significant strain on essential systems, including water supply, sanitation, healthcare, and land availability in the capital.[3]

4. In 2015, Tuvalu was ranked second in terms of population density in the Pacific region (367 persons per square kilometer).[4] Funafuti, the capital island, shows the highest density hosting approximately 60% of Tuvalu's population. Better access to education, healthcare, and employment opportunities has led to internal migration to the capital. Funafuti has grown annually from 2002-2021 by 3.87% whereas the population of outer islands declined at an average of 0.37% per annum over the same period.[5] Population growth in the capital has led to increased stress on its limited land and water resources and created challenges related to overcrowding, waste management, and infrastructure.[6] Tuvalu has also experienced international out-migration mainly to Fiji, New Zealand, and Australia.

C. Governance and Administration

5. Tuvalu operates as a democratic nation under the Westminster system, recognizing the British monarch as the head of state, with a parliament comprising 15 elected members serving a four-year term. Each island is represented in parliament by two elected members, with two exceptions. Nukulaelae, due to its smaller population, elects only one representative. Niulakita, being administratively part of Niutao Island, does not elect its own representatives but is represented by members elected from Niutao. The Prime Minister and Speaker of Parliament are elected by the Parliament.[7] The country has no formal political parties as politics are based on personal, family, and island loyalties and considerations[8].

6. At the island level, governance operates through modern adaptations of the *Falekaupule* and *Kaupule*[9] traditional systems which manage local decision-making processes such as jurisdiction of fishing rights, service provision, or local development projects. Consequently, the government collaborates closely with the *Falekaupule* and *Kaupule* on a range of initiatives, including development coordination, infrastructure development and disaster relief efforts.

7. Land tenure in Tuvalu is rooted in customary practices, with inheritance traditionally passed down through both patrilineal and matrilineal lines. However, inheritance rights are largely gendered, as men are typically the primary heirs. Women can inherit land only in the absence of male heirs or if they are the sole or surviving child. Communal land is often managed by chiefs on behalf of local *Kaupule.*[10]

8. In Tuvaluan society, land organization revolves around a family-based system known as *kaitasi*, which translates to "*eat from the same land*". This system typically includes immediate and extended family

[1] Wandres, M., A. Espejo, T. Sovea, S. Tetoa, F. Malologa, A. Webb, J. Lewis, G. Lee, and H. Damlamian, 2024: A national-scale coastal flood hazard assessment for the atoll nation of Tuvalu. Earth's Future 12 (4).

[2] CRIRO and Deloitte 2024, Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement.

3 ibit

[4] Dornan, M. and R. Curtain 2019: A pressure release valve? Migration and climate change in Kiribati, Nauru and Tuvalu. The Australian National University: Development Policy Centre.

[5] Government of Tuvalu, 2015: Second National Communication of Tuvalu to the UNFCCC.

[6] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.

[7] Government of Tuvalu, 2015: Second National Communication of Tuvalu to the UNFCCC.

[8] Gibson, K. E.; J. Barnett; N. Haslam and I. Kaplan, 2020: The mental health impacts of climate change: Findings from a Pacific Island atoll nation. In: Journal of anxiety disorders 73.

[9] Each island has a Falekaupule which serve as the traditional assembly of elders. Under the Falekaupule Act of 1997, governance responsibilities are shared between the Falekaupule and the Kaupule, which acts as its executive arm. The Kaupule consists of elected members and is led by an elected president, with an appointed treasurer managing financial matters. Additionally, the Kaupule is overseen by a committee appointed by its members,

[10] Pulea, M. and Farrier, D. 1994: Environmental Legislation Review - Tuvala. Brisbane, Australia: South Pacific Regional Environment Programme.

members but may also encompass others who derive their livelihood from that land. Land is usually registered under one individual, often a man, with joint owners, including both men and women, listed beneath them.[11] Ownership is passed down through generations and subdivided among the extended family. Under customary law, land cannot typically be sold but may be exchanged or leased. Decisions affecting the land require mutual agreement from all members of the *kaitasi* group, including women.[12]

D. Gender and Women Empowerment

9. Gender roles in Tuvalu are traditionally defined, with men often participating in fishing and governance, while women handle domestic responsibilities and community-based activities.[13] Married women in Tuvalu have limited involvement in household decision-making, although their participation tends to increase with age and social status. Tuvalu made significant strides in increasing women's representation in decision making positions in the last decade, with women holding 41% in those positions in 2022[14] , against the 22% in 2013. At the same time, the gender-based violence remains a significant issue, with nearly half of Tuvaluan women (47%) reporting experiences of either physical or sexual violence, and 12% experiencing both forms.[15] Women have fewer opportunities for generating income, since only 39.7% of women participate in the labor force (compared to 58.5% men).[16]

Women's access to and control over resources such as land and other assets is also limited and regulated by the Lands Code and Native Lands Act. These laws include provisions that support men's entitlement of land and assets, further reinforcing the patriarchal nature of Tuvaluan society. At the same time, the women bear the primary responsibility of caring for children and ensuring there is food and water for the family. The reliance on natural resources amplifies women's vulnerability to changing environmental conditions.

10. Men dominate governance structures, with women's involvement in political decision-making remaining low. In the 2024 elections, only one woman ran for office, and none currently hold a seat in the 12-member government. While there has been some progress at the local level (six out of 48 *Kaupule* positions were filled by women in 2021) overall representation remains imbalanced. Furthermore, gender considerations have yet to be systematically integrated into public policies, programs, or services, as there is no standard practice of using gender data and analysis to shape legislation or inform program design and implementation.[17]

11. Nevertheless, the Tuvalu National Gender Equity Policy 2024 has acknowledged this constraint and seeks to promote gender equality by promoting gender equity, empowering people of all genders, and uphold everyone's human rights. The policy also aims for women and men share decision-making and leadership roles across all areas of life and that women have the same opportunities to achieve financial security and support their families. Additionally, the policy aims to protect women and men from every form of violence. The policy aims to achieve this by (1) systematically integrating gender equity and equality considerations into all government policies, programs, and services, (2) advancing women's leadership and participation in decision-making at all levels, creating equal opportunities for women to be economically empowered and financially secure, and eliminating all forms of gender-based violence and provide the best services to support and protect the victims.[18]

E. Economy

12. In 2023, Tuvalu's Gross Domestic Product (GDP) was approximately USD 62.3 million with a GDP

[11] ibid.
[12] McCubbin, S.; B. Smit and T. Pearce 2015: Where does climate fit? Vulnerability to climate change in the context of multiple stressors in Funafuti, Tuvalu. In: Global Environmental Change 30, pp 43–55.
[13] United Nations Development Programme (UNDP) 2018: Gender Assessment. FP015: Tuvalu Coastal Adaptation Project.
[14] Tuvalu Government: 2022 Civil Service List.
[15] UN Women, 2012: Tuvalu. Available at: https://asiapacific.unwomen.org/en/countries/fiji/co/tuvalu (Accessed on 24 January 2025)
[16] Government of Tuvalu, 2024: Tuvalu National Gender Equity Policy
[17] Ibid.
[18] Ibid.

per capita estimated at USD 6,151.[19] The country's economy faces significant constraints due to its remote location and lack of economies of scale. Government revenue is primarily derived from fishing licenses and direct grants from international donors, including foreign governments, thematic funds, multilateral development banks and international organizations. Due to its remoteness, lack of infrastructure, investment and relevant sector development policies, tourism is limited in Tuvalu, with few tour guides, tour operators, organized activities, and no cruise ship visits.[20]

13. Aside from a small cash economy, Tuvalu's economy is primarily subsistence-based, with 75% of people engaged in relying on subsistence agriculture (fruit and vegetable gardening, coconut sap collection, copra production), livestock rearing (chickens, ducks, and pigs) and fishing (ocean, reef, lagoon, and collection). Other livelihood activities in Tuvalu include handicraft production, leasing land, house construction, and traditional methods of food preservation.[21]

14. Particularly the outer islands rely heavily on agricultural activities despite relatively poor soil, weak water retention, limited land mass, and a lack of technological innovation[22]. Similarly, 75% of the households on the outer islands are engaged in near-shore fisheries activities for subsistence and cash (compared to 55% in the capital).[23]

15. Remittances also play an important role for the economy. Approximately 20% of Tuvalu's resident population migrated abroad and transferred around USD 4.05 million, or 8.6% of the country's GDP (in 2019) in remittances.[24] In 2012, almost every second household (40%) received remittances in any given year.[25]

16. The government is the largest formal employer in Tuvalu, particularly in the capital Funafuti, accounting for 66% of all salaried workers across both public and private sectors. Private sector employment remains limited, with 700 Tuvaluans estimated to have formalized private sector employment. Employment in the overseas fishery industry has grown, with recent estimates indicating approximately 2,300 Tuvaluans are engaged in this sector.[26]

17. With an estimated USD 27 million in revenues in 2023, revenues from fisheries licensing are the major source of Government revenue (70%).[27] Additional Government revenues are royalties from internet domain service and foreign aid flows, the latter making up around 25% of Government revenues (2021).[28]

18. Tuvalu is highly dependent on imports, with limited capacity to export goods and services. In the first 6 months of 2024, the country imported goods of ca. USD 21 million, while it exported, over the same period, an estimated USD 25,000 of goods.[29] The heavy reliance on imported goods, particularly fuel for energy generation and transport and food, along with dependence on external income sources such as remittances and foreign aid, makes Tuvalu highly vulnerable to economic shocks. As a result, the country's GDP is subject to significant fluctuations in response to changes in the global macroeconomic environment.

19. Tuvalu's remoteness and reliance on imports limit its competitiveness. With minimal international air services, shipping is essential for economic and social development. The country depends solely on inter-island vessels to transport people and goods between its nine islands and connect them to key services in Funafuti. Government-owned ships also provide periodic service to Fiji, with each island typically

[19] World Bank, 2024: GDP (current USD$) – Tuvalu. Available at: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=TV (Accessed on 28 January 2025)
[20] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[21] International Organization for Migration (IOM) and International Labour Organization (ILO), 2021. Powering Past the Pandemic: Bolstering Tuvalu's Socioeconomic Resilience in a COVID-19 World. IOM and ILO, Suva
[22] Kumar, L, 2020: Climate Change and Impacts in the Pacific. Springer International Publishing.
[23] Tuvalu Fisheries Department Ministry of Fisheries and Trade Government of Tuvalu, 2020: Annual Report.
[24] International Organization for Migration (IOM) and International Labour Organization (ILO), 2021. Powering Past the Pandemic: Bolstering Tuvalu's Socioeconomic Resilience in a COVID-19 World. IOM and ILO, Suva
[25] Central Statistics Division of the Government of Tuvalu. 2013. Tuvalu 2012: Population and Housing Census Volume 1 Analytical Report.
[26] International Organization for Migration (IOM) and International Labour Organization (ILO), 2021. Powering Past the Pandemic: Bolstering Tuvalu's Socioeconomic Resilience in a COVID-19 World. IOM and ILO, Suva
[27] Tuvalu Fisheries Department Ministry of Fisheries and Trade Government of Tuvalu, 2024: Annual Report.
[28] International Monetary Fund (IMF), 2021: 2021 Article IV Consultation - Press Release; Staff Report; And Statement By The Executive Director for Tuvalu (IMF Country Report) 21/176: International Monetary Fund.
[29] Tuvalu Central Statistics Division, 2025. Available at: https://stats.gov.tv/category/economics/international-trade/#:~:text=relevant%20trade%20policies.-,Imports,Mineral%20Products%20(%247.28%20million) (Accessed on 28 January 2025).

receiving access every 2–3 weeks. However, the high costs of operating these vessels and maintaining their condition represent a significant burden on the national budget.[30]

20. The Tuvalu Trust Fund (TTF), established in 1987 by the United Kingdom, Australia, and New Zealand, plays a vital role in supporting Tuvalu's economy by addressing budget deficits, promoting economic development, and enhancing financial independence. The fund has grown significantly, from approximately USD 41 million in 1999 to around USD 170 million in 2024 and continues to serve as a crucial financial resource for sustaining government operations during fiscal challenges.[31]

21. According to the IMF, ca. 26% of the population was below the national poverty line in 2019.[32] However, family structures and community-based mutual support help mitigate challenges often associated with poverty, such as limited access to food, shelter, and other essentials.[33] Tuvalu also performs well on other human development indicators. Citizens have access to health services, formal education is almost universal, and the adult literacy rate is approximately 99 percent.[34]

F. Environment and Biodiversity

22. Tuvalu's islands support diverse vegetation types, including: inland broadleaf forests and woodlands, coastal littoral forests and scrub, mangroves and wetlands, coconut woodlands and agroforests, excavated taro gardens, and ruderal vegetation.[35]

23. Tuvalu is home to 356 terrestrial vascular plant species, of which only 18% are likely indigenous to the islands, with the remainder being introduced species. Most of the plant species consist of ornamentals and shrubs.[36] The marine biodiversity includes 1,453 species, alongside 41 species of resident and migratory birds, 21 mammals, 4 sponge species, 4 reptiles, and 2 species of mangroves.[37]

24. Invasive species and climate change impacts pressure Tuvalu's marine and terrestrial biodiversity and ecosystem health leading to species redistribution, loss of some fish, coral bleaching, die-back of seagrass and mangroves, algal blooms and the loss of other marine, bird and plant species.[38]

G. Water Resources

25. Tuvalu lacks surface freshwater resources such as rivers or lakes. Limited groundwater lenses float hydrostatically above denser saltwater, separated by a transition zone of brackish water. The lenses are replenished by rainfall, maintaining the hydrostatic balance. However, without adequate recharge, the transition zone shifts, reducing the availability of freshwater.[39]

26. Communities primarily access this groundwater through shallow wells. The development and location of groundwater significantly affects the health of vegetation, associated wildlife, and the placement of village wells and excavated taro pits. Fogafale islet on Funafuti hosts the most extensive and developed freshwater lens but freshwater resources on Fogafale are extremely limited relative to its population size.[40]

27. Consequently, Tuvalu's residents primarily depend on household and community rainwater catchment with these systems supplemented, where available, with sea-water desalination for supplementary or

[30] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[31] Tuvalu Trust Fund, 2025: Available at: https://tuvalutrustfund.tv/index.php (Accessed on 28 January 2025).
[32] International Monetary Fund (IMF), 2021: 2021 Article IV Consultation - Press Release; Staff Report; And Statement By The Executive Director for Tuvalu (IMF Country Report, 21/176: International Monetary Fund.
[33] Taupo, T. and Cuffe H. and Noy I, 2018: Household vulnerability on the frontline of climate change: the Pacific atoll nation of Tuvalu. In: Environmental Economics and Policy Studies 20:4, pp 705–739.
[34] Milan, A.; R. Oakes and J. Campbell, 2016: Tuvalu. Climate change and migration. 18: United Nations University.
[35] Thaman, R. R., Fihaki, E., Fong, T. 2012: Plants of Tuvalu. Suva: University of the South Pacific Press.
[36] Ibid.
[37] Job, S., 2009: Tuvalu Marine Life Project. Literature Review. Noumea, New Caledonia: Coral Reef Initiatives for the Pacific.
[38] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[39] Ministry of Foreign Affairs, Trade, Tourism, Environment and Labour Government of Tuvalu, 2016: Tuvalu National Biodiversity Strategy and Action Plan: Fifth National Report to the Convention on Biological Diversity
[40] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.

emergency purposes. Where available, groundwater extraction is mostly used for non-potable uses (washing clothes etc.).[41]

28. Rainwater is primarily harvested through rooftop catchment systems, while water is stored both, collectively in underground reservoirs at public buildings and individually in rainwater tanks at private homes.[42] The availability of land for water storage tanks poses a significant challenge, particularly in Funafuti, where high population densities creates competition for space among houses, recreational areas, infrastructure, livestock, and crops.[43] Circular tanks require considerable space, making rectangular or elongated tanks a more efficient and space-saving option for water catchment and storage.[44]

29. Access to water tanks has historically been inequitable and many housing structures lack functional gutters and pipes to direct rainwater into storage tanks. According to the Water Survey Reports that were conducted for all islands in 2022, on average every household has 2 water tanks available with an approximate volume of 10,000 liters each. However, the numbers largely differ among the islands. In Funafuti, where average household sizes are larger than on the outer islands, water shortages are a significant issue due to an insufficient number of tanks per household and limited physical space for installing additional tanks. In Funafuti, more than 3.5 people share one water tank followed by Nitao where around 2 people share one 10,000 liters tank. The assessment also revealed that 20% of all water tanks (4,215) and 53% of the catchment systems and gutters were assessed to be in need of repair in the 8 outer islands.[45][46]

30. Households are responsible for maintaining their rainwater and septic tanks, and *Kaupules* (Island Councils) have the authority to impose penalties on households if malfunctioning tanks are identified. However, maintaining household rainwater tanks and gutters presents a challenge, as many households lack the necessary capacity and financial means to properly clean, maintain, and flush their tanks and gutters. Previous development projects that provided water tanks showed limited effectiveness when guttering systems were not adequately installed.[47]

31. The first reverse osmosis system was installed on Funafuti in 1992, and desalination plants are reported to be operational on all nine islands. However, it is unclear whether all of them are operational due to limited use in non-emergency situations.[48] Under normal conditions, households can purchase desalinated water when additional supply is needed, while during droughts, emergency water from desalination plants is made available for domestic use. Despite its availability, many community members prefer rainwater over desalinated water due to taste preferences, although stakeholders recognize that desalinated water is likely of higher quality with a lower risk of microbial contamination.[49] Desalinated water is also costly compared to other water supply options (see section II C for details).

H. Sanitation

32. Septic tanks and pit latrines are the main methods of sewage disposal in Tuvalu. However, aging septic systems on some islands pose risks to communities by causing septic overflow and sewage leakage into the sea, water catchments, and surrounding land. According to a 2021 UNICEF report, 46% of Tuvalu's population relies on basic sanitation facilities, such as flush toilets, pour-flush systems, composting toilets, or ventilated pit latrines. Many septic tanks in the outer islands are in need of repair and upgrading to withstand increased climate risks from rising sea levels and resulting inundation.[50]

33. Although 78% of Tuvalu's population has access to basic sanitation services, waste disposal and recycling technologies are limited and insufficient to manage the growing waste volumes. Existing landfills

[41] Ibid.
[42] Government of Tuvalu., 2021: Te Vaka Fenua o Tuvalu National Climate Change Policy 2021-2030.
[43] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[44] CRIRO and Deloitte 2024, Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement.
[45] Synthesized from Water Survey Reports for all islands of Tuvalu. Available at: https://www.tuvaluclimatechange.gov.tv/data-and-documents (Accessed on 28 January 2025)
[46] Some of these tanks and catchment system in need for repair are currently being repaired with support of the Managing Water Scarcity through Strengthened Water Resource Management (see section II. F for details)
[47] CRIRO and Deloitte 2024, Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement.
[48] Stakeholder consultations.
[49] CRIRO and Deloitte 2024, Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement.
[50] Ibid.

pose risks of soil and water contamination, impacting terrestrial and marine ecosystems as well as public health. Additionally, they occupy valuable land in a country with limited land area. The increase in food imports further exacerbates waste generation, which the current waste management system cannot adequately address.[51]

34. Septic effluent discharge and overflow from non-sealed septic tanks often affect adjacent properties due to the shallow bedrock layer (which is less than one meter below the surface) and the close proximity of tanks to neighboring properties. A recent water quality assessment on groundwater wells in Nanumea showed that nearly all wells showed levels of sewage contamination.[52] This issue is exacerbated by frequent groundwater inundation, particularly in and around Funafuti, where non-sealed septic tanks flood and overflow, creating what has been described as "daily natural disasters.[53] In Funafuti, bottomless septic tanks and pit toilets have shown to lead to domestic wastewater run-off into the lagoon. Coastal sediments in Funafuti are chronically polluted mainly by domestic wastewater and contain 2.7 to 10.4 times more microbial biomass, a different microbial community structure, and reduced microbial diversity compared to undisturbed natural coastal sediments. [54]

35. Tuvalu's healthcare infrastructure and resources are limited in addressing health risks. The country operates one national hospital and eleven healthcare centers spread across its islands and has on average 12.6 medical doctors per 10,000 people. Government expenditure on public health represented nearly 20% of GDP in 2021.[55]

I. Current Climate, Historic Climate Trends and Climate Projections

36. Tuvalu experiences a tropical climate with a distinct wet season from November to April and a dry season from May to October. Monthly rainfall averages approximately 200 mm in Funafuti and 160 mm in Nanumea. The wet season is influenced by the movement and intensity of the South Pacific Convergence Zone (SPCZ), as well as year-to-year variations driven by ENSO. Rainfall distribution varies spatially, with an annual average of about 3,400 mm in the southern islands and a lower average of around 2,900 mm in the northern islands. Temperatures remain relatively consistent throughout the year, ranging from 26°C to 31°C.[56]

37. The SPCZ is the primary driver of regional weather and climate patterns. In the central tropical Pacific Ocean, easterly winds help moderate heat and humidity associated with the warm ocean waters near the equator. Climate variability in the region is influenced by three key processes: the Madden-Julian Oscillation, ENSO, and the Interdecadal Pacific Oscillation. During El Niño events, the SPCZ shifts eastward, resulting in wetter and warmer conditions across Tuvalu. Conversely, during La Niña years, the SPCZ moves westward, increasing the risk of drought throughout the country. There is strong consensus that ENSO variability will continue to dominate regional-scale climate in the future and strongly influence weather-related variables such as drought and rainfall.[57]

38. Projections for Tuvalu throughout the 21st century suggest a shift toward a warmer and wetter climate. Key climate hazards linked to these changes—many of which already affect communities and ecosystems today—include: (i) temperature increases and more frequent hot days, (ii) changes in precipitation patterns, droughts and extreme precipitation, (iii) rising sea levels and coastal inundation and (iv) tropical cyclones and extreme winds. These hazards are expected to intensify further in the coming decades (please refer to a detailed overview of Tuvalu's climate trends and projections in Annex I).

J. Climate impacts, risks and vulnerabilities for the water sector

39. With intensifying climate change, Tuvalu is expected to experience (i) higher annual-average air temperatures and hot days, (ii) a potential increase in the average annual rainfall and more extreme

[51] Government of Tuvalu, 2015: Second National Communication of Tuvalu: United Nations Framework Convention on Climate Change.
[52] Stakeholder consultations
[53] CRIRO and Deloitte, 2024: Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement
[54] Fujita, M., Suzuki, J., Sato, D. et al, 2013: Anthropogenic impacts on water quality of the lagoonal coast of Fongafale Islet, Funafuti Atoll, Tuvalu. Sustain Sci 8, 381–390.
[55] WHO, 2025. Available at: https://data.who.int/countries/798 (Accessed on 28 January 2025)
[56] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[57] Ibid.

rainfall events, (iii) a decrease or little changes in drought duration, frequency and intensity, (iv) a decrease in frequency but increase of intensity of tropical cyclones with associated wind speeds (low confidence), as well as (v) a rise in sea levels and resulting frequency and intensity of inundation events (refer to Annex I for details). Coupled with socio-economic (rapid urbanization and population growth, economic vulnerabilities etc.) and geographic factors (isolated location, import reliant economy etc.) these climate hazards make Tuvalu highly vulnerable to climate change impacts and have an impact on the demand, availability and quality of water. The below sections summarize the climate impacts, risks and vulnerabilities for the water sector.

40. **Sea level rise and coastal inundation**: With a low elevation and the highest natural elevation reaching only approximately 6.5 meters above mean sea level (in the islands of Niulakita and Nanumaga) [58], Tuvalu is highly vulnerable to the impacts of sea-level rise. Rising sea levels have led to saltwater intrusion into freshwater lenses, soil, and cultivation areas and made groundwater increasingly brackish and generally unsafe for consumption. The country's small land area limits opportunities for rainwater infiltration to replenish freshwater lenses. As sea levels continue to rise, saltwater intrusion will further reduce freshwater lenses, reducing water quality, particularly during spring tides.[59] Whereas on the islet of Fongafale this issue is less pronounced due to the absence of a significant freshwater lens and boreholes have been brackish for over a decade, other islands, such as Vaitupu, now primarily use borehole water during droughts for non-potable purposes.[60] Additional climate change impacts include coastal erosion, land loss, flooding, and storm surge inundation, all of which intensify saltwater intrusion into the nation's already scarce freshwater resources and damage water supply and wastewater infrastructure such as drains, pipes, pumps, tanks and desalination plants.[61]

41. **Tropical cyclones**: The impacts of saltwater intrusion are further intensified by tropical cyclones often accompanied by storm surges. Although there is low confidence in tropical cyclone frequency and intensity projections (refer to the Annex for details), coupled with a rising sea level, tropical storms and their surges will exacerbate the infiltration of saltwater into freshwater lenses from the surface, further compromising the suitability of essential water sources for both human consumption and agricultural use. Tropical cyclones and extreme winds also damage water and sanitation infrastructure. For example, in 2015 Tropical Cyclone Pam caused widespread destruction across the islands damaging homes, infrastructure, food gardens, graves, and coastlines. In Funafuti several islets were completely lost, and a significant amount of Tuvalu's population were displaced. Furthermore, accessing adequate and clean water in the aftermath of cyclones has been found to be often a major challenge. As a result, tropical cyclones continue to greatly put the health and well-being of local communities at risk by restricting access to safe drinking water.[62]

42. **Drought and seasonal weather patterns changes:** Although anecdotal information reports that some islands used groundwater for potable purposes until the 1970s, nowadays Tuvaluans rely heavily on rainfall (due to the challenges posed by saltwater intrusion mentioned above) which makes its communities highly vulnerable to drought, exacerbating water, sanitation, and hygiene (WASH) challenges. Drought-related water shortages and declining water quality negatively impact human health and productivity and increase the risk of infections and waterborne diseases. Pollution and sewage leakage from aging septic systems further increases water insecurities during drought.[63] For example, during the 2011 La Niña–associated drought, communal water supplies were rationed to as little as 2.1 liters per person per day, with 61% of households on some islands relying entirely on brackish well water for bathing, washing clothes, and flushing toilets.[64] Water quality tests conducted during this extreme dry period found well water unfit for human consumption, leading to a decline in sanitation and hygiene practices, including reduced handwashing.[65] As a result, a severe diarrhea outbreak occurred, hospitalizing four children and three adults in Nukulaelae.[66] Despite the implementation of the Sustainable

[58] Wandres, M., A. Espejo, T. Sovea, S. Tetoa, F. Malologa, A. Webb, J. Lewis, G. Lee, and H. Damlamian, 2024: A national-scale coastal flood hazard assessment for the atoll nation of Tuvalu. Earth's Future 12 (4).
[59] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[60] Sinclair, P., F. Atumurirava, and J. Samuela, 2012: Rapid drought assessment Tuvalu. SOPAC technical report (PR38). Funafuti, Tuvalu.
[61] CRIRO and Deloitte 2024, Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement.
[62] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[63] CRIRO and Deloitte 2024, Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement.
[64] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[65] Emont, J.P., et al., 2017: Epidemiological investigation of a diarrhea outbreak in the South Pacific island nation of Tuvalu during a severe La Niña–associated drought emergency in 2011. The American journal of tropical medicine hygiene. 96(3): p. 576.
[66] Sinclair, P., Atumurirava, F., and Samuela, J., 2021: Rapid drought assessment Tuvalu. SOPAC technical report (PR38).

and Integrated Water and Sanitation Policy (2012–2021) that was adopted following the 2011 drought, up to 70% of Tuvalu's population still lacks sufficient water catchment and storage capacity to endure prolonged dry periods. Most households have limited water storage, typically holding only enough water to last about one month during extended droughts.[67] As a result, during droughts, limited water supplies are prioritized for human consumption rather than livestock or crops, with desalinated water and groundwater reserves typically reserved for emergency use. Livestock, particularly domestic pigs, suffer during these prolonged dry spells and key crops in Tuvalu, such as coconut, breadfruit, and bananas often wilt, become inedible, or die.[68] Furthermore, costs associated to the purchase of desalinated water and sea water intrusion into freshwater reservoirs reduces the ability to access available freshwater during droughts.[69] Finally, drought induced groundwater recharge reductions also thin the freshwater lens and lower the yield of swamp taro (*pulaka*), which is traditionally cultivated in excavated pits to access the water table.[70]

43. **Increased intensity of extreme precipitation events:** On the one hand, more rainfall can enhance water security if adequate infrastructure is in place to capture and store rainwater in tanks and if infiltration of groundwater and replenishment of the groundwater lens occurs. On the other hand, extreme rainfall can also increase runoff into the lagoon or lead to groundwater pollution and deteriorate water quality. Floods can carry sediment and debris, damaging drainage systems and facilitating septic overflows that contaminate fresh water and increase the risk of diarrhea.[71] Damage to water and sanitation infrastructure also raises the frequency and cost of repairs and maintenance and power outages during these events can disrupt desalination and water pump operations, affecting disaster response efforts, water quality, public health, and economic activities.[72]

44. **Increased number of hot days:** More hot days strain Tuvalu's limited water supply by increasing demand for freshwater, both for household use and agricultural needs such as livestock watering and crop irrigation. Additionally, heat-induced power outages can disrupt water distribution from public tanks and reservoirs, as well as desalination operations, posing serious risks to human health, livelihoods, and agricultural productivity, especially during drought conditions..[73]

45. Tuvalu's water sector faces significant risks from climate change, with multiple hazards—sea level rise, saltwater intrusion, increased rainfall, drought, higher air temperatures, flooding, and damage from tropical cyclones—interacting and compounding each other. Water is the primary medium through which Tuvalu will experience the impacts of climate change, making it a crucial sector for effective adaptation strategies. Climate change is already intensifying disruptions across the entire water cycle, affecting availability, quality, and distribution of freshwater. Without integrated adaptation measures, these interconnected vulnerabilities will continue to escalate, threatening long-term water security in Tuvalu. The below table provides an overview of the drivers, risks and climate impacts for the water sector in Tuvalu.

Table 1: Climate risks, impacts and vulnerabilities of the water sector in Tuvalu

Phenomena	Type of driver	Impacts and Risks for the water sector in Tuvalu
Sea level rise and coastal inundation	Climate change driver/climatic driver (ENSO)	• Saltwater intrusion and increasing groundwater salinity will reduce both the availability and quality of freshwater sources. This decline in water supply will directly impact water security and increase health risks for communities, particularly during water emergencies. • Low-lying (water) infrastructure is at risk to increased saltwater intrusion and inundation. This will increase the maintenance, operation, and repair costs of water infrastructure as exposure will increase. • Non-sealed septic systems can overflow during inundation events. Due to the proximity of septic systems to the coast, other properties and water catchments. Communities will need to manage increased maintenance,

[67] CRIRO and Deloitte 2024, Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement.
[68] Tekinene, M, 2014: An assessment of the impacts of climate change on cultivated pulaka (Cyrtosperma chamissonis) in Tuvalu. University of the South Pacific, Fiji.
[69] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[70] Lloyd, G.G, Uesugi, A., and Gleadow, R.M., 2021: Effects of salinity on the growth and nutrition of taro: Implications for food security. Plants. 10:2319 doi.org/10.3390/plants10112319
[71] Levy, K., et al., 2016: Untangling the impacts of climate change on waterborne diseases: a systematic review of relationships between diarrheal diseases and temperature, rainfall, flooding, and drought. Environmental science. 50(10): p. 4905-4922.
[72] CRIRO and Deloitte 2024, Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement.
[73] Ibid.

		operation, and repair costs of water infrastructure and are exposed to significant health risks from freshwater contamination.
Tropical cyclones and extreme winds	Climate change driver/ climatic driver (ENSO)	• Intense tropical cyclones and accompanying extreme winds damage water and sanitation infrastructure and particularly exposed rainwater harvesting infrastructure (such as gutters etc.). Material guiding effective protection or repairing and maintaining key harvesting and catchment infrastructure is not available. • Tropical storms and their surges will exacerbate the infiltration of saltwater into freshwater lenses, further compromising the suitability of essential water sources for both human consumption and agricultural use.
Drought	Climate change driver/ climatic driver (ENSO)	• Increased saltwater intrusion into groundwater aquifers reduce available water supply, particularly during dry spells when groundwater is most needed. Reliance on brackish groundwater during droughts lead to a decline in sanitation and hygiene practices and expose communities to significant health risks (water borne diseases, infections and overconsumption of sodium). The absence of monitoring boreholes to assess water quality and capacity in the communities to conduct water quality testing further exacerbates this issue. • Increase in operations, maintenance, and repair costs for water infrastructure (such as desalination plants) due to less available fresh water will increase costs for potable water. Desalinated water is mostly available for emergency use for people during drought but not for agricultural or economic purposes. Limited local capacity on the islands to maintain desalination units, the isolated location of island communities and low run-times further increase maintenance and repair costs. • Limited storage capacity and scarce land for water tanks restrict water availability and quality, particularly during droughts. Many communities observe that rainfall is already not sufficient to meet their water security needs and inadequate household water tank capacity is a widespread issue for all islands. Maintaining household rainwater tanks and gutters is also challenging, as many households lack the resources and capacity to properly clean, maintain, and flush them while certified or experienced water infrastructure expertise (plumbers, engineers) in local communities being limited or non-existent. Additionally, sewage leakage from aging septic systems on some islands exacerbates health risks, further compounding water security challenges during dry periods. • Competition for water resources between domestic and agricultural use increases pressure on water resources and infrastructure during dry periods. This particularly exposes low-income populations as they often lack the financial resources to invest in water storage, irrigation infrastructure, and adaptive technologies, limiting their ability to cope with climate impacts. • Different perceptions on observed (by the community) and declared (as an emergency) water shortages and emergencies can lead to delays in emergency support since disaster recovery support can only be provided in States of Emergency.
Increased intensity of extreme precipitation events	Climate change driver/ climatic driver (ENSO)	• Damage caused by extreme flooding events to sanitation infrastructure can lead to overflows in septic tanks and pit latrines reducing water access due to contamination and increasing the health burden of exposed communities, particularly on marginalized groups. • Limited land availability and financial means for purchasing and maintaining water tanks reduces the capacity to capture and store increasing rainfall. • Intense rainfall and associated flooding can cause significant damage and can trigger coastal flooding and beach erosion. This can compromise water sources near the shoreline, increase salinity, and reduce access to safe water, leading to greater health risks for affected communities.
Increased air temperature and more hot days	Climate change driver	• Reductions in catchment water sources due to increased evapotranspiration affect water security and safety and reduce options for water access. • Power reliant desalination plants and sewage pumps increase vulnerability to power outages and maintenance and repair costs increase. • More frequent hot days will drive higher freshwater demand for both household and agricultural use.
Water pollution and other	Anthropogenic driver	• Absence of sewerage treatment facilities in Tuvalu and poor sanitation systems increase the risk of water borne diseases and lead to the degradation

environmental pollution		of coastal ecosystems. Nutrient runoff can increase the levels of nitrogen and phosphorus in the water, which can stimulate excess algal growth preventing sunlight for coral reefs and thus intensify coral reef degradation. In addition to posing additional challenges to Tuvalu's water security, this also weakens natural defenses against climate impacts.

46. Some or all above climate hazards will continue to increase the pressure on water security in Tuvalu and resulting human vulnerabilities. Water scarcity, saltwater intrusion, and damage to water infrastructure undermine access to safe and reliable water, increasing the risk of waterborne diseases and poor hygiene, especially during droughts and extreme weather events. Limited financial resources, technical capacity, and infrastructure, particularly in outer islands, reduce the ability of households to maintain water systems, increasing reliance on unsafe sources. Vulnerable groups, including low-income households, women, children, and the elderly, are disproportionately affected due to reduced access to health services, inadequate coping mechanisms, and heightened caregiving responsibilities. These stresses are compounded by inconsistent emergency response mechanisms and degraded natural ecosystems, making communities less resilient to both short-term shocks and long-term climate impacts. As a result, the country has identified water security as a key vulnerability sector to climate change[74]. Yet, climate risks and impacts on water security differ among various factors, including geographic location, The size of the groundwater lens, rainwater catchment area and storage infrastructure, and wastewater management systems. As a result, key water security challenges are not distributed homogenously among all Tuvalu's nine islands and their key characteristics are outlined below:

47. Due to its vulnerability to climate change and alignment to sustainable development achievements, water security is included in several key strategic documents (refer to section II D for details). By playing a key role in addressing climate-related risks and impacts on fresh water and sanitation infrastructure, the proposed project is therefore supporting Tuvalu's national priorities related to water security. A number of water security related projects have been or are currently implemented in Tuvalu. The proposed project will collaborate with and build upon these initiatives (see section II F for details).

Table 2: Key water security vulnerabilities for Tuvalu's nine islands

Island	Population[75]	Integrated Vulnerability Assessment (IVA) Score[76]	Water Security Vulnerabilities in islands
Funafuti	**6,602**	**2.2**	• Inequitable access to (and in parts insufficient) water harvesting and storage infrastructure • Insufficient rainfall to meet water needs. Prolonged dry spells impose significant social and economic costs due to high population density, limited land availability, and groundwater contamination. • A growing population has and continues to increase demand for and pressure on freshwater. • Electricity reliant desalination exposes water supply to energy insecurities (power outages during heat and flooding events, high import costs of fossil fuels etc.). • Regular septic effluent discharge and overflow from non-sealed tanks can affect several households due to their proximity. • Leaking or faulty household water tanks, along with the inability to afford maintenance, repairs, or system upgrades, contribute to water insecurity.
Nanumaga	**391**	**2.4**	• Insufficient water harvesting and storage infrastructure.
Nanumea	**610**	**2.6**	• Insufficient water harvesting and storage infrastructure. • The island has relatively stable groundwater availability and a more established reliance on wells compared to other islands.
Niulakita	**36**	**1.8**	• Insufficient water harvesting and storage infrastructure. • Groundwater is available but of poor quality and not suitable for drinking.

[74] CSIRO, 2024: Tuvalu National Adaptation Plan - Climate Impact, Vulnerability & Risk Assessment: Vulnerability Assessment Final Report. Commonwealth Scientific and Industrial Research Organisation (CSIRO), CSIRO Technical Report, Melbourne, Australia.

[75] Government of Tuvalu, 2022: Tuvalu 2022 Census on Population and Housing

[76] 1 – high vulnerability / 5 low vulnerability.

			• Insufficient rainfall to meet water needs. • Identified as island with highest vulnerabilities to water security.
Niutao	**550**	**2.0**	• Experiences issues around freshwater contamination from wastewater and waste management challenges. • Limited natural water sources are insufficient to meet water security demands.
Nukufetau	**581**	**2.1**	• The island has relatively stable groundwater availability and a more established reliance on wells compared to other islands.
Nukulaelae	**341**	**2.8**	• Insufficient rainfall to meet water needs. • Insufficient water harvesting and storage infrastructure. • Increasing salinity of groundwater resources.
Nui	**514**	**2.0**	• The island has relatively stable groundwater availability and a more established reliance on wells compared to other islands. • Insufficient water harvesting and storage infrastructure.
Vaitupu	**1,007**	**2.1**	• Limited natural water sources are insufficient to meet water security demands.

Source: CSIRO and Deloitte[77]

K. Barriers to be addressed

48. Despite past and ongoing efforts to increase water security for the Tuvaluan population, underlying barriers continue to exist. The persisting barriers that this project will address have been identified through a review of primary and secondary sources, along with a stakeholder engagement process during concept development led by the Department of Climate Change. Sources include the Sustainable and Integrated Water and Sanitation Policy (2012-2021), the draft WASH Policy, Tuvalu's Updated Nationally Determined Contribution (2022), the 2022 Water Surveys that were conducted in all islands, integrated vulnerability assessments that were conducted in 2018, all island strategic plans and the recently published Climate Hazard Assessment, Risk Assessment and Vulnerability Assessment reports that were developed within the Tuvalu National Adaptation Plan (NAP) process. Primary sources were complemented by consultations with water management experts and coordinators during the concept note development phase. Initial community level consultations were conducted during the concept phase and will be complemented during the project development phase (refer to section H on the consultative process). The main barriers to climate change adaptation in the water sector in Tuvalu include:

49. Barrier 1: Limited community awareness and skills on climate resilient water resource and ecosystem monitoring, management, and restoration.
Local communities in the outer islands of Tuvalu often face significant gaps in their understanding and capacity to manage and monitor their water resources in a climate-resilient way. This includes limited knowledge of essential practices such as household water management plans, regular monitoring, and sustainable use of available water sources. Increasing awareness on water conservation methods, providing practical training in water monitoring techniques, reducing the flow of contaminants and pollution into freshwater reserves and surrounding coastal ecosystems, and nurturing a sense of collective responsibility for ecosystem protection can help communities to better safeguard their water supplies and surrounding environments. While national and sub-national processes provide some coordination and support for the water sector, the effectiveness of infrastructure and the ability of communities to manage their systems will ultimately determine the project's success. Empowering local stakeholders with the skills and knowledge to sustainably manage and restore their resources not only enhances climate resilience but also ensures long-term health and well-being for both people and ecosystems.

Construction of household rainwater and septic tanks is usually done by individual households that have limited capacity to effectively install and maintain climate resilience water and sanitation infrastructure. Households often need to rely on drinking water from rainwater tanks that are rarely cleaned due to lacking knowledge in how to clean them and hesitation to empty tanks for cleaning. Communities also lack capacity in implementing measures that reduce climate and disaster impacts on key water infrastructure components (such as gutters). Capacity building for households and communities on critical water infrastructure components that have relatively low-complexity maintenance requirements (such as cleaning and improving gutters) is urgently needed and should be accompanied by specialized assistance from PWD on rainwater storage and sanitation infrastructure maintenance and inspection (cleaning and

[77] CRIRO and Deloitte 2024, Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement.

repairing of rainwater tanks, septic tanks, water filters etc.).

Some of the local *Kaupule* in the outer islands have designated water and sanitation coordinators but they lack the experience, capacity and equipment to conduct water quality testing. In Tuvalu's recent Vulnerability Assessment, 55% of people consulted that there is limited to no community members with skills to monitor water quality. Consulted communities also pointed out that water quality testing in the past was conducted by non-trained personnel, potentially leading to inaccurate assessments and influencing public perception and use.[78] WASH technical experience is very limited throughout the country, from the national to the local level. Whereas a WASH Policy is currently being drafted, key disaster and climate government agencies still lack essential technical experience with WASH and are mostly relying on local NGOs to implement small-scale WASH community awareness programs, mainly targeting school children on some islands.

Although drought management plans have been developed for most of the islands, local governance systems do not necessarily implement them or are even aware of them for various reasons, including staff turnover in local decision-making bodies. Furthermore, there are currently no specific water management guidelines in the communities of the outer islands, such as water consumption guidelines during droughts, water storage guidelines, efficient consumption, or a protocol on when to declare a sanitation outbreak that would further describe responsible water management in the communities. 39% of people consulted in Tuvalu's recent Vulnerability Assessment reported that the *Falekaupule* and *Kaupule* lack capacities to strategically engage with dedicated partners to address priority water projects. Leveraging existing local governance mechanisms, the project will support the establishment of necessary capacity, guidelines and management strategies to empower communities in managing their water resources effectively and sustainably.

Furthermore, given its sensitivity, developing and using groundwater requires additional expertise to monitor, manage and restore these resources and ecosystems. For example, in Nukufetau, a wind powered groundwater abstraction pump was installed but the groundwater was over-abstracted and led to the depletion of the aquifer damaging the local environment. If groundwater is used, long-term monitoring systems including boreholes need to be established to manage supply, assess climate impacts and regulate abstraction rates, ensuring sustainable water availability and maintaining its quality. Periodic groundwater sampling for bacteriological analysis is further recommended to assess contamination risks. Ultimately, a well-designed monitoring network would enable early warning systems and proactive resource management to avoid improper land use that puts groundwater resources at risk.

Outcome 1 will address barrier 1 (refer to section II A for details).

50. Barrier 2: Limited knowledge of the availability and quality of groundwater resources in some of the islands

Although thorough groundwater lens assessments have been conducted in some islands by previous water projects (i.e. in Vaitupu, Nanumea, Nui, Nukufetau and Funafuti), the groundwater of the remaining islands is yet to be assessed. For example, Niulakita, the island that is ranked highest in terms of water insecurities of all islands in Tuvalu, reportedly has groundwater but this is of poor quality and not suitable for drinking. The importance of providing communities with a better understanding of their groundwater resources is critical, as shown by the example of the island of Nukufetau. The people of the island relocated their piggeries to a part of the island that has been found, in a subsequent groundwater assessment, promising for groundwater extraction. Knowing more about the groundwater resources available and its quantity and quality is invaluable for local communities to inform local land management practices and in identifying freshwater groundwater sources that could supplement existing water supplies or provide a backup during dry periods.

Outcome 2 will address barrier 2 (refer to section II A for details).

51. Barrier 3: Financial constraints preventing individual households, communities and local public institutions from establishing climate resilient water supply and sanitation systems

In the outer islands of Tuvalu, water is largely viewed either as a private responsibility (through private rainwater harvesting systems or wells) or as a public good (through community storage and community

[78] Government of Tuvalu 2020: Tuvalu Integrated Vulnerability Assessment Report: Amatuku Islet, Funafuti.

wells). The lack of market signals, such as pricing mechanisms and permits, along with inadequate planning and incentives (Barrier 1) and inadequate available water storage and sanitation infrastructure affect water security and can lead to overextraction from limited available water sources which is further intensified by climate change impacts, such as saltwater intrusion, rising temperatures, shifting rainfall patterns, and more frequent extreme weather events.

Water surveys for all islands conducted by the Government in 2022 revealed that out of the 4,215 water tanks that were counted during this exercise, 20% were in need for repair. In addition, 53% of the catchment systems and gutters were assessed to need repair in the 8 outer islands (excluding Funafuti).[79] Particularly the islands in the north of the country (Nanumea, Nanumaga, Niutao) are in need for additional storage capacity (both at the household and the community level) due to their vulnerability to reduced rainfall and prolonged droughts. Due to the heavy reliance on private rainwater harvesting and storage, significant differences in water shortage vulnerabilities exist among the islands and households throughout the country.

Some large households with small storage capacity face water supply shortages after two weeks without rain. In such cases, households need to fall back on either community supply or expensive desalinated water at costs of AUD$ 13 per 500 gallons. Water filters are usually not available in individual households and community levels, and households rely on boiling, or if not available or too expensive, on drinking the water unfiltered from the tanks. Where available, households can purchase filtered water from shops (mainly only in Funafuti), which come at around AUD$ 2 per 5 L.

Furthermore, provisions of the Tuvalu Building Code related to water infrastructure have largely not been applied as many households face financial difficulties in meeting these standards or affording the costs associated with major water infrastructure improvements.[80]

Many communities (50% of consulted people in the Vulnerability Assessment)[81] observe that with their existing storage capacity the current rainfall is not sufficient to meet their water security needs and there is a continued need to extend water storage capacities throughout the country and particularly in the northern islands.

Finally, developing groundwater resources on atolls includes the construction of groundwater replenishment systems (such as horizontal infiltration galleries) and accompanying water infrastructure (pumps, storage etc.). Vaitupu and Nanumea are currently in the process of installing groundwater infiltration galleries as a result of their previously conducted groundwater assessments. The proposed project will enable infrastructure needs and solutions that were identified to develop groundwater resources on promising locations.

Due to Tuvalu's primarily subsistence-based economy with heavy reliance on agricultural activities and the above-mentioned structural limitations of Tuvalu's economy, technical and financial assistance plays a crucial role. [82] Accessing government programs to finance water supply projects has been repeatedly identified as issue of local communities and 71% of people consulted indicated that they have limited ability to pay for the operations, maintenance and upgrade of their household water systems.[83] Outside of emergency situations, funding is often very limited for regular inspection or preparedness activities.

Together with Barrier 1, financial constraints have led to the downscaling of infrastructure projects or inadequate funding for optimal climate resilience measures. This has heightened vulnerability as seen in the aftermaths of the 2011 droughts or recent cyclones.[84] Limited investment in water infrastructure remains a significant barrier to achieving climate-resilient water security and sanitation.[85]

[79] Government of Tuvalu, Water Survey Reports for all islands of Tuvalu. Available at: https://www.tuvaluclimatechange.gov.tv/data-and-documents (Accessed on 04 February 2025)
[80] Government of Tuvalu 2020: Tuvalu Integrated Vulnerability Assessment Report: Funafuti Community, Funafuti
[81] Government of Tuvalu 2020: Tuvalu Integrated Vulnerability Assessment Report: Amatuku Islet, Funafuti.
[82] International Monetary Fund (IMF), 2021: 2021 Article IV Consultation - Press Release; Staff Report; And Statement By The Executive Director for Tuvalu (IMF Country Report, 21/176: International Monetary Fund.
[83] Government of Tuvalu 2020: Tuvalu Integrated Vulnerability Assessment Report: Funafuti Community, Funafuti.
[84] CRIRO and Deloitte, 2024: Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement.
[85] Government of Tuvalu, 2013: Sustainable and Integrated Water and Sanitation Policy 2012-2021.

Outcomes 1, 2 and 3 will address barrier 3 (refer to section II A for details).

52. Barrier 4: Inadequate institutional and coordination capacities and absence of data sharing mechanisms for integrated and climate-resilient water management

Although public expenditures are relatively high compared to the overall size of their economies, Tuvalu, like other Small Island Developing States, has a small public sector that is constrained both by financial (see Barrier 3) and human resources necessary to deliver essential services, including water and sanitation.[86] Fragmented roles and responsibilities; lacking mandates and empowerment for existing coordination mechanisms (such as the National Water and Sanitation Steering Committee); inadequate coordination among the several programmes, low (technical) capacity in Government and local communities due to turnover and high costs; insufficient water data collection and sharing for evidence-based decision making; and a lack of policy and planning mechanisms backing up climate resilient water strategies are among the key barriers.[87] Albeit being one of the main priorities for the Government, water is currently being managed by several departments and offices in the Government (such as the Public Work Departments (PWD), National Disaster Management Office (NDMO), or the Climate Change Department (CCD) etc.) alongside several NGO and CSO groups that are actively supporting communities in the area of water and sanitation. For example, in the past, several projects conducted water storage, catchment potential and drought vulnerability assessments with little overlap or coordination between these initiatives. Data-sharing mechanisms and regular coordination among all relevant water actors in the country are needed to bring climate-resilient water governance to the next level.

PWD currently does not have staff based on the outer islands but regularly deploys technicians for the maintenance of the desalination units in the outer islands. Specialized water infrastructure expertise such as plumbers or engineers are either very limited or non-existent in local communities and need to be sourced from the capital. PWD is in need for developing a workforce plan and capacity building for its workforce of engineers, plumbers and technicians to provide water maintenance and inspection services to the outer islands. Although training has been provided in the past, frequent rotation of staff and brain drain leads to recurring loss of gained knowledge and expertise. Alongside maintenance and inspection support on water and sanitation infrastructure provided by PWD, strong local capacity is crucial for achieving enhanced water security in Tuvalu on the community level.

The country also lacks national standards on water quality and sanitation. Workforce planning and regular capacity assessments, improving data collection and management tools, ensuring and enforcing effective water policies and regulations, increasing capacities and expertise in relevant water governance departments and a stronger role of island *Kaupule* and community-based organizations in local water resource management are needed to overcome this barrier.[88]

Outcome 3 will address barrier 4 (refer to section II A for details).

Project Objectives:

The overall goal and objective of this project is to increase the resilience of the people of Tuvalu to the impacts of climate change by enhancing their water security.

[86] World Bank, 2016: Systematic Country Diagnostic For Eight Small Pacific Island Countries: Priorities For Ending Poverty And Boosting Shared Prosperity. World Bank
[87] Government of Tuvalu, 2013: Sustainable and Integrated Water and Sanitation Policy 2012-2021.
[88] CRIRO and Deloitte, 2024: Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment. Risk Assessment: Technical Supplement

Project Components and Financing:

Project Components	Indicative Activities	Expected Concrete Outputs	Expected Outcomes	Amount (US$)
1.Strengthening community-level water security and sanitation infrastructure	1.1.1 Establish a training-of-trainers (ToT) system and community-based water monitoring teams for regular water quantity and quality testing	1.1. Monitoring systems established to track water quality and ecosystem health	1. Communities are empowered to plan, monitor, and manage their climate resilient water resources	**800,000**
	1.2.1 Strengthen community understanding of climate risks and how to restore and maintain ecosystem services and functions for securing water supply 1.2.2 Conduct custom-made water and sanitation training and awareness campaigns on installation and maintenance of rainwater harvesting systems, infiltration galleries, sustainable sanitation and hygiene, demonstration projects for high school students, and new WASH and/or water conservation material 1.2.3 Support establishment of locally managed groundwater protection zones 1.2.4 Support developing or strengthening existing local water management guidelines such as local standards and protocols for water access, consumption, and sharing in times of water stress.	1.2 Training on improved water management practices delivered to minimum 50% of island communities in 5 islands (2,000 people)		
	2.1.1 Conduct groundwater resource and water need assessments 2.1.2 Construct and/or restore infiltration galleries, groundwater wells and accompanying water infrastructure 2.1.3 Establish monitoring boreholes in each island	2.1 Groundwater infiltration galleries and groundwater wells and accompanying water infrastructure established for up to 3 islands enhancing the resilience of the groundwater lens and increasing water provisioning	2. Communities have increased access to climate resilient water and sanitation infrastructure	**6,541,014**
	2.2.1 Provide new or upgrade existing water infrastructure such as rainwater harvesting tanks, cisterns, catchment systems, and water filters in vulnerable communities	2.2 Rainwater harvesting infrastructure for all households in each of the 8 islands and Motufoua Secondary School provides high quality drinking water		

	2.3.1 Design and determine suitable sanitation solutions for each island 2.3.2 Implement appropriate sanitation practices and standards in selected islands	2.3 Sanitation infrastructure is upgraded and expanded to reduce pollution and protect ecosystems and humans		
2. Enhancing institutional capacity for climate resilient water governance	3.1.1 Review and support strengthening and enforcing relevant climate and water policies for improving water storage and sanitation	3.1 National water and sanitation policies and planning frameworks reviewed, updated, and formally adopted	3. Institutions are strengthened to manage climate risks impacting water security	**1,000,000**
	3.2.1 Support technical training in water and sanitation to enhance institutional capacity 3.2.2 Develop maintenance, workforce and procurement plans for local communities and relevant water institutions	3.2 Technical staff are trained on operation, maintenance, repair and inspection of water of sanitation infrastructure to enable sustainable water and sanitation services to the island population		
	3.3.1 Establish a national water storage database and integrate data collected by local water monitoring into relevant government knowledge management platforms 3.3.2 Coordinate water stakeholders and establish an M&E framework	3.3 Water data-sharing service established to provide government departments timely, harmonized, and accessible data for informed decision-making and integrated, climate-resilient water management		
	6. Project/Programme Execution cost (9.5%)			875,576
	7. Total Project/Programme Cost			**9,216,590**
	8. Project/Programme Cycle Management Fee charged by the Implementing Entity (8.5%)			783,410
	Amount of Financing Requested			**10,000,000**

Projected Calendar:

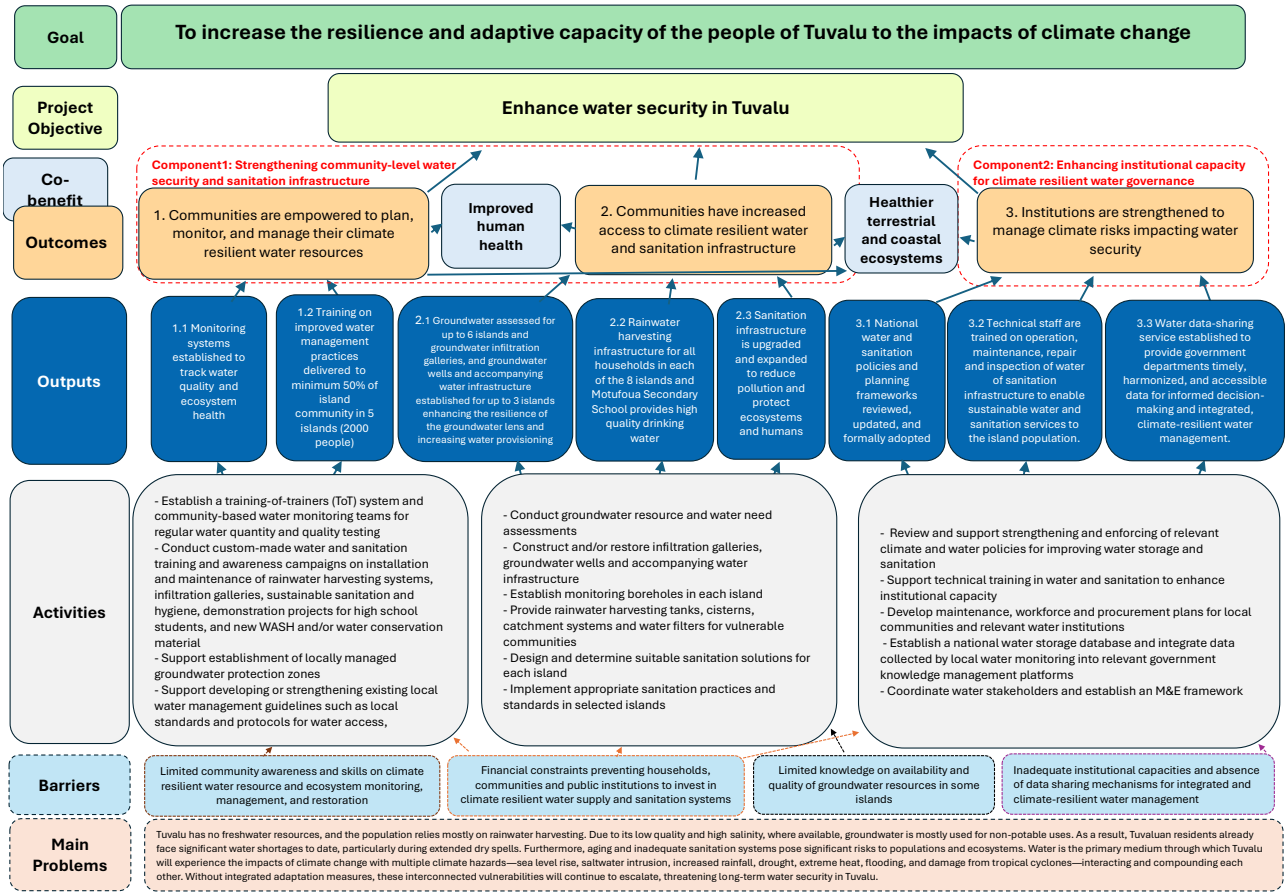
Milestones	Expected Dates
Start of Project/Programme Implementation	January 2026
Mid-term Review (if planned)	June 2028
Project/Programme Closing	December 2030
Terminal Evaluation	August 2031

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Project Components

53. Based on the above barrier analysis, a Theory of Change has been developed with outputs geared towards delivering improved water security to reduce the vulnerability of the people of Tuvalu to the impacts of climate change. Figure 1 presents the Theory of Change including the relevant Results Framework and how the project will contribute towards enhancing the adaptive capacity of the water and sanitation sectors of Tuvalu. The project goal is **IF** water provisioning investments and water management processes are made, **THEN** water security of vulnerable communities in Tuvalu will be enhanced, **AS A RESULT OF** enhanced community empowerment, awareness and capabilities, increased access to climate resilient water and sanitation infrastructure, and strengthened national water governance capabilities.
The project is expected to directly benefit 4,030 people (2,060 male / 1,970 female) residing in the outer islands. These beneficiaries include 1,383 children (age 0-14 years) and 950 people with disabilities.

Figure 1: Theory of Change



54. The project will be delivered through two components and three Outcomes to address the barriers identified in the previous section:

Component 1: Strengthening community-level water security and sanitation infrastructure
This component focuses on two aspects of community resilience towards climate change: supporting local communities in the eight outer islands of Tuvalu (Nanumaga, Nanumea, Niulakita, Niutao, Nukufetau, Nukulaelae, Nui, Vaitupu) to plan, monitor, and manage their climate resilient water resources (Outcome

1) and, at the same time, providing these communities on the outer islands (and potentially also households in the capital of Funafuti)[89] with climate resilient water and sanitation infrastructure solutions (Outcome 2).

Outcome 1: Communities are empowered to plan, monitor, and manage their climate resilient water resources

This Outcome has two Outputs, one focused on establishing community monitoring systems to track water quality and ecosystem health and one focused on establishing, or where existing strengthening, community-based ecosystem and water management practices.

Output 1.1. Monitoring systems established to track water quality and ecosystem health
Communities in outer islands of Tuvalu still lack awareness and skills on climate resilient water resource and ecosystem monitoring, management, and restoration (see barrier 1). This Output aims to address this barrier by supporting local communities in establishing community-based water monitoring teams that conduct regular quality and quantity testing of the local water resources. Particularly if groundwater resources are being developed, regular monitoring is critical to inform the community about the availability, sustainability and quality of these resources. Building on experience gained from previous projects, the project will closely work with the local *Kapule* in each island, and designated community drought, water and sanitation coordinators to establish community-led teams that regularly test the availability and quality of its water resources. The project will support this through the provision of easy to handle, lab and electricity free field water quality testing kits that are testing for bacterial contamination and salinity. Alongside the kits, the project will establish a training-of-trainers system on conducting regular testing for key water storage resources (community storage, household storage, groundwater etc.). A data sharing mechanism will be established to feed community data into relevant national databases (see Outcome 3).

Output 1.2 Training on improved water management practices delivered to minimum 50% of island communities in 5 islands (2000 people)

Although some projects have supported communities in the development of local drought management plans, local decision makers are often not familiar with these plans due to turnover rates in the local island committees. Furthermore, these plans lack guidance on water management practices, advised consumption rates, abstraction or water usage protocols during droughts. Under this Output, communities will be supported to establish or strengthen existing local water management practices and processes.

Considering the perspectives of all genders, age groups, and vulnerable populations and in close consultation with local communities, decision-makers, NGOs and women associations, the proposed activities will include support to develop local standards and protocols for water access, consumption, and sharing in times of water stress. To address limited maintenance and repair expertise on the outer islands, the project will closely work with the *Kapule* and the communities to provide dedicated training and awareness campaigns on low-complex but effective measures such as regular cleaning and repairing of guttering systems and rainwater tanks. It is important that these local trainings specially target women, youth and elderly since these are often the ones who are dealing with the systems and are usually at home when there is a break in the system. Training will follow a combined approach of hands-on training in the communities and virtual elements such as videos to regain or maintain knowledge.

Communities will also be supported with awareness raising on water storage and efficient consumption, developing and implementing household water management plans, sustainable and climate-resilient WASH practices (including for the students of Motufoua Secondary School on Vaitupu island), and with training on how to sustainably manage and restore their resources and ecosystems for securing climate-resilient water supply. The project will implement education and outreach programs through brochures, workshops, and public service announcements to raise awareness about water conservation. Community events and school collaborations will equip individuals with practical water-saving skills. Continuous monitoring and evaluation will ensure the effectiveness of these efforts, refining strategies based on feedback and impact assessments. Particularly groundwater extraction and usage require strict protection zones and abstraction protocols to protect the groundwater lens and ensure their replenishment. There is

[89] Whether the project will also support enhancing household storage capacity in Funafuti will be decided and confirmed during the project development phase (refer to Outcome 2 below).

evidence that changes in land use and managed groundwater recharge can improve water quality and replenishment, offering a promising way for low-lying island communities to strengthen their freshwater resources and adapt to the impacts of climate change.[90] Building on lessons from previous projects that established locally-led natural resource management (such as Locally Managed Marine Areas (LLMAs) under the Tuvalu Ridge to Reef project (Table 6)[91], the project will support communities in establishing locally managed groundwater protection zones.

Outcome 2: Communities have increased access to climate resilient water and sanitation infrastructure

This Outcome has three Outputs, the first focusing on assessing and, where proven feasible, developing groundwater resources in selected outer islands. The second Output will focus on providing vulnerable households with enhanced climate resilient water infrastructure. The third Output under this Outcome will tackle the sanitation infrastructure in outer islands to reduce pollution from wastewater and protect ecosystems and humans. Support provided under this Outcome will prioritize the purchase of durable equipment, contributing to the project's technical sustainability (in Part II.J).

Output 2.1 Groundwater wells and accompanying water infrastructure established for up to 3 islands enhancing the resilience of the groundwater lens and increasing water provisioning

This Output will support innovative approaches to addressing water security in Tuvalu's outer islands considering the prevailing combination of factors such as rainfall dependency for water supply, extended droughts and limited land space. Examples include studying the feasibility of communal water reservoirs and their potential to significantly enhance water storage capacity while considering the limited land space available on these islands. This will also facilitate the investigation of potentially successful and innovative solutions from other islands and from within and beyond the region facing similar geographic constraints.

Activities under this Output will also include infrastructure investment for infiltration galleries or groundwater wells and accompanying water infrastructure that is needed to develop groundwater in suitable locations (such as solar-powered groundwater pumps[92], additional storage capacity etc.). Nanumea and Vaitupu are currently in the process of installing groundwater galleries under different projects. Groundwater assessments conducted under previous projects in Nanumea and Vaitupu have revealed promising results for groundwater resources that are currently being developed by installing infiltration galleries in these islands. Infiltration galleries (or skimming wells) are horizontal systems of perforated pipes or prefabricated modules laid in trenches, designed to distribute groundwater pumping over a larger area, thereby reducing saltwater intrusion. Typically surrounded by gravel packs or using alternative materials, they connect to collector wells to supply freshwater. Infiltration galleries have been proven to be particularly effective on Pacific and have successfully implemented in Kiribati, Marshall Islands, Tonga and Cook Islands.

The project will initially focus on developing groundwater in Nukufetau and subsequently focus on up to two more islands with pending groundwater assessments to be conducted under this project (Nanumaga, Niutao, Nukulaelae and Niulakita).

Additional water resource supply though groundwater development will be coordinated to work in sync with and supply water to other planned water security measures in the local communities, such as the Solar Still Distillation (SSD) farms that are planned to be established in several islands of Tuvalu over the course of 2025.

Finally, this Output will support the establishment of monitoring boreholes on each island. Boreholes are critical to accurately measure and verify water resistivity data and interpret the vertical extents of the fresh groundwater bodies which will support accurate monitoring to be developed under Output 1.

[90] See for example Hejazian, M. et al., 2017: Land-use change and managed aquifer recharge effects on the hydrogeochemistry of two contrasting atoll island aquifers, Roi-Namur Island, Republic of the Marshall Islands.

[91] Locally Managed Marine Areas (LMMAs) have been established on all nine islands of Tuvalu, with community-led monitoring and management supported by the *Kaupules*. Through the Ridge to Reef project, extensive training was provided to strengthen local capacity, making community-based marine conservation more effective and sustainable (Terminal Evaluation of Tuvalu Ridge to Reef Project). According to the stakeholder consultations conducted during the concept development phase, most of these LMMAs are still in place to date.

[92] As prioritized in the country's forthcoming Technology Needs Assessment

Output 2.2 Rainwater harvesting infrastructure for all households in each of the 8 islands and Motufoua Secondary School provides high quality drinking water

In 2024, the Integrated Water Management Project managed by the Department of Climate Change conducted a thorough assessment on the existing public and private water tank infrastructure in all islands for its Tuvalu Water Forecasting Tool. The data reveals that 211 households in the outer islands do not have enough water storage capacity to withstand a drought of two months with water consumption to maintain essential needs of ca. 50 liters per person a day (Table 3).[93] These most vulnerable households to droughts will be supplied with additional water tanks of 10,000 liters each to increase individual minimum storage to a minimum of 3,050 liters per person. The tank size was determined based on the catchment area's limitations and the heightened health risks associated with stagnant water over extended periods.[94]

The project may support the procurement of entire tanks or establish a subsidy scheme in which parts of the finance for the tanks could be co-financed by the local communities or households. The latter would allow the expansion of the number of tanks that can be supplied with available resources and increase ownership of the equipment. The feasibility of such mechanism, including the willingness and ability to pay from local communities, will be assessed during the project formulation stage.

Although additional storage capacity in Funafuti is greatest due to its high population density, consultations with Government and other projects during the concept phase confirmed that other projects, such as the recently started ADB funded Funafuti Water Supply and Sanitation Project, will focus on enhancing water tank infrastructure in Funafuti. Whether the project will also support enhancing household storage capacity in Funafuti will be decided and confirmed during the project development phase. If additional water storage needs for Funafuti persist during implementation which are not addressed by the other projects, the project could support the identified most vulnerable 123 households that currently only have one water tank and do not have enough water storage capacity to withstand a drought of one month with water consumption to maintain essential needs of ca. 50 liters per person a day (Table 3).

Supplying water tanks to these households will be the top priority for the project and will be carried out in parallel with the groundwater assessments to identify additional water utilization options (Output 2.1). Due to their vulnerability to low rainfall and extended droughts, particularly the islands in the north (Nanumea, Nanumaga and Niutato) will be of high priority to receive additional rainwater storage infrastructure quickly. Water tanks offer a cost-effective way to improve water supply while having minimal environmental and social impacts. The table below shows estimates of the number of tanks that will be allocated to the most vulnerable households on each island. The initial step involves engaging with the community to reconfirm the exact number of tanks to be distributed for the most vulnerable households. Once finalized, the tanks will be procured and transported to the designated households. Tanks and ancillary equipment will be shipped by barge to the outer islands, then delivered directly to homes from the wharf using hired local tractors and manual labor. Based on lessons learnt from previous projects, dedicated budget for shipment and transportation of equipment will be reserved under this project and logistical efficiencies to avoid cost and time overshoots (e.g. shipping the equipment directly to the outer islands without a stop in Funafuti) will be explored.

Table 3: Estimated number of water tanks (10,000 liters each) to be supplied and repaired under the project

Name of island	Total Households	Estimated new private tanks to be supplied (per HH)	% of HH targeted with new tanks	Estimated private tanks to be repaired (per HH)	% of HH targeted with repaired tanks	Estimated public storage capacity to be repaired or replaced
Nanumea	126	37	29%	14	11%	4
Nanumaga	86	23	27%	20	23%	1
Niutao	122	30	25%	15	12%	2

[93] On average people in Tuvalu consume around 60 L per person and day and reduce this to 30L per person dan day during droughts.
[94] On average rooftops in Tuvalu are around 80m^2

Nui	106	33	31%	24	23%	2
Vaitupu	203	49	24%	54	27%	2
Nukufetau	107	16	15%	14	13%	4
Nukulaelae	61	23	38%	5	8%	2
Niulakita	8	0	0%	2	25%	0
Funafuti[95]	980	123[96]	13%	82	8%	19
Total	**1,799**	**334**	**19%**	**230**	**69%**	**36**

Since community storage systems are usually the first line of defense during droughts - households rely on these storages once their tanks are empty - this Output will also support the repair or enhancement of community storage capacity, with priority on fixing, replacing or enhancing the six identified public storage systems in Nanumea, Nanumaga and Niutato as informed by the stakeholder consultations during the concept phase. In addition, during the community consultations in the concept phase, Nukulaelae community indicated the need for additional cement community water cisterns for additional water storage. Furthermore, community storage systems will be equipped with water filters to ensure each community has at least one source of filtered water available.

Furthermore, this Output will address the urgent need to enhance the deficient water supply on Motufoua Secondary School on Vaitupu Island which functions as a national boarding school, serving students from all islands of the country as the only public high school.[97] Following a comprehensive water-need assessment for the school and in line with the school's priority to increase water storage areas, harvesting infrastructures and piping networks as recommended by the assessment made by PWD, the school will be provided by an improved storage of additional of 4110 m^3 by two new water cisterns and two tanks, and supply and harvesting system (roof catchment, gutters and piping). Support will also include repairs, including the replacement of defective gutters and piping.

Output 2.3 Sanitation infrastructure is upgraded and expanded to reduce pollution and protect ecosystems and humans

The lack of sewerage treatment and inadequate sanitation systems in Tuvalu, exacerbated by climate impacts like sea-level rise and flooding, increase contamination risks to freshwater, threaten public health, and degrade coastal ecosystems. .

Activities under this Output will include assessing the key challenges and gaps in the sanitation sector and determining suitable sanitation practices for each island, undertaking feasibility studies on potential island tailored sanitation solutions and implementing appropriate sanitation practices in selected islands. This detailed assessment will build up on a preliminary assessment which will be done in the PFG phase. To determine the most appropriate sanitation solutions for Tuvalu's outer islands, a step-by-step assessment will be conducted:

Building on the preliminary assessment conducted during the PFG phase, a detailed needs assessment will examine population details and the condition of the current sanitation infrastructure for each island and community. In a second step, a thorough understanding of local context, cultural practices, economic conditions, and geographic factors will inform the preferred and suitable solutions. Potential sanitation options, such as grey water, improved septic systems etc., will then be evaluated for technical feasibility, cultural acceptance, and alignment with water availability. Environmental impact and cost-benefit analyses will help to ensure sustainability and economic viability. Throughout the process, close community engagement will be a priority to incorporate local insights and preferences. Gender sensitive consultations will be part of this process to ensure that opinions and preferences of both genders to sanitation solutions are appropriately reflected and addressed.

Following the assessment, a pilot program will test the chosen sanitation solutions for effectiveness, community acceptance, and maintenance needs. Priority will be given to procuring and installing, in close cooperation with PWD, improved flood-resistant septic tank systems in the outer islands, particularly those what are in urgent need of repair. Any necessary adjustments will be made based on monitoring results

[95] Initially not covered by the project.
[96] Assuming minimum 1 month storage capacity (1,520 L per person per day) and for HHs that only have one tank.
[97] In line with AF00000311 CN: Strengthening adaptation against climate variability through increasing clean water supply and sanitation at Motufoua Secondary School

and community feedback before wider implementation. Once scaled up, ongoing monitoring and evaluation will continually incorporate community input and assess performance indicators to ensure the solutions remain effective and adaptable over time.

Component 2: Enhancing institutional capacity for climate resilient water governance
This component focuses on strengthening national and local institutions to manage climate risks impacting water security (Outcome 3).
Outcome 3: Institutions are strengthened to manage climate risks impacting water security
This Outcome has three Outputs, with the first focusing on supporting the improvement of relevant water and sanitation policy and planning frameworks. The second Output will train relevant technical staff in climate resilient water and sanitation management to enhance institutional capacity. The third Output will support establishing appropriate data-sharing and governance mechanisms to enable knowledge on climate-resilient water management to be managed effectively and sustainably.

Output 3.1: Technical staff are trained on operation, maintenance, repair and inspection of water of sanitation infrastructure to enable sustainable water and sanitation services to the island population
Tuvalu's water governance faces significant barriers due to fragmented institutional responsibilities, insufficient coordination, limited technical expertise, inadequate workforce planning, low community-level capacities, ineffective data-sharing, and the absence of enforced water quality and sanitation standards. Building on the thorough assessment on persisting policy gaps in the water and sanitation sectors of Tuvalu that will be conducted during the PFG phase, the project will support reviewing, strengthening and enforcing relevant climate and water policies for improving water storage and sanitation. For example, since Tuvalu currently does not have local standards on water quality, the project will support developing these and other relevant water and sanitation-related standards in line with a new Public Health Act that is currently under development. Furthermore, the project will support developing further guidance and planning documents needed to implement the WASH Policy that is currently under development. Another element of support will be reviewing relevant Drought Management Plans and the Drought Declaration Thresholds on how to integrate data from groundwater monitoring into these and other relevant drought management documents.

Finally, although a new Building Code has been adopted in Tuvalu, it is not currently being applied to private dwellings as the standards for water and sanitation are difficult to meet by individual households, mainly due to capacity issues and financial constraints. The project will support reviewing of the Building Code and suggest solutions to adapt it to the local circumstances while keeping compromises on water and sanitation to the minimum. Responding to the need expressed by schools in Tuvalu, the project will also support developing WASH infrastructure guidelines for schools that are in line with the Building Code. The Building Code and the need for associated existing guidelines will be assessed during the project formulation stage. The project will also support a feasibility study on an incentive scheme that could be rolled out to provide additional funding for climate-smart water and sanitation infrastructure in new infrastructure projects.

Output 3.2 Water data-sharing service established to provide government departments timely, harmonized, and accessible data for informed decision-making and integrated, climate-resilient water management
This output focuses on addressing institutional gaps where they are most urgently needed and have the highest likelihood of being sustained. Based on a preliminary assessment conducted during the PFG phase, as a first step, the project will review, identify gaps and needs to existing water and sanitation training needs and capacities. In a second step, based on this assessment and alongside the maintenance and repair training provided to households and communities under Output 1.2, the project will support technical training in water and sanitation to enhance institutional capacity. Examples include targeted vocational and on-the-job technical training to PWD staff to support establishing a water and sanitation repair, maintenance and inspection unit of specialized PWD staff (water engineers, plumbers, technicians). Training will also be provided to local communities and PWD technical staff on maintaining and operating the desalination units in the outer islands. This water and sanitation repair, maintenance and inspection unit will accompany the regular desalination maintenance schedules (usually every 3 months) to the outer islands to inspect water and sanitation systems and conduct more complex repair and maintenance tasks on rainwater and septic tanks, water filters, catchment systems or storage and pumping equipment for the groundwater galleries. These inspections would also serve to verify, update

and complement the information in the national database on water storage capacities (see Output 3.3).

Leveraging households' ownership and responsibility and combining it with reliable service support for specialized tasks that go beyond the individual community's ability, will ensure that systems are maintained effectively and serve their maximum purpose. In order to sustain that service level beyond the project, the project will support PWD in setting up a workforce and budget plan for sustained funding from the Government and defining the capacity needed to ensure appropriate expertise is available to provide Funafuti and the outer islands with sustained water and sanitation services. On the local level, due to ongoing supply issues of key water and sanitation parts (such as gutters), the project will work with the local *Kaupule* and Motufoua Secondary School on procurement and maintenance plans and support pre-ordering of relevant key parts so that they are available on the islands when they are needed.

Output 3.3: Data-sharing mechanisms established to support knowledge management for climate-resilient water management

Although water is a government priority, it is currently managed by multiple departments and offices in the Government and there is need for improving coordination and data-sharing among all water actors in the country. While there is consideration by the Government to establish a single Water Department or Authority to oversee water and sanitation governance in the country, this project will support these plans and establish data sharing mechanisms for integrated and climate-resilient water management. As a first step, the project will employ a data specialist embedded within PWD to ensure that all data on water storage and catchment infrastructure in the country is widely accessible, harmonized, not duplicative and up to date. New data, such as data on groundwater ability and quality, will feed into this database and be made available to relevant Government offices such as the Meteorological Office or NDMO. The project will support the use of this data in the application of groundwater modelling tools by Meteorological Office and NDMO for disaster preparedness and response and PWD for maintenance and servicing needs. Activities under this Output will also support the functioning of a future water regulatory body to share information and ensure water and sanitation activities in the country address identified needs and priorities and are complementary. This will be further discussed with Government during the PFG phase.

B. Economic, social and environmental benefits and approach to avoid or mitigate negative impacts

55. The project will lead to the following benefits:

Table 4: Economic, social and environmental benefits of the project

Benefit Category	Benefit Sub-category	Description
Economic	Health	- Clean water and good sanitation are needed to prevent serious health issues. During the severe drought in 2011, there was an outbreak of diarrhoea with a total of 244 cases recorded, predominantly in children. Decreased hand washing due to low water reserves was one factor that contributed to the risk of diarrhoea. Low household reserves also made a way for pathogens to contaminate consumed water. In order to conserve water, people also substituted clean rainwater for groundwater which is more likely to be contaminated. The increased supply of clean water for dry periods, and the improved sanitation systems, means that proper hygiene can be maintained, and health problems avoided, especially for children who are more susceptible to sanitation related health issues. - Improved sanitation also provides non-incremental benefits due to a reduction in health expenditure as a result of a decrease in the incidence of waterborne disease and avoided loss in productivity because of working days lost. Assuming that waterborne disease case costs A$124[98] per person and year, and a reduction rate of 30% diarrhea[99] and other waterborne diseases, savings of A$148,800[100] in health-related expenditure is estimated as co-benefit from this project. Furthermore, avoided yearly productivity losses are estimated at A$141,120[101].
	Education	- The use of water from underground wells at schools requires physical and time-consuming water fetching. Providing additional storage infrastructure to schools alongside awareness and

[98] ADB, 2024: Annex 3 to Funafuti Water Supply and Sanitation Project. Assuming treatment costs per waterborne disease case including medicines and tests but excluding doctor's fees.
[99] WHO, 2014: Preventing diarrhea through better water, sanitation, and hygiene: exposure and impacts in low and middle income countries.
[100] Assuming one case per person in the outer island per year (ca. 4,000).
[101] Assuming one case per economically active (60%) person in the other island per year (ca. 2,400), average salary of A$ 49 per day and two days lost of productive due to illness.

		trainings will not only increase student's knowledge about climate resilient water and sanitation but further allow them to focus on studies rather than fetching water and thus will lead to positive education outcomes.
	Agriculture	- With a diversified and increased water supply, people will be able to have sufficient water supply for livestock and agricultural use. This will also increase agricultural output and food security particularly during dry periods without impacting water security
	Improved household economy	- The cost of a water tank is significant. Low-income families are not able to buy a tank or will have to make compromises on the recommended size or design due to financial constraints. This project will provide particularly low-income families that currently do not have sufficient water tank infrastructure with additional water tanks for dry periods (Table 3). - In Funafuti, PWD provides the service of refilling tanks and cisterns at a price of AUD$13 per 500 gallons. While this service is currently not available in local communities in the outer islands, these communities possess community storage that serve as second defense for water supply once private water tanks are empty during droughts. Increasing both households and community water storage capacity will decrease the reliance and resources spent on community water resources. Leveraging diversified water supply options such as increased rainwater and groundwater usage will make communities less reliant on costly desalination plants.
Social	Reduced conflict	- There have been cases where conflicts arose concerning the use of water stored at communal centers during times of low rainfall. Having adequate storage capacity can aid in avoiding such conflicts, maintaining peace in the community, especially during times of crises such as droughts also ensure the elderly, women and children have adequate supply of water. Localizing water management and consumption guidelines will also help navigate such potential future conflicts on the community level.
	Gender equality[102]	- Women in Tuvalu play a central role in water collection and management, making them critical stakeholders in water security projects. They play a central role in ensuring their family's food security and production and bear the brunt of a household's domestic work. While women are often responsible for cultivating crops in homestead gardens, raising small livestock, and creating handicrafts, they are usually those responsible for fetching water during droughts restricting them from engaging in income-generating work or educational activities. Providing additional water storage capacity on the household level will lessen the burden on women and youth to engage in water fetching. Due to their critical role in Tuvaluan households, targeting women and youth with water management and WASH activities will be of priority for this project. - While many Tuvaluan men work overseas for many months, women, youth and elderly are often those who are at home managing the household water resources and maintaining the infrastructure. However, women are not adequately represented in decision making in local communities. Since gaining independence in 1978, only three women have been elected to the government. In 2021, women held approximately 6% of parliamentary seats, reflecting significant gender disparity in political representation. As a project co-benefit, increased gender representation is expected through women participation in the local water monitoring and management teams. - Women are also those that usually are engaged in caretaking activities of the elderly, disabled and the youth. However, a recent assessment by the Gender Department of the Government of Tuvalu revealed that access to water, such as tabs, is often not well placed to provide easy access for disabled people, youth and elderly. The project will ensure gender- and vulnerability-balanced beneficiary distribution benefiting needs of all people, particularly the vulnerable populations including women, elderly, disabled and the youth.
Environmental	Increased groundwater lens	- While seawater intrusion is the primary cause for saline groundwater, a contributing factor is the increased extraction of water from wells. Overextraction allows seawater to seep in faster as the level of freshwater decreases faster than it is replenished. Together with increased water storage capacity, the regular monitoring of groundwater resources and the establishment of groundwater protection zones will protect groundwater reserves, allow their replenishment and reduce seawater intrusion. This is particularly beneficial for outer island communities that still have potable well water as they will be able to maintain the natural water reserves.
	Reduced water pollution	- Improved sanitation will prevent the deterioration of local marine ecosystems. Wastewater transports pathogens, nutrients, contaminants, and solids into the ocean that can cause coral bleaching and disease and mortality for coral, fish, and shellfish.

[102] A gender analysis and comprehensive ESS screening will be conducted during the project development phase (see section K).

56. Avoiding or mitigating negative impacts: Acknowledging its potential impacts, the project will implement a number of measures to ensure that all risks of negative social or environmental impacts related to the project interventions are avoided or mitigated:

- The project will conduct Environmental Impact Assessments where needed, particularly for the water supply and sanitation infrastructure solutions. The full proposal will further include a concise waste management and pollution prevention plan.
- Project staff will include an environmental specialist who will ensure that the project complies with all relevant environmental legislation in Tuvalu and is implemented in a way that achieves the environmental outcomes intended, while ensuring that there are no negative environmental impacts or maladaptation as a result of the project.
- The project will employ a Gender and Social Safeguards Specialist who ensures that the project intervention takes into consideration the different impacts of climate change on men and women as well as other vulnerable groups, youth, child-headed households and people living with disabilities. For community consultations, and in cooperation with experts of the Tuvalu National Council for Women and the Gender Department of the Government, separate consultations with gender and age groups will be conducted to ensure that all community members are in an environment to express their needs and opinions and that the that project effectively responds to the unique needs of all people.
- The project will employ a gender-balanced beneficiary distribution through the integration of gender-specific needs and priorities in the delivery of infrastructure, community development and water management trainings (Outcome 3) and a gender balance in awareness raising and trainings on climate risks associated with water security (Outcome 1).
- Since women, youth and elderly are key agents of change to ensuring that water infrastructure on the local and household level is being appropriately maintained and operated, the project will develop and provide targeted training and awareness raising for these key groups under Outcomes 1 and 3.
- The project will develop gender and age specific awareness campaigns on improved sanitation and water management specifically women, youth and elderly, ensuring an adequate representation of these in trainings and improving household well-being through water conservation and usage (Outcome 1).
- The data specialist employed by the project and the project team will be trained on gender-related issues and will ensure that gender disaggregated data is collected to inform gender-sensitive indicators for the M&E framework (Outcome 3).

C. Cost-effectiveness of the proposed project

57. This project will build on established best practices and lessons learned from previous water projects, and will be carried out in close collaboration with all relevant stakeholders and ongoing water projects in the country (see section F for details). By introducing a reinforced approach that integrates risk management and climate change resilience from the outset and leveraging existing local and national government-owned and -led processes, this project intends to support Tuvalu in breaking the cycle of repeated construction and reconstruction due to inadequate infrastructure or natural hazard impacts. By providing lasting, climate-resilient water security and sanitation solutions that communities can select and be trained to implement and maintain, will allow climate vulnerable communities of Tuvalu to better prepare for and recover from climate-induced disasters and will allow stretched government budgets to be directed to other important needs.

58. Implementing improved water and sanitation systems will require an initial investment in infrastructure development, such as constructing water storage, toilets, waste treatment facilities, groundwater infiltration galleries, or other water supply systems. While the upfront costs can be substantial, the long-term benefits in terms of improved public health, reduced healthcare expenses, and increased productivity outweigh the initial investment, making it cost-effective in the long run.

59. The project will prioritize the most cost-effective adaptation solutions. Often the deployment of centralized rainwater cisterns can be more cost effective than household rainwater tanks but construction of community cisterns on atolls is often limited by the severe scarcity of available land. The project will

therefore prioritize community options where feasible, while supporting the most vulnerable households with rainwater tanks to increase water security to minimum level (Outcome 2). Rainwater catchment potential was verified during the concept phase using the available precipitation records from Nanumea and Funafuti. With the historic precipitation levels, an average household (7.7 persons) consuming 50L per person a day will need three months in Funafuti and four months in Nanumea to fill two 10,000-liter tanks. Since annual precipitation levels are not expected to change in the medium term for the RCP2.6 and RCP8.5 scenarios , rainfall is expected to be sufficient to utilize the tanks at full capacity and providing additional storage capacity is therefore an adequate climate adaptation measure. Furthermore, additional rainwater storage capacity significantly increases resilience towards more intense and longer droughts. Increasing individual storage capacity of vulnerable households to 3,050 liters per person means that each household withstand a two-month drought before falling back on community systems or groundwater resources.

60 Finally, developing groundwater has been assessed to be more cost-effective when combined with an increased water storge capacity, however costs are dependent on the location and the potential of the groundwater source. The groundwater assessments conducted under Outcome 2 will include cost-benefit assessments to ensure groundwater is cost-effective compared to other potential water solutions in each of the assessed islands. Similarly, Outcome 2 will analyze the cost-benefits of feasible sanitation solutions and will make sure the most cost-effective are being chosen for the outer islands.

Table 5: Cost comparison of different water supply technologies for Tuvalu

Technology/Intervention	Annual Cost / household in AUD $
Gutter cleaning and maintenance programme	44
Upgraded community or government cisterns	101
Household rainwater tanks	172
Groundwater development	More cost-effective than only relying on cisterns and tanks but location dependent
Desalination plant	420

Sources: Kinrade et al. (2014a), Kinrade et al. (2014b) and ADB (2024)[103]

D. Consistence with national and sub-national sustainable development strategies

61. Water security is included in several key strategic documents of Tuvalu and is one of the key climate adaptation priorities defined in the forthcoming National Adaptation Plan. By playing a key role in addressing climate-related risks and impacts on fresh water and sanitation infrastructure, the proposed project is directly linked to and in support of Tuvalu's national priorities related to water security.

62. **Tuvalu's Te Keke National Strategy for Sustainable Development (2021–2030)** prioritizes increasing water storage capacity to withstand prolonged periods of drought and ensuring access to clean water to all households in the country. It aims to achieve this by (i) continue building storage water capacity nationwide including improved guttering and catchment, (ii) promote education programmes on cleanliness to foster healthy homes and surrounding environment, (iii) increase access to quality water supply taking into full account of water quality compliance with acceptable drinking water standards and (iv) update and implement Tuvalu National Water and Sanitation Policy.[104]

63. **TeTe vaka fenua o Tuvalu: National climate change policy 2021-2030** prescribes the Government and the people of Tuvalu's strategic policies for responding to climate change impacts and related disaster risks. Salt water-intrusion into water resources and droughts are identified as key climate risks among others.[105]

[103] Kinrade, P., Arold, N., Pickering, P., and E. Rooke, 2014a: Water Security in Tuvalu. Assessing Cost-Benefits.
Kinrade, P., Arold, N., Pickering, P., Rooke E., and J. Manfredo, 2014b: Pacific Adaptation (Costs and Benefits) Scenarios.
ADB, 2024: Annex 3 to Funafuti Water Supply and Sanitation Project. Assuming treatment costs per waterborne disease case including medicines and tests but excluding doctor's fees.
[104] Government of Tuvalu, 2021: Te Keke National Strategy for Sustainable Development (2021–2030)
[105] Government of Tuvalu, 2012: Te Kaniva Tuvalu Climate Change Policy

64. **The Sustainable and Integrated Water and Sanitation Policy (2012-2021),** developed after the devastating 2011 drought, aims to include enhancing water quality and sanitation, expanding desalination and rainwater harvesting infrastructure, improving water storage systems, strengthening technical monitoring capabilities, and increasing community capacity and resilience to address water security challenges. It specifically calls for undertaking groundwater assessments and expanding sanitation practices that save water and protect groundwater resources.[106]

65. **Tuvalu's Updated Nationally Determined Contribution (2022)** emphasizes that "sustainable supply of freshwater is at risk due to changes in rainfall patterns, lack of rainwater storage capacity as well as potential salinization of ground water due to high sea level rise. Urgent and immediate adaptation needs include adaptation to frequent water shortages through increasing household water capacity, water collection accessories, and water conservation techniques and promotion of community access to quality potable water".[107]

66. **The Tuvalu Priority Infrastructure Investment Plan 2020–2025 (TISIP)** is a country-led, prioritized investment strategy for Tuvalu's economic infrastructure from 2016 to 2025. It identifies key investment needs and priorities while assessing the financial resources required for implementation. The plan spans across multiple sectors, including water and sanitation (such as building three water reserves on each island).[108]

67. **Tuvalu National Adaptation Programme of Action (2007)** was developed to support the National Strategy for Sustainable Development in synergy with other action plans and development aspirations of the government of Tuvalu. The goal of the Tuvalu NAPA was to provide a framework that will guide the coordination and implementation of adaptation activities in the country by (i) developing a country-wide programme that encompass urgent and immediate needs of communities; (ii) implementing immediate and urgent adaptation activities to climate change and variability; (iii) enhancing communities' awareness and livelihood; and (iv) mainstreaming adaptation measures into national and sectoral planning.

68. **Pacific Islands Framework for Action on Climate Change (PIFACC) (2006-2015)** informs countries' decisions and actions relating to sectoral work in disaster risk management, water, waste management, agriculture, energy, forestry and land use, health, coastal zone management, marine ecosystems, ocean management, tourism, and transport. This also includes long-term adaptation measures to increase of the pacific islands to negative impacts to climate change.

69.**Tuvalu National Adaptation Plan (NAP) process,** initiated in 2014, remains work in progress. In 2018 a database for community-level vulnerability data has been developed. The latest documents are the Climate Hazard Assessment, Risk Assessment and Vulnerability Assessment reports, all published in 2024.[109] Among other categories, water security is of critical consideration for Tuvalu because of the above mentioned geographical, economical and demographical characteristics that are compounded by climate change induced hazards.[110]

70. The country is currently developing a **WASH Policy** with a dedicated implementation plan. Once the policy is finalized, the project will closely consider prioritizing actions in sanitation and water. The country also is currently finalizing its **Technology Needs Assessments (TNA).** The draft adaptation TNA report prioritizes several water-related technologies, including solar power groundwater abstraction pumps. The groundwater infrastructure provision under this project is therefore directly aligned with this technology prioritization. The infrastructure intervention under the project will also be closely aligned to the respective island strategic plans.

E. Relevant national technical standards

71. The project is closely aligned with and in support of relevant national technical standards and complies

[106] Government of Tuvalu, 2013: Sustainable and Integrated Water and Sanitation Policy 2012-2021
[107] Government of Tuvalu, 2022: Updated Nationally Determined Contribution (NDC)
[108] Government of Tuvalu, 2020: Priority Infrastructure Investment Plan 2020–2025
[109] Government of Tuvalu, 2025: Tuvalu Climate Change Portal. Available at: https://www.tuvaluclimatechange.gov.tv/data-and-documents [Accessed on 03 February 2025]
[110] UNDP. 2016: Terminal Evaluation of the Tuvalu National Adaptation Programme of Action (NAPA) NAPA-I and NAPA-I+ Projects. Available at: https://www.adaptation-undp.org/projects/ldcf-tuvalu.

with the Environmental and Social Policy of the Adaptation Fund (AF) and UNEP's Environmental, social and sustainability framework. The project's design process is conducted collaboratively with the Government of Tuvalu, ensuring active participation from the relevant entities and organizations in the country. By strengthening community-led water security and sanitation infrastructure and institutional capacity for climate resilient water governance, the project is directly linked to the relevant national policies and strategies.

72. Environmental Impact Assessments (EIA) will be conducted as part of water supply and sanitation infrastructure solutions, particularly for sanitation activities as well as investments for galleries/wells and cisterns. In addition, the supply of material for renovation or construction activities will comply with Tuvalu's environmental guidelines on long-term storage of water for human consumption.

73. The Tuvalu National Building Code was first approved in July 2022 and Amendment 1 was approved in December 2024. Further amendments are proposed to improve Fire Safety provisions, and the project aims to support this process to also improve water and sanitation aspects of the code (Outcome 3). Over the past years, PWD has been using New Zealand's standard NZS 3604:1999 to guide the construction of infrastructure, and the project will adhere to all relevant infrastructure standards and codes in the country.

F. Complementarity of the project with other funding sources

74. Several water security related projects have been or are currently being implemented in Tuvalu. Noting that the majority of these programmes will soon come to an end, the proposed project will collaborate with and build on these initiatives. During the project formulation phase, we will assess lessons learned from closed projects and integrate them into the design of the project. This collaboration will enhance the project's impact, prevent duplication of efforts, and facilitate knowledge sharing throughout implementation. The table below provides an overview of past, ongoing, and upcoming projects in Tuvalu that focus on water security and climate resilience highlighting synergies and complementarities.

Table 6: Synergies, complementarities and alignment with other water-related projects and interventions in Tuvalu

Project/Programme	Additionality/Complementary/Alignment
Tuvalu: Funafuti Water Supply and Sanitation Project (USD $16.53 mio) (ADB/MFAT/GEF-LDCF) (2024-2030):[111] The project will set in place a new public piped water supply service, upgrade sanitation and waste treatment facilities and services and put in place a new sewage treatment plant for Funafuti. It will also strengthen institutional capacity for and public awareness of climate-resilient and inclusive WASH systems.	The infrastructure component of the project focuses on Funafuti. This proposal will build on the initial outcomes of the project, particularly by expanding water security and sanitation activities to outer islands and by leveraging nature-based solutions to strengthen the resilience of natural resources and enhance water security.
Ecosystem based adaptation for improved livelihood in Tuvalu (USD$ 4.4 million) (UNEP/GEF-LDCF) (2024-2029):[112] The project focuses on ecosystem-based adaptation by restoring damaged coastal ecosystems and increasing climate-resilient agricultural practices.	The proposed project will deliver the proposed activities in close collaboration with this project. It will not only benefit from the outcomes and lessons generated during this project, but it will complement this project by increasing groundwater usage or by addressing sanitation in the outer islands which benefit the agriculture and ecosystem restoration activities of this project. Where potential overlaps exist, such as in the area of water security for agricultural activities (water tanks for agricultural purposes, drip irrigation etc.), both projects will closely coordinate to avoid any duplication ensuring maximum effectiveness and sustainability.
Managing Water Scarcity through Strengthened Water Resource Management Project (USD $ 5.2 mio) (UNDP/SPC/GEF) (2021-2026):[113] Multi-country project focusing on the Republic of Marshall Islands, Republic of Palau, and Tuvalu which aims at improving the understanding, use, management and protection of coastal aquifers towards enhanced water security by identifying the extent, threats and the development potential of groundwater resources, increasing awareness of groundwater as a water security supply source, providing options for improved access to groundwater and improving aquifer protection and management.	The Tuvalu component of this project focuses on the islands of Nanumea, Nui, and Vaitupu. Among other activities, the project conducted groundwater assessments in Nui Island and is currently supporting the construction of a groundwater infiltration gallery in Nanumea. The project also established local water monitoring councils in the three islands. This proposal will build on the outcomes and successes of this project, particularly by expanding groundwater assessments, enhancing eco-system restoration, and establishing monitoring programs to the outer islands in Tuvalu.
Managing Water Scarcity through Strengthened Water Resource Management Project (SPC) (2020-2025):[114] Multi-country project focusing on enhancing resilience to water scarcity through improved access to and storage of drinking water, increasing knowledge and awareness for managing present and future water security risks, strengthening capacity to protect and maintain water resources and infrastructure and improving preparedness and response capabilities for drought events.	The Tuvalu component of this project focuses on providing maintenance and repair support of selected domestic and community rainwater catchment systems (such as water cisterns for the Nukufetau and Nui), development and implementation of rainwater harvesting monitoring and reporting systems in two communities, provision of desalination units and rainwater harvesting tanks. These activities complement some of the proposed activities under this project proposal. AF resources will be allocated strategically where rainwater collection and storage infrastructure needs persist for the most vulnerable households to avoid duplication and maximize impact. Persisting needs of additional storage capacity in the outer islands have been confirmed by the project and local Governments during the concept phase. Lessons learnt from this project, such as on maintenance training, will be used to shape the activities under this project proposal, ensuring maximum effectiveness and sustainability.
Integrated Water Resources Management (IWRM) Project (SPC) (2022-2025):[115] The project supports the review and updating of the National Water and Sanitation Policy 2012-2021 and the development and application of Drought Management Plans and WASH action plans for the outer islands of Tuvalu.	This proposal will build on the outcomes and successes of this project, particularly by providing support to the implementation and application of local drought management and WASH action plans, as well as by integrating and aligning water monitoring activities under this proposal into these action plans. The project also currently supports the development of a new WASH policy and action plan, and the project components will be aligned to this action plan once finalized.

[111] ADB, 2025: Tuvalu : Funafuti Water Supply and Sanitation Project. Available at: https://www.adb.org/projects/53417-002/main [Accessed on 03 Feb 2025]
[112] UNEP, 2024: Ecosystem-based Adaptation in Tuvalu. Available at: https://www.unep.org/topics/climate-action/adaptation/ecosystem-based-adaptation/ecosystem-based-adaptation-tuvalu#:~:text=A%20project%20is%20aiming%20to,of%20an%20overall%20adaptation%20strategy. [Accessed on 03 February 2025]
[113] Government of Tuvalu, 2023: Managing Coastal Aquifers in Selected Pacific Small Island Developing States Project (MCAP). Available at: https://www.tuvaluclimatechange.gov.tv/document/managing-coastal-aquifers-selected-pacific-small-island-developing-states-project-mcap [Accessed on 03 February 2025]

[114] SPC, 2025: Managing Water Scarcity through Strengthened Water Resource Management Project. Available at: https://gem.spc.int/projects/managing-water-scarcity-through-strengthened-water-resources-management#:~:text=The%20Managing%20Water%20Scarcity%20through,response%20to%20ongoing%20water%20scarcity [Accessed on 03 February 2025]
[115] SPC, 2023: Integrated Water Resources Management (IWRM) Project. Available at: https://gem.spc.int/projects/tuvalu-integrated-water-resources-management-iwrm [Accessed on 03 February 2025]

Tuvalu Ridge to Reef project (UNDP-GEF) (2015-2022)[116] The project supported Tuvalu in enhancing and strengthening conservation and protected areas, rehabilitating degraded coastal and inland forests and landscapes and supporting the delivery of integrated water resource management and integrated coastal management at national and local scales. It also provided support in enhancing governance and institutional capacities at the national, island, and community levels for enhanced inland and coastal natural resource management and on improving data and information systems that would enable improve evidence- based planning, decision-making, and management of natural resources in Tuvalu.	This underlying proposal will build on the outcomes and successes of this project, particularly by expanding the groundwater assessments that were initiated under this project for some islands (Nanumea and Nukufetau) to other islands and by supporting restoration activities that were identified as potential solutions in these assessments. The underlying proposal will also explore replication of the successes the project had with establishing Locally Managed Marine Areas (LMMAs) in all nine islands by establishing similar locally managed groundwater monitoring and management areas.
Vaitupu Water Security Project (SPC) (2020-2025) Construction of an infiltration gallery in Vaitupu island	While the SPC project focuses on building a network of tanks and pipes that convey groundwater from wells in the north Vaitupu Island to the villages of Tumaseu, this proposal aims to increase the water storage capacity Motufoua Secondary School. While community targeted capacity building under this proposal will build on this support, this proposal will also explore opportunities to leverage from additional groundwater supply to the school as back-up source.

[116] UNDP, 2021: Terminal Evaluation of the Tuvalu Ridge to Reef project.

75. Furthermore, several NGOs are actively working in the country to improve WASH and water management services, addressing sanitation and clean water needs. Most of these initiatives focus on schools and adoption of basic hygiene practices of students, but others also provide water storage capacity to some communities in the outer islands. Examples include Live & Learn, Engineers Without Borders and the Tuvalu National Youth Council. This proposed project will closely coordinate with these ongoing (mostly small-scale) initiatives and ensure activities are not duplicate. Furthermore, the establishment of a national data-sharing and coordination mechanism under Outcome 3 will contribute to better coordination among all water sector stakeholders, including NGOs and NGOs.

G. Learning, knowledge and lessons learned

76. The learning and knowledge management activities in Outcome 3 will serve as a key element within the project's overall management framework. However, it is important to recognize that knowledge management is woven throughout all project components, including Outcome 1 and 2, as the technologies and investments will be collaboratively developed and tailored to each community's needs.

77. Through the groundwater assessment, Component 1 of the project will generate valuable insights into groundwater dynamics and recharge zones in the remaining islands of Tuvalu. Together with water needs assessments and feasibility studies, this research will support the design of effective water storage and supply technologies for vulnerable communities in the outer islands. In addition, the project will train local communities in managing regular water quantity and quality testing and climate-resilient water management and WASH practices. Through supporting communities in establishing locally managed groundwater protection zones, local capacity is enhanced to manage water resources sustainably and effectively.

78. Infrastructure investment under this project will go hand-in-hand with training on the installation and maintenance of rainwater harvesting systems and infiltration galleries in local communities. Technical trainings in water and sanitation will enhance technical capacity in key water and sanitation service providers including PWD. Supporting communities and relevant water institutions in establishing maintenance, workforce and procurement plans will enable them to manage their maintenance and operation needs sustainably.

79. Finally, through Outcome 3, the project will employ a data specialist to ensure that all data on water storage and catchment infrastructure in the country is widely accessible, harmonized, not duplicative and up to date. The project will support integrating new data, such as data on groundwater ability and quality, into this national database and develop data-sharing mechanisms with relevant Government offices such as the Meteorological Office or NDMO. Through the strengthening of institutional coordination in the water sector, the project will enhance knowledge sharing among key water stakeholders in the country.

80. By integrating these measures, the project aims to effectively capture and share lessons, ensuring that the valuable knowledge and insight gained during implementation are widely disseminated for the benefit of all stakeholders including policymakers and the broader water community in Tuvalu, the wider Pacific region as well as other SIDS regions.

H. Consultative process

81. During the concept note's preparation phase, a consultative process was undertaken in compliance with the relevant environmental, social and gender policies of the Adaptation Fund and UNEP. Building on consultative processes that was conducted for the AF approved concept for Motufoua Secondary School[117], a concept mission was organized to Tuvalu from 17 to 21 February 2025. The consultations during this mission included the Gender Affairs Department, Public Health Department, Climate Change Department, National Disaster Management Office, Department of Environment, Ministry of Finance (AF Focal Point) and the Public Works Department. During the concept mission, also several CSO and NGOs were consulted including Tuvalu Climate Action Network, Engineers Without Borders, Tuvalu National Youth Council, Live & Learn Environmental Education, Tuvalu National Private Sector Organization and

[117] AF00000311 - Strengthening adaptation against climate variability through increasing clean water supply and sanitation at Motufoua Secondary School

the Tuvalu National Council for Women. Community needs were identified through recently conducted (2024) Integrated Vulnerability Assessments and Water Surveys and subsequently verified through separate follow-up consultations with community representatives. In addition, the concept note was presented to and validated by the communities of Nukulaelae, Nanumea, Nanumaga and Nui.[118] The findings from these community consultations were used to inform this concept note.

82. The concept mission also consulted in detail with ongoing water management projects – including the various NGO implemented water projects as well as the larger Government-implemented water projects in Table 6 above – to ensure complementarity and avoid duplication. These projects have ongoing interactions with the local communities and confirm the identified needs for water management enhancement in communities in the outer islands, including the identified need by island communities to further enhance water storage capacity. Following the consultations and the concept development, the final concept was validated during a validation meeting with all relevant stakeholders.

I. Justification for funding

83. The project's primary goal is to reduce the vulnerability of the people of Tuvalu to the existential threat that climate change poses to this small island nation by enhancing water security. By focusing on the on the outer islands of Tuvalu, this project benefits the most remote and vulnerable island communities that lack access to modern infrastructure and services. The project is expected to directly benefit 4,030 people (2,060 male / 1,970 female) residing in the outer islands. These beneficiaries include 1,383 children (age 0-14 years) and 950 people with disabilities[119] By implementing a comprehensive suite of interventions involving additional water supply and sanitation options supported by knowledge sharing, continued monitoring, capacity building, awareness raising, and scientific studies, the project aims to address water insecurities holistically and nation-wide. Additionally, by leveraging and strengthening communities and households in sustainable water management, the project ensures that these solutions will independently address water scarcity in the future without the need for further external donor funding.

84. The comprehensive adaptation rationale accounts for both direct and indirect costs throughout the project's entire lifespan. This includes investments in advanced water and sanitation solutions to ensure long-term water security while safeguarding against negative effects on humans and the environment. Expenses for training of communities, households and water sector professionals will ensure ongoing viability of sustainable water management practices. While the project also covers the costs of restoring and protecting valuable groundwater aquifers, thereby preventing their further degradation, parallel support to communities in establishing groundwater protection zones will ensure these achievements are sustained by the community.

85. The table below summarizes the identified climate risks and impacts and how the project addresses these through targeted adaptation interventions:

[118] During the project formulation phase, all communities and island councils will be consulted. During the concept note development, all island strategic plans were reviewed, and water security and additional storage capacity is prioritized in all plans.
[119] Government of Tuvalu, 2022: Population and Housing Census.

Table 7: Climate risks, adaptation needs, adaptation interventions and adaptation benefits/ vulnerabilities addressed

Climate Risk	Adaptation Need	Adaptation Interventions	Adaptation Benefit / Vulnerabilities addressed
Sea level rise and coastal inundation	• Improved community understanding of saltwater intrusion on groundwater resources	• Community-based water monitoring on salinity levels; support community to understand how aquifers can be protected against saltwater intrusion; development of locally managed groundwater protection and management zones and guidelines; groundwater assessments (Activities 1.1.1. 1.2.1, 1.2.2, 1.2.3, 1.2.4, 2.1.1 and 2.1.3)	• Communities are aware of and equipped to manage the quality and quantity of groundwater resources and the impact of saltwater intrusion on groundwater resources
	• Inundation resilient sanitation infrastructure	• Training and awareness raising on climate resilient water and sanitation; improved sanitation practices account for flood related issues (Activities 1.2.2, 2.3.1 and 2.3.2)	• Sanitation infrastructure upgraded to withstand sea level rise and inundation reducing the risk of waterborne diseases and degraded ecosystems
Drought, increased air temperature and mor frequent hot days	• Improved understanding of water and groundwater quantity and quality during droughts	• Community-based water monitoring to assess freshwater resources during droughts; protection and management of all water resources including groundwater to secure max. available freshwater supply during droughts; (Activities 1.1.1, 1.2.1, 1.2.2, 1.2.3, and 2.1.3)	• Communities are aware of the quality and quantity of their groundwater resources as additional water resource during droughts
	• Construction, upgrade and maintenance of climate-resilient water infrastructure	• Additional water storage infrastructure and diversified water supply options during droughts; training on installation and maintenance of climate resilient water infrastructure; maintenance, workforce and procurement plans to sustain service and infrastructure (Activities 1.2.2, 2.1.2, 2.2.1, and 3.2.1)	• Additional water storage capacity and diversified water supply decreases water insecurities and competition for water resources between domestic and agricultural use during droughts
	• Drought resilient sanitation infrastructure and improved WASH practices during droughts	• Improve community awareness and practices for sustainable sanitation and hygiene during droughts; drought resilient designs of improved sanitation infrastructure (Activities 1.2.2, 2.3.1 and 2.3.2)	• Avoided contamination from improved sanitation infrastructure and practices lead to more available freshwater during droughts • Improved sanitation and hygiene practices during droughts reducing health risks
	• Improved data-sharing, coordination and water governance to prepare for and respond to droughts	• Groundwater monitoring data will be incorporated in drought management tools; established or improved local water management and consumption guidelines during droughts; up-to-date and harmonized national water storage data to assess water vulnerabilities for droughts; improved coordination in the water sector (Activities 1.1.1, 1.2.4, 2.1.3, 3.1.2, 3.3.1, and 3.3.2)	• Improved water governance, coordination and data-sharing to effectively prepare for and respond to droughts in support of most vulnerable households and communities
Increased intensity of extreme precipitation events / Tropical cyclones and extreme winds	• Additional weather-resistant storage capacity and sanitation infrastructure to benefit from and withstand intense rainfall events	• Additional water storage capacity for vulnerable communities; conduct feasibility studies on innovative solutions to store additional water resources; construct flood-resistant sanitation infrastructure; train communities in effective protection or repairing and maintaining key harvesting and catchment infrastructure (Activities 1.2.2, 2.1.2, 2.2.1, 2.3.1, 2.3.2 and 3.2.1)	• Communities have greater access to water resources as a result of more storage capacity and less wastewater contamination

J. Project sustainability

86. From the outset, the project's long-term sustainability is ensured by leveraging existing government structures and programs rather than relying on temporary, project-specific processes. This approach integrates the project within established frameworks, such decision and governing mechanisms on the local levels or integrating the water and sanitation service into PWD's desalination maintenance service to outer islands. This ensures that activities are implemented through mechanisms that predate the project and will continue beyond its completion. By avoiding the creation of parallel structures, the project reinforces institutional continuity, embedding lessons learned and best practices into ongoing government initiatives, including the strengthening of the water sector governance on the national level. Additionally, housing the PMU within the Climate Change Department while placing critical project roles (such as the data manager) in PWD ensures that project activities align with all national water and climate mandates and priorities. The project is designed to run for five years, benefiting the entire country through enhanced institutional processes (Outcome 3). By being fully integrated into existing national and local programs and aligned with Tuvalu's policies and strategies the project's outcomes and outputs will therefore be sustained through ongoing central government funding, including support for monitoring and maintenance.

87. It will support all communities in the outer islands of Tuvalu with new water and sanitation infrastructure upgrades (Outcome 2). As a result, these communities will achieve long-term climate-resilient water security and sustainable sanitation and gain improved knowledge of climate risk management. Additionally, the project will strengthen technical capacity at the community level to maintain climate-resilient infrastructure while strengthening PWD in providing a sustainable, nation-wide water and sanitation maintenance service (as part of Outcome 3). With proper maintenance, the tanks and water catchment systems will be able remain in good condition for a longer period of time, decreasing the capital needed for new tanks and the costs of desalinated water. The designs of the sanitation systems will consider long term maintenance requirements so that they are able to continue operating long term without relying on high levels of effort from communities or PWD. This ensures that once the AF-funded activities conclude, communities will be equipped to independently manage and maintain their water security and safety infrastructure while continuing to access government-funded support through the established maintenance programme.

88. Ensuring a meaningful local inclusion and participation in governance and decision-making throughout its implementation and fully recognizing the rights of women, men, and youth in remote and rural communities, the project will provide training for community facilitators, water officers, and other members of water governance structures, equipping them with enhanced skills and expertise to continue working in the water and sanitation sectors and effectively addressing climate change risks and impacts. This capacity-building effort will strengthen the sector as a whole, improving the effectiveness of existing water governance processes. Through these trainings and awareness raising, communities will get a deeper understanding of climate change risks, especially droughts, and recognize the importance of conserving water during critical periods. Furthermore, by supporting the development of accompanying community-owned governance mechanisms (e.g. groundwater protection zones, water monitoring programmes, or water consumption guidelines), communities are empowered to sustain water management practices. As a result, these mechanisms will deliver climate-resilient water security benefits beyond the project's duration.

89. The project will support PWD in setting up a workforce and budget plan for sustained funding from the Government and defining the capacity needed to ensure appropriate expertise is available to provide Funafuti and the outer islands with sustained water and sanitation services. In close collaboration with all relevant stakeholders, the project will strengthen the government's long-term capacity, enhance regulatory frameworks, and facilitate data-driven decision-making for enduring impact. The project will therefore allow maximizing the limited public funds allocated to water security initiatives enabling the government to shift its focus beyond service delivery to include long-term monitoring and maintenance.

K. Environmental and social impacts and risks

90. The environmental and social screening conducted during the concept stage, as outlined in the table below, indicates that the proposed project presents low to moderate risks. Any site-specific risks identified

can be effectively managed, resulting in the project being classified as Category B. During the full project proposal phase, relevant assessments will be conducted in alignment with both the Adaptation Fund and UNEP's procedures, including compliance with gender policies. The concept mission already engaged in consultations with Government departments, donor and partner organizations, civil society, NGOs and associations representing women and youth. Initial community needs were vetted during the concept phase and validated with community representatives. The full proposal will further vet these needs through further consultations with beneficiaries and local communities. Comprehensive documentation will be maintained to ensure a record of all consultations conducted.

91. Aligned with local regulations and laws, the Adaptation Fund's Environmental and Social Policy and UNEP's guidelines, the consultations during the full proposal design will inform the development of a Environmental and Social Assessment (ESA) and Environmental and Social Management System (ESMS), which will outline the process for assessing and managing environmental and social risks. Additionally, mitigation strategies will be integrated into the management system to minimize potential impacts.

92. The project will support the collection of gender-disaggregated data with the expertise of a gender design specialist. This process will be conducted in accordance with UNEP's and AF guidelines:

- Conduct consultations with male and female beneficiaries and stakeholders separately, as well as in mixed groups.
- Carefully consider the timing and location of consultation meetings to ensure balanced gender representation.
- Utilize appropriate communication methods to effectively engage both women and men.
- Set targets for gender attendance to ensure meaningful participation.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law		**Low risk** The ESA during the full proposal stage will include an analysis of relevant laws and outline how the project ensures compliance with them.
Access and Equity		**Low risk** The project will prioritize vulnerable groups, including women and youth in its design and implementation. It will collaborate with national authorities and NGOs, such as the Gender Department or the Tuvalu National Council for Women, to prevent negative impacts on marginalized communities. Through participatory consultations, all individuals will have a voice to express concerns. By emphasizing transparency and accountability, the project aims to protect the rights of affected individuals and mitigate potential adverse effects.
Marginalized and Vulnerable Groups		**Medium risk** By focusing on the outer islands of Tuvalu, this project benefits the most remote and vulnerable island communities that lack access to modern infrastructure and services. During design and implementation, the project will actively consult marginalized and vulnerable groups, including women and youth, to ensure their priorities and concerns are addressed in the proposal. It will empower them to participate in decision-making on adaptation actions, recognizing their specific knowledge and needs. Through a transparent and participatory process, the project will provide space for women and youth to select adaptation activities while respecting land, property, and customary rights.
Human Rights	X	**Low risk/no risk** This project upholds the rights of all individuals and fully aligns with fundamental human rights principles.

Gender Equality and Women's Empowerment		**Low risk** The project will actively promote gender equality and women's empowerment through a targeted approach. During the development of the full project proposal, a gender analysis will be conducted to identify and address the distinct rights, roles, needs, and barriers faced by both women and men related to water security. Women's active participation will be ensured throughout the planning process and implementation through methods such as focus group discussions. Additionally, the project will facilitate women's involvement in policy formulation and decision-making particularly on the local level. Due to their key role as agents of change in the water sector, a minimum of 50% female beneficiaries will be targeted.
Core Labour Rights	X	**Low risk** The project will uphold international and national labor laws and standards
Indigenous Peoples	X	**Low risk/no risk** Any infrastructure development and local activities carried out under this project will be closely coordinated with the local island councils
Involuntary Resettlement	X	**Low risk/no risk** The project does not include any plans for resettlement.
Protection of Natural Habitats	X	**Low risk** The project focuses on enhancing water storage facilities, ensuring a more reliable water supply. Improving sanitation in the outer islands is expected to have a positive impact on natural habitats. During implementation, EIAs will be conducted to evaluate both the benefits and potential challenges of the infrastructure works.
Conservation of Biological Diversity		**Low risk** Some of the project interventions, such as improved sanitation, are expected to have a positive impact on biodiversity. Others, such as enabling the abstraction of groundwater for human consumption, may have negative impacts for local biodiversity. By establishing monitoring programmes, protection zones and abstraction guidelines, the negative impact on biodiversity from groundwater abstraction will be kept to the minimum. The ESA during project development will assess the potential impact of infrastructure provided on local biodiversity.
Climate Change	X	**Risk: Low Potential impact: High** The project area is susceptible to climate impacts such as droughts, tropical cyclone damage or inundation. The project will address this by constructing flood-resistant sanitation infrastructure as well as by training communities and technicians in constructing and maintaining climate- and stormproof water and sanitation infrastructure. The project therefore aims to reduce the vulnerability of Tuvaluans to these climate impacts but will not generate any significant emissions of greenhouse gases and thus will not contribute to climate change in any other way.
Pollution Prevention and Resource Efficiency		**Medium risk** During the infrastructure works of this project (such as installation or upgrade of tanks, cisterns, infiltration galleries etc.), pollution will be generated (solid waste, air and noise pollution) and also consume energy resources. However, the ESA will break out in detail how the project will manage and minimize the risks from pollution.
Public Health	X	**Low risk** The project activities are intended to have a positive impact on public health through improved sanitation solutions and enhanced availability of potable freshwater resources safe for human consumption.
Physical and Cultural Heritage	X	**Low risk** The selected site of the proposed interventions are not intended to affect any physical and cultural heritage in the target communities. Close coordination and consultation with the local councils during implementation will ensure that physical and cultural heritage is not compromised due to project interventions.
Lands and Soil Conservation	X	**Low risk** The project will promote sustainable water and sanitation practices which are expected to benefit land and soil conservation.

PART III: IMPLEMENTATION ARRANGEMENTS

93. Based on discussions held during the concept mission, the proposed institutional arrangements agreed upon with the National Designated Authority (NDA) are as follows:

94. **Executing Agency:** The Climate Change Department, previously under the Ministry of Finance and now under the Ministry of Home Affairs, Climate Change, and Environment, will serve as the Executing Agency closely coordinating with the Ministry of Finance, as the NDA for the Adaptation Fund.

95. **Project Management Unit:** A Project Management Unit (PMU) will be established at the Climate Change Department. The project will engage a technical data specialist, who will be embedded in PWD.

9. **Implementing Entity (IE):** UNEP as IE will undertake the oversight and quality control of the proposed project ensuring that the Gender Policy and Environmental and Social Policy is respected.

A. Project Alignment with the Results Framework of the Adaptation Fund

Project Objective(s)[1]	Project Objective Indicator(s)	Fund Outcome	Fund Outcome Indicator	Grant Amount (USD)
Enhance water security in Tuvalu	% of communities that have sufficient water supply to withstand droughts % of communities with innovative flood-resistant sanitation infrastructure % of communities developing, protecting and monitoring groundwater	Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets Outcome 5: Increased ecosystem resilience in response to climate change and variability induced stress	4.2. Physical infrastructure improved to withstand climate change and variability-induced stress 5. Ecosystem services and natural resource assets maintained or improved under climate change and variability-induced stress	
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**
1. Communities are empowered to plan, monitor, and manage their climate resilient water resources	# of households trained in climate-resilient water, sanitation and ecosystem management # of people trained in installation and maintenance of rainwater harvesting systems and infiltration galleries # of communities with established local water monitoring teams and groundwater protection zones # of local water management guidelines developed	Output 3.2: Strengthened capacity of national and subnational stakeholders and entities to capture and disseminate knowledge and learning	3.2.1 No. of technical committees/associations formed to ensure transfer of knowledge 3.2.2 No. of tools and guidelines developed (thematic, sectoral, institutional) and shared with relevant stakeholders	**800,000**
2. Communities have increased access to climate resilient water	# of rainwater tanks provided to vulnerable households	Output 4: Vulnerable development sector services and	4.1.2. No. of physical assets strengthened or constructed to withstand	**6,541,014**

and sanitation infrastructure	# of community cisterns upgraded # of innovative flood-resistant sanitation provided # of infiltration galleries and wells restored/constructed	infrastructure assets strengthened in response to climate change impacts, including variability Output 5: Vulnerable ecosystem services and natural resource assets strengthened in response to climate change impacts, including variability	conditions resulting from climate variability and change (by sector and scale) 5.1. No. of natural resource assets created, maintained or improved to withstand conditions resulting from climate variability and change (by type and scale)	
3. National and local institutions are strengthened to manage climate risks impacting water security	# of technical staff trained in climate resilient water and sanitation # of institutions supported with development and strengthening of maintenance, workforce and procurement plans #of meetings of the established national water coordination group National water storage and community vulnerability database established # of climate and water policies developed and improved	Output 2.1: Strengthened capacity of national and sub-national centers and networks to respond rapidly to extreme weather events Output 7: Improved integration of climate-resilience strategies into country development plans	2.1.1. No. of staff trained to respond to, and mitigate impacts of, climate-related events (by gender) 2.1.2 No. of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale) 7.1. No. of policies introduced or adjusted to address climate change risks (by sector)	**1,000,000**

[1] The AF utilized OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[2] *Provide the name and position of the government official and indicate date of endorsement. If this is a regional project/programme, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an annex to the project/programme proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project/programme:*

(Enter Name, Position, Ministry)	Date*: (Month, day, year)*

B. Implementing Entity certification*Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address*

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (……list here…..) and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy and the Gender Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.

Mirey Atallah,

Chief, Adaptation and Resilience Branch,
Climate Change Division, UNEP
July 25th, 2025

[6] Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

Name & Signature Implementing Entity Coordinator	
Date: *(Month, Day, Year)*	Tel. and email:
Project Contact Person:	
Tel. And Email:	

GOVERNMENT OF TUVALU
MINISTRY OF FINANCE AND ECONOMIC DEVELOPMENT
HEADQUARTERS
GPO Vaiaku, Funafuti, TUVALU; Phone: (688) 20408; Email: pnelesone@gov.tv

7 August 2025

Mr. Mikko Ollikainen
Manager of the Adaptation Fund Board Secretariat
c/o Global Environment Facility
Mail stop: N 7-700
1818 H Street NW
Washington DC 20433, USA
Email: mol1ikainen@adaptation-fund.org

Dear Mr. Mikko Ollikainen,

Endorsing Tuvalu Water Security Project Concept Note submitted by the Climate Change Department through the United Nation Environment Programme

I hope this letter finds you well. I am writing to further support and endorse the Tuvalu Water Security Concept Note submitted by our Climate Change Department through the United Nation Environment Programme. Part of this concept note content includes the Ministry of Finance and Economic Development submission for improving water security in Motufoua Secondary School.

The Ministry would like to endorse this submission from the Climate Change Department under the Ministry of Home Affairs, Climate Change and Environment.

Sincerely,

Honorable Panapasi Nelesone

Deputy Prime Minister and Minister of Finance and Economic Development

ADAPTATION FUND

Revised PFG Submission Form[1] (additions in red)

Project Formulation Grant (PFG)

Submission Date:

Adaptation Fund Project ID:
Country/ies: Tuvalu
Title of Project/Programme: Reducing the vulnerability of the people of Tuvalu to the impacts of climate change by enhancing water security
Type of IE (NIE/RIE/MIE): MIE
Implementing Entity: UNEP
Executing Entity/ies: UNEP will execute the PFG in collaboration with Climate Change Department, Ministry of Public Works of Tuvalu

A. Project Preparation Timeframe

Start date of PFG	September 2025
Completion date of PFG	September 2026

B. Proposed Project Preparation Activities ($)

List of Proposed Project Preparation Activities	Output of the PFG Activities	US$ Amount	Budget note[2]
1. Baseline assessments and feasibility of interventions: a. Ground water (GW) assessments and water storage intervention design b. Sanitation baseline assessment, needs and intervention design **c.** Policy and governance requirements and implementation	a. GW assessment report and water storage intervention design b. Sanitation baseline assessment report and needs c. Policy and governance review report	41,175 47,250	**45,000 is co-financed by UNCCD**

[1] As presented in AFB/PPRC.33/40 Annex 1.
[2] The proposal should include a detailed budget with budget notes indicating the break- down of costs at the activity level. It should also include a budget on the Implementing Entity management fee use.

2. Environmental, Social and Gender and Risk Assessments	• Environmental and Social Impact Assessment and Environmental and Social Management Plan (ESMP) • Gender analysis and gender action plan	10,000	
3. Stakeholder consultation	Stakeholder consultation report	30,000	
4. Preparation of full-pledged project document	Fully-fledged project document with annexes and plans	50,000	
Total of PFG without IE fee		137,250	
Total of co-financing without IE fee		41,175	
Sub-total		**178,425**	
Implementing entity management fee		16,575	
Total of Project Formulation		**195,000**	

Please describe below each of the PFG activities and provide justifications for their need and for the amount of funding required:

Significant data collection and analysis have been completed during the concept development phase of the project, yet additional effort is still required to finalize several detailed baseline and other assessments in line with UNEP and Adaptation Fund requirements. These include the below.

1. **Baseline assessments and feasibility of proposed interventions**
   A complete detailed baseline study will be undertaken that will help enhance the project design elements including a refined Theory of Change. These include the below assessments.
   a. Ground water (GW) assessments and water storage intervention designs
      Although other donor funded projects have supported GW assessments, four of Tuvalu's outer islands (Nanumaga, Niutao, Nukulaelae and Niulakita) are yet to conduct comprehensive groundwater assessments. Assessing the groundwater resources of the remaining islands can reveal potential untapped freshwater resources that could serve as a crucial additional water supply particularly during extended droughts. The study will also help determine designs of proposed measures, including that of the infiltration galleries.
   b. Water-sanitation-and-hygiene (WASH) baseline assessment, needs and intervention designs
      This baseline assessment will review weaknesses of existing sanitation infrastructure and assess feasibilities of alternative and suitable sanitation solutions for each island and confirming their designs.
   c. Policy and governance requirements and implementation
      This is a thorough assessment on persisting policy gaps in the water and sanitation sectors of Tuvalu and to review, and identify gaps and needs to existing water and sanitation governance system.

2. **Environmental, Social and Gender and Risk Assessments**

The PFG will be used to undertake Environmental and Social Impact Assessment to assess the project's potential environmental and social risks and prescribe the measures, responsibilities, and monitoring needed

to prevent, mitigate, or offset those impacts in order to protect people and the environment. Particularly the environmental and social risks related to project infrastructure interventions, such as installation or upgrade of tanks, cisterns, infiltration galleries etc., will be of priority. It will scope the main environmental and social safeguards risks and identify mitigation measures through consultations and lessons learned. An Environmental and Social Management Plan (ESMP) will be developed to align with the Environmental and Social Policy of the Adaptation Fund and UNEP's Social and Environmental Sustainability Framework.

A Gender analysis will also be undertaken to assess the distinct needs, roles, and constraints of women, men, and marginalized and vulnerable groups, and, in a second step, develop a concrete Gender Action Plan with measures, budgets, and indicators that secure their equitable participation, benefits, and decision-making power throughout the project lifetime.

3. Stakeholder consultations

A round of additional stakeholder consultations will be organized at the main atoll (Funafuti) and in the selected outer islands to confirm and validate the proposed interventions, as well as to pinpoint the locations of those interventions. Importance of such consultations has been noted by stakeholders during the concept development process.

The consultation process will inform the:

- Identification of criteria for the selection of communities and households and preliminary selection of appropriate sites and households for provisions of water tanks, cisterns and infiltration galleries.
- Identification of partnering organizations and capacity assessment.
- Identification of the roles and responsibilities of each government institution and stakeholders at the Government at the main atoll and in outer islands, as well as beneficiary communities in project implementation and monitoring.
- Identification of result framework SMART indicators and targets.
- Costing of planned activities and developing a detailed budget.
- M&E and knowledge management plan, Gender Action Plan and Environmental and Social Management Plan.
- Sustainability and exit strategy

4. Full proposal development and annexes

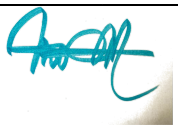
Based on the outcomes of the assessments, studies and consultations described above, a full-fledged proposal will be developed, including:

- Stakeholder Engagement and Project Implementation Plan defining the roles and responsibilities of each government institution, implementation partners and stakeholders at the national, regional, district and community level in the project implementation and monitoring at different levels. The plan will include measures to mitigate financial, reputational, security and other risks.
- Detailed Results Framework for the project, including SMART indicators and targets aligned with the Adaptation Results Framework.
- Project institutional and management arrangements
- Implementation workplan and milestones.
- Costed M&E and learning and knowledge management plan.
- Costed Gender Action Plan
- Costed Environmental and Social Management Plan
- Detailed budget and budget notes including quantification of stakeholders' in-kind contributions
- Procurement plan

- Legal due diligence
- Sustainability and exit strategy

C. Implementing Entity

This request has been prepared in accordance with the Adaptation Fund Board's procedures and meets the Adaptation Fund's criteria for project identification and formulation

Implementing Entity Coordinator, IE Name	Signature	Date (Month, day, year)	Project Contact Person	Telephone	Email Address
UNEP Mirey Atallah		July 25th, 2025	Jessica Troni	254795751062	jessica.troni@un.org

Annex I

Trends and projections for annual average temperatures

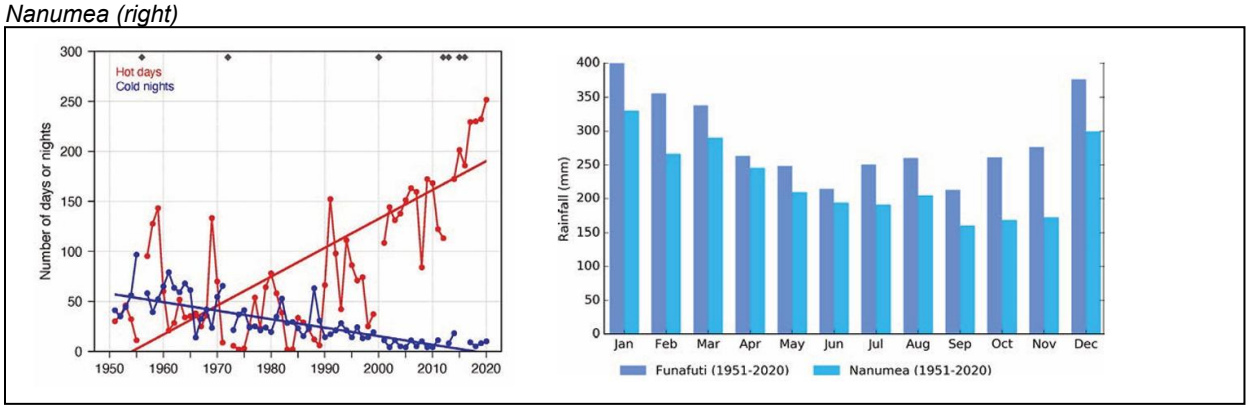
Air temperatures in Tuvalu show little seasonal variation, with monthly maximum and minimum temperatures differing by less than 1°C throughout the year. As atoll islands, Tuvalu's air temperatures are strongly influenced by surrounding sea surface temperatures. During El Niño years, air temperatures tend to be higher, while La Niña years bring cooler conditions. A noticeable warming trend has emerged over recent decades, with average monthly temperatures most of the times higher between 1991–2020 compared to 1961–1990. Average annual and seasonal temperatures at Funafuti have increased significantly, with May–October temperatures warming at a faster rate than those from November to April. Daily minimum temperatures are also rising more quickly than daily maximum temperatures.[120]

Uncertainties of future climate change projections are driven by greenhouse gas emissions trajectories, regional climate responses to these trajectories as modeled by climate simulations, and natural climate variability driven by factors such as ENSO. In the near term (2020–2039), the projected temperature changes are similar for different pathways. However, by the medium term (2040–2059), the pathways begin to diverge, and by the long term (2060–2079), they result in significantly different outcomes (Figure 2). By 2030, warming is projected at 0.7°C, by 2050 at 0.8°C (RCP2.6) to 1.4°C (RCP8.5) (uncertainties between 0.5 and 1.9°C), and by 2070 at 0.8°C (RCP2.6) to 2.1°C (RCP8.5) (uncertainties between 0.5 and 3.1°C), relative to 1986-2005.

Trends and projections for hot days

Since 1951, Tuvalu has experienced a rise in hotter days. The annual average number of hot days (days with maximum temperatures above the 90th percentile for 1961–1990) has increased by 29 days per decade, while warm nights (minimum temperatures above the 90th percentile for 1961–1990) have risen by 14 days per decade. From 2015 to 2020 over half of all days each year were considered hot. Conversely, the annual average number of cool days (maximum temperatures below the 10th percentile) has decreased by 5 days per decade, and cool nights (minimum temperatures below the 10th percentile) have declined by 8.5 days per decade (Figure 2, left).[121]

Figure 2: Annual number of hot days and cold nights at Funafuti (left) and mean annual rainfall at Funafuti and Nanumea (right)



Left Figure: Straight lines indicate linear trends. Diamonds indicate years with insufficient data for one or both variables. Right figure: Source: McGree et al. 2022[122]

Projections show that the mean of annual maximum temperatures increases by 1.8°C under low, 2.1°C under medium and 2.5 °C under high emission scenarios by mid-century (2040-2060), relative to the 1985-2014 period. This is in line with the IPCC Assessment Reports that conclude that in a warmer climate in the future, it is virtually certain that globally there will be more frequent hot extremes and fewer cold extremes over most land areas and it is very likely that heatwaves will occur with a higher frequency and longer duration.[123] By 2080-2100 the annual maximum mean temperature is projected to increase between 2.2 °C and 5.8 °C depending on the emission scenario and relative to the 1985-2014 period. Models also show a general tendency of shorter return periods for extreme temperatures.[124]

Trends and projections for annual precipitation

Rainfall observations across the Pacific region show significant year-to-year and decade-to-decade variability. However, long-term trends in annual and seasonal rainfall have shown minimal change at most locations over the past

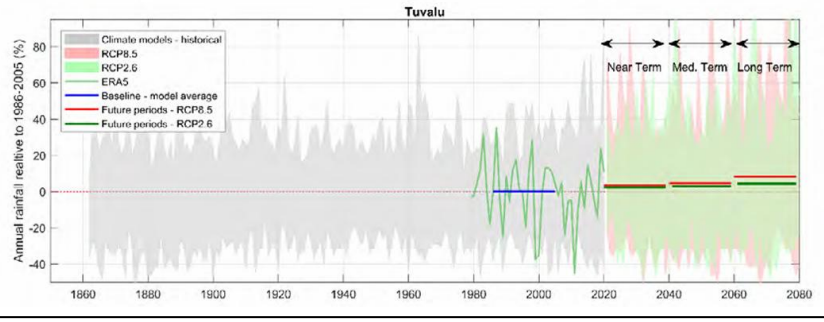
[120] McGree, S., G. Smith, E. Chandler, N. Herold, Z. Begg, Y. Kuleshov, P. Malsale, and M. Ritman, Climate Change in the Pacific 2022: Historical and Recent Variability, Extremes and Change. 2022 Climate and Oceans Support Program in the Pacific. Pacific Community: Suva, Fiji.
[121] McGree, S., G. Smith, E. Chandler, N. Herold, Z. Begg, Y. Kuleshov, P. Malsale, and M. Ritman, Climate Change in the Pacific 2022: Historical and Recent Variability, Extremes and Change. 2022 Climate and Oceans Support Program in the Pacific. Pacific Community: Suva, Fiji.
[122] Ibid.
[123] Seneviratne, S.I., et al., 2021. The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate ChangeCambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1513–1766, doi:10.1017/9781009157896.013.
[124] CSIRO, Federation University, Climate Comms (2024). Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.

70 years. Tuvalu experiences a wet season from December to March and a dry season from April to November. Seasonal cycles are heavily affected by the SPCZ which is most active during the wet season. Daily historical rainfall and air temperature records since 1951 are only available for Funafuti and Nanumea. Funafuti and Nanumea receive 43% of their annual rainfall between December and March. Funafuti averages approximately 3,460 mm of rain annually, with about 410 mm in January and 210 mm in June. Nanumea receives around 325 mm in January and only 160 mm in September.[125]

Since 1951, trends in annual and seasonal rainfall at Funafuti have not shown statistically significant changes, indicating minimal variation over time. Annual rainfall has ranged between approximately 2,000 mm and 4,800 mm, with rain occurring on more than half of the days each year on average. The annual number of wet days has declined by 2.2 days per decade, though this trend is not statistically significant. However, a statistically significant increase of 0.36 consecutive dry days per decade has been observed in Funafuti between 1951 and 2020. Longer dry spells and droughts are more common during La Niña years.[126] Historic annual total rainfall shows large year-to-year and decade-to-decade variabilities and is considerably influenced by ENSO and SPCZ displacement and there is no clear climate change signal on rainfall variability in the past.[127] During an El Niño event, sea surface temperatures northeast of Tuvalu are warmer than usual, while during a La Niña event, they are cooler. This influences the position and intensity of the SPCZ. During El Niño, the SPCZ shifts northeast, bringing increased rainfall to Tuvalu. Conversely, during La Niña, the SPCZ moves southwest, resulting in reduced rainfall over the country (Figure 4, right).[128]

Due to the large influence of ENSO and SPCZ, precipitation patterns are difficult to predict with current climate models. Projected rainfall either decreases or increases, depending on the model, but a multi-model average suggests a small increase of rainfall on average. However, climate models predict larger rainfall changes (both positive and negative) in high emission scenarios. For instance, projections for annual rainfall by 2030 show changes ranging from -4% to +10% across all RCP scenarios. By 2090, however, the range remains between -4% and +12% under very low emissions (RCP2.6) but widens significantly to -26% to +31% under very high emissions (RCP8.5)[129] (Figure 3).

Figure 3: Tuvalu region average annual rainfall (in %) relative to historical (1986-2005) and future climate models data



Simulations from up to 40 models are displayed for the historical period (grey) and future projections under a high emissions pathway (RCP8.5, pink band) and a low emissions pathway (RCP2.6, green band). Thick lines represent the average across all models for 20-year periods centered on 1995 (blue), 2030, 2050, and 2070, with red lines for RCP8.5 and green lines for RCP2.6. Source: SCIRO and SPREP, 2021[130]

Trends and projections for extreme precipitation

As described above, extreme rainfall is heavily influenced by the SPCZ, which reaches its peak intensity during the wet season. El Niño events tend to move the SPCZ northeast, resulting in warmer sea surface temperatures, heavier rainfall and more tropical cyclones. The annual maximum daily rainfall in Tuvalu ranges between 100 and 350 mm/day. Since 1951, this amount has shown a slight decline of 1 mm per decade, though the trend is not statistically significant.[131] Tropical cyclones contribute 19%, 21%, and 22% of the annual maximum rainfall over 1-day, 2-day, and 3-day periods, respectively, meaning approximately 80% of extreme rainfall events result from non-cyclone weather systems.[132] Despite uncertainties related to predicting rainfall patterns, CSIRO et al. (2024) present results of simulations of annual maximum rainfall intensity that are projected to increase over the century with high emission scenarios. With baseline maximum rainfall intensity of 133.9 mm/day (uncertainty 119 to 160) for the 1985-2014 period,

[125] McGree, S., G. Smith, E. Chandler, N. Herold, Z. Begg, Y. Kuleshov, P. Malsale, and M. Ritman, Climate Change in the Pacific 2022: Historical and Recent Variability, Extremes and Change. 2022 Climate and Oceans Support Program in the Pacific. Pacific Community: Suva, Fiji.
[126] Ibid.
[127] CSIRO and SPREP, 2021: 'NextGen' Projections for the Western Tropical Pacific: Current and Future Climate for Tuvalu.
[128] McGree, S., G. Smith, E. Chandler, N. Herold, Z. Begg, Y. Kuleshov, P. Malsale, and M. Ritman, Climate Change in the Pacific 2022: Historical and Recent Variability, Extremes and Change. 2022 Climate and Oceans Support Program in the Pacific. Pacific Community: Suva, Fiji.
[129] CSIRO and SPREP, 2021: 'NextGen' Projections for the Western Tropical Pacific: Current and Future Climate for Tuvalu.
[130] Ibid.
[131] McGree, S., G. Smith, E. Chandler, N. Herold, Z. Begg, Y. Kuleshov, P. Malsale, and M. Ritman, Climate Change in the Pacific 2022: Historical and Recent Variability, Extremes and Change. 2022 Climate and Oceans Support Program in the Pacific. Pacific Community: Suva, Fiji.
[132] Deo, A., S.S. Chand, H. Ramsay, N.J. Holbrook, S. McGree, A. Magee, S. Bell, M. Titimaea, A. Haruhiru, and P. Malsale, 2021: Tropical cyclone contribution to extreme rainfall over southwest Pacific Island nations. Climate Dynamics (56): p. 3967-3993.

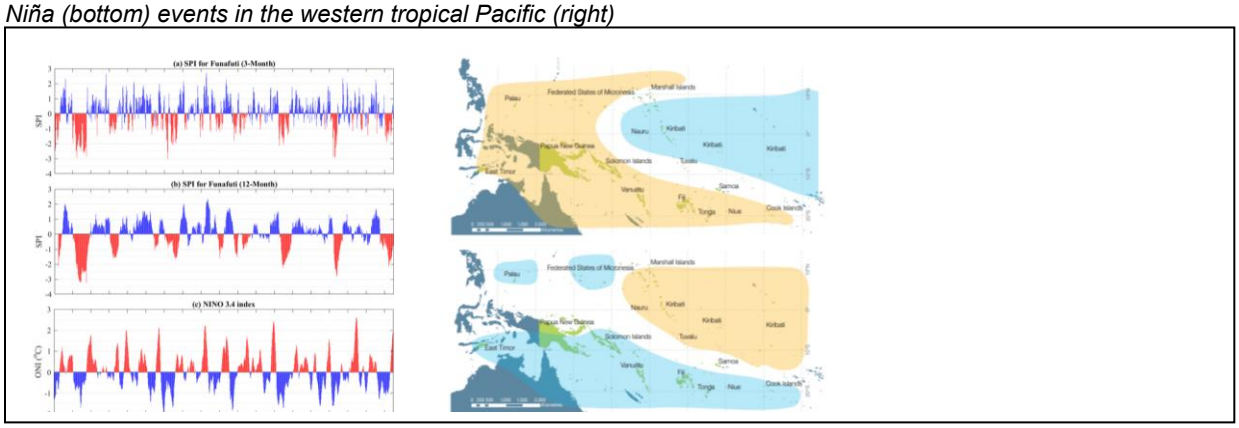
the model predicts increases to 146.0 mm/day (uncertainty 117 to 173) under low emissions, 143.5 mm/day (uncertainty 127 to 163) under medium emissions and 148.4 mm/day under high emissions for the 2040-2060 period. For the 2080-2100 period, the model predicts a more modest increase in annual maximum rainfall intensity in a low emission scenario (11%), while medium emission and high emission scenarios show a sharp increase in annual maximum rainfall intensity by the end of the century (17 and 28% respectively).[133]

Extreme rainfall events are also generally expected to become more frequent in the future. For example, a 175 mm/day event, which historically had a return period of 80 years, is projected to occur every 12 years under low and medium emissions scenarios and every 8 years under high emissions by 2040–2060. By 2080–2100, the return period shortens further to approximately 8.2 years for low emissions, 5.5 years for medium emissions, and 3.6 years for high emissions.[134] Additionally, the projected increase in the frequency of extreme ENSO events may further influence extreme rainfall patterns.[135] [136]

Trends and projections for droughts

Between 1951 and 2023, Funafuti experienced 32 meteorological drought events lasting three months (Standardized Precipitation Index (SPI)-3) and 11 events lasting 12 months (SPI-12) (Figure 4, left).[137] Both the intensity and frequency of droughts decreased for SPI-3 and SPI-12 over the same period. The duration of SPI-3 events decreased but increased for SPI-12 events. However, all trends in intensity, duration and frequency are not statistically significant at the 95 % confidence level[138]. Furthermore, no statistically significant trend was found when comparing 1981–2010 and 1951–1980 periods.[139] Changes in ocean temperatures influence atmospheric circulation patterns, resulting in significant and persistent variations in air temperatures, rainfall, cyclones, and sea levels. ENSO, plays a major role in shaping drought conditions in the Pacific region, including Tuvalu. As stated above, typically, El Niño events bring wetter conditions to Tuvalu, while La Niña events are associated with drier weather (Figure 4, right). The left graph in Figure 4 also illustrates the strong link between drought and La Niña events. Out of the 16 La Niña events recorded between 1951 and 2023, only three (1995, 2006, and 2018) were not associated with drought. Additionally, drought intensity is correlated with the strength of ENSO events.[140]

Figure 4: SPI plot for Funafuti for different accumulation periods and the 3 monthly running average of the Oceanic Nino 3.4 index for the 1950 to 2023 period (left) and typical changes to rainfall patterns during El Niño (top) and La Niña (bottom) events in the western tropical Pacific (right)



Left figure: (a) shows the SPI plot for Funafuti for 3-month and (b) for 12-month accumulation periods from 1950 to 2023. (c) shows the 3 monthly running average of the Oceanic Nino 3.4 index. Right figure: blue shading shows wetter than average and yellow shading shows drier than average Source: CSIRO et al, 2024[141] (left) and Australian Bureau of Meteorology and CSIRO, 2014 (right)[142]

Projections show that drought duration is expected to decline for moderate, extreme and severe droughts and the frequency of moderate and severe droughts are also expected to decrease. Drought intensity is expected to remain relatively unchanged. While this is consistent with the projected increase in average rainfall (see above), it should be noted that the projections are conservative since they are based on the SPI which does not account for the impact of projected increases in evapotranspiration and thus the potential influence of rising temperatures on evapotranspiration. Furthermore, an increase in extreme La Niña and El Niño events driven by climate change can significantly impact

[133] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[134] Ibid.
[135] Cai, W., S. Borlace, M. Lengaigne, P. van Rensch, M. Collins, G. Vecchi, A. Timmermann, A. Santoso, M.J. McPhaden, and L. Wu, 2014: Increasing frequency of extreme El Nino events due to greenhouse warming. Nature Climate Change, 4(2): p. 111-116.
[136] Ibid.
[137] Expressed as a Standardized Precipitation Index (SPI) of -1 or lower during which total precipitation received in Funafuti was less than expected at the time of year over 3 months / 12-month rainfall accumulation.
[138] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[139] McGree, S., S. Schreider, and Y. Kuleshov, 2016: Trends and variability in droughts in the Pacific Islands and Northeast Australia. Journal of Climate, 29(23): p. 8377-8397.
[140] Ibid.
[141] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[142] Australian Bureau of Meteorology and CSIRO, PACCSAP factsheet: Large-scale climate features in the western tropical Pacific. 2014 Bom and CSIRO

Tuvalu's weather and rainfall patterns leading to more severe and frequent occurrences of both flooding and drought.[143]

Trends in sea level rise and coastal inundation

Due to its small and low-lying land area, one of Tuvalu's most urgent climate change challenges is sea-level rise and the resulting shoreline retreat.[144] Between 1901 and 2018, global mean sea levels increased by 20 cm[145][146], with 15 cm of that rise occurring in the past 30 years.[147] In the western tropical Pacific, sea levels rose by approximately 10–15 cm from 1993 to 2020[148], a rate higher than in the central and eastern tropical Pacific.[149] From 1993 to 2024, sea level in Funafuti rose by 14 cm or ca. 0.45cm per year on average, which is one-and-a-half times of the global average.[150] Between 1993 and 2023, a land subsidence rate of 1.4 mm per year has been observed in Fongafale.[151]

Sea levels in the tropical Pacific exhibit significant internal and decadal variability, influencing regional sea-level rise rates. Seasonal fluctuations occur due to changes in ocean temperature, currents, and atmospheric conditions, with Funafuti experiencing a range of 0.00 to 0.09 meters, peaking in March and lowest in September.[152] Year-to-year variations are strongly linked to ENSO, where sea levels around Tuvalu typically drop between January and March following the start of ENSO in the year before. Sea level drops in Tuvalu during El Niño events can exceed 20 cm, though variations occur year to year. In contrast, La Niña events have little impact on sea levels. The Madden-Julian Oscillation, particularly active in the austral summer, also contributes to significant sea level fluctuations due to wind-stress anomalies, with more pronounced effects along western coastlines. [153]

Inundation risk is made up by several factors including tides, storm surges, storm waves and interannual sea level variability caused, for example, by ENSO. In addition, the local geomorphology (for example coastal bathymetry) plays a key role in determining how these various factors interact and contribute to extreme sea levels. Historically, flooding in Tuvalu has occurred during high spring tides between January and March. However, in recent years, flooding has also been caused by cyclone-generated waves, such as those from Tropical Cyclone Pam (2015) and Tropical Cyclone Tino (2020), as well as by swell waves originating from distant sources.[154] Although mean sea level rise is a slow and gradual process, coastal inundation is already occurring regularly across Tuvalu during each spring tide.[155]

Wave setup and runup and total associated water levels can vary depending on the approach of a storm or direction of waves generated far away. As sea levels rise, wave runup impacts in Tuvalu are expected to intensify, as higher water levels over coral reefs will allow larger waves to reach the shore. Future sea level rise is projected to significantly increase both the frequency and severity of flooding, with more than 100 flood days per year expected by 2100.[156] [157] Compared to a 20-year baseline centered on 1995 (1986–2005), sea level rise projections for Tuvalu show a median rise of ca. 0.13 m by 2030, 0.22-0.27m by 2050 and 0.41-0.71m by 2090, depending on the emission scenario.

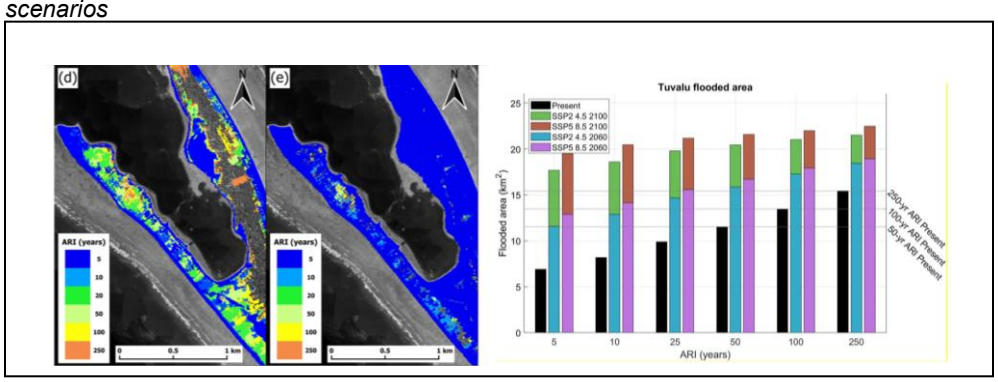
With rising sea levels, saltwater can infiltrate freshwater groundwater reserves through a process known as saltwater intrusion. Projections for Tuvalu estimate ca. 70 m of saltwater intrusion at depth. Furthermore, limited unsaturated space may force the groundwater table to shift inland through alternative discharge pathways or result in localized flooding. For Funafuti, the southwest part of the island is at higher risk to saltwater intrusion compared to higher parts of the island.[158]

56. Recent inundation modelling for Tuvalu show that sea level rise decreases the average return interval (ARI) of flooding events. For example, in Nanumea, many areas that are currently flooded once every 50, 100, or 250 years may flood once every 5 or 10 years (Figure 5, left). Under current sea levels nearly 7km2 (13.5km2) or almost 30% (53.1%) of Tuvalu's land mass is inundated every 5 (100) years. As sea levels rise, extreme floods that are currently rare are expected to occur more frequently. By 2060, a flood that presently has a 50-year return interval is projected

[143] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[144] Ceccarelli, D.M., Chapter 32 - Tuvalu. 2019 Academic Press.
[145] IPCC, ed. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. ed. V. Masson-Delmotte, et al. 2021, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
[146] IPCC, The ocean and cryosphere in a changing climate. 2019.
[147] Adams, K., C. Blackwood, R. Cullather, B. Hamlington, E. Heijkoop, K. Karnauskas, R. Kopp, E. Larour, T. Lee, and R.S. Nerem, Assessment of Sea Level Rise and Associated Impacts for Tuvalu. 2023.
[148] Marra, J.J., J.T. Potemra, A. Espejo, N. Fauchereau, A. Genz, V. Hernaman, S. Heron, G. Smith, L. Webb, M.J. Widlansky, P.I. Woodworth-Jefcoats, D. (Eds.), and P.D. 10.5281/zenodo.6965143, Ocean Ch 2 in Pacific Climate Change Monitor: 2021, Marra et al., Editor. 2022: The Pacific Islands-Regional Climate Centre (PI-RCC) Network Report to the Pacific Islands Climate Service (PICS) Panel and Pacific Meteorological Council (PMC).
[149] Fasullo, J.T. and R.S. Nerem, Altimeter-era emergence of the patterns of forced sea-level rise in climate models and implications for the future. Proceedings of the National Academy of Sciences, 2018. 115(51): p. 12944-12949.
[150] NASA, 2024: Sea Level Summary for Funafuti, Tuvalu.
[151] Adams, K., C. Blackwood, R. Cullather, B. Hamlington, E. Heijkoop, K. Karnauskas, R. Kopp, E. Larour, T. Lee, and R.S. Nerem, Assessment of Sea Level Rise and Associated Impacts for Tuvalu. 2023.
[152] CSIRO and SPREP, 2022: Extreme Sea Level Climatologies for the Western Tropical Pacific. Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Secretariat of the Pacific Regional Environment Programme (SPREP): Melbourne, Australia.
[153] Adams, K., C. Blackwood, R. Cullather, B. Hamlington, E. Heijkoop, K. Karnauskas, R. Kopp, E. Larour, T. Lee, and R.S. Nerem, 2023: Assessment of Sea Level Rise and Associated Impacts for Tuvalu.
[154] Ibid.
[155] Lin, C.-C., C.-R. Ho, and Y.-H. Cheng, Interpreting and analyzing king tide in Tuvalu. Natural Hazards and Earth System Sciences, 2014. 14(2): p. 209-217.
[156] Adams, K., C. Blackwood, R. Cullather, B. Hamlington, E. Heijkoop, K. Karnauskas, R. Kopp, E. Larour, T. Lee, and R.S. Nerem, 2023: Assessment of Sea Level Rise and Associated Impacts for Tuvalu.
[157] Hoeke, R.K., K.L. McInnes, J.C. Kruger, R.J. McNaught, J.R. Hunter, and S.G. Smithers, Widespread inundation of Pacific islands triggered by distant-source wind-waves. Global and Planetary Change, 2013. 108: p. 128-138.
[158] Adams, K., C. Blackwood, R. Cullather, B. Hamlington, E. Heijkoop, K. Karnauskas, R. Kopp, E. Larour, T. Lee, and R.S. Nerem, 2023: Assessment of Sea Level Rise and Associated Impacts for Tuvalu

to happen less than every five years, even under the moderate SSP2-4.5 scenario. By 2100, a 250-year ARI flood is expected to occur more frequently than once every five years under the same scenario. Under the high-emissions SSP5-8.5 scenario, flooding is anticipated to become even more severe and frequent (Figure 5, right).[159]

Figure 5: Average return intervals (ARI) for flooding in Nanumea and flooded areas in Tuvalu under different emission scenarios



The picture on the left shows ARI for flooding in Nanumea under present sea levels (d), and under SSP2 4.5 by the year 2100 (e). The graph on the right shows flooded area above MHWS across all of Tuvalu for different ARI and sea levels. Colors represent different sea level scenarios. Source: Wandres et al., 2024[160]

Although variations exist among the islands, overall trends and timelines remain consistent. In Funafuti, Nui, Nukufetau, and Vaitupu, floods that currently have a 50-year ARI are projected to occur more frequently than once every five years by 2060. In Nanumaga, Nanumea, Niutao, and Nukulaelae, the same 50-year ARI floods are expected to occur more than once every 10 years by 2060, even under the moderate SSP2-4.5 sea level rise scenario.[161]

Trends in tropical cyclones and extreme winds

Tropical cyclones are intense, rotating storms that develop over warm tropical oceans where sea surface temperatures exceed 25.5°C. They generally form at least 5° latitude away from the equator, where the Coriolis force is strong enough to initiate rotation. Despite existing variations, these storms typically span around 500 km in diameter.[162] The impacts of tropical cyclones arise both directly and indirectly from strong winds, heavy rainfall, and storm surges. The severity of these effects depends on the cyclone's intensity, path, and speed of movement. Since Tropical Cyclones in the southern hemisphere typically form in the SPCZ and move southeast, and since Tuvalu lies on the northern edge of the cyclone formation zone, it experiences fewer landfalling cyclones, which are generally not classified as severe. Between the 1970/71 and 2021/22 tropical cyclone seasons, a total of 59 tropical cyclones were recorded within Tuvalu's EEZ, either forming or passing through the area. This equates to an average of 11.6 cyclones per decade.[163]

Due to large interannual integrability and small number, reliable long-term trends of cyclone intensity and frequency are difficult to derive. Generally, cyclones occurred most frequently during El Niño years followed by neutral and La Niña years. Cyclones became less frequent but more intense between 1996/97-2021/22 compared to 1970/71-1995/96. However, these results are not statistically significant and could also be explained by more frequent La Niña events in the past decades (leading to fewer cyclones) and those that occurred, were associated mostly with El Niño events (increasing their intensity).[164] Nevertheless, observations for Tuvalu align with those for the Pacific region, where historical data shows a decline in the total number of tropical cyclones but an increase in intensity.[165]

Existing climate models have limitations regarding their ability to predict cyclone intensity and frequency under different climate scenarios (due to resolution etc.). Within these limitations, most models show a decline of cyclones by the end of the century with increased intensity. However, since these results have a low confidence level and due to the large impact of ENSO on cyclone formation for Tuvalu, other trends may play increasing roles as well. For example, in the broader southwest Pacific, cyclones are projected to become 20–40% more frequent during future El Niño periods compared to current El Niño conditions, while becoming less frequent during La Niña and neutral phases.[166] Since climate models predict an increase in El Niño-like conditions,[167] a resulting increase in cyclone frequency could also

[159] Wandres, M., A. Espejo, T. Sovea, S. Tetoa, F. Malologa, A. Webb, J. Lewis, G. Lee, and H. Damlamian, 2024: A national-scale coastal flood hazard assessment for the atoll nation of Tuvalu. Earth's Future 12(4).
[160] Ibid.
[161] Wandres, M., A. Espejo, T. Sovea, S. Tetoa, F. Malologa, A. Webb, J. Lewis, G. Lee, and H. Damlamian, 2024: A national-scale coastal flood hazard assessment for the atoll nation of Tuvalu. Earth's Future, 12(4).
[162] NOAA, 2023: Tropical Cyclone Structure. Available at: https://www.noaa.gov/jetstream/tropical/tropical-cyclone-introduction/tropical-cyclone-structure (Accessed on 30 January 2025).
[163] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[164] Chand, S.S. and K.J. Walsh, 2009: Tropical cyclone activity in the Fiji region: Spatial patterns and relationship to large-scale circulation. Journal of Climate, 22(14): p. 3877-3893.
[165] Knutson, T., S.J. Camargo, J.C. Chan, K. Emanuel, C.-H. Ho, J. Kossin, M. Mohapatra, M. Satoh, M. Sugi, and K. Walsh, 2019: Tropical cyclones and climate change assessment: Part I: Detection and attribution. Bulletin of the American Meteorological Society, 100(10): p. 1987 2007.
[166] Chand, S.S., K.J. Tory, H. Ye, and K.J. Walsh, Projected increase in El Niño-driven tropical cyclone frequency in the Pacific. Nature Climate Change, 2017. 7(2): p. 123-127.
[167] Erickson, N.E. and C.M. Patricola, Future projections of the El Niño—Southern Oscillation and tropical Pacific mean state in CMIP6. Journal of Geophysical Research: Atmospheres, 2023. 128(21): p. e2022JD037563.

be the case Tuvalu. This challenges the broader trend of declining cyclone numbers observed globally and across the wider Pacific, highlighting the need for careful consideration of regional variations. The projected decrease in frequency and increase in intensity have low confidence, and further research is needed to increase projection confidence.[168]

Trends in ocean warming and ocean acidification

Between 1982 and 2022, sea surface temperatures (SSTs) rose by 0.22°C per decade. Marine heatwave durations significantly increased across most of the Pacific in the 2010s, lasting between 8 and 20 days. Since 1988, oceanic pH measurements indicate that the tropical Pacific has become 12% more acidic.[169]

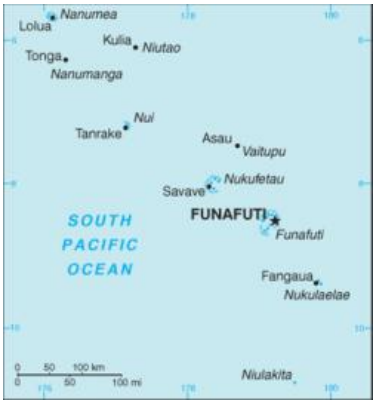
In Funafuti, marine heatwaves are projected to become significantly more frequent, increasing from fewer than 10 days per year in 1995 to approximately 130 days per year by 2050 under a low warming/low emissions scenario and up to 360 days per year under a high warming/high emissions scenario. This will have serious consequences for marine ecosystems, particularly coral bleaching. Severe coral bleaching events, where corals experience prolonged heat stress with no recovery period, are expected to become an annual occurrence in Tuvalu's EEZ by around 2060 under low emissions and by 2035 under very high emissions. Ocean acidification is also expected to continue, with aragonite saturation levels falling below 3 by 2060 under high emissions, a threshold at which coral reefs may begin to shrink as they dissolve faster than they can grow. However, under a low emissions pathway aligned with the Paris Agreement's target of keeping warming well below 2°C, aragonite saturation may start to recover after 2060. By 2050, ocean pH around Tuvalu is projected to decline by 0.05 units under a low emissions scenario and by 0.12 units under a high emissions scenario, leading to increased ocean acidity and further risks to marine ecosystems.[170]

Annex II

Table 8: Groundwater assessments and development supported under this project for each island

Island	Groundwater Assessment and Development Activities	
	GW Assessment	GW Development
Funafuti	GW has been assessed	Not viable based on assessment
Nanumaga	GW to be assessed under this project	Possibly, depending on results from assessment
Nanumea	GW has been assessed	GW being developed under different project
Niulakita	GW to be assessed under this project	Possibly, depending on results from assessment
Niutao	GW to be assessed under this project	Possibly, depending on results from assessment
Nukufetau	GW has been assessed but may need reassessment to reconfirm results	GW potential was confirmed in previous assessment
Nukulaelae	GW to be assessed under this project	Possibly, depending on results from assessment
Nui	GW has been assessed but may need reassessment to reconfirm results	GW potential was confirmed in previous assessment
Vaitupu	GW has been assessed	GW being developed under different project

Figure 6: Map of Tuvalu showing all nine islands and project target areas



[168] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[168] Chand, S.S. and K.J. Walsh, 2009: Tropical cyclone activity in the Fiji region: Spatial patterns and relationship to large-scale circulation.
[169] CSIRO, Federation University, Climate Comms, 2024: Assessment of climate hazards and associated sectoral impacts for Tuvalu under current and future conditions.
[170] Ibid.