

## DEMONSTRATION PROJECT PAPER

**A. Country:** TONGA

**B. Title:** Improvement and Sustainable Management of Neiafu; Vava'u's Groundwater Resource

**C. Executing Body:**

The Ministry of Lands, Survey, Natural Resources and Environment (MLSNRE) shall be the national Executing Agency.

**D. Overall Objective:** Sustainable water resource assessment and protection of the fragile Neiafu Groundwater Resources

**E. Project Purpose:** Improved understanding of the quality and quantity of surface water, groundwater, rainwater, coastal receiving waters, and their vulnerabilities to land based pollution.

**Components:**

A: Mitigation of threats from contaminants;

B: On-the-ground protection; and

C: Development of a Water Resource Management Plan.

The project will address land-based pollution, protection of water supply, vulnerability to climate change and prevention of land degradation. In relation to the Strategic Action Plan for Pacific International Waters, it will include measures to reduce modification to the ecosystems, protect biodiversity and promote integrated coastal and watershed management. It will directly address Theme 1: water resource management, Theme 2, island vulnerability, and Theme 3, awareness raising in the Pacific Regional Action Plan on Sustainable Water Management.

**F. Cost of Project:**      **GEF Funding:** \$519,000      **Co-Funding:** \$9,627,000

**G. Linkage to National Priorities and Programmes:**

Within the GEF Operational Strategy for International Waters this project tackles water and environmental problems using an IWRM approach across GEF Strategic Programme III: Balancing overuse and conflicting uses of water resources in transboundary surface and groundwater basins (with a specific focus on SIDS to protect community surface and groundwater supplies while reducing sewage releases).

The geographical nature of SIDS allows IWRM approaches to rapidly demonstrate the multiple benefits of tackling water resource management in an institutionally horizontal manner, whilst applying a ridge to reef approach, tackling technical and socio-economic issues with communities and civil society at large to demonstrate equity, efficiency and environmental sustainability.

The project will also tackle, through IWRM approaches, many of the issues under GEF Strategic Programmes I and II through identifying and understanding multiple stresses on fragile coastal environments and linking these to freshwater and land management, especially upstream practices; IWRM will contribute to improving coastal fishstocks and biodiversity. IWRM approaches will also include methods to reduce economic and ecologic dead-zones of oxygen deficient water as a result of human and animal sewage waste.

The improvement and sustainability of Neiafu's underground water resource is linked to the following national priorities of the National Strategic Development Plan 8 (SDP8): National Goal 6: Improve health standards; and National Goal 7: Ensure environmental sustainability and disaster risk reduction.

The proposal is also compatible with the following International and Regional Multilateral Agreements to which Tonga is a signatory:

- Pacific Regional Action Plan on Sustainable Water Management
- Strategic Action Plan for Pacific International Waters
- Convention on Biological Diversity
- The Cartagena Protocols
- United Nations Convention to Combat Desertification (UNCCD)
- United Nations Framework Convention on Climate Change (UNFCCC)
- Stockholm Convention on Persistent Organic Pollutants
- Marine Pollution Convention
- Protocol to the Convention on the Prevention of Marine Pollution by Dumping Wastes and other matters

Related to global environmental conventions and agreements, the Ministry of Lands, Survey, Natural Resources & Environment (MLSNRE) is now the coordinating and implementing agency for the outputs of the UN Conference on Environment and Development. For example, the Agenda 21, Barbados Programme of Action and the World Summit on Sustainable Development which resulted in the Johannesburg Plan of Implementation focusing on freshwater and sanitation, energy, health, agriculture & biodiversity.

#### **H. Name and Post of Government Representative endorsing and Demonstration Activity:**

1. Dr. Nailasikau Halatuituia, Secretary, Ministry of Lands, Survey, Natural Resources & Environment
2. Mr. Kelepi Mafi - Principal Geologist, Ministry of Lands, Survey, Natural Resources & Environment

#### **I. Project Objectives and Activities**

##### **i. Background**

The Kingdom of Tonga is an archipelago of 172 coral and volcanic islands, of which 36 are inhabited, spread over 360,000 km<sup>2</sup> of territorial seas in the South Pacific. The total land area is 747 km<sup>2</sup> aggregated into the four major groups of Tongatapu and 'Eua (370 km<sup>2</sup>), Ha'apai (119 km<sup>2</sup>), Vava'u (143 km<sup>2</sup>) and the two small Niuas (71 km<sup>2</sup>) (see Figure 1). The largest of these is Tongatapu on which is located Nuku'alofa, the capital, where about 68 percent of the total population live. The islands are recognized as either volcanic or uplifted coral limestone on a deep pile of sediments of volcanic origin. The volcano form a linear chain on the western side and coral islands to the east. The Limestone islands have been uplifted in blocks in response to crustal movements. During this uplift, which occurred in stages, coral terraces and accumulation of volcanic debris formed the base of the islands seen today.

The 2006 population census reported a total population of 101,169 with a low annual average population growth of only 0.3 percent in the ten years since the previous census, and with an average population density of about 150 persons per km<sup>2</sup>, which is high compared to other islands in the Pacific. The total number of households increased from 16,174 in 1996 to 17,776 in 2006. An estimated population of 80,000 now resides in Australia, New Zealand and the United States (Statistics Department, 2006). There is also significant internal migration, particularly from the outer islands to Tongatapu. The climate of the Tonga archipelago is tropical maritime mild to warm, humid and moderately wet throughout the year, with a mean annual rainfall varying from approximately 1,770mm on Tongatapu and 2,350mm on Vava'u. Table 1 contains some basic climatic data for the three main regions from (1986 – 2004).

Rainfall seasonality is most marked on the Vava'u and the Ha'apai island groups. High humidity occurs throughout the year. The annual mean humidity ranges from 77 percent in Tongatapu to 79 percent in Vava'u. The prevailing winds are Southeast Trades winds, which dominate during the months of May to October, a period when rainfall is lowest and when periodic water shortages occur, especially in the warmer season.

**Table 1: Mean annual temperatures and total rainfall for the three main island groups.**

<b>Group</b>	<b>Mean Annual Temperatures (in °C)</b>	<b>Total Annual Rainfall (in mm)</b>
Tongatapu	24.4	1728
Ha'apai	25.6	1780
Vava'u	26.5	2180

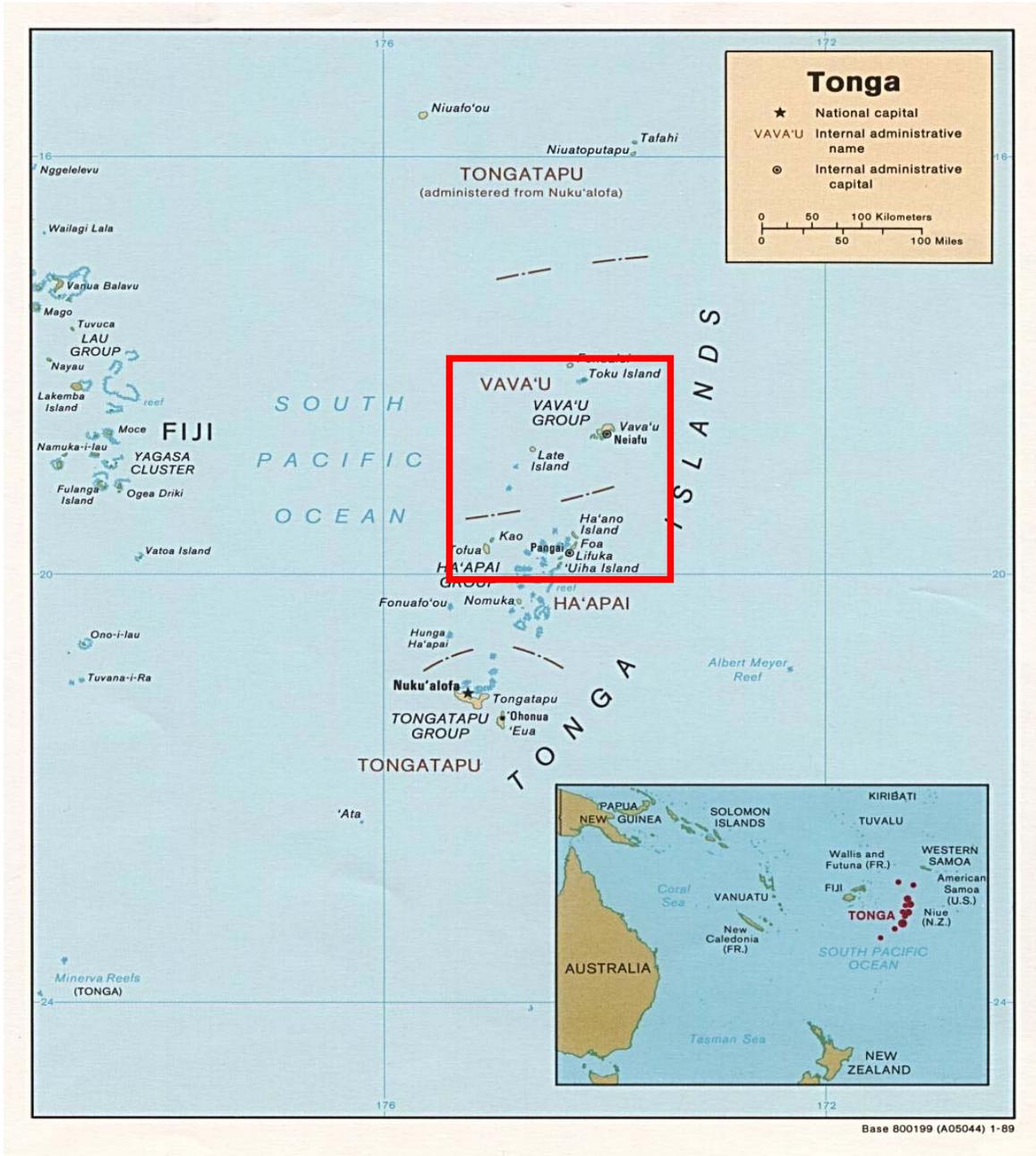
*Source: Civil Aviation Department, 2005*

**Demonstration Site**

Vava'u is the second largest island group situated in the northern part of Tonga (173° 59' West Longitude and 18° 39' South Latitude) (Figure 2). It has a population of (15 485 people (census 2006) and has a total land area of 119 square kilometers (km<sup>2</sup>). Its flat to rolling topography and moderately steep to steep slopes (between 12% to more than 30%) as well as its scenic beauty make Vava'u an attractive tourist haven. It has 37 villages situated in six districts, Neiafu, Pangaimotu, Eastern, Leimatu'a, Western and Outer Islands (Motu).

Neiafu is the capital of Vava'u (Figure 3). Its aquifer has not been surveyed during the past to understand the quality and quantity of water available to be used by the public. It is also not known how safe this water is for human consumption. Human induced impacts have been increasing and the effect of increased tourism has forced some new developments to be carried out in this area. Not only that but the increase in agricultural demand such as squash pumpkins, kava, root crops such as taro, sweet potato, etc. has introduced farmers to use pesticides to increase their production yield. Sewage treatment and disposal associated with recent commercial and industrial programmes, storm water runoff along major roads traversing the aquifer have led to an unprecedented increase in the loadings of nitrates and phosphates. It is also under threat from over-extraction and attempts at development as prime real estate. Recognising the over-riding importance of the underlying water resource to the demands of Neiafu as well as the adjacent environment, the government is seeking to find a way to ensure the long-term sustainability of this resource. The low and inconsistency in agricultural production and quality is a major problem particularly in maintaining the export markets. This was also identified by the Participatory Rural appraisal under the current DSAP project farmers identified soil water stress as one of the key problems causing low agricultural productivity.

Figure 1: Map of the Kingdom of Tonga with the location of Vava'u.





## **Pollution**

A pollution source survey was conducted in Neiafu where most industrial, commercial, public and government institutions, and the main harbour are located. Waste ranged from medical wastes, transformers containing toxic chemical of PCBs, leaking oil from diesel water pumps and garages, septic waste from households and yachts, cleaning agents, food scraps, and so-forth. Some aluminium cans and glass bottles are recycled and re-used, however, the majority of waste is dumped at an open, unmanaged dump site.

It was reported that septic waste, oil and chemical runoff is a more emerging pollution issue than other wastes produced. Many of the businesses along the harbour have septic tanks at sea-level. Some are not even reachable by the Ministry of Health's septic collection truck. Therefore, the septic tanks are overflowing into the harbour, especially during heavy rains. The businesses also have kitchen drains that drain directly into the harbour. Chemicals from cleaners and boat maintenance are being dumped down the drain and going directly into the harbour. Since the landscape of the harbour makes it very hard to dry dock boats, boat repairs are being done in boat slips in the harbour. This means that paint and oil and other chemicals are directly dumped into the harbour. Yachties dumping into the harbour is also a problem. Not only are they dumping rubbish, but also, they are emptying their septic system into the harbour. All of this direct dumping into the harbour along with construction of causeways, slows the flushing rate of the lagoon and it is a cause for major concern. If these problems continue, the fish, coral, turtles, whales and all other organisms will die or go elsewhere. Polluted coastal waters may seep and contaminate groundwater supply. The harbour will become unsafe for recreational and daily subsistence purposes.

**Sanded off paint contaminating the harbour**



**Boats docking at Neiafu harbour**



**Leaking oil and gasoline seeps into the ground  
leaking oil containing PCB**



**Broken down transformer**

## Policies

There is no effective policy on water use efficiency and proper management of water resources within Vava'u or for the Kingdom, however, there is a Water Resources Management Bill which is yet to be enacted. The apparent lack of management and capacity is due to no regulation, no staff/resources, little baseline data on aquifer and no one knows who is doing what, when, extracting how much, approval for extraction not present, etc. It is now imperative that policy makers and users accept that existing water resources are finite and need careful management and protection. The hotel and tourism sector generally are critically important to the developing economy of the country, but are also major exploiters of water resources. In view of this growing sector it is now critical to plan water resource management well in advance, enact the Water Resources Management Bill, improve and monitor data on aquifer to enable the protection of the quality and quantity of the resource.

The principal concerns related to the Neiafu Aquifer can therefore be summarised as:

- Threats from agricultural and industrial pollution;
- Threats from domestic (sewage and wastewater) pollution;
- Improper land usage and inappropriate development planning threatening the integrity of the aquifer and water supply;
- Inadequate management and control of water extraction to ensure sustainability;
- Inadequate overall protection of the area and its ecosystem functions (particularly as a water resource);
- Lack of control over leakage and wastage, or in appropriate use of water resources.

As the coastal areas of Neiafu are main areas of tourism and urban development as well as marine livelihoods, this demonstration project will aim to show how it is necessary to control activities in a watershed to protect vital natural resources, in this case, an unconfined coastal aquifer. Protecting this vital natural resource is not only an environmental issue but also one of economic importance.

### Tourism and urban development

- Tourism and urban planning as part of the IWRM (with particular emphasis on water resources and wastewater management)
- Mitigating land degradation as a result of inappropriate policies

### Protection of water supplies

- Development and implementation of improved and coordinated water resource management and conservation practices
- Improved policies and regulations addressing water supply and demand
- Information capture to drive and support water management policy development
- Ambient environmental monitoring programmes relating to water resource and wastewater management and coastal welfare

## **ii. Objectives and Activities:**

Based on this background, the project proposes to demonstrate the proper management and protection of a critical aquifer through a parallel process of A. Mitigation of threats from contaminants; B. On-the-ground protection; and C. Development of a Water Resource Management Plan.

### 1. Mitigate Threats from Contaminants

1.1 *Review and develop options for implementation for agricultural practices and land-use as they pertain to well-field and aquifer integrity*

This will address the growing threat of pollutants and contaminants to the aquifer (both actual and potential) from intensive farming techniques which require high levels of pesticides and fertilizers, tend towards the selection of one cash-crop only, and both actively and passively exclude other natural species of flora and fauna.

*1.2 Develop and implement alternative options to minimise impacts of sewage and liquid waste practices (onsite demonstrations)*

With the absence of a properly managed landfill for all wastes, septic beds, and the establishment of improper sized septic tanks, etc., these are contributing factors to the potential threat to the aquifer and the health of the people. It is in the hope that the project will establish pilot trials of environmentally friendly septic beds and septic tanks and to develop a Code of Conduct for household septic tanks to be incorporated into the existing Building Code.

*1.3 Review health statistics that may be associated to water contamination and address them in all stages of the project*

This will involve looking into the health statistics associated with waterborne diseases and monitoring it over the duration of the project and beyond. There should be a noticeable decrease and/or stabilisation in numbers of illness associated with waterborne diseases. This is very much reliant on the information gathered, pilot trials, community and the private sector participation and awareness.

*1.4 Consult and address community concerns*

This would involve community and stakeholder consultations by use of workshops/meetings and conducting a series of qualitative and quantitative household/business survey. There would be a requirement for a fully participatory consultative process to include all relevant stakeholders throughout the lifetime of the project and beyond. Such a participatory approach is essential for the long-term sustainability of the objectives and deliverables of this initiative.

*1.5 Monitoring and compliance based on Water Resource Management Bill*

It is crucial to the management of the water resources if the Water Resource Management Bill is implemented under mutual agreement between the managers and consumers of water resource.

**2. Protect Aquifer and Supportive Ecosystem**

*2.1 A Hydro-Geological survey of the aquifer and well-field area*

A hydro-geological feasibility analysis component of the project attempts to identify the threats to the groundwater resources base. Three (3) main activities have been identified:

- a) Hydro-chemical and biological tests: involves the testing of water for pH, salinity, faecal coliforms, pesticides and nutrients; and soil samples from within the study area for Persistent Organic Pollutants (POPs) and heavy metals.
- b) Test Borings: which involves boreholes at regular intervals so as to assess the water quality at different levels;
- c) Computer modeling: to assess and make predictions on present and future threats, so that mitigative efforts could be resolved before serious and potentially irreversible impact could take effect.

It is intended to conduct a quantitative and qualitative assessment of the underground water system; prepare water balances and carry out studies of desirable water systems.

*2.2 Survey of water wastage and leaks in the groundwater extraction and distribution process*

The project will identify those areas of excessive use, areas of wastage, and areas where practices are inappropriate (such as the use of high quality potable water for irrigation purposes).

2.3 *Review of options for recovery and recycling of water and reductions in losses in the system (both commercial and domestic)*

This would enable to formulate strategies for improved practices (such as recycling, and use of grey-water for irrigation) and reduce wastage which will be coupled to incentives for adopting these improved practices through the pilot trials, relevant stakeholder participation and implementing the Water Management Bill.

2.4 *Strengthen evaluation and monitoring of water resources*

Strengthening evaluation and monitoring of water resources. This includes strengthening Ministry of Health (MoH), Tonga Water Board (TWB) and Geology surveillance and monitoring of ground water supplies (urban and rural). This strategy may prevent shortages, renovate hydrology stations where necessary, and formulate a scheme for sharing of data amongst key stakeholders.

Strengthening of Geographical Information System (GIS) of MLSNRE to include a system using the current assessment data on soil type, land use intensity risk and desertification risk areas that can easily identify areas most susceptible to drought. This information can be used for determining the type of activity that is recommended for each area and monitoring the changes in land use. Mapping of water users for the aquifer: who uses the water, how much, when, what for, economic benefits, etc., are also useful information for evaluation and monitoring purposes.

2.5 *Development of an awareness and training programme for implementation*

Reducing pollution through awareness raising using the media, brochures, educational material, community workshops/consultations to strengthen improved sanitation practices to reduce pollution, septic tank rehabilitation, etc. are just a few effective methods of empowering the village communities to take more ownership and responsibility for their water resources. It should hopefully empower communities to take necessary precautionary measures.

2.6 *Establish a Committee to oversee the management of the Neiafu aquifer and a Technical Working Group for technical assistance*

An establishment of a Neiafu Water Resources Steering Committee with representatives from government, local politicians, nobles, farmers groups, youth groups, women groups, and NGOs would oversee the operation of the demonstration sites with the objective of sustaining the operation of the project towards the end of the project. The coordination will still remain with MLSNRE. A Technical Working Group would also be established to provide technical assistance.

2.7 *Capacity Building for institutional strengthening (communities, health services, farmers affected, Neiafu Groundwater Management Committee, etc)*

Capacity building for institutional strengthening is very important in order to sustain operations after the duration of the project. This will involve on-the-job training within the project, in-country technical training, community workshops, and a few scholarships for long-term and short-term trainings.

3. Develop Water Resource Management Plan for Neiafu, including incentives for water conservation

3.1 *Develop scenarios for the future of the Aquifer (e.g. major proposed developments and their expected impacts, etc.)*

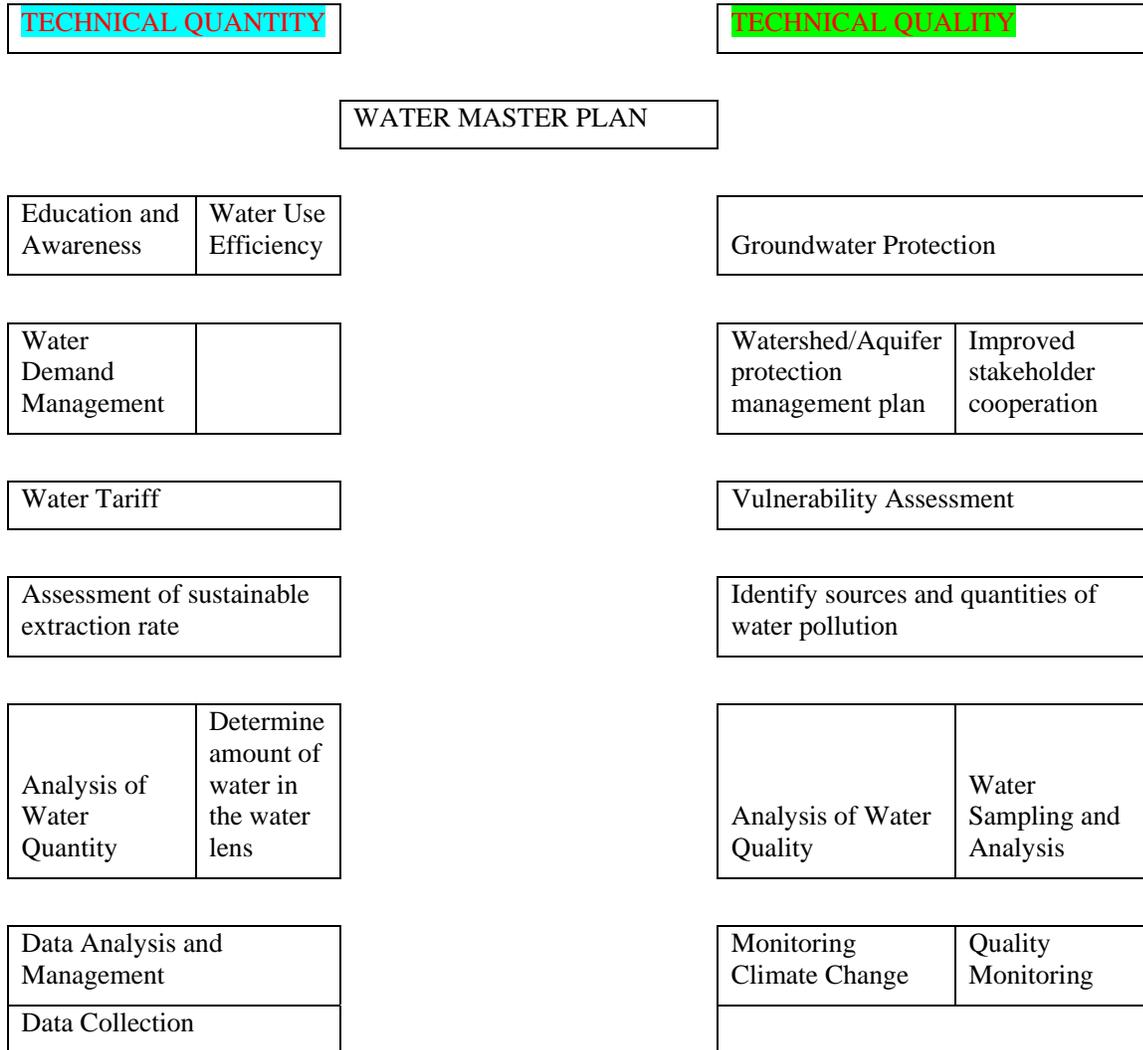
3.2 *Management strategies*

3.2 *Financial sustainability mechanisms*

As a critical importance to the short-term usage and long-term conservation of the existing finite resource, the project will identify those areas of excessive use, areas prone to drought, areas where practices are inappropriate, and areas prone to high levels of contamination. Strategies will be formulated according to the assessments found over the project years to sustainably manage the ground water resource. It will include improved practices, incentives for adopting these improved practices through policy reforms and development of scenarios. Financial strategies to encourage such better management of the finite resource

will also be developed. All will be presented for Cabinet’s approval as the Neiafu Water Resource Management Plan.

All the above-mentioned components can be depicted as shown below:



One of the primary success indicators of the project would be a realistic sustainability and replicable plan which would not only demonstrate and implement financial provisions for the continuation of all objectives with full political support, but would also include a mechanism to replicate any successful lessons and practices within other appropriate areas in Tonga. Most importantly, strengthen cooperation between government organisations and the private sector in managing this resource.

**iii. End of Project Landscape:**

At the end of the project, control and management of the water resource in Neiafu will be linked and integrated into improved control and management of quality and quantity supply of groundwater. Water abstraction will be carefully monitored and controlled and where the groundwater and well-fields are actively used, it will be protected against contamination and over-extraction.

In particular, the following primary indicators should be apparent:

- i. agricultural practices will have altered resulting reduced pollution from agro-chemicals and improved water quality within the aquifer;

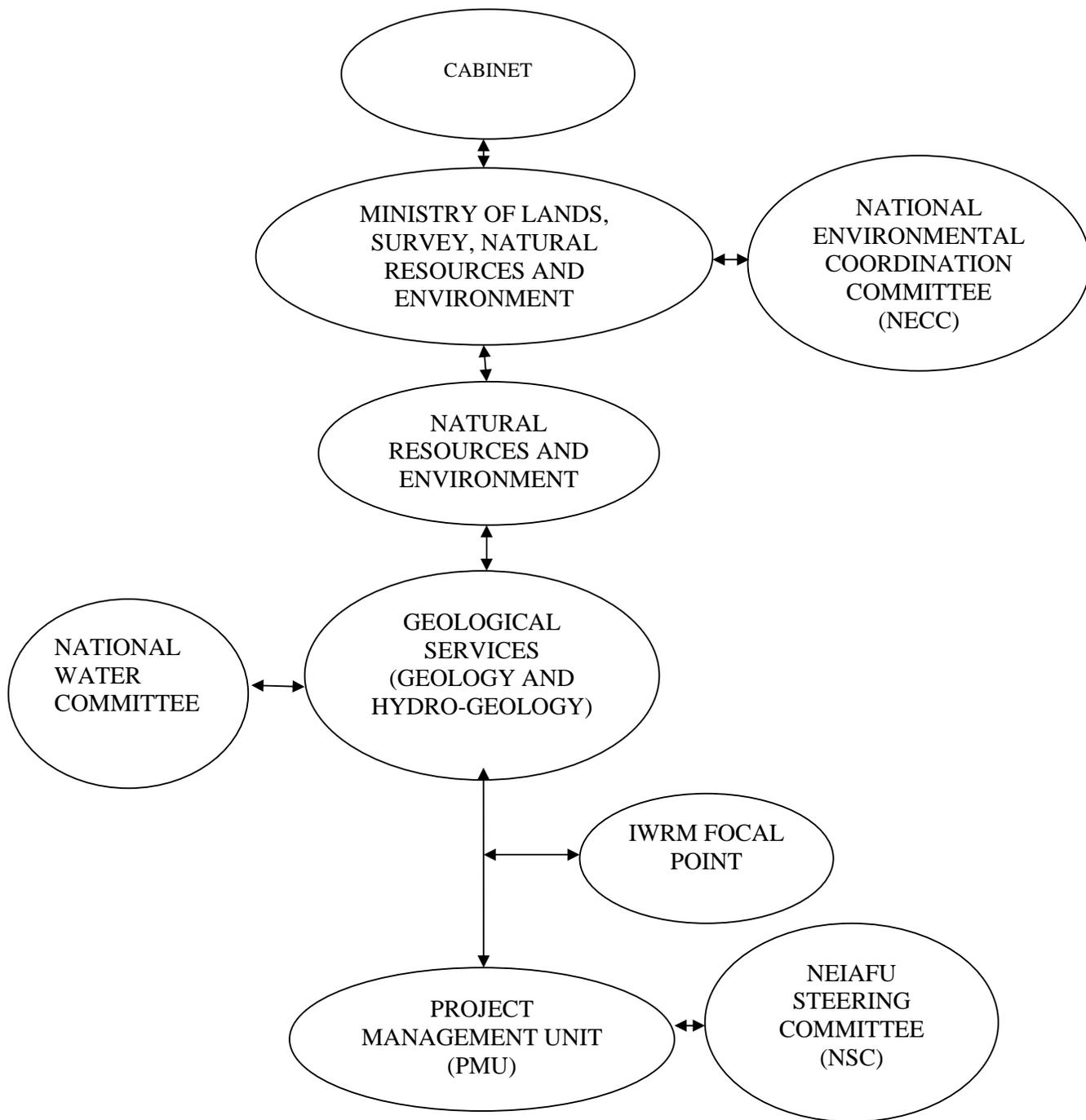
- ii. sewage and wastewater handling practices will have improved resulting a reduced threat to the aquifer;
- iii. policy reform and legislative approvals will reflect support for changes in land-use practice, reduced pollution, sustainable and protective management of the aquifer and well-fields;
- iv. incentives will be in place to promote the policy reform and to actively encourage better management and sustainable use of the water resource as well as conservation of supportive ecosystem functions;
- v. effective monitoring and compliance will be in place to ensure policy requirements are actively maintained;
- vi. a comprehensive management plan will have been adopted by the Cabinet, based on detailed studies of the aquifer and associated resources, and focusing on sustainable development of the land area integrated with long-term protection and conservation of the water resource;
- vii. A government-supported participatory, multisectoral Management Committee will be in place and will be overseeing and monitoring the requirements of the Management Plan

The regional environmental benefits from developing such a model would be in its replication within other Pacific SIDS situations. The adoption of effective models for aquifer protection and sustainable management should result in a marked regional improvement in coastal and watershed environmental quality, supported by communities and stakeholders who recognise improvements within their own quality of life as a result of these initiatives. It is intended that lessons and best practices from this model and from the demonstration approach as a whole could be transferred globally to other SIDS (and non-SIDS) situations as relevant.

**J. Project Management Structure and Accountability:**

A Project Management Unit (PMU) will be set up under the Environment & Natural Resources Management Division, Ministry of Lands, Survey, Natural Resources & Environment. The PMU will be based in Neiafu, Vava'u and will consist of a Project Coordinator, Project Officer and an Administrative Assistant. The PMU will be guided and instructed by the Neiafu Water Resources Steering Committee. This Committee will include representatives from the relevant government departments, NGOs and the private sector. Other members may be co-opted at the discretion of the permanent membership. The Steering Committee will be chaired by a member from the Environment & Natural Resources Management Division of the Ministry of Lands, Survey, Natural Resources & Environment. The Steering Committee will report to the National Environment Coordinating Committee (NECC) who is chaired by the Minister of Lands, Survey, Natural Resources & Environment. Members of the NECC consist of Ministers of relevant stakeholders, and CEOs, or its equivalent. The Steering Committee ensures that there is appropriate facility for non-government and private stakeholder participation, review, monitor and evaluate project strategies as they are being developed and implemented.

A Technical Working Group will be established to advise the Steering Committee on specific issues. The Technical Working Group may involve stakeholder from Tongatapu, as capacity in Neiafu is very limited. It will also report from time to time, through the PMU, on the status of the demonstration project.



#### **K. Stakeholders and Beneficiaries:**

Various government, non-government organizations and institutions will be involved in an integrated and multi-sectoral approach to the development and implementation of the objectives and deliverables of this demonstration project. Permanent memberships of the Water Resource Steering Committee are from the following organisations:

- Ministry of Lands, Survey, Natural Resources & Environment
- Ministry of Health
- Tonga Water Board
- Ministry of Agriculture & Food, Forestry and Fisheries
- Ministry of Works
- Ministry of Tourism
- Ministry of Finance
- Meteorological Services
- Tonga Trust (NGO)
- Langafonua (NGO)
- Rep. from the farmers
- Rep. from National Youth Congress
- District Officer
- Town Officer
- Rep. from private sector
- Rep from Australian Aid
- Rep from New Zealand Aid
- Rep from other Donor (if needed)

It will be essential to involve the public sector and the community to capture knowledge and expertise, to explore new and innovative ideas and options, to foster support for the overall process, and to actively contribute to the implementation of a shared vision for Neiafu, Vava'u.

#### **L. Long-term Sustainability Strategy:**

Public awareness and education raised by the use of awareness materials and on the ground demonstration sites plays an important part in strategic plans such as this to minimise the activities that contribute to land and water degradation and drought. People are more passionate about implementing tasks they can relate to and understand compared to those they do not. Use of community-based approaches will benefit from gaining relevant information, and it would also catalyse stakeholder support for basic conservation measures. Stakeholders will be more likely to comply with restrictions on their resource use activities if they understand and support the rules, which can be accomplished through direct community participation in monitoring, planning, and decision-making.

The engagement of the Steering Committee members, Technical Working Group and the community will guarantee long-term sustainability. The national executing agency will keep its role in coordinating the management of water resources and its ongoing implementation as the Management Plan will have established an annual budget to be approved by Cabinet. Each member of the Steering Committee would have incorporated relevant functions of the Management Plan to their respective organisations operations and provide support to the Neiafu Water Management Committee.

Capacity building of civil servants and relevant stakeholders would strengthen implementation of the Management Plan, as they will acquire the necessary skills and knowledge to ensure continuity of the management of the water resource.

**M. Replicability:**

The project will report back to the NECC once the water resource management process has been successfully demonstrated, and will submit a proposed model for future replication. This report will emphasise the cost of implementing and maintaining similar management strategies in other watersheds versus the long-term economic and environmental damage associated with not providing such mechanisms. It will capture the experiences in community involvement and stakeholder participation as well as the lessons and practices learnt, changes in land-use practices, incentives for water conservation, etc. Where feasible, it will identify other suitable locations within Tonga where similar management approaches could and should be developed. The report will provide indications for funding sources and sustainable revenues to support such approaches. It will also include a work-plan and scheduled cost-estimates for sequential replication.

Equally, if not more important with respect to replicability, will be the potential for transferring the best lessons learnt and practices developed through this demonstration to SOPAC for dissemination throughout the Pacific SIDS. Contacts of relevant agencies involved in the process will also be provided. This approach to groundwater and water resource management will prove extremely valuable to other Pacific and non-Pacific SIDS.

**N. Monitoring and Evaluation Process:**

The project will be overseen by a Steering Committee made up of stakeholders to the project and chaired by the national executing agency, MLSNRE. The Project Management Unit will produce a brief quarterly Progress Report updating the Steering Committee and the project executing agency on the progress of the Demonstration. A detailed report will be submitted to the regional executing agency via the national executing agency once a year. This report will provide a full review of the workplan to identify project achievements and deliveries versus the approved schedule, budget expenditures, recommendations with respect to any amendments to the workplan and budget, staff contracting and performance, and any other information required by the regional executing agency. Furthermore, the Regional IWRM executing and implementing agency will carry out monitoring and evaluation of all of the national IWRM demonstration projects as part of the Full IWRM Project.

The End-of Project landscape provides initial guidance on the indicative areas of success that would need to be measured (section I.iii, i-vii above). As part of its implementation stage, the PMU will develop a detailed list of indicators which will be approved by the Steering Committee and will be submitted to the Executing Agency as part of the PMU's first Progress Report. This indicator measurement mechanism will be linked to and measured against a baseline situation as defined in the early stages of the Demonstration Project through the establishment of a baseline inventory. Table 2 shows a draft project Monitoring and Evaluation Framework. This will be expanded on during the first 6 months of the project with all project stakeholders.

<b>Components</b>	<b>Activities</b>	<b>Baseline Indicators</b>	<b>Target Indicators</b>
A. Mitigate Threats from Contaminants	A1. Review and develop options for implementation for agricultural practices and land-use as they pertain to well-field and aquifer integrity	Identification of type and quantity of pollutants entering aquifer at project start	Reduction in pollutants by 20% from baseline levels
	A2. Develop and implement alternative options to minimise impacts of sewage and liquid waste practices (onsite demonstrations)	No of septic tanks leaking and volume of pollution	Reduction in septic tank leakage by 50% above baseline levels
	A3. Review health statistics that may be associated to water contamination and address them in all stages of the project	No. of reported illnesses related to waterborne diseases and pollution	Reduction in reported illnesses by 40% from baseline levels
	A4. Consult and address community concerns	No. of community consultations and involvement in decisions at project start	Increase in community involvement by 100% from baseline levels
	A5. Monitoring and compliance based on Water Resource Management Bill	Water Resources Mgmt Bill in place and working	Fully functioning water resources mgmt bill in place and regulated and draft IWRM plan and policies in place
B. Protect Aquifer and Supportive Ecosystem	B1. A Hydro-Geological survey of the aquifer and well-field area	Water Quality testing at project start	Regular water quality monitoring system in place with distribution of results to stakeholders via the Aquifer Mgmt Committee
	B2. Survey of water wastage and leaks in the groundwater extraction and distribution process	Leakage and water use survey at project start. % of daily supply leakage.	Reduction by 40% from baseline in water supply. Leakage monitoring processes in place and TWB actively working to reduce leaks including cost recovery improvement for O&M
	B3. Review of options for recovery and recycling of water and reductions in losses in the system (both commercial and domestic)	Assessment of existing water re-use schemes and approaches	10% of urban water recycled by project end
	B4. Strengthen evaluation and monitoring of water	Evaluate existing monitoring approaches	Monitoring plans in place and

	resources	across different institutions	institutions actively monitoring and reporting to the Aquifer Mgmt Committee.
	B5. Development of an awareness and training programme for implementation	Evaluate existing awareness materials and their impact with target audience	50% increase in awareness materials and monitoring of their impact and effectiveness on an annual basis by project end
	B6. Establish a Committee to oversee the management of the Neiafu aquifer and a Technical Working Group for technical assistance	Evaluate existing management approaches and mechanism for the Neiafu aquifer at project start	Aquifer Mgmt Committee and TWG in place by Year 3 of project
	B7. Capacity Building for institutional strengthening (communities, health services, farmers affected, Neiafu Groundwater Management Committee)	Evaluate existing training given & identify & evaluate other capacity building activities done	Increase in targeted, relevant and applicable capacity building up by 30% from baseline.
C. Develop Water Resource Management Plan for Neiafu, including incentives for water conservation	C1. Develop scenarios for the future of the Aquifer (e.g. major proposed developments and their expected impacts, etc.)	Evaluate the develop scenario and make modification as time goes by to fit the overall objective.	60% of the developed scenarios fully tested by the end of the project
	C2. Management strategies	Continuous Evaluate the management strategies with the intention to make it more effective and efficiency.	70% of the target management strategies obtain during the lifetime of the project
	C3. Financial sustainability mechanisms	Continuous evaluate option of financial resources in order to ensure the sustainability of the project is obtained after the life-time of the project.	At the end of the project funding sources have been secured to run the project for another 5 years.

**Table 2: Monitoring and Evaluation Framework**

**O. Co-Financing**

<b>Donor</b>	<b>Co-financing Project/Programme</b>	<b>US\$</b>
EU	Pacific HYCOS	79,000
EU Water Facility	IWRM National Planning Programme	48,000
EU	Disaster Preparedness Initiative	1,000,000
EU	Vava'u Outer Islands Photovoltaic Electrification Rehabilitation	7,000,000
Govt of Tonga	Community Support Programme and Urban Development	1,500,000
<b>Total</b>		<b>9,627,000</b>

## P. Budget

Budget line	Description of Expenditure	A	B	C	D	E
		USD GEF	in-kind	USD Other Funds	Donor	USD TOTAL
<b>Project Management Unit</b>						
<i>Full-time Project Staff (48 months GEF, 1 year Govt.)</i>						
Project Manager	Level 7 govt. rate	40,000		19,440	Govt	59,440
Administrative Assistant	Level 11/10 govt. rate	10,000		7,560		17,560
<i>Project office</i>						
Office rental	60 months @ 500/month			30,000		30,000
Communication	telephone, fax, e-mail @ 200/month	6,000				6,000
Utilities	electricity, water @ 150/month			900	Govt	900
Office equipment	Laptop, printer, desktop, etc.	6,000		6,000		12,000
Software and licenses	for computers, etc.			1,000		1,000
Office supplies	stationery			3,600		3,600
<i>Project management and monitoring systems established</i>						
Workshops	two @ 200/workshop	400				400
Digital video/still camera	1 Digital camera & supplies	1,500				1,500
<i>Maintenance</i>						
Office equipment	computers, etc.			4,500	Govt	4,500
<i>Neiafu Water Resources Steering Committee meetings</i>						
PMU travel	PMU travel, per diem, etc. to 4 meetings/year @ 1,250/meeting	5,000		8,000	Govt	13,000
NECC	1 meeting/year			1,000		1,000
	<b>Sub-total:</b>	<b>68,900</b>	<b>0</b>	<b>82,000</b>		<b>150,900</b>
<b>Mitigate Threats from Contaminants</b>						
<i>Review and develop options for implementation</i>						
Review of Land-use practices and associated pollution threats	Agricultural practices review	6,000		3,000	Disaster Preparedness Initiative, Photovoltaic Rehabilitation, Community Support Programme, Pacific HYCOS	9,000
	Wastewater practices	6,400		3,000		9,400
Review water supply infrastructure	infrastructure and identify leakages, survey of water wastage and leaks, review options for recovery and recycling of water	26,000		100,000		126,000
Develop and implement alternative options	onsite demonstrations to minimise impacts of sewage and liquid waste practices	30,000		35,000		65,000
<i>Review health statistics and community consultation</i>						
Health statistics	literature review, setup database of information	4,000		1,000	Community Support Programme	5,000
Participatory ecological and socio-economic surveys	10 x 5-day survey@120/day	8,000		8,000		16,000
Consult, address community concerns	Conduct 4 workshops	4,000		3,000		7,000
	<b>Sub-total:</b>	<b>84,400</b>	<b>0</b>	<b>153,000</b>		<b>237,400</b>
<b>Protect Aquifer and Supportive Ecosystem</b>						
<i>Hydro-geological survey</i>						
hydro-chemical and biological tests	testing of water pH, salinity, faecal coliforms, pesticides and nutrients; soil samples, and heavy metals	6,000				6,000
Environmental sampling/survey equipment	for water quality analyses	7,000				7,000
Natural resource and ecosystem survey	baseline foundation survey	15,000			Disaster Preparedness Initiative, Photovoltaic Rehabilitation, Community Support Programme, Pacific HYCOS	15,000
Well-sampling gear	drilling and boring gears	40,000				40,000
Specialised technical equipment and software	for hydro-geological surveys and modelling equipment, data processing, etc.	80,000				80,000
Maintenance of field equipment	maintenance of sampling equipment, etc.	40,000				40,000
Capacity building	training of officers, communities, health inspectors on use of equipment, analysis, survey techniques, etc.	40,000				40,000
Awareness materials	Production of brochures, educational materials, community awareness workshops, TV and radio programmes, posters, etc.	40,000				40,000
	<b>Sub-total:</b>	<b>268,000</b>	<b>0</b>	<b>0</b>		<b>268,000</b>
<b>Develop Water Resource Management Plan</b>						
Management Strategy	establish & implement resource management legislation and Neiafu Water Management Plan	40,000		15,000		55,000
	Develop effective enforcement system	11,000		3,000		14,000
Financial sustainability mechanism	Identification of long-term funding	4,100		12,000	EU Water Facility, Govt	16,100
	Financial and sustainability training for all water communities	25,000		12,000		37,000
Monitoring & evaluation undertaken by stakeholders within the Project		9,000		6,000		15,000
Monitoring & evaluation of Project activities		8,600		2,000		10,600
	<b>Sub-total:</b>	<b>97,700</b>	<b>0</b>	<b>50,000</b>		<b>147,700</b>
	<b>TOTAL:</b>	<b>519,000</b>	<b>2,500,000</b>	<b>7,127,000</b>		<b>10,146,000</b>

Notes: The co-financing allocated against each budget row does not necessarily equal the total amount of co-financing available to the project as activities will be further defined in the first 6 months of the project and co-financing will be re-allocated during this period

**Q. Letters of Co-Financing**

See country files for co-financing letters.

**ANNEX 1: INCREMENTAL COST ASSESSMENT DATA**

**REGIONAL SUSTAINABLE INTEGRATED WATER RESOURCES AND WASTEWATER MANAGEMENT IN PACIFIC ISLAND COUNTRIES**

**INCREMENTAL COST ASSESSMENT DATA - NEIAFU, VAVAÚ, KINGDOM OF TONGA**

**BASELINE ACTIVITIES**

<b>On-going/planned activities related to IWRM</b>	<b>Benefits</b>	<b>Remark on Baseline scenario</b>
Water Safety Plan for Tongatapu	1.Provision of safe water supply 2. Efficient water services 3. Sustainability and reliability of services 4. Public health	Benefit mostly by Tongatapu therefore activity regarded as Baseline
Assesment of Groundwater Resources (Tongatapu)	1. Community developments 2. access to clean water supply,schools, roads and capacity building	Community benefits therefore activity regarded as Baseline
Japanese Grassroots Grant Projects	Small scale projects for rural communities (RWSS water projects)	Normal rural communities support therefore activity regarded as Baseline
Regional food security program	Food security and alternative marine trade in rural areas	1. Food security 2. Marine resources for communities therefore Baseline activity
Community Support Program & Urban Development	1. Neiafu Community Development 2. Improvement of Neiafu drainage 3 Improvement of Community sanitation infrastructure	1. Access to safe water supply, 2. Improved sanitation, 3. Improved standard of living, 4. Small scale social and economic developments in the rural areas therefore normal Baseline activity

Water Safety Plan Awareness for Tongatapu	1. Benefit Community 2. Development of skill and Knowledge	1. Increase awareness of the water safety 2. Support economic growth, 3. Sustainable management of water resources therefore regarded as Baseline activity
Water Safety Plan Project	1. Provision of safe water supply, 2. Improved sanitation, 3. Public health, 4. Economic growth, 5. Social activities	Normal water supply upgrade for Nukuálofa township thus a Baseline activity
Hydrological Services	1. Water resources data, 2. Management and planning of use of water resources, 3. Water related hazards, 4. Education and awareness	Normal activity of the country thus can be a Baseline activity
Meteorological Services	1. Climate data, 2. Weather forecasting, 3. Climate change and cyclone, 4. Education and awareness	Normal activity of the country thus can be a Baseline activity

**ANNEX II: INCREMENTAL COST ASSESSMENT DATA; ALTERNATIVE SCENARIO**

**REGIONAL SUSTAINABLE INTEGRATED WATER RESOURCES AND WASTEWATER MANAGEMENT IN PACIFIC ISLAND COUNTRIES**

**INCREMENTAL COST ASSESSMENT DATA KINGDOM OF TONGA**

**ALTERNATIVE SCENARIO**

<b>On-going/planned activities related to IWRM</b>	<b>Benefits</b>	<b>Remarks on Alternative scenario</b>
National Plant Growing Project	Promote the growing of traditional plant and other plant through out the Kingdom of Tonga and also strengthening communities participation and develop capacity to manage and protect the resources	This program is a function of the Forest Department therefore may be regarded as potential Alternative scenario
Forestry sector management and conservation	Identified issues to promote forest sustainability and conservation will be implemented by various organisation	Additional to current Forest Department function therefore the activity contributes to global benefits thus regarded as potential Alternative scenario
Pacific HYCOS	A regional project supporting countries to further current activities in water resources	This additional to current in-country activities in water resources assessment therefore it is regarded as potential Alternative scenario
IWRM ACP-EUWF	A regional project supporting countries to further current activities in water resources	This additional to current in-country activities in water resources assessment therefore it is regarded as potential Alternative scenario

National Adaptation Program for Action (NAPA)	To prepare the country to cope with climate change impacts	Additional to current function of the Meteorological Services in providing advise to understand and cope with extreme climate events thus may be regarded as potential Alternative scenario
Second National Communication	To prepare programs and measures to facilitate the adequate mitigation and adaptation to climate change	This is additional to current environmental functions in the country which provides global benefit therefore regarded as potential Alternative scenario
SOPAC Disaster Preparedness Initiative	Improve water security through water legislation and policy reform in the water sector	This promotes IWRM and furthers current activities in the country therefore can be regarded as Alternative scenario
Urban Development	To prepare the urban area to meet the necessary requirement to maintain sustainable used of natural resources (Water and energy	This will promote IWRM and furthers activities in the country therefore can be regards as alternative
Increase Water Production and Storage capacity (Vavaú and Tongatapu	To provide continuous supply of water to the Neiafu and Nukuálofa area.	Increase the water storage and ensure sustainability of water supply is maintain. This regard as Alternative scenario

### Comparison of activities and project outputs

<b>Baseline activities</b>	<b>Project component</b>	<b>Cost (US\$)</b>
Assesment of Groundwater Resources (Tongatapu)	1	\$1,000,000
Increase Water production and Storages for Tongatapu and Vavaú	2	\$7,000,000
Water Safety for Tongatapu	3	\$1,000,000
Japanese Grassroots Grant Projects	4	\$100,000
<b>Total</b>		<b>\$9,100,000</b>

<b>Alternative scenario activities</b>	<b>Project component</b>	<b>Cost (US\$)</b>
Pacific HYCOS	1	\$79,000
Community and Support Program and Urban Development	2	\$1,850,000
SOPAC Disaster Preparedness Initiative	3	\$1,490,000
Increase Water production and storages for Tongatapu and Vavaú	4	\$3,400,000

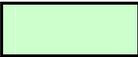
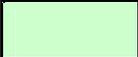
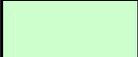
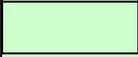
<b>Total</b>	<b>\$6,819,000</b>
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**ANNEX III: INCREMENTAL COST ASSESSMENT**

**REGIONAL SUSTAINABLE INTEGRATED WATER RESOURCES AND WASTEWATER MANAGEMENT IN PACIFIC ISLAND COUNTRIES**

**INCREMENTAL COST ASSESSMENT DATA - KINGDOM OF TONGA**

On-going/planned activities related to IWRM	Activity type	Benefits	Baseline	Potential Alternative scenario
National Plant Growing Project	National activity	National and Global		
Forestry sector management and conservation	National activity	National and Global		
Water Safety Plan for Tongatapu	National activity	National only		
Assesment of Groundwater Resources (Tongatapu)	National activity	National only		
Pacific HYCOS	National activity	National and Global		
IWRM ACP-EUWF	Regional project	National and Global		
National Adaptation Program for Action (NAPA)	Regional project	National and Global		
Second National Communication	Regional project	National and Global		

SOPAC Disaster Preparedness Initiative	Regional project	National and Global		
Regional food security program	National activity	National only		
SOPAC Disaster Preparedness Initiative	National activity	National and Global		
Water Safety Plan Project	National activity	National only		
Japanese Grassroots Grant Projects	National activity	National only		
Vavaú outer island photovoltaic electrification rehalitation	Regional project	National and Global		
Hydrological Services	NGO activity	National only		
Meteorological Services	National activity	National only		
Community Support Program and Urban Development	National activity	National only		

