GOVERNMENT OF TOKELAU

ASSET MANAGEMENT PLAN

Quality Record Sheet

ASSET MANA

GEMENT PLAN

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This Asset Management Plan (AMP) has been prepared for the Government of Tokelau and the New Zealand Ministry of Foreign Affairs and Trade. The extent is limited to the scope of the work agreed upon between the client and Waugh Infrastructure Management Limited.
This AMP is based on the information collected during a site visit to Tokelau during March 2014. Project limitations encountered include time constraints and limited institutional knowledge of assets.
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TABLE OF CONTENTS

TABLE OF TABLES & APPENDICE TABLES

TABLE OF FIGURES & APPENDICE FIGURES

1.0 EXECUTIVE SUMMARY

This is the first Asset Management Plan produced for the Government of Tokelau. To date there has been no formal documented asset management in Tokelau. However, Tokelau have practiced asset management to some degree, although it has not been documented. The Government of Tokelau and the Taupulega practiced asset management by fixing a leak in the roof of a building to prevent more costly damage in future and by doing regular proactive maintenance to prolong the life of a vehicle or an outboard motor. These were done to ensure that they maintain what they own in the most cost effective way to a standard that they felt is acceptable.

This Asset Management Plan outlines and summarise in a coordinated manner the Government of Tokelau's long term asset management approach for the provision and management of government and community assets in Tokelau. This Plan examines major asset management issues over a 15 year period.

The Government of Tokelau and community asset values per atoll are summarised below.

Asset Group	Atoll	Replacement Costs	Percentage
Public Buildings	Atafu	$7,404,250	
	Fakaofo	$12,514,200	
	Nukunonu	$9,057,700	
	Apia	$17,011,703	
Total Public Buildings		**$45,987,853**	60%
Transportation	Atafu	$1,140,000	
	Fakaofo	$1,346,000	
	Nukunonu	$887,000	
	Apia	$12,500,000	
Total Transportation		**$15,873,000**	21%
Energy	Atafu	$2,220,000	
	Fakaofo	$2,470,000	
	Nukunonu	$2,055,000	
	Apia	-	
Total Energy		**$6,745,000**	9%
Plant & Equipment	Atafu	$1,547,500	
	Fakaofo	$1,789,000	
	Nukunonu	$1,327,210	
	Apia	$501,800	
Total Plant & Equipment		**$5,165,510**	7%
Telecommunication	Atafu	$1,090,000	
	Fakaofo	$1,205,000	
	Nukunonu	$1,065,000	
	Apia	-	
Total Telecommunication		$3,360,000	4%
Grand Total		**$77,131,363**	**100%**

Note: Water and sewerage systems are included in building data

Key issues include:

- Improving health and safety practices
- Improving asset management practices
- Improving resilience to natural events
- Managing Tokelau's isolation
- Planning for the future, including the effects of natural events and managing the associated risks
- Nukunonu Bridge requires urgent engineering assessment and remedial work. As a precautionary measure Nokunonu Bridge should be restricted to light traffic until detailed structural engineering assessments can be completed.

Levels of Service

The following levels of service have been developed in conjunction with the AMP.

Buildings and Facilities are available for use, fit for purpose and operational. Maintenance and renewal plans are developed and then the buildings are maintained as agreed.

Plant and Equipment is available, well maintained and fit for purpose. Procurement is to agreed standards, and maintenance to manufacturers recommendations.

Power and Telecommunications are reliable, affordable and sufficient for needs. 24/7 availability with pricing as agreed.

Tokelau-Samoa Link, Ship to Shore, Boats are reliable and safe. Maintenance and repair is completed as required. Certification is held (Tokelau-Samoa link). Operated by suitably experienced crew.

Channels and Wharves are reliable, safe and operational. Maintenance is completed as required. Safety inspections are completed.

Roads are available with repairs and maintenance completed as required.

Water and Sanitation - Water has sufficient storage, with back-up systems in case of drought. PACC+ is completed and maintenance as required. Sewerage systems are available and operational, with maintenance and cleaning as required.

Seawalls are fit for purpose, operational and maintained. Development of seawalls and maintenance of seawalls is completed as required

The delivery of levels of service is proposed by the development of an annual maintenance and renewal plan for each Atoll, which will be agreed by Taupulega and the Atoll General Manager. Monitoring of service level delivery will generally be by the Atoll General Manager.

The following service level gaps were also noted:

1. Water and Sanitation
2. Air transport service
3. Telecommunications – further development
4. Justice assets

Demand

It is important to balance the needs of the community with the physical and financial resources available. Tokelau needs to monitor trends and be able to adjust to an ever changing environment to ensure they meet the needs of the community in relation to asset procurement, renewal and replacement. The future demand drivers and effects are tabled below.

Asset Group	Population	Demographics	Technology	Environment	Samoa Link
Health	Places a greater demand on services	Aging population places greater demand on specific health services. A younger population places greater demand on educational facilities and specific health services	Changes in technology creates a higher level of service expectation	Changing climate and environmental effects may increase hazardous events	Improving the link may result in more people visiting, placing a greater demand on services, while deteriorating this link places a greater demand for providing adequate services in Tokelau
Education					
Transport					
Telecommunication					
Energy					
Plant & Equipment					

Sustainability

Sustainability needs to form part of everything the Government of Tokelau does. It should be considered in all tasks performed by the Government of Tokelau. In managing, operating and maintaining infrastructure assets and services the Government of Tokelau would like to do this to a level of excellence. However, this is not sustainable and all infrastructure assets and services should be managed, operated and maintained to an optimum level appropriate for that specific asset and service.

Risk

It is important for the Government of Tokelau to consider the following 'big picture' risks.

Risk	Comment
Cyclones	Present the biggest risk for Tokelau. It is important to acknowledge the risks associated with cyclones and prepare for it i.e. natural defences, structural defences, developing a risk reserve, contingency plans
Drought	As Tokelau is highly dependent on roof collection of water it is important to complete the PACC+ project of installing flush diverters. A contingency plan for drought is to be developed
Fire, Transport, Boat safety, Search and Rescue, Safe houses	Implement recommendations of the Tokelau National Disaster Risk Reduction Plan (2011) and Tokelau Evacuation Sites Assessment (2013)
Asset procurement	Ensure all asset replacements and new asset construction is built to standards that incorporate risk considerations and appropriate standards
Operational	Identify operational risks such as fire and fuel storage risks and develop and implement appropriate risk reduction or mitigation strategies

Lifecycle Management

Lifecycle asset management focuses on management options and strategies from initial planning through to disposal, while considering all relevant economic and physical consequences.
The lifecycle management programme covers five key categories:

Key Lifecycle Plan	Activities/Strategies	Comments
Management	Strategic planning	Develop levels of service and professional skills of staff
	Data management and evaluation	Optimise asset register; data collection and quality assurance
	Business processes	Review AMP. Implement risk mitigation measures and develop contingency plans
	Monitoring	Monitor and review LoS and processes
	Financial management	Ensure financial sustainability
Operation and Maintenance	Asset strategies	Regular inspections & maintenance
	Non asset strategies	Ensure appropriate supervision and use only approved materials while maintaining health and safety

Key Lifecycle Plan	Activities/Strategies	Comments
Renewal/Replacement	Renewal Plan	Develop a Renewal Plan
Asset Development	New assets	Schools, hospital, solar plants, barges, Apia Ferry
	Planned assets	School, hospital and church replacement
Asset Disposal	No formal strategy exist	Investigate disposal of solar batteries in 2019/20

No formal renewal plan exists for the assets in Tokelau. As a result the only method to provide an indicative renewal projection s to use the data in the newly developed asset register. This takes the expected lives and date of construction/acquisition and projects a future renewal date. This is very theoretical and does not take into account any future maintenance or condition assessments which may extend or decrease the expected useful lives. This results in a projected renewal figure of $2.5M required for the next 15 years, the term of this Plan.

Operation and maintenance costs is estimated at $420,000 per year.

To calculate the natural event (cyclone) risk reserve 10% of the assessed asset value ($77.1M x10% = $7.71M) was taken and divided by the 10 year frequency of major cyclone damage ($7.71M/10 = $771,000). Thus the annual 'natural event- risk reserve' component is estimated to be approximately $771,000. This can be further developed by using actuarial analysis similar to the New Zealand EQC Fund.

This AMP does not attempt to anticipate possible cyclone damage and adjust probable renewal figures to include allowance for cyclone repairs. Accepted asset management practice following a large natural event is to reassess asset condition and replacement, and then adjust forward renewal requirements and estimates following that assessment.

The total annual depreciation requirement for the assets of Tokelau amount to $2.9M. The Tokelau Asset Management requirement consist of:

Asset Management Component	Costs
Natural Events – Risk Reserve	$771,000
Operation and Maintenance	$420,000
Depreciation	$2,857,000
TOTAL	**$4,048,000**

Capital Projects
In development of this Asset Management Plan a range of Capital projects were identified. These include:

- Buildings
  - Channels & Wharves upgrades
  - Hospital replacement
  - Schools replacement
  - Administration/Police/Teletok building replacement
  - Church replacement
  - Storage
- Transportation
  - Apia Ferry
  - Bridge
- Energy
  - Batteries
  - Inverters

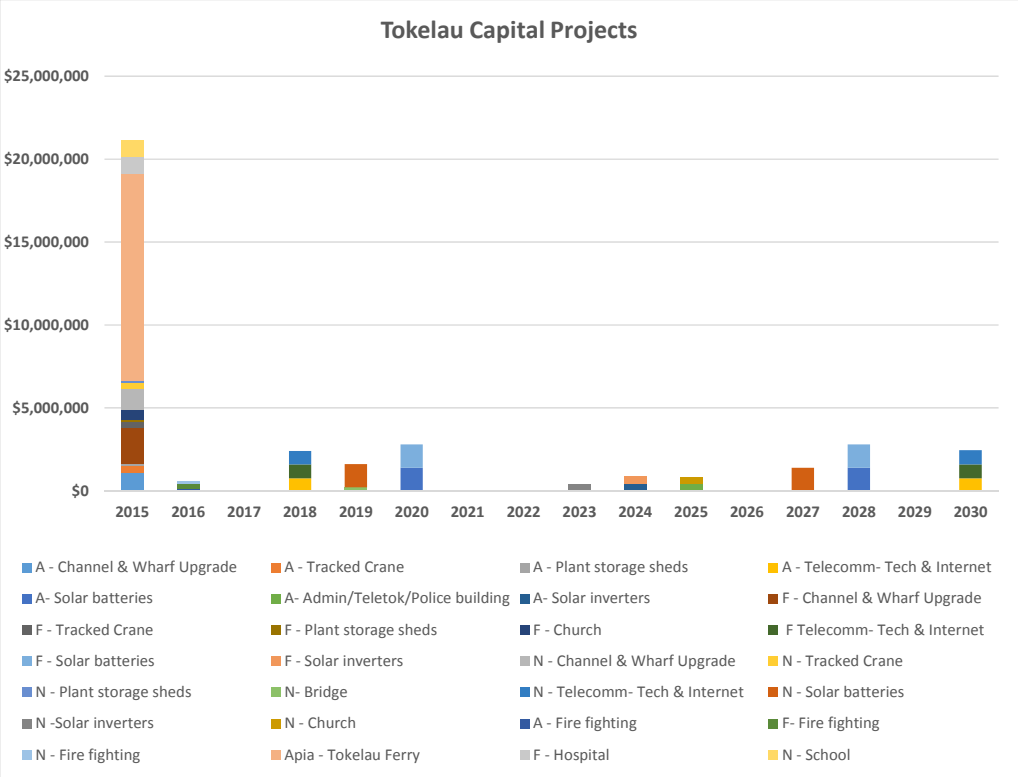
- Telecommunication equipment
- Plant & equipment
- Risk items
    - Bulk storage for fuel
    - Firefighting

The following table lists the Capital Projects identified for each atoll during the next 15 years.

Year	What	Costs
Atafu		
2015	Channel & Wharf upgrade	$1,115,000
	Tracked crane	$400,000
	Shed storage for plant & bulk fuel	$120,000
2016	Fire fighting	$150,000
	Medical equipment	$150,000
2018	Telecommunication – Technical & Internet Equipment	$750,000
2020	Energy – Solar Batteries	$1,400,000
2025	Replace Admin/Teletok/Police Building	$430,000
2024	Energy –Inverters	$400,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$750,000
Fakaofo		
2015	Channel & Wharf upgrade	$2,137,000
	Tracked crane	$400,000
	Shed storage for plant & bulk fuel	$120,000
	Church Replacement	$563,000
	Hospital	$1,000,000
2016	Fire fighting	$250,000
2018	Telecommunication – Technical & Internet Equipment	$850,000
2020	Energy – Solar Batteries	$1,400,000
2024	Energy –Inverters	$470,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$850,000
Nukunonu		
2015	Channel & Wharf upgrade	$1,262,000
	Tracked crane	$400,000
	Shed storage for plant & bulk fuel	$120,000
	School	$1,000,000
2016	Fire fighting	$150,000
2018	Telecommunication – Technical & Internet Equipment	$800,000
2019	Replace Bridge	$210,000

Year	What	Costs
2020	Energy – Solar Batteries	$1,400,000
2024	Energy –Inverters	$400,000
2025	Replace/Renew Church	$395,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$850,000
Apia		
2015	500GT SOLAS vessel	$12,500,000

The capital projects is graphically represented below.



The potential Air Service is discussed in Scenario B1. The capital and operational costs for this service are not included in the summary above.

Affordability

A key issue for the Government of Tokelau that from the AMP is the ongoing affordability of services provided, and capital projects (asset renewal and new capital). It is expected this issue and the annual cost estimates developed in this plan will be the subject of much discussion and negotiation between the Government of Tokelau and its funding partners.

2.0 INTRODUCTION

This section sets out the purpose of this Asset Management Plan (AMP) and shows the plan framework.

2.1 Purpose of the Plan

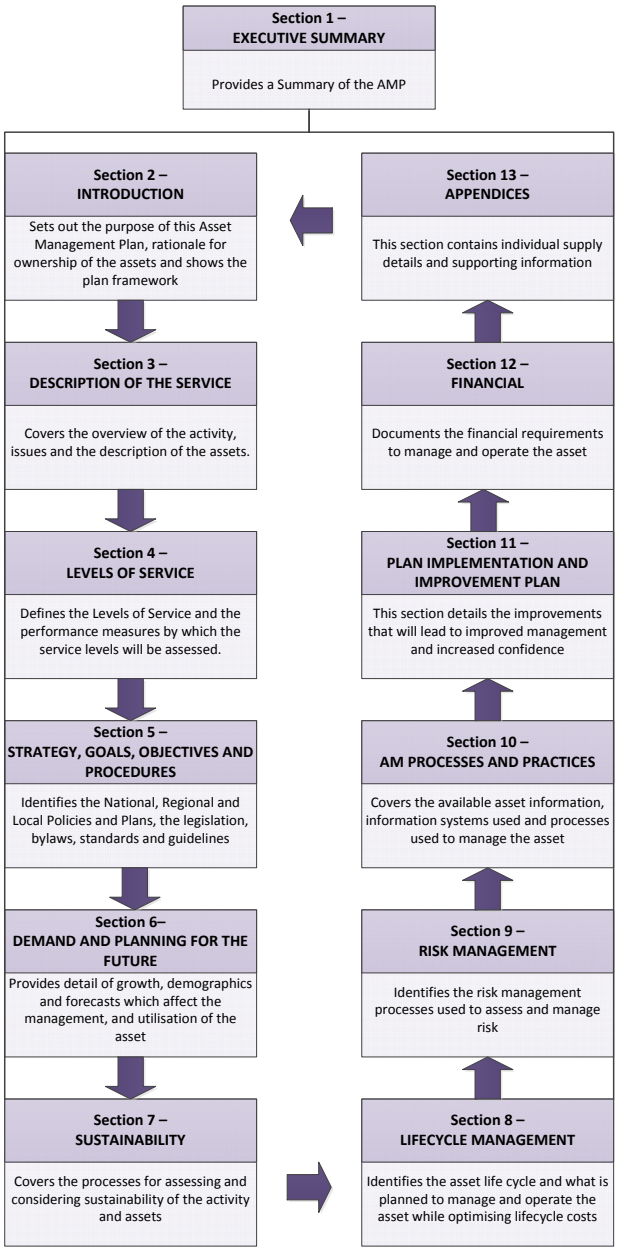
The purpose of this AMP is to outline and summarise in a coordinated manner the Government of Tokelau's long-term asset management approach for the provision and management of government and community assets in Tokelau. This may also be considered the overall objective of Asset Management.

This AMP is intended to be read in conjunction with the Asset Management Policy and Asset Management Strategy.

2.2 The AMP Format

The AMP structure is graphically represented below:

Figure 2-1: AMP Structure



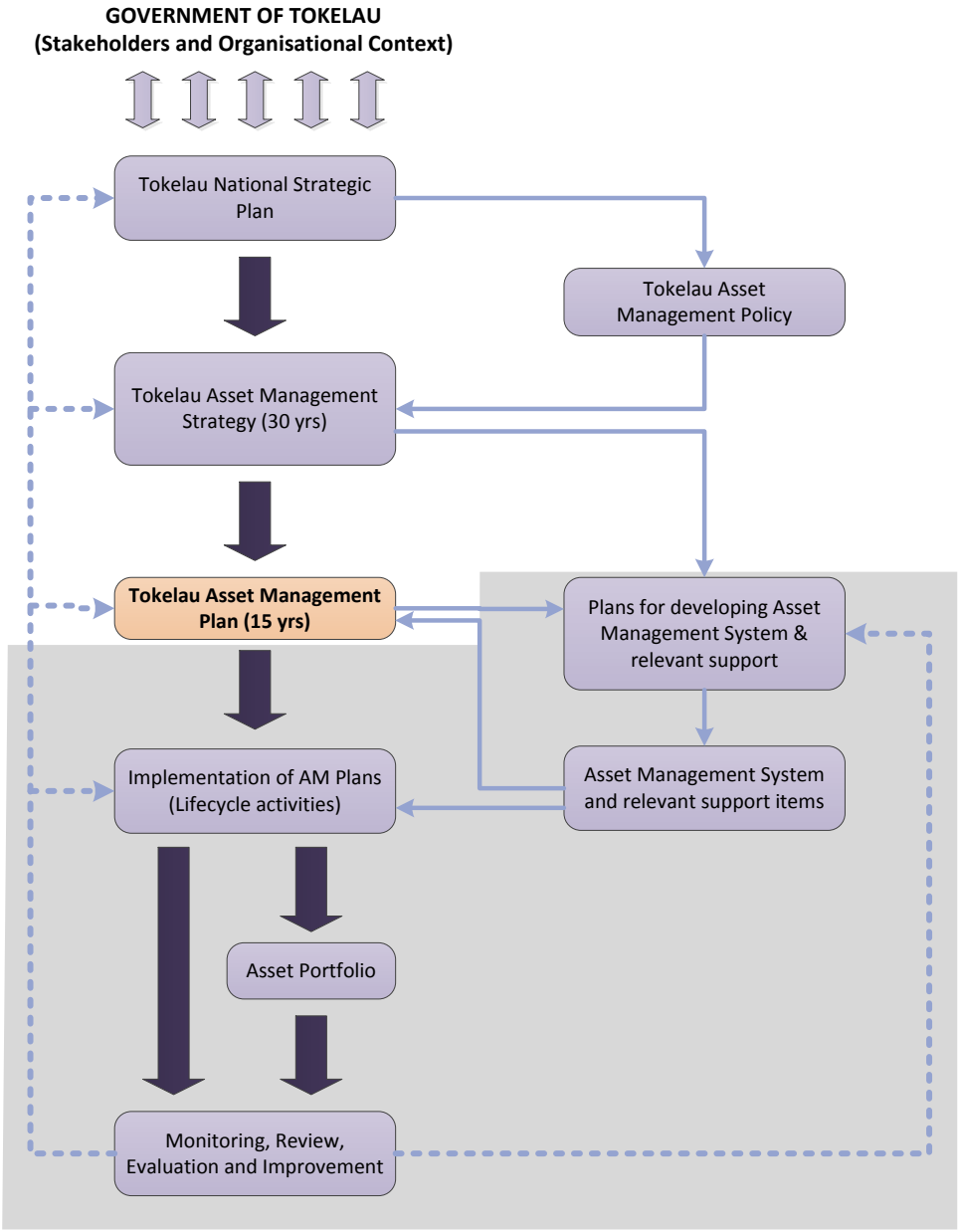
2.3 Linkage with Other Documents

To deliver the Government of Tokelau's vision of "**providing improved standard of living through adequate, reliable and efficient infrastructure**"[1] there must be a clear 'line of sight' of connectivity between the high-level organisation policy, strategic plan and objectives, and the daily activities of managing our assets.

This document forms part of that 'line of sight' by setting out the asset management plan in support of our asset management strategy and asset management policy. It informs the more detailed figures contained in the lifecycle, demand and asset management processes.

The diagram below shows this connectivity.

Figure 2-2: Linkage with other documents



Adapted from ISO55000:2014, Figure B1

[1] Tokelau National Strategic Plan

3.0 DESCRIPTION OF THE SERVICE

This section of the Plan covers the description of assets. This section also highlights the critical assets.

3.1 Description of Assets

The assets covered by this AMP include:

- Buildings
  - Health
  - Education
  - Public & Administration
  - Storage facilities
  - Guest houses
  - Channels
  - Wharves
  - Seawalls
  - Solid Waste Facilities
- Transport
  - Tokelau Samoa link
  - Ship to shore
  - Boats
  - Roads
- Telecommunication
  - Building
  - Equipment
  - Cable
- Energy
  - Buildings
  - Solar Panels
  - Batteries
  - Inverters
  - Generators
  - Cable
  - Fuel
- Plant & Equipment

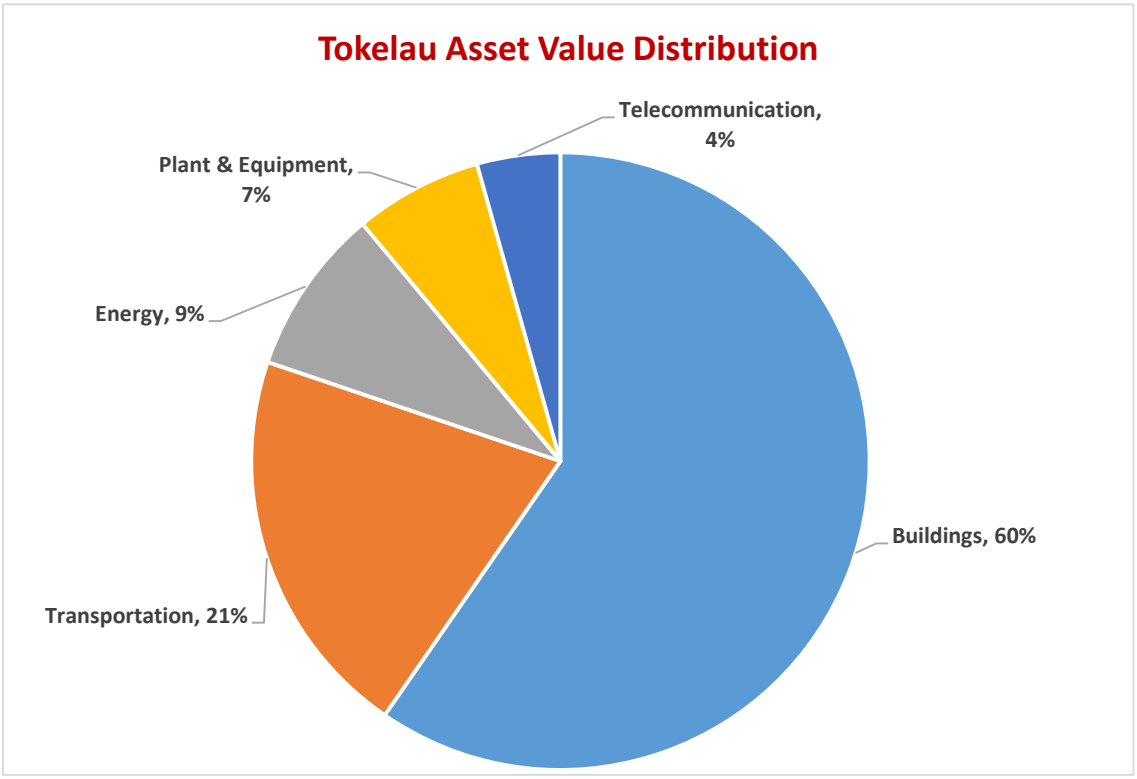
The summary of assets for each atoll are tabled below:

Table 3-1: Summary of Assets

Description			Replacement Value (NZ$)			
			Atafu	Fakaofo	Nukunonu	Apia, Samoa
Population served						
Assets	**Buildings**	Health	$588,000	$772,500	$1,008,250	
		Education	$1,574,750	$2,142,000	$1,684,050	
		Public & Administration	$1,677,850	$3,087,800	$2,656,500	$17,011,703
		Storage facilities	$482,850	$433,950	$511,950	
		Guest houses	$45,000	$701,000	$176,250	
		Channels	$300,000	$450,000	$300,000	
		Wharves	$1,115,000	$2,321,400	$1,262,000	
		Seawalls	$1,280,000	$1,610,000	$800,000	
		Solid waste	$10,800	-	-	
			-	$24,000	$36,000	
		Other	50,700			
	Transport	Tokelau Samoa link	-	-	-	$12,500,000
		Ship to Shore	$306,000	$476,000	$190,000	
		Boats	$336,000	$276,000	$271,000	
		Roads & Streetlights	$450,000	$456,000	$426,000	
		Bridges			$210,000	
	Telecom	Building	$15,000	$290,250	$15,000	
		Equipment	$280,000	$165,000	$165,000	
			$750,000	$850,000	$800,000	
		Cable	$60,000	$190,000	$100,000	
	Energy	Building	$262,500	$594,900	$276,900	
		Solar Panels	$350,000	$400,000	$300,000	
		Batteries	$1,400,000	$1,400,000	$1,300,000	
		Inverters	$400,000	$470,000	$350,000	
		Generators	$213,000	$213,000	$213,000	
		Cable		$200,000	$105,000	
		Fuel	$1,800	$86,400	$120,800	
	Plant & Equipment		$1,382,500	$1,714,000	$1,114,210	$501,800
	Grand Total		**$13,401,750**	**$19,324,200**	**$14,391,910**	**$30,013,503**
TOTAL ASSET VALUE			**$77,131,363**			

Details of the assets on each atoll are included in the Appendices and contained within the Asset Register.

Figure 3-1: Tokelau Asset Value Distribution



This shows that the assets with the greatest value is Buildings and Transport totalling 81% of the total asset value. However, this does not indicate the criticality of the asset e.g. Telecommunication is a critical asset but only a small percentage (4%) of the total asset value.

3.2 Issues

Key issues include:

- Improving health and safety practices
- Improving asset management practices
- Improving resilience to natural events
- Managing Tokelau's isolation
- Planning for the future, including the effects of natural events and managing the associated risks

3.3 Buildings Asset Group

The Buildings Asset Group are grouped into:

- Health
- Education
- Public & Administration
- Storage Facilities
- Guest houses
- Channels
- Wharves
- Seawalls
- Solid waste

These buildings make up 61% of the total Tokelau Infrastructure asset value. Buildings range from concrete structures to timber frame weatherboard structures to basic timber frame lean-to structures.

The majority of roofs in Tokelau are corrugated iron. Corrugated iron/steel roofs are lightweight, easy to handle, easy to install and low cost compared to other roofing materials. However, the disadvantage is that steel roofs are susceptible to rust and corrosion. In a harsh marine environment such as Tokelau the expected lives of steel roofs are significantly affected. In general, unpainted steel roofs in New Zealand have an expected life of 20 years, but in Tokelau that expectation is halved to 10 years.

Under New Zealand conditions pre-painted steel is expected to last up to 35 years and aluminium up to 55 years. Rough order costings indicate that pre–painted steel roofing are approximately 12% more expensive than unpainted steel and aluminium are 63% more expensive than unpainted steel. Using these materials in Tokelau conditions may extend the life of the roofs to 17 or 25 years. The viability of changing roofing materials should be investigated (**IP 1**).

The Tokelau Evacuation Sites Assessment Report (November 2013) states "*Beca engineers met with some of the local builders in Tokelau to discuss common design and construction processes, and the regulatory requirements.* ***It is understood that sea water may have been used for mixing concrete in some cases***".

Using seawater for mixing concrete, especially reinforced concrete is not accepted practice as the salt content affects concrete strength and are highly corrosive on the reinforced steel leading to increased degradation of the concrete structure. The expected useful lives of concrete structures usually range from 75 to 100 years. However, in view of the above the expected useful lives for all concrete structures are adjusted to 70 years.

3.3.1 Health

The Health buildings consist of:

Buildings	Atoll	Condition
Hospital	Atafu	Fair
	Fakaofo	Poor
	Nukunonu	New, but not operational
Doctor's residence	Atafu	Fair
	Fakaofo	Poor
	Nukunonu	Fair

Apart from the new hospital on Nukunonu, which requires specific intervention to resolve issues, the general condition of health buildings are deemed to be fair to poor and if maintenance is neglected and specific issues not addressed the structures may require a higher level of maintenance and may result in potential service delivery failure.

During the site visit it was noted that there was a general lack of beds and proper screens to conduct medical examination in privacy within the wards. Discussions with medical professionals suggested a need for multiple sets of basic equipment i.e. basic anaesthetic equipment, paramedic pack, lifting equipment, diagnostic equipment, retinoscope, various types of needles, splints, crutches, and wheel chairs.

The Tokelau Health Strategic Plan 2009 – 2015 states:
The current situation of the health of the population of Tokelau is that:

- *There has been an increase in non-communicable diseases (NCDs) with the leading causes of death being Cardiovascular disease and Cerebrovascular accidents*
- *Type 11 Diabetes has a prevalence rate of 73% in males over the age of 45yrs*
- *Obesity is common and attributed to diet, physical inactivity*
- *Alcohol consumption - prevalence rates of 70% men and 83% for women between the ages of 30 & 39yrs*
- *Smoking is common (97% over age of 15 yrs)*
- *Life expectancy is less than 65 yrs*
- *High rate of Suicide in youth*

- *High rate of Mental health issues including depression*
- *26% of current school age population have Special Needs*
- *Poor dentition across population*

In view of the above and the aging population it is important that medical facilities are adequately equipped to ensure provision of an appropriate health service on each atoll.

3.3.2 Education

The Education buildings consist of:

Buildings	Atoll	Condition
Main School building	Atafu	New
	Fakaofo	New
	Nukunonu	Fair/Poor
Additional school buildings including Pre-primary, USP, toilets etc.	Atafu	Fair
	Fakaofo	Fair
	Nukunonu	Fair/Poor

The main school buildings on Atafu and Fakaofo are both new with some minor issues to be resolved. The general condition of education buildings are deemed to be fair to poor and if maintenance is neglected and specific issues not addressed the structures may require a higher level of maintenance and may result in potential service delivery failure.

3.3.3 Public and Administration

The Public and Administration buildings consist of:

Buildings	Atoll	Condition
Meeting Houses	Atafu	Good
	Fakaofo	Good
	Nukunonu	Excellent
Administration	Atafu	Good
	Fakaofo	Fair
	Nukunonu	Good
Police/Finance/Teletok	Atafu	Fair
	Fakaofo	Part of Administration building
	Nukunonu	Good
Churches	Atafu	Excellent
	Fakaofo	Good
	Nukunonu	Good

The majority of Public and Administration buildings are prime examples of well-maintained structures. The meeting houses and administration buildings have all been constructed at different times, but it is evident that these structures are highly valued by the Taupulega and the community and this is reflected in the upkeep of the buildings.

There is a significant portion of Public and Administration buildings in Apia, Samoa, but the condition and lifecycle of these assets are not discussed as they were not assessed during the site visit due to time constraints.

3.3.4 Storage Facilities

The Storage facilities consist of:

Buildings	Atoll	Condition
Freezer house	Atafu	Good
	Fakaofo	Good
	Nukunonu	Fair
Bulk Storage	Atafu	Fair
	Fakaofo	Good to Poor
	Nukunonu	Poor

The condition of the storage facilities are considered to range from good to poor. The buildings require significant maintenance to raise the condition of storage facilities and at various instances heavily corroded steel framing have been supported with timber, but the structural integrity may be compromised.

The general observation of storage facilities is that there is no order and no material handling standard. It is recommended that:

1. A logistics champion be appointed (**IP 2**)
2. Standardisation be considered to ensure less variety and customisation of methods and equipment be employed (**IP 3**)
3. Storage facilities be cleaned out and re-organised (**IP 4**) to:
    a. Ensure effective and efficient use of space
    b. Maximise storage space
    c. Employ methods for easy identification of materials and products and the status of stock levels
    d. recognise hazardous materials have special needs with regard to spill protection, combustibility and other risks
    e. Simplify processes and eliminate unnecessary moves effectively reducing work
    f. Recognise human capabilities to ensure safe and effective operations

3.3.5 Guest Houses

The guest houses consist of:

Buildings	Atoll	Condition
Guest houses	Atafu	Fair
	Fakaofo	Good
	Nukunonu	Fair to Very Poor

The condition of the guest houses are considered to range from good to very poor. The three new guest houses on Fakaofo (Fenua Fale) are new, but the quality of workmanship is questioned. It is important that construction of new buildings and renovations are performed to accepted standards (**IP 3**).

3.3.6 Firefighting

Apart from fire extinguishers at the battery house of the Solar Energy Plants there are no firefighting assets on any of the atolls. At present firefighting will require the use of buckets with sand and sea water to try and extinguish any fire. Traditionally firefighting ability is incorporated within the design of a reticulated water supply system, but in the absence of a reticulated water supply system on the atolls no firefighting ability exist.

It is important that options to establish firefighting ability on the atolls be investigated, this may consider a fire fighting truck with a pump providing ability to pump from the ocean/lagoon to the fire or a fixed pump with a piped system (**IP 6**). An amount of $150,000 is included for each atoll under the Capital Projects. This will require development of a volunteer fire brigade with associated training, equipment and storage facility for equipment.

3.3.7 Channels

All of the channels, on each atoll have major maintenance, rehabilitation and upgrading requirements. All the channels show signs of silt deposits. This severely hampers navigation of the channel during low tide as the depth is significantly reduced.

This will require dredging and cutting equipment together with some underwater blasting. While the straightening out of channels may facilitate safe navigation, it may also add to risks of shore corrosion. The Tokelau Ship to Shore Project: Onshore Infrastructure Options and Environmental Impact Assessment (June 2014) considers the potential onshore infrastructure options of proposed wharf and channel infrastructure (**IP26**).

The report details options with a consistent construction methodology and includes:

- A wider turning circle to enable the barge to turn quickly and face seaward
- Channel markers
- Dredging to increase depth in each channel.

Please refer to Sections A1.3.6; A2.3.6 and A3.3.6 Channels in each atoll for more detailed discussion on proposed improvements.

3.3.8 Wharves

Each atoll has a small concrete wharf area at the end of each reef channel. Passengers and cargo are loaded/off loaded from the barges at the wharves. The wharves are generally very small and limits vehicle/plant movement at the wharves. Cargo loading plant (mounted cranes and tractor cranes) are either out of order or mainly not fit for purpose resulting in most cargo loaded by hand. This is labour intensive, time consuming and presents significant health and safety issues. Upgrading of the wharf and channel infrastructure is a high priority to reduce health and safety risks.

The Tokelau Ship to Shore Project: Onshore Infrastructure Options and Environmental Impact Assessment (June 2014) estimates channel and wharf upgrades in the amount of $4.5M included in the Capital Projects and propose (**IP26 & 27**):

- Tracked cranes for each atoll
- Minimum 7m wide by 14 long hard-standing area to the right and landward end of each channel
- A 6m wide access way between the hard-standing and land
- Associated walls to reduce wave splash and wave energy dissipation structures

Please refer to Sections A1.3.7; A2.3.7 and A3.3.7 Wharves in each atoll for more detailed discussion on proposed improvements.

3.3.9 Seawalls

Coastal protection by way of seawalls is at varying degrees of completion on each of the three atolls with work to date being focused at the most vulnerable areas of the villages. The atolls are surrounded to various degrees by a variety of seawall structures, some are well constructed and others less so.

There are a range of different seawall construction methods used on each atoll. These include but are not limited to:

- Gabion baskets filled with coral rocks
- Gabion baskets filled with corals rocks and covered with a cement/concrete layer
- Stacked coral blocks
- Mass concrete (using various forms of formwork)

All these defences are in various state of repair, some still performing effectively but requiring maintenance while others are beyond repair and providing little or no protection.

The NIWA report ‘Reducing the risks of cyclone storm surge inundation on the atolls of Tokelau (Atafu, Fakaofo and Nukunonu)’ details options and recommendations for reducing cyclone storm surge

inundation and other coastal hazard risks for both the short and long term. These reports detail the seawalls, seawall ownership and storm surge inundation risk on each atoll.

The condition of seawalls are in various states of repair, but in general the seawalls are considered to be in condition grade 2, good.

It is important to maintain the existing natural vegetation on the shoreline which acts as a natural barrier during storm surge. Consideration should be given to alternative, natural defence structures or concepts such as bio-engineering which focus on copying nature and propose the use of plants and trees to create engineered structures for protection against storm surge inundation (**IP 29**).

3.3.10 Solid Waste Asset Group

The Solid Waste Management Service in Tokelau consists of:

Waste Collection	Wheel bins collected at various frequencies on each atoll
Recycling	Sorting and recycling of glass and aluminium cans
	Crushing of aluminium cans
	Transporting crushed and baled aluminium cans to Samoa
Organics	Kitchen and yard waste is fed to the pigs or composted at banana patches
Residual Waste	Burnt and buried at the landfill

Fakaofo and Nukunonu each has a solid waste management facility (building) where recyclables are sorted, crushed and baled. Atafu has an area and plans to build a facility.

The Integrated Waste Management , Water and Sanitation Review and Action Plan 2010 provides an integrated action plan for removing biological waste, and minimising the impact of liquid, chemical and solid waste to the atolls, including the lagoons. The plan builds on the existing Sustainable and Integrated Solid Waste Management Strategy. It is important the Action Plan is implemented (**IP 7**).

3.4 Transport Asset Group

The Transport service consist of:

- Tokelau Samoa link
- Ship to shore
- Boats
- Bridges
- Roads and street lights

3.4.1 Tokelau – Samoa link

Tokelau's only transport link with the rest of the world is the shipping service between Tokelau and Samoa. This is currently a chartered service provided by the Government of Tokelau, but a government owned ship is being constructed at the time of writing this Plan. The vessel will be the first purpose built SOLAS (Safety of Life at Sea) passenger ship serving Tokelau, carrying up to 60 passengers in addition to 50 tonnes of cargo and supplies. It is estimated that the 270 nm voyage between Tokelau and Apia, Samoa will take just under 24 hours at the design speed of 11.5 knots. The vessel is also fitted with a crane for loading/unloading. The procurement of this vessel is included in the Capital Projects at a cost of $12.5M in the 2015 year.

Each of the atolls are dependent on this Tokelau Samoa shipping service for passengers, cargo, medical and emergency evacuations.

Samoa Shipping Co vessels are used for additional charters not only to transport passengers during peak travelling times between Apia and Tokelau, but also when large orders of supplies for

government/village projects are required or when there are national activities which necessitate moving large groups between atolls.. Additional charters have averaged 10 – 12 per annum over the period 2005 -2010.

3.4.2 Ship to Shore

None of the three Tokelau atolls has any seaport, due to the particularly steep drop off from each atoll's fringing coral reefs into very deep water. In the absence of harbour/port facilities motor powered barges provide a ship to shore transfer service. This is a very basic service which will always be significantly reliant upon a combination of local skills, and available technology and its maintenance.

Ship-to-shore safety issues were highlighted in the MFAT 'Internal Audit on Maritime Safety' wherein a range of recommendations were made. The Tokelau Ship to Shore Project: Onshore Infrastructure Options and Environmental Impact Assessment (June 2014) considers the potential onshore infrastructure options, develops preliminary designs and assess the potential environmental impacts of proposed wharf and channel infrastructure. The report also provides estimated costs and lists recommended priorities of the work (**IP 26 & 27**).

Each atoll has a number of barges and powered by 40-60hp outboard motors. At the time of the site visit new barges were nearing delivery to each atoll. The new barges were deemed to be a significant improvement on the existing barges. Fakaofo has an additional barge (school barge) to transport school pupils, teachers and residents between Fale and Fenua Fale.

The condition of the barges are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed. The barges are used in a harsh environment and as such the expected lives of the barges are low.

3.4.3 Boats

Each atoll has a number of boats ranging from fishing boats to aluminium dinghy and pontoons. Fakaofo has additional boats for solid waste management and the hospital providing transport between Fale and Fenua Fale.

The condition of the boats are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed.

3.4.4 Roads

All the formed roads on the atolls consist of rolled crushed coral. Traffic is light, mainly pedestrian and golf carts. The heaviest vehicles that use the roads are light trucks and tractors. Heavy loads are limited to the transport of fuel from the wharf to bulk storage facilities. The crushed coral is free draining and there is little evidence of water damage despite the regular frequency of rain.

The key maintenance activity is the filling of potholes and ruts that develop. These shall be tended to as soon as they develop. During the site visit is was noticed that in some cases potholes are filled in without any or adequate compaction. Attention shall be given to compaction during road maintenance activities to ensure appropriate road surface.

Each atoll has approximately 45 street lights fitted with a sensor which switch the streetlight on during low light conditions. During the site visit it was observed that streetlights come on during overcast conditions using unnecessary energy. Consideration should be given to manual switching of the streetlight when conditions require. This will limit wasteful use of energy.

The overall condition grade of roads and streetlights are deemed to be condition grade 2, good.

Nukunonu Bridge

Nukunonu has a bridge as part of its road infrastructure connecting the Nukunonu motu and Motuhaga motu. This bridge forms an integral part of the community transport as the hospital is located on the Motuhaga motu. There are significant concrete spalling and corrosion to exposed reinforcement in the underside of the bridge deck, beams and piers/columns. A superficial assessment estimates that if no remedial action is done the bridge life is less than 5 years and pose a significant risk to the community.

Spiire (via Neil Buchanan), with preliminary assessment by their structural engineers have provided advice as follows:

Having reviewed the photos from the site inspection, we are of the opinion that it will not be cost effective to repair the concrete spalling to the bridge spans as we believe that the exposed reinforcing steel has lost to much sectional area. The spalling to the bridge piers is repairable by treating the current corrosion and installing additional steel with additional concrete to provide adequate cover. It is not possible at this stage to determine the effect of the current deterioration on the load capacity of the bridge and hence risk of failure. We would need details of the span lengths and section dimension along with reinforcement sizes and spacings to be able to calculate the loadings.
Spiire verbally advised Waugh Infrastructure Management that as a precautionary measure (until detailed assessments can be made) the bridge should only be used by light traffic – light vehicles, light trucks, no heavy loads
A replacement deck should be considered as a short term priority. The simplest way of doing this would be to remove the current deck, repair the existing piers and install new precast deck beams. These would be wither double tee units or hollow core beams fabricated off site and transported to the Atoll. This will give the best quality control on the deck elements.

Remedial work may extend the life 10 to 15 years, although this needs further assessment.

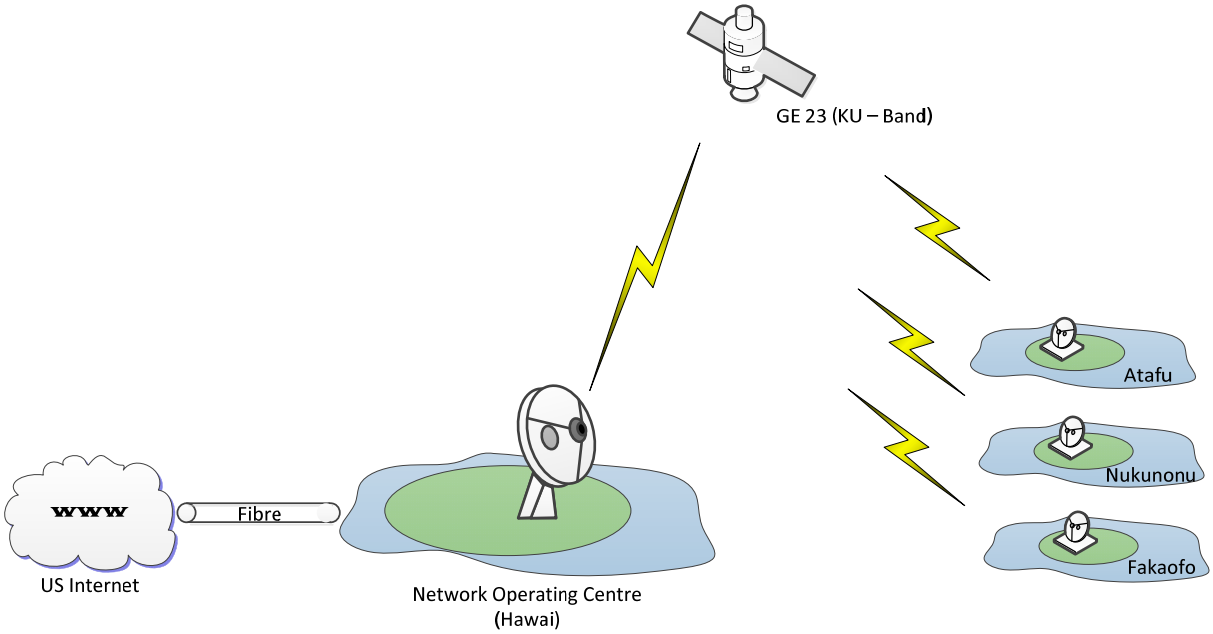
Suggested remedial works are listed in the Spiire comments above. The expected remaining life of the bridge is dependent on conditions and use of the bridge. However, it is a **high priorit**y to engage a professional registered structural engineer to conduct a comprehensive condition assessment prior to any remedial works are done (**IP 28**).

3.5 Telecommunication Asset Group

All telecom services are provided by Telecommunications Tokelau Corporation (TeleTok), the community-owned corporation established in 1996. Basic local, national and international telecom services are provided via a satellite link using the Pactel's VSAT system. This is based on the KU-Band Star Topology VSAT network, using the US backbone to provide dynamic allocation of bandwidth between the three atolls.
This provides:

- Internet browsing services
- Telephone and Fax over IP
- File Transfer Protocol
- Instant messaging
- Content Filtering
- Online billing procedures, allowing users to manage their own usage and subscription levels

The basic system connectivity is diagrammatically represented below:



The telecommunication assets on each atoll consists of:

- Communications Building
- Equipment
    - Satellite dishes
    - Solar Panels
    - Radio masts
    - Technical & Internet
- Telecommunications cable

The telecommunication assets are deemed to be condition grade 2, good to 3, fair with some larger maintenance required.

The draft 'Telecommunications in Tokelau' (June 2014) report considers issues for improvement of telecommunications services delivery. The recommendations from this report should be considered and implemented as appropriate (**IP 8**) to provide a robust telecommunications system improving Tokelau's link with the rest of the world.

3.6 Energy Asset Group

The Tokelau Renewable Energy Project (TREP) resulted in the construction of a solar/diesel hybrid system on each atoll of Tokelau. Previously, the atolls used diesel generator sets to provide electricity on a centralised distribution network. The new solar power systems were designed to provide the majority (90%) of the islands 'electricity needs from solar power, and are expected to save hundreds of thousands of dollars per year in diesel costs.
The Energy assets consist of:

- Buildings
- Solar Panels
- Batteries & Inverters
- Generators
- Power Cable
- Fuel

The buildings consist of the battery houses (where the solar batteries and inverters are housed), the generator house (where the generators are housed), the bulk fuel storage (where fuel are stored) and the solar plant fences.

The solar panels, inverters and batteries on each atoll amount to:

Atoll	Solar Panels (230Watt)	String Inverters	Batteries
Atafu	1,296	63	432
Fakaofo	1,584	77	428
Nukunonu	1,152	56	384
Total	**4,032**	**196**	**1,344**

There are three fixed generators on each atoll providing backup power and top up battery charging plus a mobile generator.

The solar panels, batteries and inverters are considered condition grade 1, excellent to very good. The fixed generators are consider to be condition grade 3, fair with some larger maintenance work needed, and the mobile generator is considered to be condition grade 2, good.

No specific maintenance issues were noted at the Energy buildings. Cleaning of the battery house gutters to minimise the contamination of roof collected water will prevent dirt and debris clogging the deionizer (**IP 9**). The solar panels will require regular cleaning and monitoring of the foundations and fastenings (**IP 9**). Cleaning is best performed after rain events or early morning and late afternoon when the panels are cool and damp. Water levels in batteries will require regular checking and topping up with deionized water when required (**IP 9**). Checking the State of Charge of batteries and system alarms and regular charging of batteries to ensure the batteries reach their expected lives (**IP 9**). On each atoll the generators are three different generators creating maintenance issues as each will require different parts etc. Standardising to one type and size of generator (**IP 10**) will greatly enhance maintenance and operational status of the backup power supply.

3.7 Plant & Equipment Asset Group

There are significant number of various plant and equipment on each atoll. The most significant plant and equipment are tabled below:

Plant		
Excavator	Forklift	Compressor
Tractor crane	Desalination plant	Pneumatic hammer
Wharf crane	Trailer x 2	Concrete mixers
Tractor x 2	Van x 2	Miscellaneous equipment
Village freezer	Wood chipper	Office equipment
Trucks	Mini loader	

The condition of the plant and equipment range from condition grade 1, excellent to 4, poor. A range of maintenance issues (**IP 11**) were observed including but not limited to:

Plant	Issue
Village freezer	Not operational. Make operational
Desalination plant	Perform regular test runs to confirm operational status
Tractor	Repair/Replace tyre
Tractor crane	Brake lining issues. Retrofit to make operational
Wharf crane	Requires power to point of installation. Never been used

The atolls of Tokelau are located within a harsh marine environment and as such plant and equipment is exposed to seawater air and salt air aerosols increasing the potential for corrosion. Therefore, it is

important that plant, when not in use, are stored within enclosures providing a level of protection against this harsh environment (**IP 12**).

3.8 Critical Assets

Critical assets are considered those assets in which failure would result in a major disruption to the community. No detailed assessment of critical assets have been conducted, but as a matter of completeness a broad-brush desktop assessment identified those assets whose failure will impact significantly on the communities of Tokelau. These assets include but are not limited to:

- Seawalls
- Hospitals
- Schools
- Tokelau Samoa link
- Ship to shore (Barges)
- Telecommunication
- Energy

4.0 LEVELS OF SERVICE

Defines the Levels of Service and the performance measures by which the service levels will be assessed.

4.1 Community Outcomes

The Government of Tokelau in the Tokelau National Strategic Plan 2010-2015 has expressed the community outcomes required in four Policy Outcome Area's

Policy Outcome Area 1 – Good Governance
Policy Outcome Area 2 – Infrastructure Development
Policy Outcome Area 3 – Human Development
Policy Outcome Area 4 – Sustainability

These four Policy Outcome Areas have been used as the framework for the development of levels of service for the Tokelau Asset Management Plan.

4.2 Consultation & Expectations

Levels of Service Consultation is carried out in Tokelau in accordance with the governance structure and arrangements in place. The Taupulega (Village Council of Elders), General Fono (National Assembly) and Council for the Ongoing Government (Executive Government) of Tokelau have all adopted a very consultative approach to governance. At a practical and village level the Taupulega maintain a close working appreciation of the issues and expectations that need addressing on each Atoll.

These arrangements provide sufficient and effective levels of consultation in determining policy, required levels of service and ongoing infrastructure maintenance, replacement and management considerations.

The Government of Tokelau will require ongoing consultation with funding partners around service levels, and the long term funding of asset operation, maintenance, renewal and new capital infrastructure. In particular consultation with the Government of New Zealand will be required around the delivery of service levels and any changes to service level expectations.

4.3 Levels of Service

4.3.1 TNSP Levels of Service

The following Levels of Service statements are documented in the Tokelau National Strategic Plan 2010-2015:

Asset Group	Goal	Targets/Indicator
Buildings	Develop an efficient and effective health system Improved Water Waste and Sanitation	New and equipped hospitals on each atoll Ratio of functioning toilets per school population – for girls and boys increases to 100% by end of TNSP period
Transport	Reliable, efficient and appropriate transport	Proportion of national budget for maintenance of ship-to-shore facilities and equipment Actual expenditure on upgrading ship-to-shore facilities and equipment 80% total cost recovery from passengers and cargo by the end of the TNSP period 50% increase in qualified/certified staff by the end of the TNSP period 50% decrease in charters from Samoa Shipping
Solid Waste	Improved Water Waste and Sanitation	Waste management champions on each atoll to increase their time by 50 % (max) for both Vector control and Waste Management
Telecommu nications	Reliable, efficient and appropriate telecommunications	50% reduction in the number of system failures – telephone service, internet service • 50% reduction in the number of bad debts • Number of training workshops provided • % increase in number of qualified staff • Number of households continuously connected for 12 months or more.
Energy	Reliable, efficient and appropriate energy	20% reduction in the number of power outages per year 50% increase in trained and qualified staff 50% decrease in staff turnover per year Electricity consumption per annum meets planned targets xx% improved on energy efficiency All households installed with prepaid meters by 2015

4.3.2 AMP Levels of Service

The following levels of service have been developed in conjunction with the AMP.

The levels of service have considered all supporting documents and discussions with Taupulega, and Government of Tokelau staff. It is expected that these levels of service will be adjusted and refined over time.

These service levels have been adapted from New Zealand practice and have been developed to meet the needs of the Taupulega and General Fono. Monitoring, Review and Evaluation requirements have been developed to a level appropriate to Tokelau governance structures.

Levels of Service are deliberately asset related and do not cover wider activity service provision for Health, Education and Environment as these are covered in separate planning documents.

The Levels of Service can be summarised as follows:

Buildings and Facilities are available for use, fit for purpose and operational. Maintenance and renewal plans are developed and then the buildings are maintained as agreed.

Plant and Equipment is available, well maintained and fit for purpose. Procurement is to agreed standards, and maintenance to manufacturers recommendations.

Power and Telecommunications are reliable, affordable and sufficient for needs. 24/7 availability with pricing as agreed.

Tokelau-Samoa Link, Ship to Shore, Boats are reliable and safe. Maintenance and repair is completed as required. Certification is held (Tokelau-Samoa link). Operated by suitably experienced crew.

Channels and Wharves are reliable, safe and operational. Maintenance is completed as required. Safety inspections are completed.

Roads are available with repairs and maintenance completed as required.

Water and Sanitation - Water has sufficient storage, with back-up systems in case of drought. PACC+ is completed and maintenance as required. Sewerage systems are available and operational, with maintenance and cleaning as required.

Seawalls are fit for purpose, operational and maintained. Development of seawalls and maintenance of seawalls is completed as required

The delivery of levels of service is proposed by the development of an annual maintenance and renewal plan for each Atoll (**IP 11, IP 24**), which will be agreed by Taupulega and the Atoll General Manager. Monitoring of service level delivery will generally be by the Atoll General Manager.

Table 4-1: Levels of Service

TNSP Policy Outcome	Specific Goals	Asset Group Supporting Outcome	Specific Asset Supporting Outcome	Customer Level of Service	Technical Level of Service	Performance Measure	Monitoring, Review, Evaluation
Policy Outcome 1 – Good Governance	1.1 Governance	Buildings	Public and Administration Buildings	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
	1.2 Public Sector Management	Buildings	Public and Administration Buildings	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
	1.3 Financial Management	Buildings	Public and Administration Buildings	AMP's, Renewals, Improvement Prog, Transparency of cost allocation	5 year review	Review completed to support TNSP	Sign-off by Taupulega, General Fono
	1.4 Law and Justice	Buildings	Public and Administration Buildings	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
Policy Outcome 2 – Infrastructure Development	2.1 Energy	Energy	Energy Buildings	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
			Solar Equipment	Reliable, affordable, sufficient power available	24/7 availability Price/unit as agreed	100% targets met	Sign-off by Taupulega, General Fono
			Cable	Reliable, Safe	24/7 availability	100% targets met	Annual review by Power General Manager
	2.2 Transport	Transport	Tokelau Samoa link	Reliable, Safe, Cost effective operation	Meets all international certification requirements Operated by suitably qualified and experienced crew	100% compliance with certification requirements Annual running costs to approved budget	Annual review by General Fono, Minister of Transport
			Ship to shore	Reliable, Safe	Maintenance and repair as required Operated by suitably experienced crew	100% of agreed work completed	Annual review by Atoll General Manager
			Boats	Reliable, Safe	Maintenance and repair as required Operated by suitably experienced crew	100% of agreed work completed	Annual review by Atoll General Manager
			Roads	Roads available	Maintenance and repair as required	100% of agreed work completed	Annual review by Atoll General Manager
			Channels	Reliable. Safe, Operational	Maintenance as required Safety inspections	100% of agreed work completed	Annual review by Atoll General Manager
			Wharves	Reliable, Safe, Operational	Maintenance as required Safety inspections	100% of agreed work completed	Annual review by Atoll General Manager
	2.3 Telecommunications	Telecommunications	Buildings / Equipment	Reliable, affordable, internet availability, speed	24/7 availability Price/unit as agreed	100% targets met	Sign-off by Taupulega, General Fono
			Cable	Reliable, Safe	24/7 availability	100% targets met	Annual review by Teletok General Manager
	2.4 Water and Sanitation	Buildings	Water Tanks, Septic Tanks	Sufficient Water Storage Back-up systems in case of drought Sewerage systems available and operational	PACC+ completed Maintenance of systems as required Cleaning of systems as required	Quality Testing completed to agreed schedule Maintenance and cleaning completed as agreed	Annual review by Atoll General Manager

TNSP Policy Outcome	Specific Goals	Asset Group Supporting Outcome	Specific Asset Supporting Outcome	Customer Level of Service	Technical Level of Service	Performance Measure	Monitoring, Review, Evaluation
		Private Buildings	Water Tanks, Septic Tanks	Sufficient Water Storage Sewerage systems available and operational	PACC+ completed Maintenance of systems as required Cleaning of systems as required	Maintenance and cleaning completed as agreed	Annual review by Atoll General Manager
	2.5 General	Plant and Equipment	Plant and Equipment	Available, well maintained, fit for purpose	Maintain to manufacturers recommendation Procurement to agreed standards	General Manager quarterly report	Taupulega annual review
Policy Outcome 3 – Human Development	3.1 Health	Buildings	Hospital	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
			Doctors Residence	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
	3.2 Education	Buildings	Schools	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
			Guest Houses	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
	3.3 Community Based Organisations	Buildings	Meeting Halls, Women's Buildings	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
			Churches	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
	3.4 HR Capacity and Development	Buildings	Public and Administration Buildings	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
Policy Outcome 4 – Sustainability	4.1 Village Economic Development	Buildings		Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
	4.2 Small Business Development	Buildings		Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
	4.3 Tourism	Buildings	Guest Houses	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
	4.4 Language and Cultural Heritage	Buildings	Churches	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
			Public Buildings	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager

TNSP Policy Outcome	Specific Goals	Asset Group Supporting Outcome	Specific Asset Supporting Outcome	Customer Level of Service	Technical Level of Service	Performance Measure	Monitoring, Review, Evaluation
	4.5 Agriculture	Buildings	Public Buildings	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
			Land and Fencing	Land available for agriculture Protection fencing in place as required	Agricultural land prepared as agreed Agricultural planting and maintenance completed as agreed	100% of agreed work completed	Annual review by Atoll General Manager
	4.6 Fisheries		Wharves, Fishing Boats	Reliable. Safe, Operational	Maintenance as required Safety inspections Operated by suitably experienced crew	100% of agreed work completed	Annual review by Atoll General Manager
			Channels	Reliable. Safe, Operational	Maintenance as required Safety inspections	100% of agreed work completed	Annual review by Atoll General Manager
	4.7 Environment	Buildings	Recycling facilities	Facility available for use Facility fit for purpose Facility operational	Facility maintained agreed Facility systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
	4.8 Waste Management	Buildings	Waste Management Buildings	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	
			Recycling facilities	Facility available for use Facility fit for purpose Facility operational	Facility maintained agreed Facility systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
			Plant and Equipment	Available, well maintained, fit for purpose	Maintain to manufacturers recommendation Procurement to agreed standards	100% of agreed work completed	Annual review by Atoll General Manager
	4.9 Disaster Risk Reduction		Seawalls	Seawall fit for purpose Seawall operational Seawall maintained	Seawalls developed as required Seawalls maintained as agreed	100% of agreed work completed	Annual review by Atoll General Manager
		Buildings	Public and Administration Buildings	Building available for use Building fit for purpose Building operational	Buildings maintained agreed Building systems fully operational	100% of agreed work completed	Annual review by Atoll General Manager
		Transport	Wharves and Channels	Reliable. Safe, Operational	Maintenance as required Safety inspections	100% of agreed work completed	Annual review by Atoll General Manager
		Buildings	Emergency safe houses	Houses identified and made known	Readiness exercise as required	Annual exercise completed	Annual review by Atoll General Manager

4.4 Levels of Service Gaps

In examining the levels of service developed, previous reports and recommendations and the expressed desires of the Taupulega the following service level gaps have been noted.

4.4.1 Water and Sanitation

There are no reticulated water or sewer systems in Tokelau. Water is collected in tanks attached to public and private buildings. Bottled drinking water is imported. Each atoll has a desalination plant for use in times of drought.

Sewerage disposal is via septic tanks, septic cells attached to public and private buildings. There are a few remaining lagoon toilets.

In May 2010 the Government of Tokelau received the 'Integrated Waste Management, Water and Sanitation Review and Action Plan,' by SPREP and Parsons Brinkerhoff. This report completed a comprehensive review of water and sanitation issues, and provided a large number of recommendations.

The recommendations from the May 2010 report should be completed by Government of Tokelau (**IP 32**).

In particular in relation to this AMP the following recommendations are highlighted:

1. Complete the PACC+ installation programme
2. Complete household water tank installation
3. Maintain the Desalination Plant (and periodically test run)
4. Undertake a community options and feasibility report for appropriate sewerage management systems (**IP 33**)
5. Instigate and continue regular water sampling, wastewater sampling and lagoon water sampling to track any issues and build an evidence base for further action

These items have also been included as appropriate in the AMP service levels above.

Sewerage management systems will require further study (**IP 33**), and it is likely any solutions will require further expenditure. This potential expenditure has not been added to this AMP, as the solutions are unknown at this stage, and could range from the status quo through to reticulated and managed sewerage treatment systems. Any additional costs for this will need to be added to future revisions of this AMP.

4.4.2 Air Transport Service

The potential for development of an Air Transport Service is a service level gap that is concerning the Taupulega and Government of Tokelau. The current sea voyage from Samoa to Tokelau is time consuming, and adds to Tokelau's isolation.

An Air Transport Service is a large felt need in Tokelau for:

- Family visits
- Medical evacuations, treatment, specialist and general support
- Education, specialist and general support, off island education
- Efficient operation of government
- Tourism
- Ease of access to Apia, New Zealand and the rest of the world

There have been several previous reports on this topic that have examined a range of scenarios to meet this service level gap, with a range of cost estimates. The issues surrounding the Air Transport Service have been briefly outlined in Appendix B1.

The introduction of an Air Transport Service is estimated to have an initial capital cost of around $10 million and an annual lifecycle cost of around $1 million. These costs would significantly add to the Government of Tokelau cost of service provision.

4.4.3 Telecommunications – Further Development

Tokelau is currently (August 2014) examining further development options for telecommunications services. It has recently received the 'Telecommunications in Tokelau Report', John M Haydon which outlines a range of development options. A summary of this report is briefly outlined in Appendix B2

Once this report has been considered by the Government of Tokelau, and decisions for the development of future telecommunications options taken, the results can be included into a future revision of this AMP. This would include capital costs, operations and maintenance costs, and asset renewal costs.

4.4.4 Justice Assets

Police and Justice needs have been met within public and administration buildings. It is noted that as result of Tokelau cultural practice and Taupulega administration, there is no requirement for separate justice facilities. Resulting from this no allowance has been in this plan for such facilities.

Should the situation change in the future then the need for Justice Assets may need to be reconsidered.

4.4.5 Summary of Service Level Gaps

The development of future services outlined above is dependent of the cost of delivering these services, and the ability of the Government of Tokelau to fund those costs. When considering these costs the whole of service delivery lifecycle costs should be considered, that is

- Initial capital cost of service
- Operational costs of service
- Maintenance costs of service
- Renewal costs of service

The prioritisation of action on these identified service level gaps is a matter for the Government of Tokelau (Taupulega and General Fono) and their funding partners.

5.0 STRATEGY, GOALS, OBJECTIVES AND PROCEDURES

This Section identifies the National Strategies, Plans, legislation, standards and guidelines.

5.1 National Strategies and Plans

5.1.1 Economic Support Arrangement

The Economic Support Arrangement (ESA) between Tokelau and New Zealand was designed in accordance with the Principles of Partnership which provide a framework of economic and administrative assistance for Tokelau. The ESA followed a gradual process in which Tokelau has moved to greater responsibility for its core budget management. The ESA 2007 – 2010 was the first support arrangement in which Tokelau was responsible for managing its recurrent budget. The ESA builds on a process of 'devolution' of political and financial control to village authorities and away from central government which began in the late 1990s and culminated in actual devolution of core service provision to the village level in July 2004.

The first ESA was designed according to Tokelau's national strategic priorities set over that period which focused on six areas:

1. Village development, including upgrading village infrastructure, good governance, capacity building, sustainable resource use and population, culture and language retention;
2. Provision of quality health services;
3. Provision of quality education services;
4. Provision of appropriate transport services;
5. Improved Information and Communications Technology (ICT) capability;
6. Economic development.

5.1.2 Tokelau National Strategic Plan 2010-2015

The Tokelau National Strategic Plan 2010 – 2015 (TNSP) builds on the strategic vision identified and used to establish the first ESA in 2007. While the strategic priorities have not changed significantly since this time, the development of a formal document which details the aspirations of Tokelau and how the Nuku through the Taupulega Office and the national departments plan to achieve these is a milestone. The next ESA with New Zealand will be based on the priorities identified in the TSNP. The TNSP is reviewed every five years.

5.2 Key Legislation and Regulation – Implications for Asset Management

With the changeover to the New Zealand administration in 1925, the Gilbert and Ellice Colony Law remained in effect. The 1917 Ordinance, which forbade alienation of land to non-Tokelauans, was of particular importance, as was the 1922 Ordinance that required a land registration system, but these are deemed to have had little impact on traditional land customs of the time.

The Tokelau Islands Act of 1948, when the group was declared to be part of New Zealand, did not extend the statute law of New Zealand and under existing laws the land tenure has remained largely under traditional customary control.

The major current land legislation is the Tokelau Amendment Act of 1967, which vests all land in the crown (i.e. the government as absolute title holder). There are three legal categories of land:

i. Land not subject to any other interest –
    a. The foreshore, seabed and subsoil, under Section 10 of the Tokelau (Territorial Sea and Fishing Zone) Act of 1976
    b. Land taken for public purposes under Section 24 of the 1967 Act
    c. Land acquired by the Crown under Section 25 of the 1967 Act.
ii. Land held subject to customary title –
    a. Pure custom
    b. Subject to non-customary rights acquired before 26 October 1967 (following Sections 20(1) and 23 of the Act
    c. Subject to Crown lease under Section 25(4) of the Act.
iii. Land subject to an estate in fee simple, which was owned before 1 January 1949.

In effect, land held under any other category than custom use (2a) is extremely small. The land held under category 2a is subject to customary title, in which "the beneficial ownership…. shall be determined in accordance with the customs and usages of the Tokelauan inhabitants of Tokelau." This provision is potentially important given the large number of Tokelauans resident in New Zealand and the Acts Definition of a Tokelauan, in Section 18 as "a person belonging to the Polynesian race of Tokelau and includes a person descended from a Tokelauan". The 1967 Act also forbids the alienation of land, or of an interest in land other than in accordance with customs and usages, or to the Crown.

Government of Tokelau policy is to meet minimum legislative requirements, or exceed requirements where deemed appropriate and cost effective through Levels of Service Consultation. The asset management response to legislative requirements is a compliance based approach.

5.3 Standards, Codes of Practice and Guidelines

There are no adopted Standards, Codes of Practice or Guidelines for Tokelau. It is important that appropriate Standards, Codes of Practice and Guidelines be developed for Tokelau (**IP 13**).

It is apparent that various standards have been deployed in the design and construction of more modern buildings, but there is no information to suggest these have been adopted.

6.0 DEMAND & PLANNING FOR THE FUTURE

This Section provides detail of growth, demographics and forecasts which affect the management, and utilisation of the assets.

6.1 Overview

The future demand for servicers will change over time in response to a wide range of influences such as:

- Local population trends
- Accuracy of predicted future population
- Local economic trends
- Changing technology
- Changing legislative requirements
- Change in land use
- Resource issues
- Climate change

6.2 Demand Drivers

The future demand for assets in Tokelau will be driven by:

- Growth or decline in population
- Population demographics
- Technology changes
- Environmental effects
- Tokelau – Samoa link

Table 6-1: Demand Drivers

Asset Group	Population	Demographics	Technology	Environment	Samoa Link
Health	Places a greater demand on services	Aging population places greater demand on specific health services. A younger population places greater demand on educational facilities and specific health services	Changes in technology creates a higher level of service expectation	Changing climate and environmental effects may increase hazardous events	Improving the link may result in more people visiting, placing a greater demand on services, while deteriorating this link places a greater demand for providing adequate services in Tokelau
Education					
Transport					
Telecommunication					
Energy					
Plant & Equipment					

6.2.1 Population Demographics and Trends

The 2013 Tokelau Census of Population and Dwellings state Tokelau's population has a unique composition as a significant proportion of the country's population is away from the atolls at any one time, for various reasons (e.g. healthcare or education).

The de jure usually resident population are tabled below:

Table 6-2: De Jure Population 2013

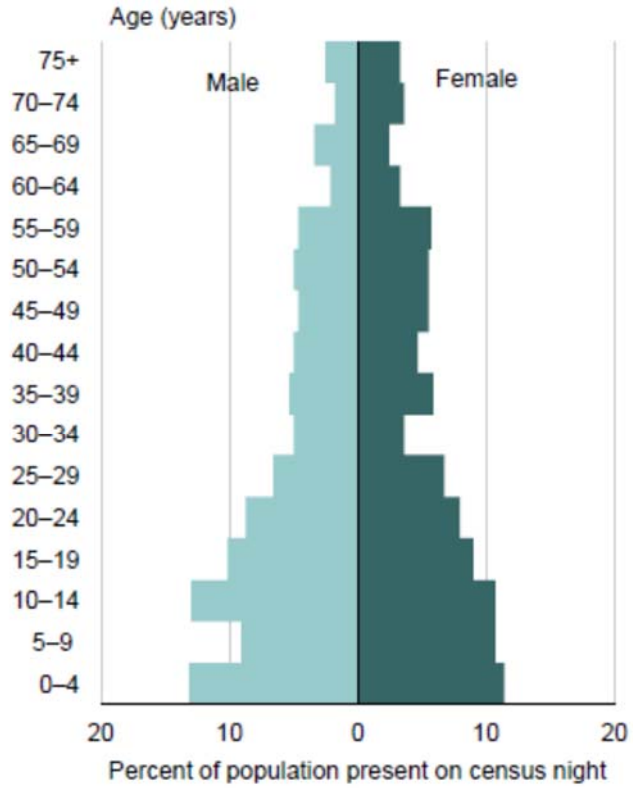
Atoll	Present	Absent	Total
Atafu	374	84	458
Fakaofo	448	67	515
Nukunonu	335	75	410
Total	**1,157**	**226**	**1,383**

The table above includes Tokelau Public Service employees and their immediate families who are usually resident in Samoa. In the above table they are included in their home atoll and they amount to 47 people.

The 2013 Population Count was undertaken primarily to collect the number of de jure usual residents in order to satisfy the requirements of the Constitution of Tokelau 2009. The Constitution and the Statistics Rules 2013 require a count of the population to be undertaken in the year prior to a National Election, in order to determine the number of nuku delegates that can be elected for the General Fono.

As a result the following information is taken from the 2011 Census as the data is more comprehensive and there will be little change between 2011 and 2013.

Figure 6-1: Age Sex Distribution



Source: 2011 Tokelau Census of Population and Dwellings

Figure 6-1: Age Sex Distribution (*taken from the 2011 Census count*) above shows a pyramid that narrows between ages 30 to 59, and from 60 to 75+ years. The pyramid is significantly wider for ages 0 to 29 years indicating a young population, where most of the usual residents present on census night were under 30 years (59%).

The graph also shows the sex structure of each age group. The number of males and females is relatively uneven across the age groups, especially across the older age groups. This reflects the generally higher life expectancy for females.

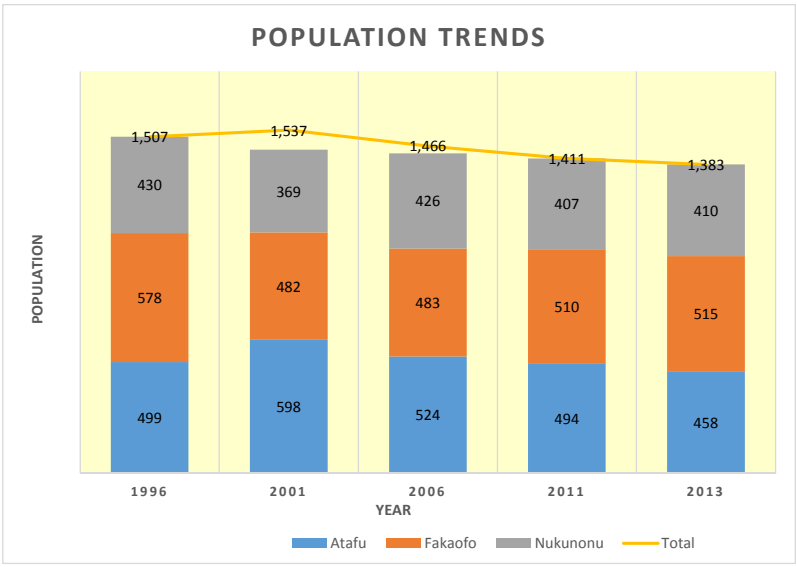
The median age for the usually resident population present in Tokelau on census night was 24 years (in 2006 it was 22 years). The median age for males was 22 years (in 2006 it was 20), while the median age for females was 25 years (in 2006 it was 23). This shows the population has aged slightly.

Table 6-3: Tokelau Population Trends

Atoll	1996	2001	2006	2011	2013
Atafu	499	598	524	494	458
Fakaofo	578	482	483	510	515
Nukunonu	430	369	426	407	410
Total	**1,507**	**1,537**	**1,466**	**1,411**	**1,383**

The 2001 atoll population excludes 88 persons counted in Apia, Samoa. The 2006, 2011 and 2013 population includes 369, 226, 226 usually resident population absent on census night and includes 33, 42 and 47 persons of the Tokelau Public Service counted in Apia, Samoa.

Figure 6-2: Tokelau Population Trends



The above shows that there is slight decline in the de jure population over the last twelve years. It shows that since 2001 there has been on average a 3.5% decrease between population counts and in total a 10% decrease in population over the 12 years.

The 2011 Census of Population and Dwellings compares the age sex distribution of 2006 and 2011 stating '*the change in shape between the two pyramids is due to several factors. In the 0 to 4-year age group, childbirth is the most dominant factor. In the 25 to 59-year groups, migration plays the largest role, and in the 60+ age groups, a growing life expectancy is likely to be the biggest driver of change*'.

Therefore, with a crude birth rate of 22.5 (2012 global average = 19) there is a demand for health and educational facilities. Due to its isolated location and limited opportunities Tokelau will always be subject to significant migration patterns. The growing life expectancy will further place greater demand on adequate health services.

6.2.2 Technology Changes

Technological changes will create a higher level of service expectation among the Tokelau people. For example - exposure to the internet will raise awareness of educational methods and technologies, health treatments and facilities, and general standards of living.

6.2.3 Environment

Tokelau is vulnerable to changes in climate and the environment. It is isolated and located in a region prone to severe weather events. A changing climate, sea level rise, more frequent and severe weather events, and a changing environment will all contribute to placing a greater demand on resilient infrastructure to ensure sustainability and protection of the people of Tokelau.

6.2.4 Tokelau Samoa Link

Apart from the telecommunications infrastructure, the Tokelau Samoa link is the only link that Tokelau has with the rest of the world.

There are no airstrips in Tokelau – all transportation in to and out of Tokelau is by ship, as is transport between the three atolls. All travel and shipment of supplies, including medical evacuations, are via Apia, Samoa.

This places a significant demand on providing a resilient and sustainable transport and telecommunications service.

6.3 Demand Management Plan

The Demand Management Plan involves implementing strategies to promote efficient infrastructure operations.

These strategies involve asset strategies (altering or repair the asset) and non asset strategies (manage demand).

No formal demand management plan has been developed for Tokelau, but the table below provides some broad brush strategies applicable to various infrastructural assets.

Table 6-4: Demand Management Strategies

Strategy	Description
Response time	Prompt response and rectification of observed/reported faults
Replacement/Rehabilitation Programme	To ensure assets are not utilised beyond their useful life when the risk of unidentified failure is greatly increased
Codes of Practice	Develop and enforce Codes of Practice to ensure all maintenance is carried out to the relevant standards (**IP 13**)
Technical Standards	Ensure new assets are constructed/procured to the correct standards and tested before being commissioned
Standard materials	The use of standard (high quality) materials (**IP 3**)
Standard equipment	The use of standard (high quality) equipment
Quality audits	To ensure all standards above are met (**IP 22**)
Education	Encourage and educate residents to manage demand (health & education)
New technology	Encourage the adoption of new technologies to manage demand (health & education)
Health	Ensure sufficient assets and expertise are available to meet changing health needs for the population especially with demographic changes predicted by aging population and longer life expectancy

7.0 SUSTAINABILITY

This section looks at the processes for assessing and managing sustainability for Tokelau and its integration with activities.

7.1 Overview

Sustainability can be defined as meeting the needs of the current generation without compromising the ability of future generations to meet their own needs.

Therefore the GOT needs to consider:

- The social, economic, and cultural well-being of people and communities
- The need to maintain and enhance the quality of the environment
- The reasonable foreseeable needs of future generations

7.2 Sustainability and Lifecycle

Asset management is designed to improve decision-making about assets to enable the better management of existing and future assets. Effective asset management ensures that agreed levels of service are met and risks, including public health, financial and environmental are minimised, while costs are optimised. Improved decision-making is crucial to achieve asset management and sustainability goals. Therefore, having the correct asset information available is important to support the decision-making process. It is thus clear that lifecycle costs is part of and supports asset management and sustainability.

Asset management practices include action that recognise the need for environmental, economic, social and cultural sustainability, that is –

- The natural environment needs to be preserved for future generations and not degraded as a result of GOTs' asset management operations and development projects
- Financially, there is a limit to what GOT can afford. Expenditure needs to remain within this limit and the costs need to fall equitably on the generations which derive the benefits
- Social relationships between individuals, interest groups and Taupulega are valuable, and GOT needs to facilitate and encourage this by providing infrastructure
- Our history, customs and creativity are valuable to us. Their preservation and enhancement over time is facilitated by providing venues where they can be practiced, preserved and displayed

7.3 Sustainability and GOT

Sustainability needs to form part of everything GOT does. It should be considered in all tasks performed by the GOT. In managing, operating and maintaining infrastructure assets and services GOT would like to do this to a level of excellence. However, this is not sustainable and all infrastructure assets and services should be managed, operated and maintained to an optimum level appropriate for that specific asset and service. GOT endeavours to always act in the best interest of the community.
GOT will consider the following under sustainability:

- Appropriate transport services
- Appropriate health services
- Appropriate educational services
- Appropriate solid waste services
- Appropriate water and sanitation services
- Efficient use of energy
- Efficient operation of facilities
- Within Public Service:

- Staffing levels
- Skills
- Training
- Succession planning

In this context ‘appropriate’ means ‘fit for purpose’ under the circumstances. Thus as an example an appropriate health service means a health service that is sustainable and takes into account:

- Travel time for medical evacuations vs on site treatment
- Cost of providing medical treatment on site vs cost of medical evacuation and implications of a change in boat schedule
- A relatively young population
- An ageing population, etc.

7.4 Procurement & Options

Tokelau operates a system that has been described as 'coral up' government. In this system, Taupulega are the ultimate source of authority. The Taupulega direct village activities and in turn delegate their authority on national issues to the General Fono. The General Fono is made up of delegates from each atoll including three Faipule (Village Heads) who rotate the leadership of the country, a position known as the Ulu-o-Tokelau.

GOT receives most of its budgetary support from New Zealand under the Economic Support Arrangement (ESA). Under this arrangement GOT manages resource allocation and has asked for New Zealand’s assistance in commissioning an Asset Management Project (Policy, Strategy, Plan and Asset Register), leading to an action plan to improve asset management across all sectors. The Special Relations Unit in MFAT/NZAID manages the provision of New Zealand’s assistance to Tokelau. The Tokelau Department of Health (DOH) and the Department of Economic Development, Natural Resources and the Environment (DEDNRE) provide policy advice and inputs on water and sanitation and waste management.

Day to day governance, including funding, implementation of activities and supervision occurs at village level through the Taupulega. The Taupulega on each atoll oversee village budgets, coordinate health related activities (including disposal of waste) and manage the village workforce.

Contracts are let on a project basis and executed in the following order:

- Concept approved by GOT
- Design by consultants
- Documentation and supervision provided by a mix of Public Service officials and consultants
- Construction labour provided by the Aumaga (men’s working group)
- Materials are generally shipped in through Samoa

The Aumaga also perform other village duties under the instruction of the Taupulega.

Due to its location and small population there are not a lot of options in how projects are procured. However, in relation to materials and plant and equipment it would be beneficial to investigate preferred suppliers and then entering into an agreement. For example – having one supplier/manufacturer of outboard motors will greatly enhance the ability to operate, maintain, source and stock replacement parts (**IP 3**).

7.5 Human Resource Management – Skills, Training and Succession Planning

7.5.1 Skills

Assessment of staffing levels needs to consider the skill requirements to meet the demands of the infrastructure and plant and equipment that GOT does and will own and operate.

Complex systems need skilled and trained professionals to operate and maintain. The GOT needs to stay abreast of any resource requirements and qualifications to ensure the most appropriate method for delivery of the required levels of service.

7.5.2 Staffing

Staffing is influenced by the external and internal environments. The external environment is the educational, socio-cultural, legal-political, and economic constraints and opportunities. Many of these factors are beyond the control of the GOT. However, the internal environment being the internal policies regarding promotion from within, open competition, responsibility for staffing and top-management support is able to be improved or degraded by management decisions within an organisation. The GOT shall be committed to improving the internal environment for the workforce.

7.5.3 Training

Training of staff is presently on an ad-hoc basis with no structured long term development plans for the individual staff members in the asset management field. There is a clear link between asset life, and the ability to deliver levels of service with the skills of the people who plan, design, install, operate and maintain the assets. It is crucial that the skill gaps of staff, contractors and service providers are identified. There are structured training programmes to close these gaps (**IP 19**).

7.5.4 Succession Planning

Succession planning within any business is considered necessary to reduce the risk associated with staff leaving the organisation. Succession planning allows institutional knowledge to be passed on, and assists in ensuring continuity of organisational culture.

Public Service have traditionally not been particularly successful at implementing succession planning techniques and practices. Whilst there is always potential for staff in key positions to move on to further their careers, succession planning can help to mitigate the effects of this.

Succession planning techniques to be considered can include:

- Sourcing replacement staff from within the organisation wherever possible
- Comprehensive personal career development plans in place for all relevant staff. This can include identifying weaknesses in training and experience and attempting to address those weaknesses by use of mentoring, relevant projects and continuing professional development programmes etc.
- Identifying likely staff retirements, promotions, resignations or position changes on an annual basis. Identifying potential internal staff to fill those positions, providing those staff with projects that extend them, and giving them relevant experience for filling the positions

7.6 Environmental Management

Due to its isolated location and fragile ecosystem Tokelau is particularly vulnerable to adverse environmental conditions.

The atolls consists of coral reef, sands and rock with the soils being highly porous and nutrient poor. Sands and coral rock are used in construction methods. The poor condition of the soil is considered one of the country's major restricting factors in relation to land-based agricultural development, and limits the country's current agricultural economy to a subsistence level.

There is no surface water available on any of the atolls and limited groundwater sources have been contaminated by poor wastewater management systems and seawater during storm surge inundation.

In the outer islets, limited fresh water can be obtained from thin water lenses below the atoll formations. Drinking water is captured through run-off rainwater from rooftops and stored in freestanding polyethylene tanks or within concrete tanks within foundations under homes/buildings.

The vegetation found on the atolls are widespread throughout the Pacific. The atolls have been described as being generally low in both plant and animal diversity. This may be expected on such a remote and insular atoll environment, but further degradation and/or loss of the limited biodiversity is highly undesirable.

Cultivated food crops are generally limited to breadfruit, taro, bananas, papaya, pandanus, pumpkin; and coconut.

Tokelau's greatest natural assets are its marine resources. Tokelau's fisheries comprise an inshore lagoon and reef fishery, and an offshore pelagic fish and deep water fishery. The lagoon fishery is mainly used for domestic consumption. The offshore fishery are mainly tuna and the deep water fishery comprise mainly of snapper, shark, groper and emperor. Substantial revenue is generated through Tokelau's Exclusive Economic Zone (EEZ) under Tuna Treaties and licensing of foreign vessels to fish within the EEZ.

The Department of Economic Development, Natural Resources and the Environment (DEDNRE) manages the environmental aspects of Tokelau through policy advice and inputs on fisheries, water and sanitation and waste management.

The impacts of:

- Seawalls
- Sanitation
- Solid waste management
- Fisheries
- Energy (fuel storage)

needs to be carefully managed to ensure a sustainable future for the children of Tokelau.

7.6.1 Energy

Until 2012 Tokelau's electrical energy was provided through a set of 3 diesel generators on each atoll. This costs of running the generators and shipping fuel to the atolls was very high and not environmentally friendly.

The Tokelau Renewable Energy Project (TREP) resulted in the installation of solar power systems on each atoll. The new systems provide 90% of the island's electricity needs through solar power with the existing generators providing backup during extended periods of low light and to charge batteries when required.

The TREP won the 2014 Energy Efficiency and Conservation Authority (EECA) Renewable Energy award.

8.0 RISK MANAGEMENT

This Section identifies the risk management processes used to assess and manage risk. Risk Management is:- 'The systematic application of management policies, procedures and practices to the tasks of identifying, analysing, evaluating, treating and monitoring those risks that could prevent an authority or organisation from achieving its strategic or operational objectives or plans, or from complying with its legal obligations'.

8.1 Introduction

A systematic and consistent approach to risk assessment will improve GOT's ability to manage its assets within resource limitations and to prioritise expenditure and actions that can avoid or mitigate the effects of any event. Risks can be grouped into financial, operational, or organisational categories. Their negative consequences can seriously impact public health and safety, incur financial loss or adversely affect public image. The risks identified might be relevant to many activities and be of concern at organisation level, or they might be localised, at an asset specific level.

8.2 Risk Events

The risk events that might impact on assets include but are not limited to:

Table 8-1: Risk Events

Risk Event	Description	Example
Natural Events	Where there is no control over the timing or the extent of the event	Cyclones Tsunami Earthquake Droughts
Physical Failures	Where condition or performance of the asset could lead to failure	Nukunonu bridge
External Impacts	Organisations not providing services, such as material supply failures or transport failures	Tokelau Samoa link
Operational	Where the management or operational activities might impact adversely on an asset	Spills/Water contamination

8.3 Current Approach

Various Risk Management Plans have been developed by the GOT, and these include:

- Tokelau National Disaster Risk Reduction Plan (2011)
- Tokelau Evacuation Sites Assessment (2013)
- Tsunami Hazard Potential for the Atolls of Tokelau (2013)
- Reducing the risks of cyclone storm surge inundation on the atolls of Tokelau – an overview of cyclone related coastal hazards (2005)
- Reducing the risks of cyclone storm surge inundation on the atolls of Tokelau – Atafu (2005)
- Reducing the risks of cyclone storm surge inundation on the atolls of Tokelau – Fakaofo (2005)
- Reducing the risks of cyclone storm surge inundation on the atolls of Tokelau – Nukunonu (2005)

In addition to the above, various other risk management tools and techniques, based on the practical experience of the Taupulega and Public Service officials are used.

8.4 Risk Assessment

8.4.1 Natural Events

Cyclone

Cyclones present the highest risk to Tokelau as it is the most common natural event affecting Tokelau. Over the last century there have been approximately 10 cyclones that have caused significant damage to one or more of the atolls. During 2005 Cyclone Percy (category 3) passed near Tokelau and caused wide-spread damage in each of the nuku. The atolls of Fakaofo and Nukunonu was worst affected, while inundation was also an issue on Atafu and Fakaofo. Cyclone Percy was the worst cyclone to strike Tokelau since a similar cyclone hit the area in 1966.

It suggests that one or more of the Tokelau atolls can expect to suffer damage from a significant cyclone on average every ten years.

The NIWA report 'Reducing the risks of cyclone storm surge inundation on the atolls of Tokelau – an overview of cyclone related coastal hazards (2005)' identified that:

- All cyclones that have significantly impacted on the three atolls occurred during the El Niño periods
- La Niña conditions may decrease the occurrence of cyclones
- Ten cyclones have caused significant damage over the last 100 years
- Half of the most significant cyclones coincided with spring tide
- Extreme water levels during cyclones are a combination of factors including astronomical tide, long period sea level fluctuations, storm surge, wave setup, and sea level rise.
- Small boats channels appears to have a detrimental influence

The NIWA reports developed specific for each atoll (Reducing the risks of cyclone storm surge inundation on the atolls of Tokelau – Atafu, Fakaofo, Nukunonu) developed a series of recommendations within four general risk reduction themes:

1. Ensuring protection of the natural coastal defences
2. Options for land management i.e. moving key infrastructure from high risk areas
3. Reducing the risks of damage to property and content through building design
4. Protection measures,
    a. seawalls and structures that enhance natural defences,
    b. are sensitive to important natural processes
    c. optimised to be more effective in reducing inundation
    d. more sustainable structures i.e. length of time structure is effective and ongoing maintenance costs

It is important that the Taupulega and the GOT ensure that these risk reduction themes are applied throughout the atolls **(IP 14**).

Tsunami

The Tsunami Hazard Potential for the Atolls of Tokelau (2013) finds that **the risk of tsunami causing damage is small, but not negligible**. Depending on the location and the magnitude flooding from tsunami may occur and in the event of large earthquakes (greater than magnitude 8.1) may cause fast flowing water in parts of the villages up to waist height. Tsunami waves have the potential to inundate buildings in low lying areas and potentially cause significant damage from wave and debris impact sources.

Earthquake

The Tokelau Evacuation Sites Assessment (2013) report states **'***Tokelau is located away from plate boundaries and does not typically experience significant seismic activity. An unusual earthquake which occurred near Tokelau in recent times was Magnitude 5.3 at a 10km depth in September 2006. The*

epicentre was approximately 200km north-east of Tokelau. It is unusual for earthquakes with epicentres more than 200km from a site to be damaging.

The resulting ground-shaking hazard from earthquakes is considered to be a low risk when compared to potential wind and wave actions from cyclones and tsunami'.

Drought
During October 2011 the GOT declared a state of emergency as the atolls experienced a prolonged dry spell. Drinking water is captured through run-off rainwater from rooftops and stored in freestanding polyethylene tanks or within concrete tanks within foundations under homes/buildings. Any extended dry spell result in a shortage of drinking water.

As a result of the 2011 drought the GOT signed a Memorandum of Understanding with the Secretariat of the Pacific Regional Environment Programme (SPREP) to improve long term water security.

This initiative was undertaken as part of the Pacific Adaptation to Climate Change Plus Project (PACC+). PACC is a regional programme which helps Pacific Island Countries and Territories adapt to climate change in three areas – coastal management, water resource management and, food production and security. PACC+ is an addition to this project.

Through the PACC+ project, household water tanks are standardized and additional water tanks have been installed for older homes with insufficient storage. Further to this 'flush diverters' have been installed to help improve the available flow of water by partial removal of bacteria and sediment.

This initiative will aid in providing drinking water in response to the immediate and longer term impacts of climate change. Each atoll have a desalination plant which should provide the ability to provide emergency water by removing salt from sea water producing fresh water. It is important that each atoll/Taupulega ensure that the desalination plants are operational through regular testing (**IP 15**).

8.4.2 Physical Failures

Physical failures are those events where the condition or performance of the asset could lead to failure e.g. the Nukunonu Bridge.

Physical failures are mainly in direct response to inadequate lifecycle management i.e. neglecting one or more of the following key stages

- Asset planning – decisions made at this time influence the cost of operating, maintaining, and the lifespan of the asset
- Asset creation/acquisition – capital costs, design and construction standards, commissioning of the asset, guarantees by suppliers influence the cost of operating the asset and the lifespan of the asset
- Asset operations and maintenance – Operation relates to throughput, efficiency and power and more applicable to mechanical plant. Maintenance relates to preventative maintenance where minor work is carried out to prevent more expensive work in the future, and reactive maintenance where the failure is repaired
- Asset condition and performance monitoring – when the asset is examined and checked to establish the remaining life of the asset, what corrective action is required, including maintenance, rehabilitation or renewal and what timeframe
- Asset rehabilitation and renewal – when the asset is restored or replaced to ensure that the required level of service can be delivered
- Asset disposal and rearrangement – when a failed or redundant asset is sold off, put to other use or abandoned

8.4.3 External Impacts

External impacts are those where outside organisations do not provide services as agreed, such as material supply failures or transport failures e.g. the Tokelau Samoa link. If this transport link fails it will have a significant effect on residents of Tokelau.

8.4.4 Operational

Operational risk events are those events where the management or operational activities might impact adversely on an asset e.g. a fuel spill during ship to shore activities.

It is important to identify and consider each of these risks (natural, physical, external and operational) and develop measures to prevent or reduce the risk.

8.5 Risk Reduction

The Tokelau National Disaster Risk Reduction Plan (2011) records the disaster risk management arrangements for sustainable management of risks, the preparedness for, response to, and recovery from hazard events that threaten or impact Tokelau.

This Risk Reduction Plan considers hazards and risks, discuss the emergency management and risk reduction and documents responsibilities and response arrangements.

The Risk Reduction Plan identifies the following Contingency Plans:

Table 8-2: Contingency Plans

Contingency Plan	Status
Cyclone	Completed
Tsunami	Completed
Fire	To be developed
Transport	To be developed
Boat safety	To be developed
Search and Rescue	To be developed
Drought	To be developed

It is important that all contingency plans be developed to ensure preparedness and the procedures and response to these events are documented (**IP 16**).

The Tokelau Evacuation Sites Assessment (2013) documents an assessment of the structural resilience of specific buildings to be used as safe houses during and after the occurrence of natural events such as storm surge, cyclones, tsunami, and earthquakes.

Among others this report found that:'

- The buildings in Tokelau that have been identified for use as emergency evacuation shelters are vulnerable to strong cyclone winds and wave inundation from cyclone and tsunami events
- Strengthening of assessed roofs will require rebuild as the roof-framing for the majority of the assessed buildings had poor detailing for wind uplift
- In general, the shelter buildings are likely to be more resilient to moderate tsunami and storm surge inundation than cyclone-strength winds
- Elevated water tanks supported on concrete-framed towers may be vulnerable to toppling
- Evidence suggests that the reinforcing steel being used in reinforced concrete beams and columns for domestic construction is not consistent with design principles for these elements
- Seawater should not be used for mixing concrete
- There is little regulatory process for design and construction of domestic dwellings. There is need for design standards
- Louvered glass windows have the potential to be very hazardous to the people in the shelters during high winds
- The water tanks beneath buildings may be vulnerable to contamination by sea-water ingress

The Tokelau Evacuation Sites Assessment (2013) also recommends:

- A case should be made for all roof structures to be strengthened by the addition of simple connections between the roofing material and the structure
- The current design and construction processes should be reviewed and, in discussion with the builders, develop a system to ensure buildings are constructed to codes and designs
- Similarly, standard designs for structures supporting elevated domestic water tanks should be developed. Existing water tanks should be braced
- The making of concrete with sea water should stop
- Adequate protection measures (e.g. shutters) for windows need to be prepared and ready for emergency installation
- Ground-level water-tank vents should be fitted with snorkels where practical
- The new hospitals and schools are likely to be the best safe houses available in the short term
- Emergency supplies should be prepared and maintained for all shelters, particularly with regards to water supplies

The recommendations of the Tokelau Evacuation Sites Assessment (2013) should be considered and implemented where practical and possible (**IP 17**).

8.5.1 Key Risk Items

During the site visit in March 2014 key risk items noticed were:

- Fuel storage and handling, and
- Lack of firefighting equipment

Fuel Storage

The bulk storage of fuel on Fakaofo is a cause for concern as this facility is in close proximity of houses and pose a high risk. There is no ventilation and the facility have a significant presence of fuel fumes. There are signage (no smoking or danger) providing a warning of the risks associated with the facility. The bulk fuel storage on all the atolls require significant safety improvements and/or relocation to ensure risks are minimised and can be appropriately managed (**IP 30**). An amount of $120,000 for each atoll is provided in the Capital projects consisting of $60,000 for additional storage for plant and equipment (**IP 12**) and $60,000 for new or improved bulk fuel storage solution (**IP 30**).

Firefighting

The only fire extinguishers found were in the battery houses of the solar plants. However, these are small wall mounted fire extinguishers only suitable for immediate extinguishing of a flare up. In some cases, especially Fale at Fakaofo, houses and buildings are very close to each other. This increases the likelihood of fire spreading from one house to another. The consequences of a fire can be significant and taking into account the close knit communities of Tokelau, the loss of life and/or property will have a major impact on the people of Tokelau.

Options for firefighting ability on the atolls should be investigated. Options may include but are not limited to:

- Firefighting truck
- Fixed pump with a piped system
- Establishing a volunteer fire brigade
- Appropriate firefighting training
- Appropriate storage facilities for firefighting equipment

An amount of $150,000 is included for each atoll under Capital Projects for firefighting.

8.6 Assumptions and Uncertainties

Significant forecasting assumptions and risks that underlie the financial estimates, assumptions concerning the useful life of significant assets and an estimate of the potential effects of the uncertainty on the financial estimates are provided below.

Table 8-3: Significant Forecasting Assumptions

Significant Assumption	Level of Assumption (low=small risk)	Likely Impact if Assumption is not Realised
The information provided has been developed from:		Additional funding required
– A sound base	Low	
– Asset register of moderate quality	Medium	
– Renewal projections based purely on age	Medium	
Population will remain static with slight increases/decreases	Medium	If population increase significantly then upgrades may be necessary. If population decrease significantly it will place significant stress on service delivery (health/education/transport)
It is assumed that there will be no major adverse natural event. While an event may occur at any time the GOT focus will be on operational resilience and Emergency Management	Medium	Natural disaster cannot be funded from existing budgets or insurance. The impact of the risk (should it occur) has increased materially. Financial risks are mitigated through an expectation for emergency support from NZ and the UN
Assets will be replaced at the end of their economic life. As part of condition assessments and revaluations, the economic lives of assets are reassessed consistent with asset valuation and estimated asset lives	Low	Asset lives are shorter or longer than expected. Inadequate replacement reserves or more than required. If assets needs replacement more quickly than forecast, capital expenditure projects may need to be brought forward. The GOT will consider funding implications of any early replacements as it occurs
That climate change impact will be similar to that predicted	High	There is uncertainty around the rate of climate change and the full impact it will have. However, it is important that the GOT has regard to possible impacts when considering investment in infrastructure which have long lives and are expensive

9.0 LIFECYCLE MANAGEMENT

This Section identifies the asset lifecycle and what is planned to manage and operate the asset while optimising lifecycle costs.

Lifecycle asset management focuses on management options and strategies from initial planning through to disposal, while considering all relevant economic and physical consequences. The effective application of asset management principles will ensure the reliable delivery of service and reduce the long-term cost of ownership and in this way reduce service costs. A well-structured lifecycle management plan will reduce the long term costs of ownership and in so doing reduce the service cost.

The Lifecycle Management Programme cover five key categories of work necessary to achieve the required outcomes. These key categories and goals are:

Table 9-1: Lifecycle Categories

Key Lifecycle		Goal
Management Plan		To maintain the service potential of the assets and ensure that the assets achieve that potential
	Management functions required to support the other Programmes	
Operation and Maintenance Plan		
	To ensure efficient operation and serviceability of the assets so that they achieve their service potential over their useful lives. This includes the day-to-day work to keep the assets operating	
Renewal Plan		
	To provide for the progressive replacement of individual assets that have reached the end of their useful lives (restores the original capacity)	
Development Plan		Meeting future demand Closing service gaps
	To improve parts of the system currently performing below target service standards and to allow development to meet future demand requirements	
Disposal Plan		Appropriate disposal of assets
	To better plan for disposal of assets through rationalisation of asset stock or when assets become uneconomic to own and operate	

9.1 Management

Management and monitoring strategies set out the activities required to support the maintenance, operations, cyclic renewal and asset development programmes. These activities include:

- Strategic planning
- Data management and evaluation
- Business processes
- Monitoring
- Financial management.

The following management activities are used to achieve the desired outcomes.

Table 9-2: Management Activities

Activity	Objective
Strategic Planning	
Strategic alignment	This AMP supports the achievement of the TNSP, AM Policy and AM Strategy
Service Levels	To develop Levels of Service aligned with strategies and plans (**IP 18**)
Human Resources	To develop the professional skills of the staff through adequate training and experiences (**IP 19**)
Data Management	
Asset Management	To develop and optimise the asset register and develop functionality in line with business needs (**IP 20**)
Data Collection	Appropriate data collection programmes (condition, performance, asset registers) closely aligned with business needs implemented in accordance with documented quality processes (**IP 21**)
Quality Assurance	To ensure the asset data are subject to defined quality assurance processes (**IP 22**)
Business processes	
AMP updates	To ensure the AMP is s strategic 'living' document through regular updating and 5 yearly reviews (**IP 23**)
Risk Management	Risk Management is an essential part of Asset Management and will be managed by the implementation of risk mitigation measures to maintain risk exposure at acceptable levels including but not limited to maintaining emergency response planning, condition monitoring of critical assets, preventative maintenance, development and implementation of operations manuals and standards (**IP14, IP15, IP16, IP17**)
Quality Assurance	To document, review and implement quality processes (**IP 22**)
Monitoring	
Monitor	To ensure agreed service levels
Review	To ensure service levels are appropriate for demand
Financial	
Budgeting	To ensure expenditure programmes are in accordance with funding and budget preparation policies and procedures
Sustainable funding	To ensure systems are managed in a financially sustainable manner over the long term

9.2 Operations and Maintenance

The objective of maintenance and operational strategies is to maintain existing assets economically to:

- Achieve their service potential through efficient operation
- Achieve customer levels of service
- Achieve health and safety standards
- Reduce the GOT's exposure to risk due to unforeseen failure of assets

The operations and maintenance expenditure for assets is a significant proportion of the total lifecycle cost. Therefore, efficiencies in these day-to-day activities must be identified and implemented to lower the overall lifecycle cost. The GOT is committed to optimising the operation, maintenance and management of these assets.

There are no documented Strategies adopted by the GOT, but GOT will consider the following Strategies where practical and appropriate:

- Assessment of Operation & Maintenance vs Replacement
- Review of service where it is in excess of the agreed Level of Service
- Demand management

- Policy development & implementation
- Quality Assurance
- Supervision
- Specifications
- Holding records

Maintenance work is defined as “All actions necessary for retaining an asset as near as practicable to its original condition, but excluding rehabilitation or renewal”. Maintenance strategies which apply to the GOT owned assets are classed as “Asset Strategies” and are divided into:

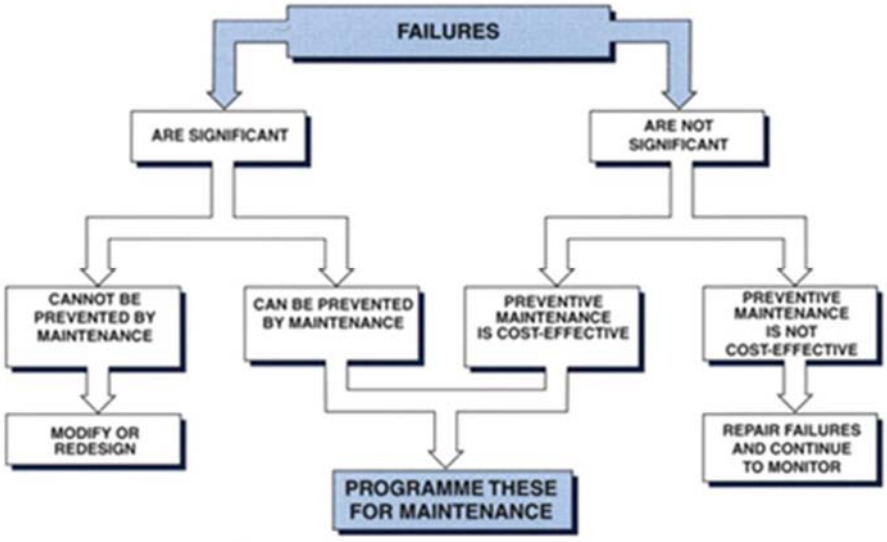
- Unplanned maintenance strategies
- Planned maintenance strategies

Unplanned Maintenance includes all reactive maintenance such as repairs and modifications usually following a reported fault or failure by the public or is obvious through an onsite observation.

Planned Maintenance includes Preventive Maintenance, Servicing and Condition Monitoring. Planned Maintenance is usually carried out at a given frequency either at fixed intervals or ‘on condition’ to preserve the required levels of service at a minimum cost. On Condition means that once an asset has degraded to a certain condition (detected through condition monitoring) a decision as to the most appropriate maintenance must be made. This does not mean once an asset has failed.

The process for the identification of whether planned maintenance strategies will be effective for an individual asset is as per the chart below (extracted from IIMM):

Figure 9-1: Maintenance Engineering Analysis Process



9.2.1 Management and Maintenance

The Taupulega (Village Council of Elders), General Fono (National Assembly) and the Council for the Ongoing Government (Executive Government) of Tokelau are the principal administration institutions of governance in Tokelau. The Taupulega provides policy direction at the village level whereas the General Fono provides all policy direction at the national level.

The public service sector implement government policies. The public service sector delivers services within the constraints of the allocated budgets.

The Tokelau Public Service refers to two levels of service:

1. Those services provided at the national level, under the coordination of the General Manager, Apia, are the Departments of -

a. Finance,
b. Health,
c. Education,
d. Economic Development,
e. Transport and Support Services,
f. Energy and the Office of the Council for Ongoing Government and

2. The services provided at the village level, under the management of the respective village General Manager (Director or Coordinator) include staff who work in the
   a. school,
   b. hospital,
   c. Information Technology support services,
   d. co-operative store,
   e. finance,
   f. FM radio,
   g. general village workers and
   h. the traditional workforce

The Taupulega on each atoll has responsibility for all the public assets on the atoll including public buildings, schools, storage facilities, transport and wharves. The operation and maintenance of these facilities are a major part of the Taupulega's responsibilities and a substantial part of its annual budget. Day to day governance, including funding, implementation of activities and supervision occurs at village level through the Taupulega. The Taupulega on each atoll oversee village budgets, coordinate health related activities (including disposal of waste) and manage the village workforce.

The Aumaga also perform other village duties under the instruction of the Taupulega.

The GOT and Taupulega will consider the following Asset and Non Asset Strategies in operating and maintaining the asset set.

Table 9-3: Operation and Maintenance Strategies

Strategy	Description
Asset Strategies	
Inspections	Regular inspection for identification of areas requiring maintenance prior to major problems developing
Maintenance	Perform maintenance tasks in accordance with Operation and Maintenance manuals (where these exist) e.g. the Solar Power Plant (**IP 9**)
Unplanned maintenance	When a defect has been identified, remedial work is programmed before the risk and consequence of failure become unacceptable
	Priority is given to defects which are a safety hazard, likely to cause premature failure or severe economic deterioration
	Remain alert and prepared for emergency situations
	Respond to and repair failures by the most economic method available, making temporary repairs if major repairs or renewals are required
Non Asset Strategies	
Approved Materials	Only approved materials shall be used (where applicable)to ensure the quality and longevity of the asset (**IP 3**)
Health and Safety Audits	Audits undertaken randomly to ensure all work completed complies with the appropriate Health and Safety legislation
Supervision	Supervision to ensure these assets are maintained appropriately

9.3 Renewal/Replacement

Renewal is defined as the group of activities which renew, restore, rehabilitate or replace an existing asset to extend its economic life or service potential and which does not increase the design capacity of the asset. Work which increases the design capacity of the asset is upgrade/development work.

There is currently no documented renewal strategy for the assets on Tokelau. In the absence of a formal documented renewal strategy criticality will drive the renewal decision making process. Criticality or the consequence of failure is a practical assessment of the economic, social, cultural and environmental drivers related to asset components.

The renewal approach will incorporate consideration of criticality in decision making and utilise asset maintenance history, condition and performance knowledge for key asset classes.

The table below details possible selection criteria for asset renewal.

Table 9-4: Selection Criteria for Asset Renewal

Priority	Renewal Criteria
1 (high)	Asset failure has occurred and renewal is the most cost effective option Asset failure of a critical system or component is imminent Does not meet level of service Does not meet legislative requirement Fault has, or is liable to become a public health risk
2	Failure of non-critical asset is imminent and renewal is the most efficient life cycle cost alternative Fault causes repeated problems and complaints
3	Maintenance is high Difficult to repair, due to fragile nature of material, or obsolescence
4	Existing assets have a low level of flexibility and efficiency compared with replacement alternative
5 (Low)	Existing asset materials or types are such that known problems will develop in time

No detailed condition assessments have been undertaken for any of the Asset Groups in Tokelau. A Renewal Plan shall be developed for each Asset Group (**IP 24**) considering the different asset components within each asset group.

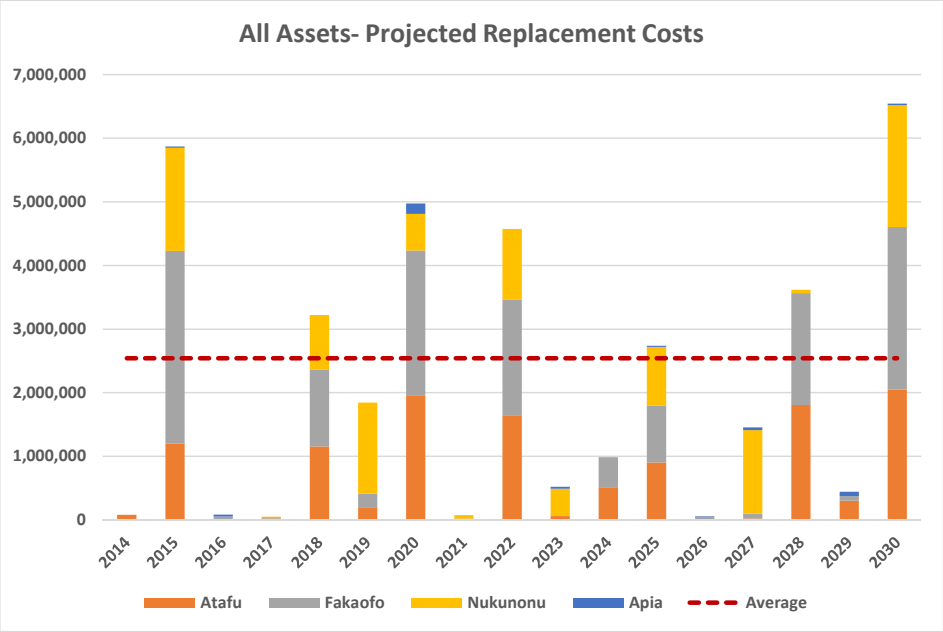
Case Study Example - Building roofs:
The majority of roofs in Tokelau are corrugated iron. Corrugated iron/steel roofs are lightweight, easy to handle, easy to install and low cost compared to other roofing materials. However, the disadvantage is that steel roofs are susceptible to rust and corrosion. In a harsh marine environment such as Tokelau the expected lives of steel roofs are significantly affected. In general unpainted steel roofs in New Zealand have an expected life of 20 years, but in Tokelau that expectation is halved to 10 years.

Under New Zealand conditions pre-painted steel is expected to last up to 35 years and aluminium up to 55 years. Rough order costings indicate that pre–painted steel roofing are approximately 12% more expensive than unpainted steel and aluminium are 63% more expensive than unpainted steel. Using these materials in Tokelau conditions may extend the life of the roofs to 17 or 25 years. The viability of changing roofing materials should be investigated (**IP 1**) and should consider full lifecycle costs e.g. removal of old roof, installation of new roof, ordering and freight of materials and maintenance (painting) where required.

9.3.1 Projected Renewal Requirements

The following graph shows the projected replacement costs based on the expected lives within the asset register. It is important to note that this is projected replacement and not planned replacement. Asset condition assessments may extend or decrease expected useful lives affecting actual planned renewal programme.

Figure 9-2: All Assets Projected Replacement Costs



The above graph shows that based on the expected useful lives within the asset register the assets will require an average of $2.5M per year over the next 15 years.

9.3.2 Planned Renewals

No formal Renewal Plan exists for the assets in Tokelau. Replacement of assets will be funded from depreciation reserves when these become available in future. The known renewals planned for each atoll is tabled below:

Table 9-5: Planned Renewals

Year	What	Costs
Atafu		
2018	Telecommunication – Technical & Internet Equipment	$750,000
2020	Energy – Solar Batteries	$1,400,000
2025	Replace Admin/Teletok/Police Building	$430,000
2024	Energy –Inverters	$400,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$750,000
Fakaofo		
2015	Church Replacement (project started 2014)	$563,000
	Hospital	$1,000,000
2018	Telecommunication – Technical & Internet Equipment	$850,000
2020	Energy – Solar Batteries	$1,400,000
2024	Energy –Inverters	$470,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$850,000
Nukunonu		
2015	School	$1,000,000
2018	Telecommunication – Technical & Internet Equipment	$800,000

Year	What	Costs
2019	Replace Bridge	$210,000
2020	Energy – Solar Batteries	$1,400,000
2024	Energy –Inverters	$400,000
2025	Replace/Renew Church	$395,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$850,000

9.4 Asset Development

Asset creation means the provision of or improvement to an asset where the outlay can reasonably be expected to provide benefits beyond the year of outlay. The main reason for creating an asset is to satisfy or improve the level of service, provide for new demand or to provide a commercial return.

Recently created assets include but are not limited to:

- School - Atafu
- School - Fakaofo
- Hospital - Nukunonu
- Solar Power Plants – Atafu, Fakaofo and Nukunonu
- Barges
- Apia Ferry (under construction at the time of writing this Plan)

Planned asset development includes:

- School - Nukunonu
- Hospital – Fakaofo
- Church replacement – Fakaofo
- Potential air service (refer to Scenario - Air Service)
- Potential telecommunications upgrade (refer to Scenario – Telecommunication)

9.5 Asset Disposal

No formal documented records exist of asset disposals. Asset disposals will be recorded within the Asset Register.

When considering disposal options all relevant costs of disposal will be considered, including:

- Evaluation of options
- Consultation/advertising
- Professional service, including engineering, planning and legal survey
- Demolition/making safe
- Site clearing, decontamination, and beautification

It is important to consider the options available for the future disposal of TREP batteries in 2019/20 (**IP 31**).

9.6 Lifecycle Funding

Lifecycle funding recognises and plan using the full life cycle costs of infrastructure assets (capital costs, operating and maintenance, rehabilitation, disposal, etc.) right from the start i.e. prior to acquisition of the asset.

It is critical that equity of funding for renewals between current and future (intergenerational) users occurs. It is important to consider the lifecycle costs at asset creation to allow for:

- informed decision-making
- no future surprises

This will ensure that one generation does not have the benefit of an asset and service while the next generation cannot afford to maintain it.

10.0 ASSET MANAGEMENT PROCESS AND PRACTICES

This Section covers the available asset information, information systems used and processes used to manage the asset.

10.1 Background

Infrastructure asset management is the way we manage the infrastructure we own. To date there has been no formal documented asset management in Tokelau. However, Tokelau have practiced asset management to some degree, although it has not been documented. The GOT and the Taupulega practiced asset management by fixing a leak in the roof of a building to prevent more costly damage in future. The GOT and Taupulega practiced asset management by doing regular proactive maintenance to prolong the life of a vehicle or an outboard motor. These were done to ensure that they maintain what they own in the most cost-effective way to a standard that they felt is acceptable.

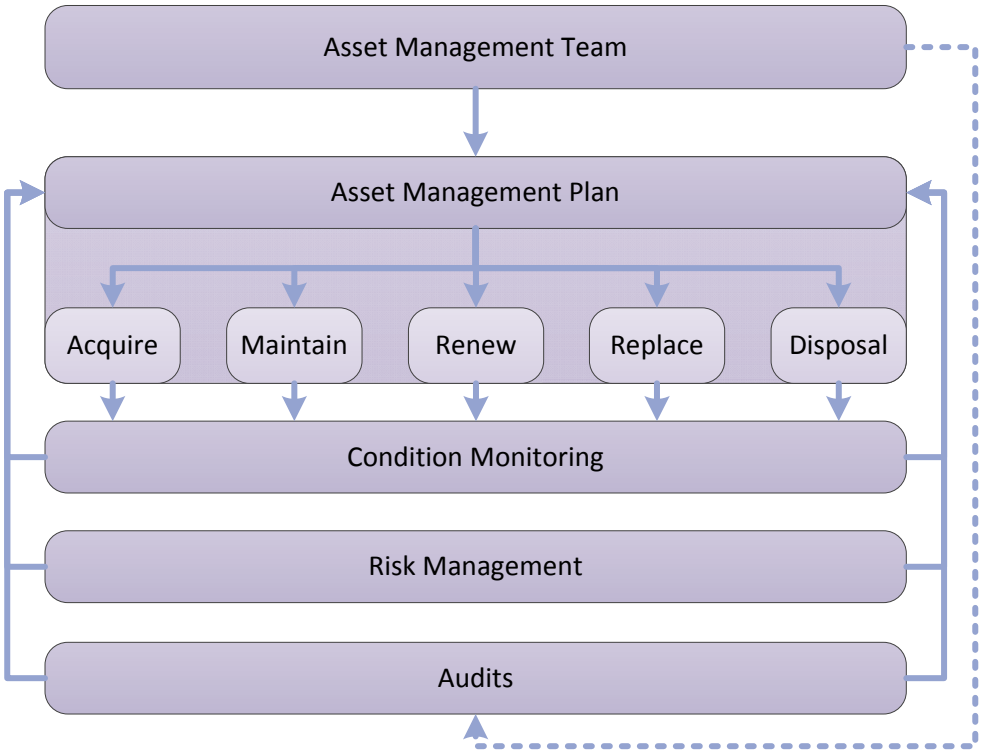
10.1.1 Asset Management

It is important to note that:

- Asset management is **NOT** a computer system
- Asset management is **NOT** a management system

Asset management should not be confused with the tools that enable asset management. Asset management is a set of procedures to manage assets through their lifecycle. To be effective these procedures must be implemented through an asset management programme. The essential elements of an asset management programme is diagrammatically represented below:

Figure 10-1: Asset Management Programme



The Asset Management Team – is responsible for management of the asset management process and ensure implementation of the asset management principles. The AM team involve all users of assets and asset information, gathers data, define objectives, prepare the AMP and manage audits.

The Asset Management Plan – is a 'living' document that defines the goals, objectives, and strategies, the activities required by the assets (acquisition, maintenance, renewal, replacements, and disposal). The AMP also documents the costs associated with the activities required by the asset.

The Condition Monitoring – is the ongoing process of assessing asset condition and what actions and frequencies are required to maintain the asset and update the AMP. Therefore, condition monitoring supports optimising asset management activities to minimise costs.

Audits – the asset management process requires periodic audits of all elements to ensure:

- Required levels of service are met
- Asset management procedures are implemented and performed as planned
- Asset related costs are tracked and reduced where possible
- Asset Management Plan is reviewed and updated

The Asset Management Programme shall become entrenched within the GOT, Taupulega and Public Service (**IP 25**).

10.2 Data Management

This AMP and the Asset Register is the outcome of the Tokelau Asset Management Project. This sets the platform for future improvements and refinements of the AMP and Asset Register.

The Asset Register is an Excel spreadsheet and contains the available information of each asset i.e.

- Asset number
- Asset type
- Asset description
- Asset location
- Asset cost
- Installation/acquired date
- Expected life
- Remaining useful life
- Assessed condition
- Asset Owner
- Asset Manager
- Comments

The asset number consist of the following parts to identify the asset.

Atoll	Asset Type	Number
A	LB	01
A = Atafu F = Fakaofo N = Nukunonu S = Apia, Samoa	LB = Land & Building PM = Plant & Equipment MV = Motor Vehicle	

The Land and Building assets contains further detail to show building components i.e.

- Roof
- Foundation
- Structural

- Walls
- Windows
- Doors
- Water Storage

This provides the ability to assign expected lives to components and calculate expected replacement for these building components.

The Asset Register provide the Public Service staff with the ability to obtain, store, analyse and report on the significant quantities of data that is associated with the infrastructure assets.

It is acknowledged that at this stage data is basic and to some extent assumed, but over time the data will be validated and become more complex as asset management principles become entrenched within the management of the Tokelau assets.

10.3 Data Confidence and Accuracy

The confidence in data for the assets is detailed in the table below:

Asset	Component	Confidence
Buildings	Attributes	2
	Condition	2
	Performance	2
Transport	Attributes	2
	Condition	2
	Performance	2
Channel	Attributes	3
	Condition	3
	Performance	3
Wharf	Attributes	3
	Condition	3
	Performance	3
Seawalls	Attributes	3
	Condition	3
	Performance	3
Solid waste	Attributes	2
	Condition	2
	Performance	2
Telecommunication	Attributes	2
	Condition	2
	Performance	2
Energy	Attributes	2
	Condition	2
	Performance	2
Plant & Equipment	Attributes	2
	Condition	3
	Performance	3

Where the confidence grade relates to the following definitions.

Score	Description	Definition
1	Accurate	100%
2	Minor inaccuracies	± 5%
3	50% estimated	± 20%
4	Significant data estimated	± 30%
5	All data estimated	± 40%

The above is confidence scores are from the New Zealand Infrastructure Grading Guidelines 1999.

10.4 AMP Preparation

The GOT engaged Waugh Infrastructure Management Ltd (WIML) to develop the Asset Management Policy, Asset Management Strategy, Asset Management Plan and Asset Register.

The project started with a meeting held in Auckland, New Zealand, between the three Pulenuku, the Director of Transport and Support Services, NZ Ministry for Foreign Affairs and Trade (MFAT) and WIML staff.

This was followed with a site visit to each of the atolls of Tokelau between 15 and 24 March 2014. A visual assessment (condition, location, purpose, size, etc.) was made of each of the infrastructural assets and recorded while interviewing key staff members from the Tokelau Public Service to obtain any historical information (installation/acquire date, history, purpose, maintenance, etc.).

Project limitations encountered include time constraints and at times limited institutional knowledge of infrastructural assets.

10.4.1 Asset Register Assumptions

The following assumptions were made in developing the Asset Register.

Table 10-1: Asset Expected Lives

Asset	Expected Life (Years)
Land & Buildings	
Concrete buildings	70
Corrugated Iron Roof	10
Colorsteel	25
Weatherboard	50
Tiles	20
Internal timber	50
Ply wood	10
PE Water tanks	25
Sealed timber frame	50
Timber windows	50
Aluminium doors/windows	50
Plasterboard (GIB)	20
Power cables	70

Asset	Expected Life (Years)
Plant & Equipment	
Apia Ferry	25
Boats	30
Solar panels	25
Generator	20
Satellite dish	20
Outboard motors	15
Trucks/Vehicles	15
Compressor/Wood chipper	15
TREP Inverters	12
Barge	10
Excavator/Crane/Fork lift	10
Tractor/Trailer	10
Desalination plant	10
TREP Batteries	8
Concrete mixer	5

The Tokelau Evacuation Sites Assessment Report (November 2013) highlighted that salt water was used in some cases for mixing concrete. This will affect the expected lives of these concrete structures. The expected useful lives of concrete structures usually range from 75 to 100 years. However, in view of the above the expected useful lives for all concrete structures are adjusted to 70 years.

Despite minor issues observed with new buildings they are still rated as condition 1.

Based on historical figures provided by the GOT public service staff the following replacement costs were used.

Table 10-2: Historical Building Costs

Asset	Costs	Size (m^2)	Rate ($/m^2$)
Nukunonu Hospital	$675,000	458	1,474
Schools	$2,025,000	(910 + 1,130)	993

Using the above as base replacement costs the following replacement costs were derived:

Table 10-3: Derived Replacement Costs

Asset	Rate
Wharf	$2,000- $2,500 /$m^2$
Hospital	$1,500/$m^2$
Seawalls	$1,400/m
Church	$1,250/$m^2$
Administration buildings	$1,000/$m^2$
Concrete houses	$1,000/$m^2$
Weatherboard houses	$500 - $750/$m^2$
Fale/Steel frame stores	$400/$m^2$
Roads	$120/m
Basic timber frame lean to	$100/$m^2$
Fencing	$75/m

Plant and equipment costs were based on the cost of the item in New Zealand with an additional 30% on cost for transport to Tokelau.

As future projects are built and assets purchased or replaced good financial record keeping will allow these derived replacement costs to become more accurate.

10.5 Quality Assurance

To establish and ensure the ongoing improvement of the quality of this Plan a series of audits (**IP 22**) shall be considered and includes

- Financial audits
    - Independent financial audits of significant activities
- Systems audits
    - System audits are continuous and ongoing in operational practices. However, systems shall be discussed and reviewed every 5 years to ensure continual improvement
- Technical audits
    - To ensure quality in terms of completeness, objectivity, logical, technical content and presentation, while identifying strengths and weaknesses. Shall recommend specific areas of improvement
- Performance audits
    - Will establish whether the stated objectives for the operation of the asset have been achieved. Measurement of the success of the operation of the asset will be assessed using the results of key service criteria compliance and customer satisfaction

11.0 PLAN IMPLEMENTATION & IMPROVEMENT PLAN

An important component of this Activity Management Plan is the recognition that it is a "live" document in need of monitoring, change and improvement over time. This Section details the improvements that will lead to improved management and increased confidence.

11.1 Asset Management Development

This Asset Management Plan was developed by Waugh Infrastructure Management Ltd with assistance from the Government of Tokelau Public Service staff and NZ Ministry for Foreign Affairs and Trade staff. The objective of the GOT Asset Management Policy: is to ensure that the GOT service delivery is optimised to deliver agreed community outcomes and levels of service, manage related risks, and optimise expenditure over the entire life cycle of the service delivery, using appropriate assets as required.

The Asset Management Policy requires that the management of assets be in a systematic process to guide planning, acquisition, operation and maintenance, renewal and disposal of the required assets. Delivery of service is required to be sustainable in the long term and deliver on Council's economic, environmental, social, and cultural objectives.

The Tokelau Asset Management Policy sets the appropriate level of asset management practice for Tokelau as '**Core**' asset management practice.

> **Definition**: '**Core**' asset management practice is basic technical asset management planning undertaken at a level designed to meet minimum legislative and organisational requirements for financial planning and reporting. 'Core' practice provides technical management outputs for current levels of service, demand management, asset lifecycles, asset forward replacement programmes, new capital expenditure and associated cash flow projections.

11.2 Plan Improvements

The Asset Management Improvement Plan will be focussed on the following key areas:

- Optimising the asset register
- Development of Standards
- Consolidation and standardising plant & materials
- Develop contingency plans
- Implementing waste, risk action plans

11.2.1 Improvement Plan

The improvement items identified throughout the AMP document is tabled below.

Table 11-1: Improvement Plan

IP#	Project Description	Section	Responsibility	Timeframe
IP 1	Viability of other roofing materials	3.3		
IP 2	Logistics champion	3.3.4		
IP 3	Standardisation of materials	3.3.4		
IP 4	Storage facilities – clean & organise	3.3.4		
IP 5	Enforce Standards	3.3.5		
IP 6	Fire fighting	3.3.6		
IP 7	Solid Waste Action Plan	3.3.10		
IP 8	Options for a robust telecommunication system	3.5		
IP 9	Maintain Solar Plant	3.6		

IP#	Project Description	Section	Responsibility	Timeframe
IP 10	Standardise generators	3.6		
IP 11	Resolve maintenance issues	3.7		
IP 12	Improve & create more storage facilities for plant & equipment	3.3.4		
IP 13	Develop/adopt Standards & Codes of Practice	5.3		
IP 14	Implement Cyclone Risk Reduction themes	8.4.1		
IP 15	Regular testing of desalination plant	8.4.1		
IP 16	Develop contingency plans	8.5		
IP 17	Implement recommendations from Tokelau Evacuation Sites Assessment	8.5		
IP 18	Develop Levels of Service for all asset groups	9.1		
IP 19	Continue staff skills development	9.1		
IP 20	Optimise asset register	9.1		
IP 21	Develop and implement an appropriate data collection programme	9.1		
IP 22	Quality assurance	9.1		
IP 23	AMP updates	9.1		
IP 24	Develop and implement a Renewal Plan	9.3		
IP 25	Entrench AM Programme (AM team etc.)	10.1.1		
IP 26	Health & Safety – Upgrade channels & wharves	3.3.8		
IP 27	Health & Safety – Procure a tracked crane	3.4.2		
IP 28	Nukunonu Bridge – Condition assessment & renewal	3.4.4		
IP 29	Investigate and consider bio-engineering	3.3.9		
IP 30	Improve bulk fuel storage	8.5.1		
IP 31	Investigate disposal options for TREP batteries	9.5		
IP 32	Implement recommendations of 2010 Integrated Waste Management, Water and Sanitation Review	A1.5, A2.5, A3.5		
IP 33	Undertake a community options and feasibility report for appropriate sewerage management systems	A1.5, A2.5, A3.5		

11.3 AMP Review and Monitoring

This AMP will continue to be developed over time to incorporate further advanced asset management techniques, make use of improved data collection and management systems, respond to legislative and policy changes, and address evolving issues. It is anticipated that the sustainability themes introduced in this Plan will be further tested and developed with ongoing focus on legislative compliance, planning for climate change, environmental management, and improving efficiency.

This Plan will be reviewed periodically as circumstances change, and will be comprehensively reviewed at intervals of not less than five years.

It is important that Asset Management principles be entrenched within the daily operation of the GOT, the Taupulega and Public Service staff (**IP 25**).

12.0 FINANCIAL

This Section documents the financial requirements to manage and operate the assets.

12.1 Funding

Tokelau is a territory of New Zealand and this relationship has strengthened over the years with the gradual transfer of governance to Tokelau. As a result Tokelau is able to informally govern itself while being part of New Zealand.

Tokelau is substantially dependent on New Zealand for financial assistance and the Government of Tokelau receives most of its budgetary support from New Zealand under the Economic Support Arrangement (ESA). The national revenue is raised primarily through the issue of fishing licenses in Tokelau's Exclusive Economic Zone.

Day to day governance, including funding, implementation of activities and supervision occurs at village level through the Taupulega. The Taupulega on each atoll oversee village budgets, coordinate health related activities and manage the village workforce.

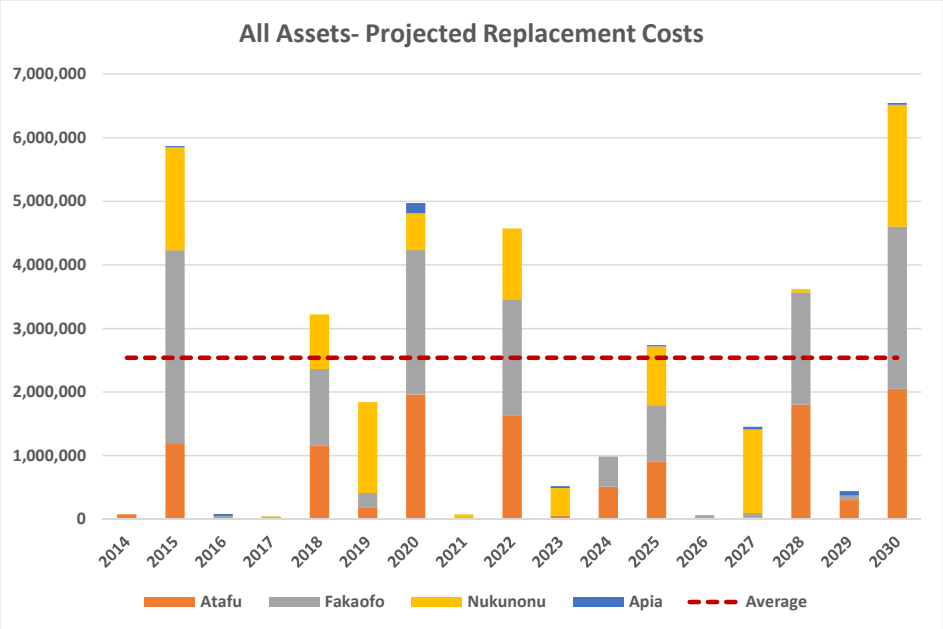
12.2 Financial Forecasting – Renewals, O&M, Risk, Capital, Total AM Requirement

The following Sections details the Projected Renewals, Operation and Maintenance costs, Risk Reserve, Capital and Total Asset Management Requirement. These graphs/projections have been developed on spreadsheets, which have been delivered as part of this Plan.

12.2.1 Projected Renewals

No formal Renewal Plan exists for the assets in Tokelau. As a result the following graph shows the projected replacement costs based on the expected lives within the asset register. It is important to note that this is projected replacement and not planned replacement. This means that these are theoretical replacements required, based purely on the expected useful lives of the assets within the asset register. Asset condition assessments may extend or decrease expected useful lives affecting actual planned renewal programme.

Figure 12-1: All Assets – Projected Replacement Costs

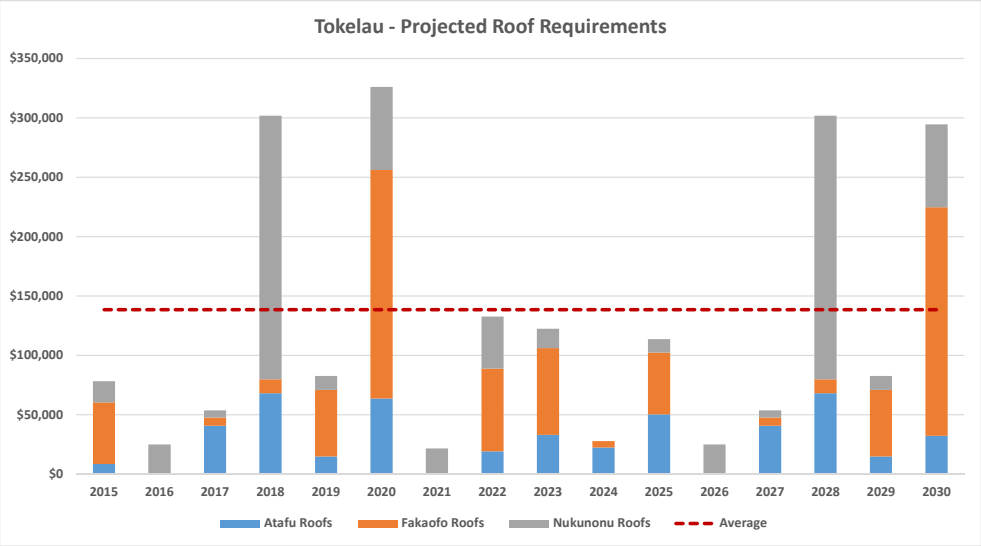


The above graph shows that based on the expected useful lives within the asset register the assets will require an average of $2.5M per year over the next 15 years.

Building Roofs
The majority of roofs in Tokelau are corrugated iron and staff interviews suggest that the expected lives of the corrugated iron/steel roofs are severely affected by the harsh marine environment. In general, unpainted steel roofs in New Zealand have an expected life of 20 years, but in Tokelau that expectation is halved to 10 years.

Taking the estimated size of each corrugated iron roof and estimated installation date and using an estimated replacement cost of $55/m^2 a projected roof renewal requirement was developed. This requires a total of $2.1M for roof renewals over the next 15 years with an average of $140,000 per year. This should be funded out of the building depreciation component.

Figure 12-2: Projected Roof Requirements

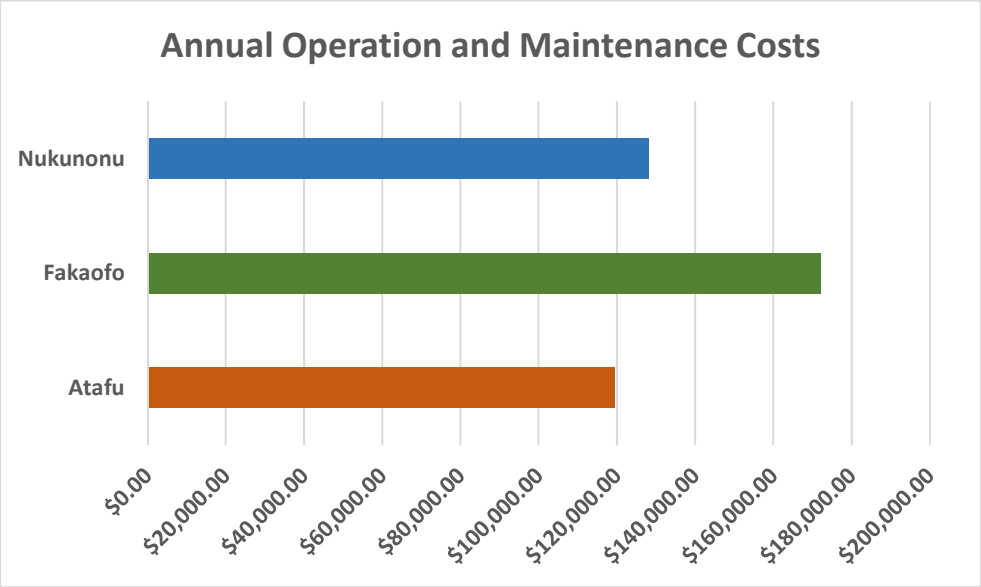


The viability of changing roofing materials from corrugated iron to pre-painted steel or aluminium should be investigated (**IP 1**).

12.2.2 Operation and Maintenance

The Taupulega on each atoll has responsibility for all the public assets on the atoll including public buildings, schools, storage facilities, transport and wharves. The operation and maintenance of these facilities are a major part of the Taupulega's responsibilities and a substantial part of its annual budget. Operation and Maintenance costs is estimated at $420,000 per year.

Figure 12-3: Annual Operation and Maintenance Costs



12.2.3 Risk Reserve

Cyclones pose the highest risk to Tokelau as it is the most common natural event affecting the atolls. Over the last century there have been approximately 10 cyclones that have caused significant damage to one or more of the atolls. The risk of tsunami causing damage is small, but not negligible. In view of this it is important to ensure that Tokelau planned for the risks and made provision to fund repairs and replacement of damaged assets following a natural event. The annual 'natural event – risk reserve' component is estimated to be approximately $726,000. This can be further developed using actuarial analysis similar to the New Zealand EQC Fund.

The natural event (cyclone) annual risk reserve has been calculated by taking 10% of the assessed total asset value ($77.1M x 10% = $7.71M) and then dividing that by the expected 10 year frequency of major cyclones ($7.71M/10 = $771,000 per year).

This AMP does not attempt to anticipate possible cyclone damage and adjust probable renewal figures to include allowance for cyclone repairs. Accepted asset management practice following a large natural event is to reassess asset condition and replacement, and then adjust forward renewal requirements and estimates following that assessment.

12.2.4 Capital Projects

The following table lists the Capital projects identified for each atoll of Tokelau over the following 15 years.

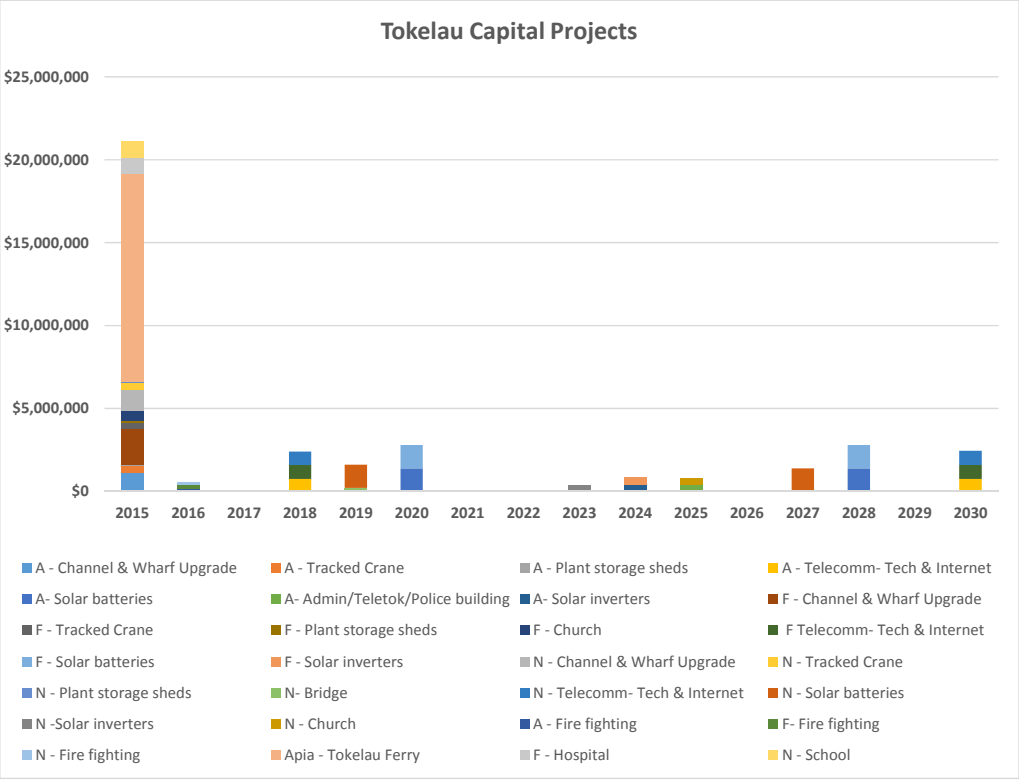
Table 12-1: Capital Projects

Year	What	Costs
Atafu		
2015	Channel & Wharf upgrade	$1,115,000
	Tracked crane	$400,000
	Shed storage for plant & bulk fuel	$120,000
2016	Fire fighting	$150,000
	Medical equipment	$150,000
2018	Telecommunication – Technical & Internet Equipment	$750,000
2020	Energy – Solar Batteries	$1,400,000
2025	Replace Admin/Teletok/Police Building	$430,000

Year	What	Costs
2024	Energy –Inverters	$400,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$750,000
Fakaofo		
2015	Channel & Wharf upgrade	$2,137,000
	Tracked crane	$400,000
	Shed storage for plant & bulk fuel	$120,000
	Church Replacement	$563,000
	Hospital	$1,000,000
2016	Fire fighting	$250,000
2018	Telecommunication – Technical & Internet Equipment	$850,000
2020	Energy – Solar Batteries	$1,400,000
2024	Energy –Inverters	$470,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$850,000
Nukunonu		
2015	Channel & Wharf upgrade	$1,262,000
	Tracked crane	$400,000
	Shed storage for plant & bulk fuel	$120,000
	School	$1,000,000
2016	Fire fighting	$150,000
2018	Telecommunication – Technical & Internet Equipment	$800,000
2019	Replace Bridge	$210,000
2020	Energy – Solar Batteries	$1,400,000
2024	Energy –Inverters	$400,000
2025	Replace/Renew Church	$395,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$850,000
Apia		
2015	500GT SOLAS vessel	$12,500,000

The above is graphically represented below.

Figure 12-4: Capital Projects



12.3 Asset Valuations

No formal documented asset valuation has been performed. This Asset Management Project developed the Asset Register and this Asset Management Plan.

The newly created Asset Register and associated values are based on the best information available – in many cases this was minimal, resulting in "global best guess" estimates being made. It is envisaged that over time much more accurate, detailed and reliable information on assets will be collected, meaning that regular and more reliable asset values can be developed and incorporated into the Asset Register providing the basis for a more robust Asset Valuation.

12.3.1 Asset Lives and Assumptions

The base life of an asset is set during the valuation process in order to identify what is believed to be the average length of time that the asset will be capable of providing the required level of service. The setting of the base life is the factor in the valuation process that directly affects the annual depreciation requirement for the asset.

The expected base lives are reviewed as part of each valuation to align the expected lives, and the method of setting these with the renewal decision making practice. The asset lives and assumptions are detailed in Section 10.4.1 Asset Register Assumptions.

12.4 Depreciation

The introduction of accrual accounting during the early 1990's changed the way in which authorities in New Zealand accounted for their assets, particularly long life assets. This meant that instead of cash based accounting where the replacement/renewal cost of an asset is recognised only when it wears out, authorities were required to spread the cost, and any reduction in value of these assets over its useful life.

Generally Accepted Accounting Practice (GAAP) includes a definition of "operating expenses " *As depreciation is defined as an operational expense it must be included with other operational costs, including interest, when a council sets its operating revenue*.

GAAP defines depreciation as follows:
Depreciation is the systematic allocation of the depreciable amount of an asset over its useful life.
Therefore, deprecation measures the annual consumption of an asset so that the reduction in its value is accounted for as it is consumed. The purpose of depreciation is not to provide for the replacement of the asset, although this is a consequence of depreciation. For example, if an asset will last for 10 years, the annual depreciation charge is 1/10th of the value of the asset.

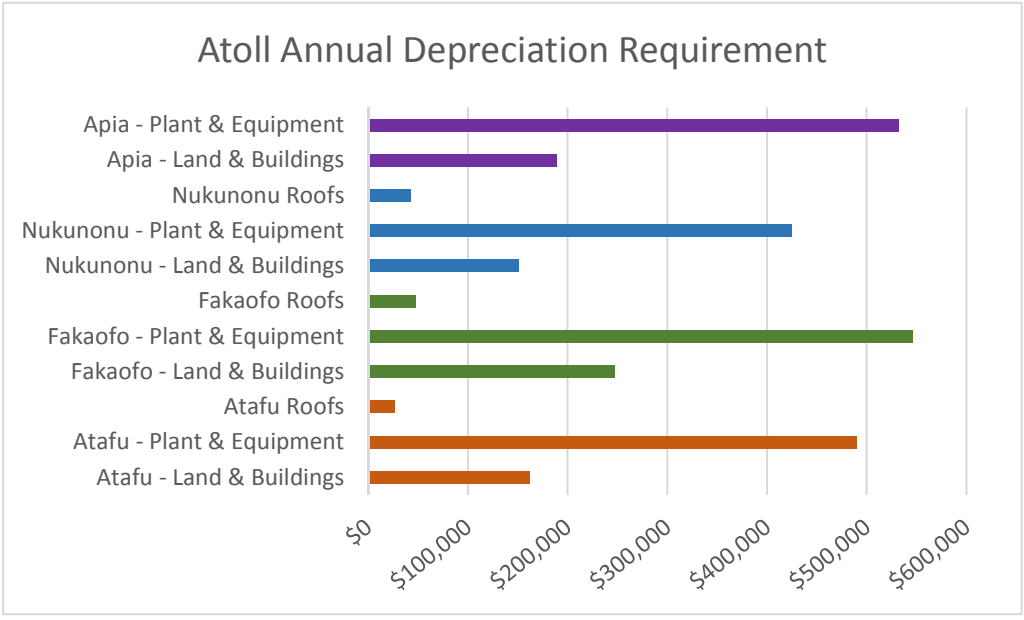
The basic value of an asset reduces in accordance with the wearing out or consumption of benefits over the assets life arising from use, the passage of time, or obsolescence. This reduced value is called the depreciated value. It is accounted for by the allocation of the cost (or revalue amount) of the asset less its residual value over its useful life.

The decline in service potential is thus provided on a straight line basis on all fixed assets. The GOT should consider implementation of accrual accounting (depreciation) where the costs is spread over the life of the asset.

Table 12-2: Annual Depreciation Requirement

Atoll	Asset Group	Annual Depreciation Requirement
Atafu	Land & Buildings	$162,286
	Plant & Equipment	$489,674
	Roofs	$26,912
Fakaofo	Land & Buildings	$246,969
	Plant & Equipment	$546,155
	Roofs	$47,342
Nukunonu	Land & Buildings	$150,742
	Plant & Equipment	$424,916
	Roofs	$42,909
Apia	Land & Buildings	$188,541
	Plant & Equipment	$531,437
Total Annual Depreciation		**$2,857,883**

The total annual depreciation requirement for the assets of Tokelau is graphically represented below:



It should be noted that as there has been limited accrual accounting ($1,350,000 in the Infrastructural Replacement Fund) to date and with most of the assets partway through their expected lives there is a portion of depreciation in arrears e.g. an asset has an estimated value of $100 with a 10 year life. Therefore the annual depreciation component is $10 each year over 10 years. But the asset is already 3 years old and no depreciation has been collected. As a result there is a depreciation arrears of $30 (3 year x $10) which needs to be collected prior to the asset reaching the end of its expected life. The depreciation arrears for each of the atolls are tabled below:

Atoll	Depreciation Arrears
Atafu	$5,710,260
Fakaofo	$9,337,450
Nukunonu	$6,627,591
Apia	$2,813,505
Infrastructural Replacement Fund	Minus $1,350,000
Total Depreciation Arrears	**$23,138,806**

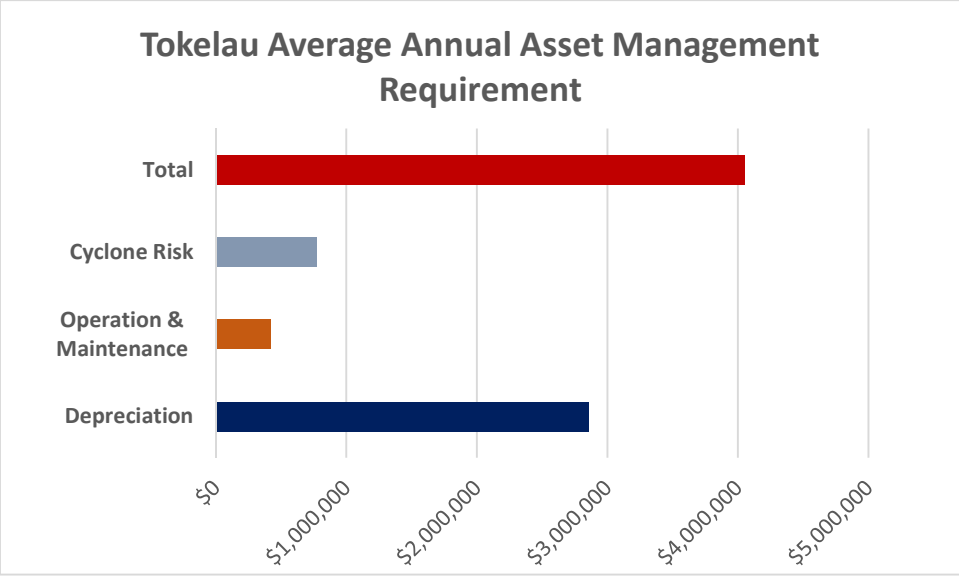
12.4.1 Total Average Annual Asset Management Requirement

The Tokelau Average Annual Asset Management Requirement total $4.05M and consists of:

Table 12-3: Tokelau Average Annual Asset Management Requirement

Asset Management Component	Costs
Natural Events – Risk Reserve	$771,000
Operation and Maintenance	$420,000
Depreciation	$2,857,000
TOTAL	**$4,048,000**

Figure 12-5: Tokelau Average Annual Asset Management Requirement



12.5 Scenarios

Potential projects such as the development of an airport/s is discussed in the Appendix Scenarios.

APPENDICES

A INDIVIDUAL ATOLL DESCRIPTION AND OVERVIEW (ASSETS)

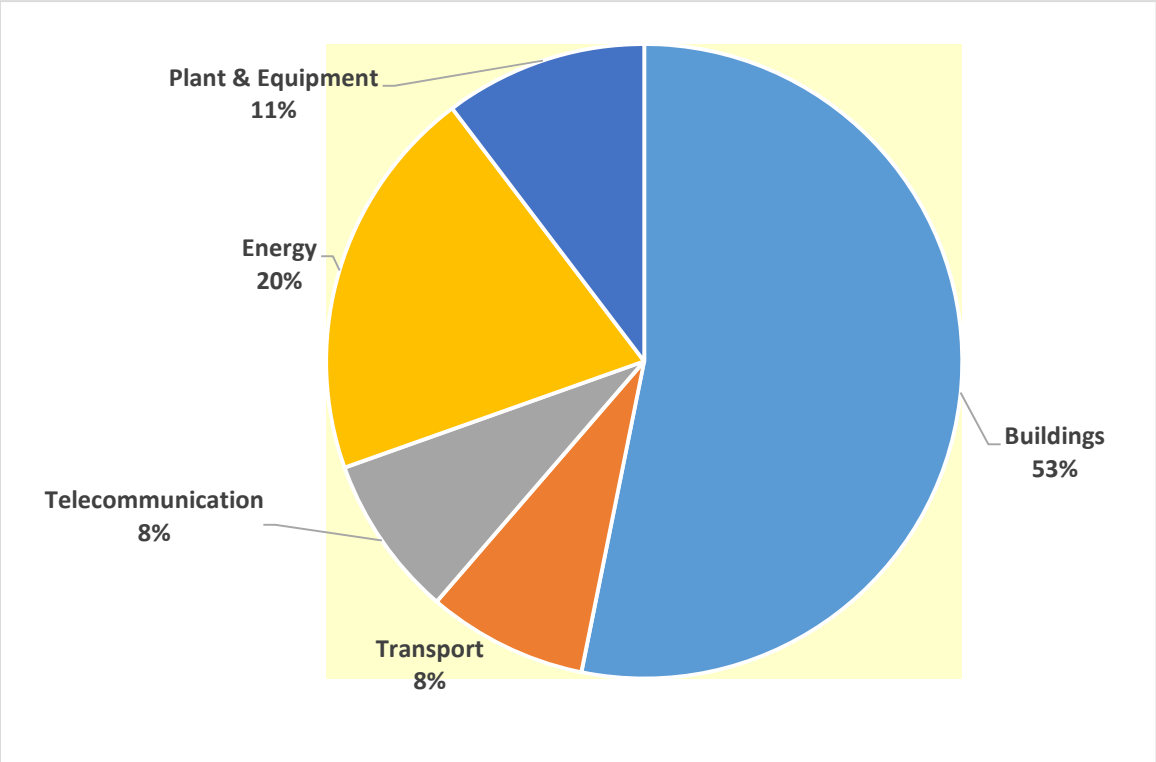
A1 Atoll – Atafu

A1.1 Overview

Description			Quantity/Detail	Replacement Value (NZ$)
Population served			458	
Assets	**Buildings**	Health	Hospital & Doctor's residence	$588,000
		Education	Pre-Primary, School, USP, Toilets	$1,574,750
		Public & Administration	Church, Meeting house & Admin	$1,677,850
		Storage facilities	Bulk Stores, Freezer, Kileva buildings	$482,850
		Guest houses		$45,000
		Channels	1	$300,000
		Wharves	1 x Main wharf	$1,115,000
		Seawalls	1.2 kilometre	$1,280,000
		Solid waste	1 Landfill	$10,800
			Solid waste area	-
		Other	Cemetery wall	50,700
	Transport	Charter boats	Charter boat (share between Tokelau atolls)	-
		Ship to Shore	3 Barges	$306,000
		Boats	3	$336,000
		Roads & Streetlights	3 kilometres & 45	$450,000
	Telecom	Building	1 x Communications building	$15,000
		Equipment	Satellite dishes & solar panels, etc.	$280,000
			Technical & Internet	$750,000
		Cable	1.2 kilometre	$60,000
	Energy	Building	2	$262,500
		Solar Panels	1,296	$350,000
		Batteries	432	$1,400,000
		Inverters	63	$400,000
		Generators	4	$213,000
		Power cable	1.4 kilometre	$70,000
		Fuel	Storage area	$1,800
	Plant & Equipment		28	$1,382,500
	Grand Total			**$13,401,750**

Note: Water and sewerage systems are included in building data

A graphical representation of the Atafu asset value distribution is shown below:



This shows that the assets with the greatest value is Buildings and Energy totalling 73% of the total asset value. However, this does not indicate the criticality of the asset as Telecommunication is a critical asset but only a small percentage of the total asset value.

A1.2 Key Issues

Issue	Description	Mitigation
Health & Safety	Channel	Planned upgrades of the channel and wharf
	Wharf	
	Cargo handling	Planned procurement of new tracked crane
	Fire fighting	Investigate options and procure firefighting equipment
	Hospital	Improve basic medical equipment
Materials	Roofs	Investigate different roof materials and viability
Storage	Facilities & materials	A logistics champion
Solid waste	Improvements	Implement the Solid waste Action Plan
Solar Plant	Batteries, Inverters, Panels	Maintain as per operation and maintenance manuals
Plant & Equipment	Maintenance	Resolve maintenance issues
	Storage	Provide more storage facilities

A1.3 Buildings

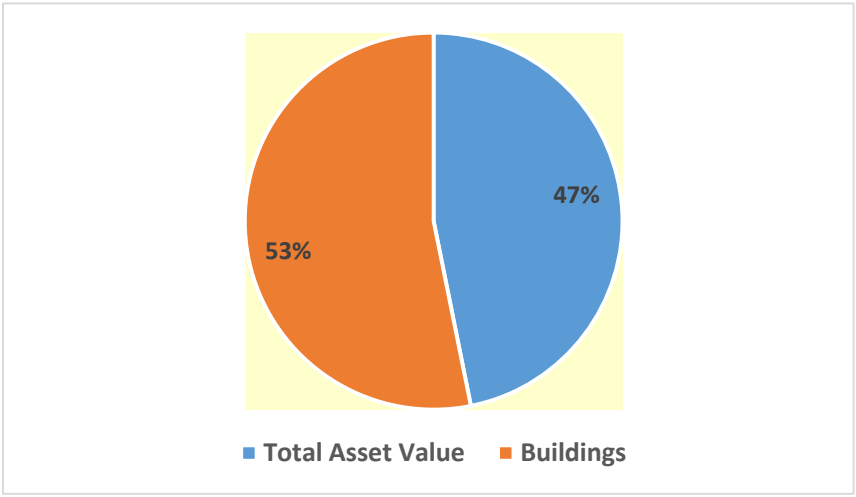
The buildings can be grouped into:

- Health
- Education
- Public & Administration
- Storage facilities

- Guest houses
- Channel
- Wharves
- Seawalls
- Solid waste

There are other buildings e.g. generator building, battery building, but these are grouped under Energy or Telecommunications.

As shown below the Buildings make up 53% of the Total Atafu Asset Value.



The majority of roofs in Tokelau are corrugated iron. Corrugated iron/steel roofs are lightweight, easy to handle, easy to install and low cost compared to other roofing materials. However, the disadvantage is that steel roofs are susceptible to rust and corrosion. In a harsh marine environment such as Tokelau the expected lives of steel roofs are significantly affected. In general unpainted steel roofs in New Zealand have an expected life of 20 years, but in Tokelau that expectation is halved to 10 years.

Under New Zealand conditions pre-painted steel is expected to last up to 35 years and aluminium up to 55 years. Rough order costings indicate that pre–painted steel roofing are approximately 12% more expensive than unpainted steel and aluminium are 63% more expensive than unpainted steel. Using these materials in Tokelau conditions may extend the life of the roofs to 17 or 25 years. The viability of changing roofing materials should be investigated (**IP 1**).

A1.3.1 Health Buildings

The Health Buildings consist of the Hospital Buildings (Lomaloma Hospital) and the doctor's residence. The Hospital Buildings consist of four separate concrete structures joined by a concrete walkway/veranda. This concrete walkway contains underground water storage. The four structures each has its own purpose:

1. Male ward
2. Female ward
3. Doctor's office, surgery, administration office
4. Dentistry, administration, toilets & storage

The hospital buildings also has two large concrete water tanks (one above and one underground) and four free standing polyethylene water tanks.

The doctors residence is located next to the hospital and consists of a timber framed weatherboard structure (upper level) atop a concrete structure (lower level). The lower level provides a storage area and a concrete water tank with the upper level the actual residence.

A1.1.3.1 Condition

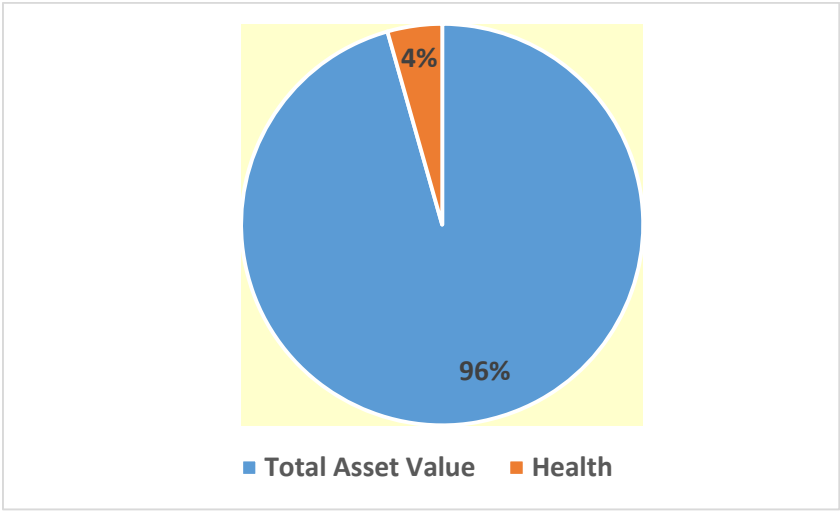
The condition of the Lomaloma Hospital building are deemed to be condition grade 3 fair with some larger maintenance work needed. There are signs of significant maintenance required e.g. the stairs to the doctor's residence shows significant spalling and exposed reinforcing showing significant corrosion and rust while the hospital shows parts of the corrugated iron roof have been replaced, but other parts requiring replacement in the near future.

A1.2.3.1 Lifecycle

It is evident that the hospital and doctor's residence have been maintained since its construction in the mid 1970's. However, if maintenance is neglected and specific issues not addressed the structures may require a higher level of maintenance and may result if potential failure. Specific maintenance issues include replacement of parts of the roof at the hospital (wards). Spouting needs replacement, some painting and replacement of timber columns at the hospital veranda/walkways. The spalling at the doctor's residence needs urgent attention and there are other items that require attention e.g. interior painting and general electrical maintenance.

During the site visit it was noted that there was a general lack of beds and proper screens to conduct medical examination in privacy within the wards. Refer to Section 3.3.1.

As shown below the Health Buildings make up 4% of the Total Atafu Asset Value.



A1.3.2 Education Buildings

The Education Buildings consist of:

1. Pre-Primary building (Sir David Beattie)
2. Old School Building
3. New School Building
4. USP Building
5. School Toilets

The buildings are a mix of concrete, timber framed weatherboard/fibre cement board with corrugated iron roofs. Apart from the new school buildings and toilets which were constructed in 2013, all of the buildings are estimated to have a construction date of early to mid-1980's. Water storage is a mix of concrete tanks forming part of the foundation and free standing polyethylene tanks. Roof water is collected in the tanks.

A1.1.3.2 Condition

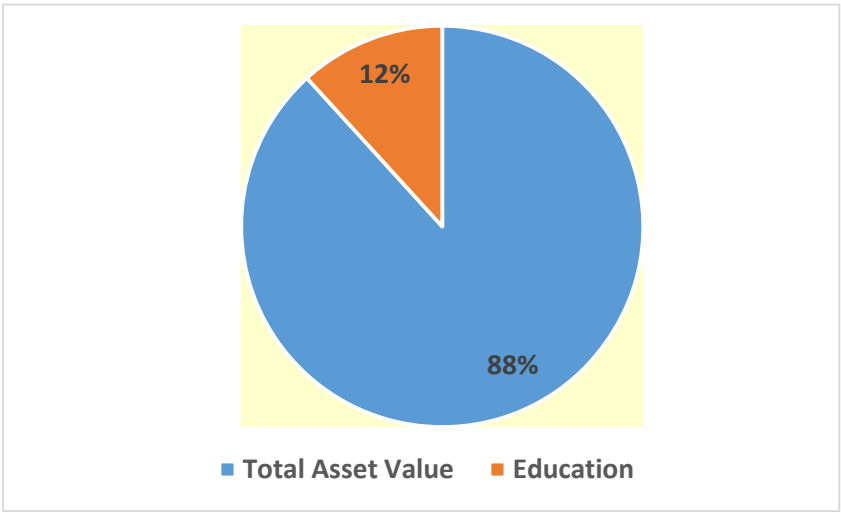
The condition of the new Mata Ala School and toilets is considered a condition grade 1, excellent to very good, as the buildings are still very new. However, quality of workmanship requires some attention as honeycomb was observed in the concrete stairway, timber joists are joined halfway between bearers rather than on bearers, and painting generally appears to be of lower quality (one coat and uneven coverage).

The condition of the remainder of the education buildings are deemed to be condition grade 3, fair with some larger maintenance work needed. There are signs of significant maintenance required.

A1.2.3.2 Lifecycle

It is evident that the older education buildings have been maintained since its construction in the 1980's. However, if maintenance is neglected and specific issues not addresses the structures may require a higher level of maintenance and may result if potential failure. Specific maintenance issues include repair and maintain weather boards and window frames, repair concrete steps, repair spalling in concrete foundation and connect spouting.

As shown below the Education Buildings make up 12% of the Total Atafu Asset Value.



A1.3.3 Public and Administration Buildings

The Public and Administration Buildings consist of:

1. Traditional Fale
2. Lotala Building (Meeting house)
3. Administration Building (Offices & Kitchen)
4. Public toilets
5. Police/Store/Finance/Teletok Building
6. Lagoon – reception/distribution building
7. Atafu Congregational Church

Police and Justice needs have been met within public and administration buildings. It is noted that as result of Tokelau cultural practice and Taupulega administration, there is no requirement for separate justice facilities. Resulting from this no allowance has been in this plan for such facilities.

The buildings are a mix of concrete, timber framed weatherboard with corrugated iron roofs. The construction dates for the buildings range from 1930's to 2000. The buildings are all in relative close proximity of another and forms the heart of Atafu. Water storage is a mix of concrete tanks forming part of the foundation and free standing polyethylene tanks. Roof water is collected in the tanks.

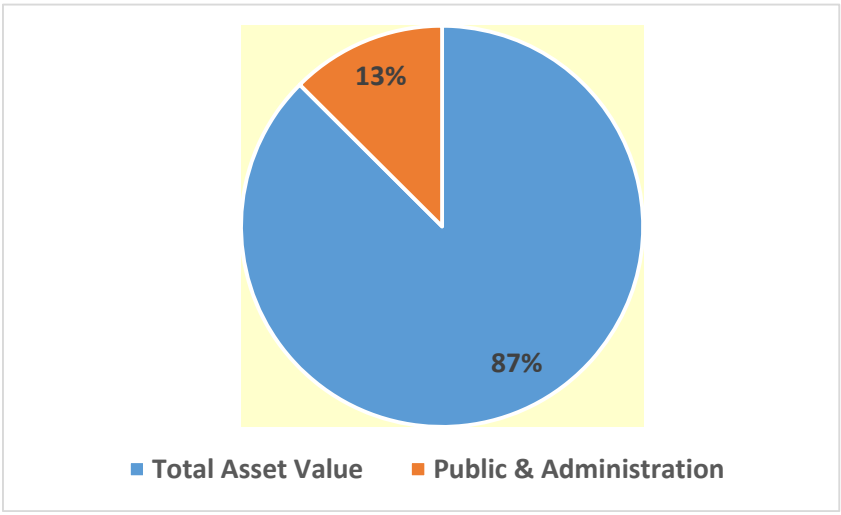
A1.1.3.3 Condition

The Traditional Fale, Lotala building and Atafu Congregational Church are prime examples of well-maintained structures. Although these buildings were constructed at different times it is evident that these buildings are highly valued by the Taupulega and the community and this is reflected in the upkeep of the buildings. The Traditional Fale, Lotala building, Administration building, public toilets and Church are all considered to be a condition grade 2, good. The Police/Store/Finance/Teletok building and Lagoon- reception/distribution building is deemed to be a condition grade 3, fair with some larger maintenance work needed. There are signs of significant maintenance required.

A1.2.3.3 Lifecycle

It is evident that the majority of the Public and Administration buildings have received a high level of maintenance, but the Police/Store/Finance/Teletok building and Lagoon- reception/distribution building have not received the same level of maintenance. If maintenance is neglected and specific issues not addressed these structures may require a higher level of maintenance and may result if potential failure. Specific maintenance issues include repair and maintain weather boards and window frames, repair eaves and plan roof renewal.

As shown below the Public and Administration Buildings make up 13% of the Total Atafu Asset Value.



A1.3.4 Storage Facilities

The Storage facilities consist of:

1. Freezer house
2. Bulk Storage (PWD shed)
3. Storage shed (next to school)
4. Bulk Store 1
5. Bulk Store 2
6. Kileva Fisheries 1 (abandoned)
7. Kileva Fisheries 2 (abandoned)
8. Kileva Fisheries 3 (abandoned)

The buildings range from large steel framed bulk stores to basic timber framed lean to type structures. The materials are a mix of concrete, steel framed corrugated iron cladded walls, or timber framed with corrugated iron roofs. The construction dates for the buildings range from 1985 to 2012. There are no water collected from the roofs of storage facilities. Concrete tanks are part of the Freezer house and Kileva Fisheries buildings, but not connected to the spouting or no spouting exists.

It was observed that bulk storage facilities have different levels of storage. The Bulk Store 1 and 2 had materials stored in an orderly fashion showing systematic arrangement and grouping of materials. However, this was not evident at the PWD shed where materials, plant and equipment were placed in a

disorderly fashion The Bulk Storage facilities require cleanout of all scrap and reorganisation of operational and useable plant and materials in an orderly fashion. Appointing a logistics champion who is responsible for keeping records of stock of all materials, plant and equipment and ordering of replacement parts, plant and materials will greatly enhance the overall upkeep of storage facilities and plant and equipment. (**IP 2**)

There is a bulk fuel storage facility (lean to) that is grouped under Energy.

A1.1.3.4 Condition

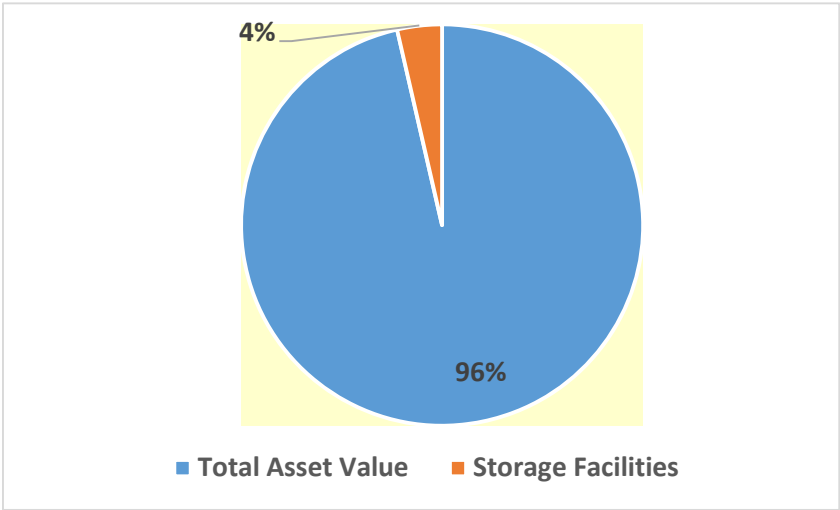
Apart from the Freezer house with a condition grade of 2, good, the condition of the remainder of the storage facilities are deemed to be condition grade 3 fair with some larger maintenance work needed. There are significant maintenance required to raise the condition of the storage facilities.

The Kileva Fisheries buildings are recorded in the Asset Register as 'abandoned' as it is not used at present and general neglect is evident. However, these buildings provide sound structures and with reasonable effort can be restored to a suitable facility for a range of uses e.g. bulk fuel storage, building materials or workshops.

A1.2.3.4 Lifecycle

Maintenance of the storage facilities have been neglected, but in some respects there are signs of significant maintenance to keep the asset operational. Significant portions of the steel framing in the Bulk Store 1 and 2 have been replaced with timber in an attempt to keep the structure operational. However, the structural integrity may be compromised.

As shown below the Storage Facilities make up 4% of the Total Atafu Asset Value.



A1.3.5 Guest Houses

There is only one guest house on Atafu. It is a timber framed weatherboard building estimated to be built in the 1980's.

The condition of the guest house is deemed to be condition grade 3, fair with some larger maintenance work needed. There is significant maintenance required to raise the condition of the guest house.

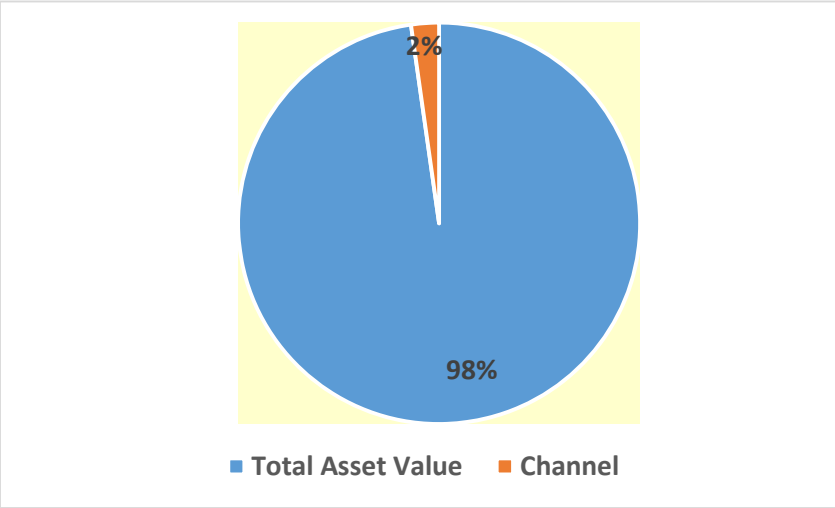
Specific maintenance issues include repair steel strap tying joists to piles, maintain weatherboards and window frames.

A1.3.6 Channels

The channel is approximately 100metres long and is quite narrow approximately 11 metres wide in most places. The depth at low tide is around 1 metre on average.

There are no significant issues associated with the channel. Some dredging is required to ensure adequate depth and installation of two channel markers (**IP 26**). Refer to Section 3.3.7 and the Spiire report.

As shown below the channel make up 2% of the Total Atafu Asset Value.



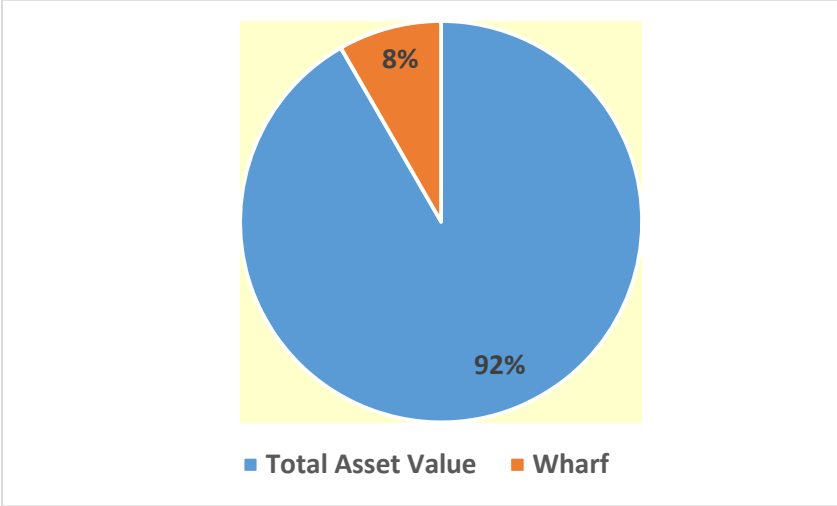
A1.3.7 Wharf

There is concrete wharf structure of approximately 2.8 metres wide and in a V-shape and a total berth face of approximately 12m. In addition there is a concrete driveway starting from the shore and extending approximately 40 metres connecting to the V shaped wharf. The driveway is breaking apart as there appears to be very little or no reinforcing steel used to disperse forces. Fenders to protect the barge and bollards to tie the barge were installed during March 2014.

The Tokelau Ship to Shore Project: Onshore Infrastructure Options and Environmental Impact Assessment (June 2014) propose (**IP26**):

- A hardstand area of 14m x 7m
- Improved ramp
- Raising the existing access way
- Wave energy dissipation structures

As shown below the Wharf make up 8% of the Total Atafu Asset Value.



A1.3.8 Seawalls

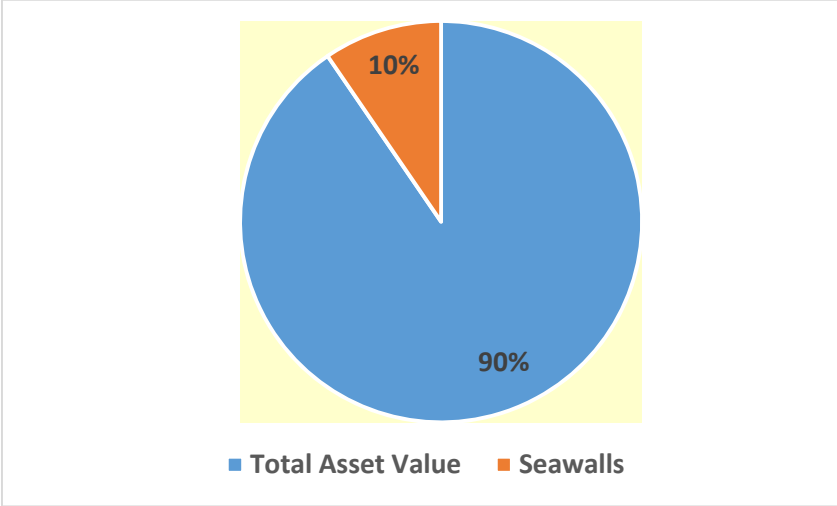
There is approximately 200 metres of seawall on the ocean side and 1,000 metres of seawall on the lagoon side on Atafu. There are a range of different types of seawall construction on Atafu. These include but are not limited to:

- Gabion baskets filled with coral rocks
- Gabion baskets filled with coral rock and covered with a cement/concrete layer
- Stacked coral blocks

The report "Reducing the Risks of Cyclone storm surge inundation on the atolls of Tokelau – Atafu (2005)" details the existing coastal defences and provides a range of options for future risk management of storm surge inundation. The figure below taken from this report shows the extent of seawalls on Atafu.

The condition of the seawalls are in various states of repair, but in general the seawall are considered to be in a condition grade 2, good.

As shown below the Seawalls make up 10% of the Total Atafu Asset Value.



A1.3.9 Solid Waste

On Atafu there are two areas used for Solid Waste Management. One the landfill, where residual waste is burnt and buried. The other is the Solid Waste Management area where all recyclables are sorted, crushed and baled. Recyclables include aluminium cans, plastic containers and glass. This Solid Waste Management area is an open area in the forest close to the pig pens and appear to be a bit disorganised with redundant white ware and various other refuse thrown about.

However, the current solid waste management area will be moved to the current landfill as the foundations have been constructed for a solid waste facility providing one central facility. It is envisaged that this will contribute to a more organised system.

The location of the current landfill appears to be too close to the ocean as it shows signs of being washed open by king tides. Relocation of the landfill further inland and away from the beach should be considered.

Kitchen and yard waste are well managed by feeding to the pigs or placing in banana patches. There is also a chipper/shredder to improve the management of green waste.

The waste in Atafu contains a large proportion of recyclables (aluminium/tin cans, plastic bottles, and glass), however only aluminium cans are recycled through the MOU with Samoa, and the some revenue comes from the sale of the cans in Samoa. The recycling system is not as effective as it could be because a community recycling facility has not been constructed and the can crusher has not been installed. Consequently a lot of aluminium cans are being dumped out at sea.

A lot of beer bottles are being stockpiled and are also being dumped in the ocean. This practice is not cost effective as the brewery in Samoa will buy back empty bottles.

The waste collection system generally operates well with collection two to three days per week.

The Integrated Waste Management, Water and Sanitation Review and Action Plan 2010 states:

The Waste Champion for Atafu estimates the weekly quantity of waste generated to be about 30 of the 45-gallon (205-litre) drums. Using this estimate to calculate the waste generation, along with the average bulk density of 150 kg per m^3, the amount of waste generated for Atafu in one year is estimated at 48 tonnes. Using a population estimate of 500 people, this equates to a daily waste generation rate of about 0.3 kg per person, which is similar to the estimate derived for the other atolls. To be conservative, and given that the population is roughly the same as Fakaofo, the Fakaofo estimate of 68 tonnes will be also be used for Atafu.

Littering of cans and plastic bottles can be observed throughout the community. Plastic waste is burnt, while waste that is not recycled is dumped at sea – this includes some aluminium cans, bulky waste, metals, etc.
Disposable nappies are taken by the residents to a community hole where they are buried.

Small quantities of medical waste are generated by the hospital. Dressings and similar contaminated wastes are burnt at a designated site. Sharps are stored and stockpiled in an open building, which is accessible to the general public. Similar to the other atolls, small amounts of expired drugs and used ampules are taken to Samoa for disposal.

Bulky waste on Atafu includes derelict vehicles, metal drums, derelict boats and boat engines, and whiteware goods such as refrigerators and washing machines. This kind of waste can be seen littered throughout the community, with some of it dumped in the ocean with other waste. There is no management system in place for recycling or exporting this waste.

The transportation and storage of oil and fuel on Atafu is as described for Fakaofo. Waste oil is mainly generated from the power generation plant and from the many powered fishing boats on the atoll. In the case of the power plant, about 10 litres of waste oil is generated in a month and this is stored in drums – some of it is used on formwork to prevent the concrete sticking to the timber, but the majority is stockpiled. There are about 6 drums of waste oil stored with no specific plan in place for disposing of this waste.

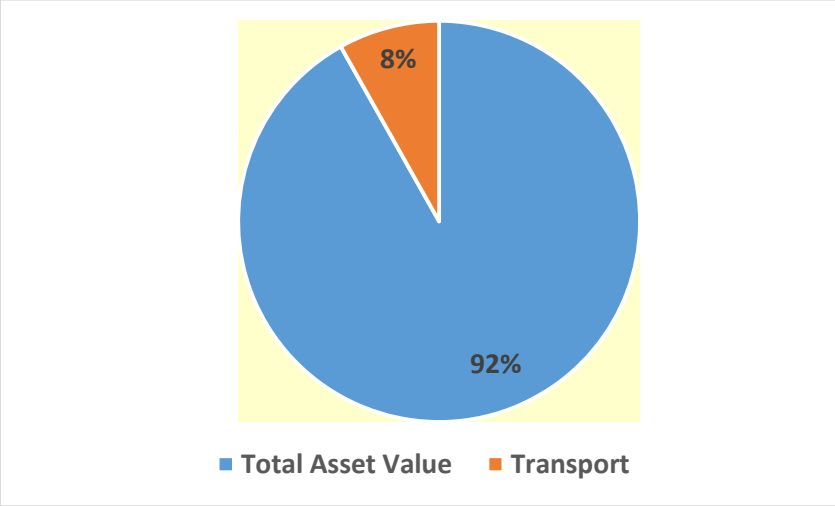
It is important to implement the Solid Waste Action Plan (**IP 7**).

A1.4 Transport

The Transport service consist of:

- Tokelau Samoa link
- Ship to shore
- Boats
- Roads and street lights

As shown below the Transport assets make up 8% of the Total Atafu Asset Value.



A1.4.1 Tokelau Samoa link

Tokelau's only transport link with the rest of the world is the shipping service between Tokelau and Samoa. This is currently a chartered service provided by the Government of Tokelau, but a government owned ship is being constructed at the time of writing this Plan.

Each of the atolls are dependent on this Tokelau Samoa shipping service for passengers, cargo, medical and emergency evacuations.

Samoa Shipping Co vessels are used for additional charters not only to transport passengers during peak travelling times between Apia and Tokelau, but also when large orders of supplies for government/village projects are required or when there are national activities which necessitate moving large groups between atolls.. Additional charters have averaged 10 – 12 per annum over the period 2005 -2010.

The GT500 SOLAS Ferry (under construction at the time writing this Plan) is included as a transport asset under Apia.

A1.4.2 Ship to Shore

None of the three Tokelau atolls has any seaport, due to the particularly steep drop off from each atoll's fringing coral reefs into very deep water. In the absence of harbour/port facilities motor powered barges provide a ship to shore transfer service. This is a very basic service which will always be significantly reliant upon a combination of local skills, and available technology and its maintenance.

Ship-to-shore safety issues were highlighted in the MFAT Internal Audit on Maritime Safety wherein a range of recommendations were made. The Tokelau Ship to Shore Project: Onshore Infrastructure Options and Environmental Impact Assessment (June 2014) propose procurement of a tracked crane (**IP27**) which will be fit for purpose and aligned with proposed channel and wharf upgrades.

There are three operational barges on Atafu. One large, one medium and one small sized barge. The Large barge is powered by two 60hp Yamaha outboard motors.

The condition of the barges are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed. The barges are used in a harsh environment and as such the expected lives of the barges are low.

At the time of writing a new barge was near delivery to Atafu. The new barge is deemed to be a significant improvement on the existing barges.

A1.4.3 Boats

There are four boats owned by the Taupulega on Atafu. Two fishing boats, an aluminium dinghy style boat and a fishing boat (Matauala) including numerous outboard motors, either fitted to the boats or new motors stored in the PWD shed.

The condition of the boats are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed.

A1.4.4 Roads and Streetlights

There are approximately 3km of roads on Atafu. All the formed roads consist of rolled crushed coral. Traffic is very light, mainly pedestrian and golf carts. While the heaviest vehicles that use the roads are light trucks and tractors. Heavy loads are limited to the transport of fuel from the wharf to the bulk fuel storage facility. The crushed coral is free draining and there is little evidence of water damage despite the frequency of heavy rain.

The key maintenance activity is the filling in of the few potholes and ruts that develop, preferably as soon as they are first noticed. There is some evidence that where potholes have been filled there has not been sufficient attention paid to compacting the fill material. In the places where there are water table drains (shallow drainage channels) these need to be kept clean and free of debris.

There are approximately 45 streetlights each fitted with a sensor which switch the streetlight on during low light conditions.

The overall condition of the Atafu roads and streetlights are deemed to be condition grade 2, good.

A1.5 Water and Sanitation

Water and Sanitation assets have been included in the asset register with Buildings and consist of water tanks attached to public buildings and private houses, and septic tanks, septic cells also attached to public buildings and private houses.

There are some remaining lagoon toilets in service, which are small timber and corrugated iron structures. No allowance for the replacement of these structures has been made in this plan.

There are no reticulated water or sewer systems in Tokelau.

Each atoll has a desalination plant for use in times of drought. These have been included in the Plant and Equipment assets.

In May 2010 the Government of Tokelau received the 'Integrated Waste Management, Water and Sanitation Review and Action Plan,' by SPREP and Parsons Brinkerhoff. This report completed a comprehensive review of water and sanitation issues, and provided a large number of recommendations.

The recommendations from the May 2010 report should be completed by Government of Tokelau (**IP 32**).

In particular in relation to this AMP the following recommendations are highlighted:

6. Complete the PACC+ installation programme
7. Complete household water tank installation
8. Maintain the Desalination Plant (and periodically test run)
9. Undertake a community options and feasibility report for appropriate sewerage management systems (**IP 33**)
10. Instigate and continue regular water sampling, wastewater sampling and lagoon water sampling to track any issues and build an evidence base for further action

These items have also been included as appropriate in the AMP service levels.

Sewerage management systems will require further study (**IP 33**), and it is likely any solutions will require further expenditure. This potential expenditure has not been added to this AMP, as the solutions are unknown at this stage, and could range from the status quo through to reticulated and managed sewerage treatment systems. Any additional costs for this will need to be added to future revisions of this AMP.

A1.6 Telecommunication

The Telecommunication assets consist of:

- Communications Building
- Equipment
- Telecomm Cable

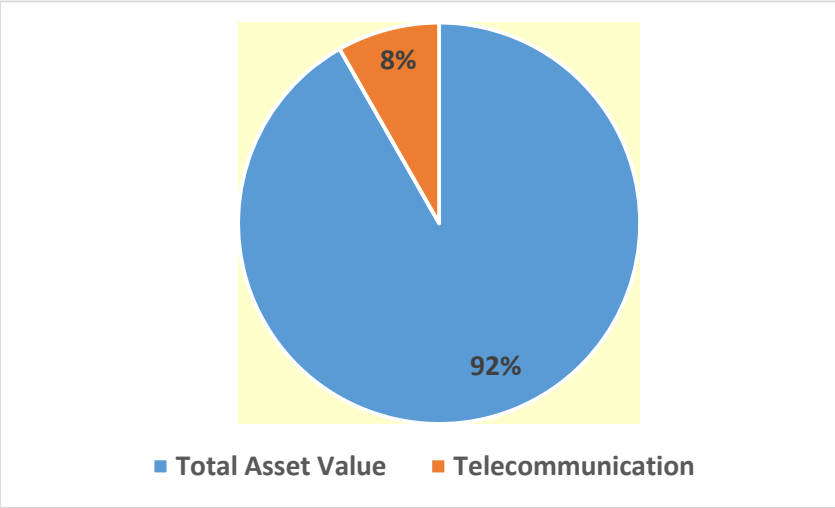
The Communications building is a James Hardie Bondor structural insulated panel kitset building on a 1.8m raised concrete foundation. This raised concrete foundation prevents storm surge inundation of the telecommunication equipment, housed within the building, during a cyclonic event. The equipment housed within the Communications building consist of modems, exchange, switches, equipment racks and air conditioning. The other telecommunication equipment consists of:

- 3 Satellite dishes
- Solar panels
- Radio masts (3)
- Satellite dish (USP)

- Solar Panels (USP)
- Technical and Internet equipment

The solar panel at the Communications building had one damaged panel and this will need replacement. The condition of the telecommunication assets are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed.

As shown below the Telecommunication assets make up 8% of the Total Atafu Asset Value:



A1.7 Energy

The Energy assets consist of:

- Buildings
- Solar Panels
- Batteries
- Generators
- Power cable
- Fuel

The buildings consist of the battery house (where the solar power batteries and inverters are housed), the generator house (where the generators are housed), the bulk fuel storage (a lean to where the bulk fuel are kept) and the solar plant fence.

The solar panels are 230 Watt Sunrise panels. The panels are certified to the IEC 61701 Standard – Salt mist corrosion testing of photovoltaic (PV) modules. There are nine clusters, each cluster consisting of 144 panels. Each cluster has two connection configurations, one for the panels connected to the string inverters, and one for the panels connected to the DC charge controllers. The panels are mounted on aluminium frames which are bolted into concrete foundations. The anodized aluminium frames were chosen above galvanised steel or stainless steel due to its low weight and low cost and proven performance in harsh marine environments. The panels are tilted to 12^{o} allowing for self-cleaning during rainstorms. However, regular manual cleaning is required.

The batteries are installed in the battery house. Each cluster in the Tokelau systems includes a 48V battery bank to store surplus PV energy generated during the day for use at night or periods of low light. The battery banks are composed of two strings of 24 batteries, and have a storage capacity of 288 kWh. They have been sized to provide enough storage to last 1.5 – 2 days without any solar input before the backup generator is turned on.

The battery cells are flooded lead-acid and require regular topping up with distilled water as their electrolyte levels reduce when being charged. A deionizer is installed in the battery room. Rainwater is collected in a tank, and then pumped through the deioniser to be used in topping up the batteries.

Lead-acid batteries are sensitive to being discharged for extended periods of time. An alarm is triggered when the state of charge of the batteries drops below 60%. This alarm notifies the system operators to turn on the backup generators. If the state of charge drops below 30%, the battery inverters disconnect the loads from the PV system, which means that the island loses power (unless the backup generator is running). The batteries have an expected useful life of 8-10 years if properly maintained. Note, however, that the lifetime of a battery is defined as being 80% of its original capacity. Batteries can still be used beyond their rated life, though at a reduced capacity (<80%) and only for a limited amount of time as their usable capacity decreases rapidly after their end of life.

The batteries are located in a room separate from the inverters, as hydrogen gas is produced by the batteries during the charging process and there is a risk of explosion caused by a spark from electronic equipment. The battery room is well-ventilated to evacuate any hydrogen gas that is produced, although the catalytic combiner caps should minimize the amount of hydrogen gas released.

The battery inverters are SMA's Sunny Island 5048. They control the current flow to and from the batteries, and form the grid (i.e. set the voltage and frequency of the grid) when the generator is not active. Each cluster is composed of three battery inverters, with one battery inverter as master and the other two as slaves. The battery inverters are covered by a 10-year warranty.

The string inverters are SMA Sunny Boy 3000 inverters. The string inverters convert the DC electricity from the panels into AC electricity that is injected into the power grid. The string inverters are covered by a 10-year warranty.

There are three generators housed in the generator building near the battery building and PV array. The generators were once the sole source of electricity, but are now used as backup for the solar power system. The generators have to be manually switched on when required. This could be automated, but the manual approach keeps the operators actively involved, keeps them familiar with the system and signals issues with the system i.e. awareness of continual generator power required.

The generators are:

Make	Model	Hz	kVA	kW
Cummins	C80D5		70	
JG		50	62.5	50
Cummins	95DGDF		106	

At the time of the site visit it was not clear which generators were operational.

The system is monitored by SMA's Sunny Web Box data monitoring systems. There are three on each atoll, monitoring the battery inverters and charge controllers, the string inverters, and a small solar radiation measuring device on the array. The Web Boxes upload their data to the SMA Sunny Portal website, for remote monitoring and analysis.

Two touchscreen computers (one in the inverter room and one at the powerhouse) and custom monitoring software were installed with each system to provide operators with a live feed of solar production, charge/discharge currents to and from the batteries, generator production, solar radiation and the loads on the grid. The computers allow access to the Web Boxes so that operators can change system parameters on the battery inverters and the string inverters. The computers are sealed against the environment and are not fan-cooled, so do not have fans to fail.

There is also an additional mobile generator, MPMC MTG 100CS (50Hz, 100KVA), located next to the freezer house. This can be used to power telecommunications systems during emergency events.

The power cable is estimated to be approximately 1.4 kilometres long.

The fuel consists of diesel, petrol and kerosene stored in the bulk fuel storage shed (lean to).

A1.1.7.1 Condition

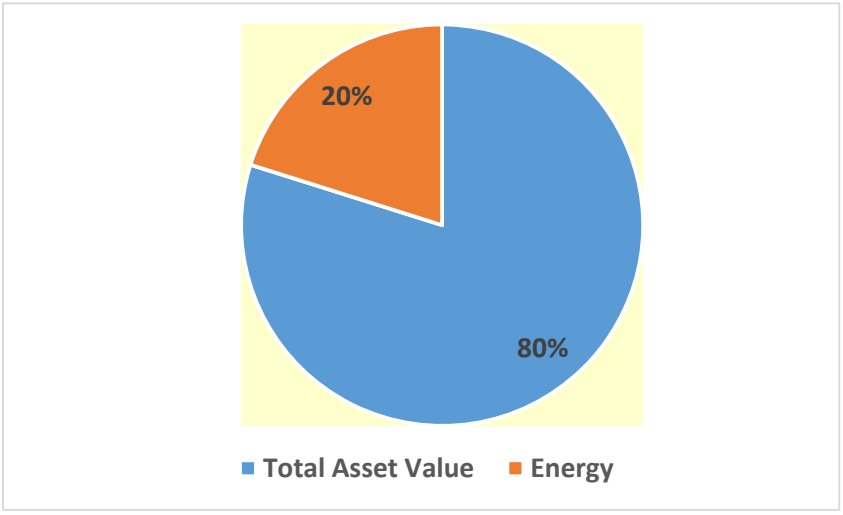
Apart from the bulk fuel storage lean to which is considered to be a condition grade 3, all the other buildings are considered condition grade 2, good.

The PV arrays, batteries and inverters are considered condition grade 1, excellent to very good. The fixed generators are consider to be condition grade 3, fair with some larger maintenance work needed, and the mobile generator is considered to be condition grade 2, good.

A1.2.7.1 Lifecycle

No specific maintenance issues were noted at the Energy buildings. Cleaning of the battery house gutters to minimise the contamination of roof collected water will prevent dirt and debris clogging the deionizer. The solar panels will require regular cleaning and monitoring of the foundations and fastenings. Cleaning is best performed after rain events or early morning and late afternoon when the panels are cool and damp. Water levels in batteries will require regular checking and topping up with deionized water when required. Checking the State of Charge of batteries and system alarms and regular charging of batteries to ensure the batteries reach their expected lives (**IP 9**). The generators are three different generators creating maintenance issues as each will require different parts etc. Standardising to one type and size of generator will greatly enhance maintenance and operational status of the backup power supply (**IP 10**).

As shown below the Energy assets make up 20% of the Total Atafu Asset Value.



A1.8 Plant and Equipment

There are significant number of various plant and equipment on Atafu. The most significant plant and equipment are tabled below:

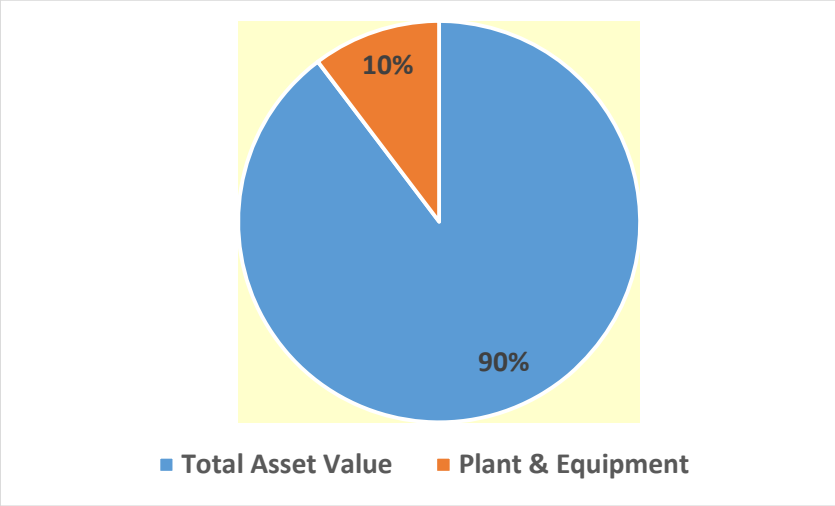
Plant	Manufacturer	Size/Model
Excavator	Caterpillar	12 tonne
Tractor crane	ACE	12 tonne
Wharfe crane	Palfinger	
Tractor x 2	John Deere	5075E
Village freezer		
Truck	Mitsubishi	3 tonne Canter
Forklift	Hangcha	5 tonne
Desalination plant	AMPAC	
Trailer x 2	Coombridge & Alexander	
Van x 2		
Wood chipper	Vermeer	
Mini loader	Bobcat	
Compressor	Atlas Copco	XAS97
Pneumatic hammer	Tiger	
Concrete mixers		
Miscellaneous equipment	Fridges, freezers, stoves	
Office equipment	Administration & EDNRE	

The condition of the plant and equipment range from condition grade 1, excellent to 4, poor. A range of maintenance issues (**IP 11**) were observed including but not limited to:

Plant	Issue
Village freezer	Not operational. Make operational
Desalination plant	Perform regular test runs to confirm operational status
Tractor	Repair/Replace tyre
Tractor crane	Brake lining issues. Retrofit to make operational
Wharf crane	Requires power to point of installation. Never been used
Trailer	Repair hole in timber deck

The atolls of Tokelau are located within a harsh marine environment and as such plant and equipment is exposed to seawater air and salt air aerosols increasing the potential for corrosion. Therefore, it is important that plant, when not in use, are stored within enclosures providing a level of protection against this harsh environment (**IP 12**). An amount of $60,000 is included in the Capital Projects for shed storage for plant.

As shown below the Plant & Equipment assets make up 10% of the Total Atafu Asset Value.



A1.9 Data Confidence

The confidence in data for the assets is detailed in the table below:

Asset	Component	Confidence
Buildings	Attributes	2
	Condition	2
	Performance	2
Transport	Attributes	2
	Condition	2
	Performance	2
Channel	Attributes	3
	Condition	3
	Performance	3
Wharf	Attributes	3
	Condition	3
	Performance	3
Seawalls	Attributes	3
	Condition	3
	Performance	3
Solid waste	Attributes	2
	Condition	2
	Performance	2
Telecommunication	Attributes	2
	Condition	2
	Performance	2
Energy	Attributes	2
	Condition	2
	Performance	2
Plant & Equipment	Attributes	2
	Condition	3
	Performance	3

Where the confidence grade relates to the following definitions.

Score	Description	Definition
1	Accurate	100%
2	Minor inaccuracies	± 5%
3	50% estimated	± 20%
4	Significant data estimated	± 30%
5	All data estimated	± 40%

The above is confidence scores are from the New Zealand Infrastructure Grading Guidelines 1999.

A1.10 Financials

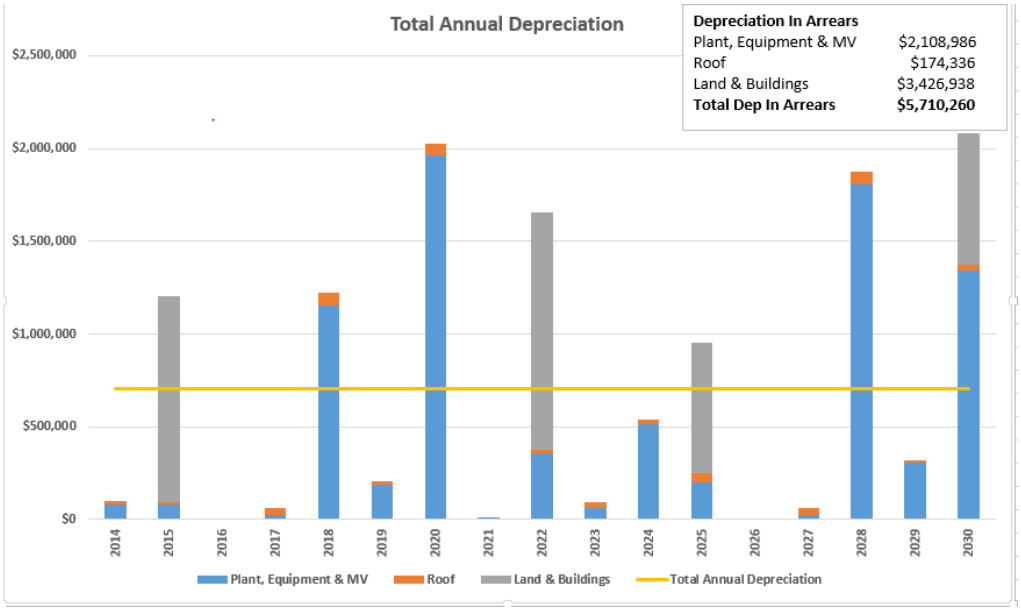
A1.10.1 Asset Valuations

No formal documented asset valuation has been performed. This Asset Management Project developed the Asset Register and this Asset Management Plan.

The newly created Asset Register and associated values are based on the best information available – in many cases this was minimal, resulting in "global best guess" estimates being made. It is envisaged that over time much more accurate, detailed and reliable information on assets will be collected, meaning that regular and more reliable asset values can be developed and incorporated into the Asset Register providing the basis for a more robust Asset Valuation.

A1.10.2 Depreciation

There has been limited accrual accounting with the current practice is mainly cash based accounting which results in replacement/renewal cost of an asset only being recognised when it wears out. This places unnecessary pressure of funding mechanisms and no consideration for lifecycle management. Tokelau should consider implementation of accrual accounting (depreciation) where the costs is spread over the life of the asset. Depreciation/decline in service potential is thus provided on a straight line basis. The required annual depreciation component for all Atafu assets amount to $680,000.



It should be noted that as there has been limited accrual accounting to date and most of the assets partway through their expected lives there is a portion of depreciation in arrears e.g. an asset has an

estimated value of $100 with a 10 year life. Therefore the annual depreciation component is $10 each year over 10 years. But the asset is already 3 years old and no depreciation has been collected. As a result there is a depreciation arrears of $30 (3 year x $10) which needs to be collected prior to the asset reaching the end of its expected life. The depreciation arrears for Atafu assets amount to $5,710,260. The Tokelau Infrastructural Replacement Fund has a balance of $1,350,000 at 30 June 2014 for all of Tokelau's infrastructural assets. Refer to Section 12.4 providing detail on the balance of depreciation arrears.

A1.10.3 Operation & Maintenance

The Taupulega (Village Council of Elders), General Fono (National Assembly) and the Council for the Ongoing Government (Executive Government) of Tokelau are the principal administration institutions of governance in Tokelau. The Taupulega provides policy direction at the village level whereas the General Fono provides all policy direction at the national level.

The public service sector implement government policies. The public service sector delivers services within the constraints of the allocated budgets.

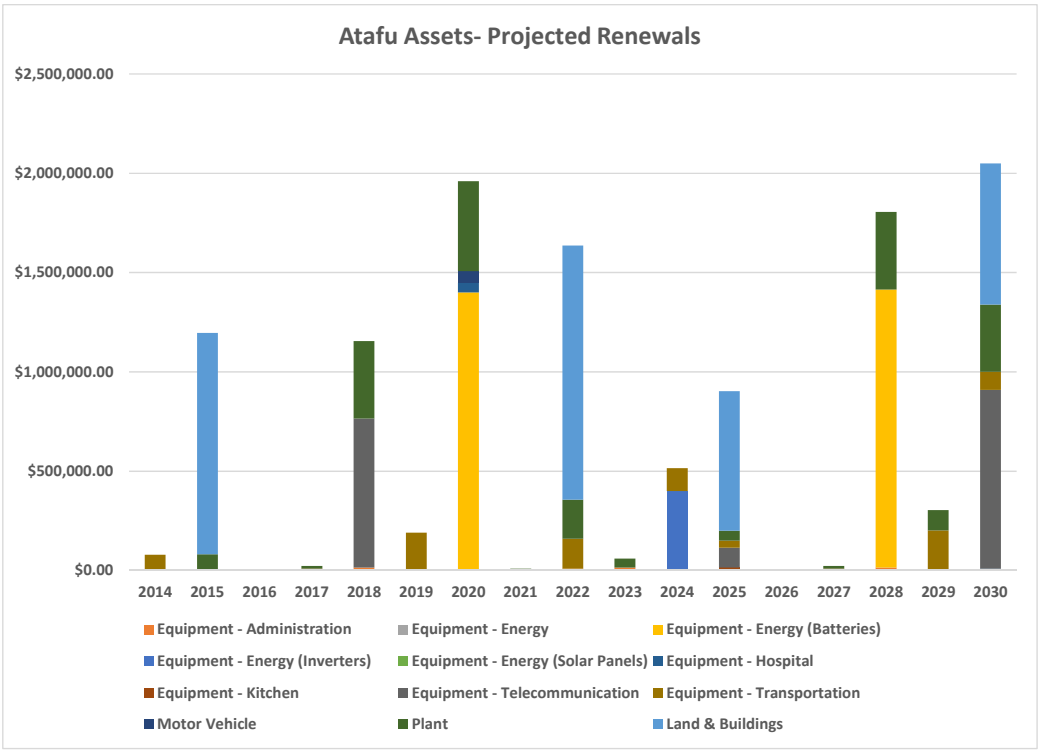
The Tokelau Public Service refers to two levels of service:

1. those services provided at the national level, under the coordination of the General Manager, Apia, are the Departments of -
    a. Finance,
    b. Health,
    c. Education,
    d. Economic Development,
    e. Transport and Support Services,
    f. Energy and the Office of the Council for Ongoing Government and
2. the services provided at the village level, under the management of the respective village General Manager (Director or Coordinator) include staff who work in the
    a. school,
    b. hospital,
    c. Information Technology support services,
    d. co-operative store,
    e. finance,
    f. FM radio,
    g. general village workers and
    h. the traditional workforce

The Taupulega on each atoll has responsibility for all the public assets on the atoll including public buildings, schools, storage facilities, transport and wharves. The operation and maintenance of these facilities are a major part of the Taupulega's responsibilities and a substantial part of its annual budget. Operation and Maintenance costs is estimated at $120,000 per year.

A1.10.4 Renewals

No formal Renewal Plan exists for the assets in Tokelau. The following shows the renewal requirements for the Atafu assets based on the expected useful lives within the asset register.



The most significant renewals projected in the above graph include but are not limited to:

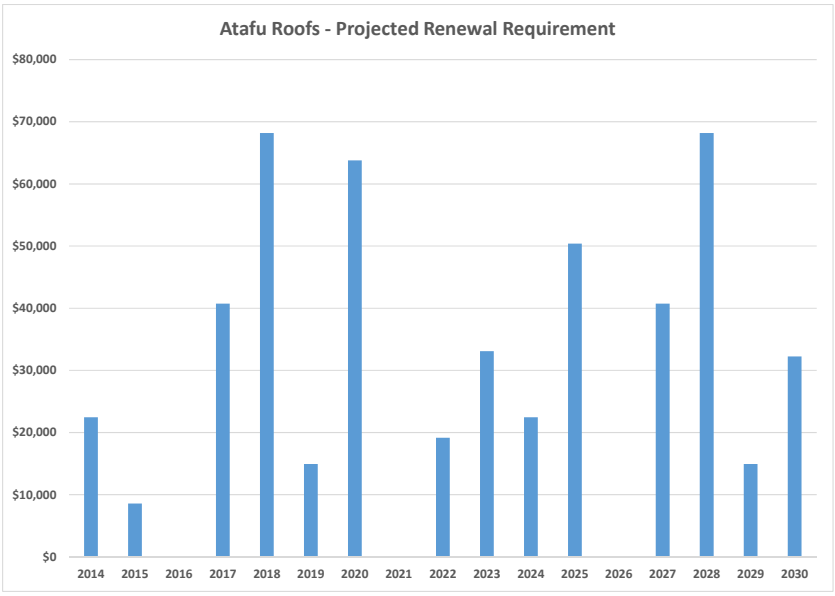
- Wharf
- Telecommunication (technical & internet) equipment
- Seawalls
- Energy – Batteries & Inverters
- Various buildings

It is important to note that this is projected replacement and not planned replacement. This means that these are theoretical replacements required, based purely on the expected useful lives of the assets within the asset register. Asset condition assessments may extend or decrease expected useful lives affecting an actual planned renewal programme. It is therefore important that Tokelau develop a Renewal Plan (**IP 24**).

Building Roofs

The majority of roofs in Tokelau are corrugated iron and staff interviews suggest that the expected lives of the corrugated iron/steel roofs are severely affected the a harsh marine environment. In general, unpainted steel roofs in New Zealand have an expected life of 20 years, but in Tokelau that expectation is halved to 10 years.

Taking the estimated size of each corrugated iron roof and estimated installation date and using an estimated replacement cost of $55/m^2 a projected roof renewal requirement was developed. This requires a total of $500,000 for roof renewals over the next 15 years with an average of $33,000 per year. This should be funded out of the building depreciation component.



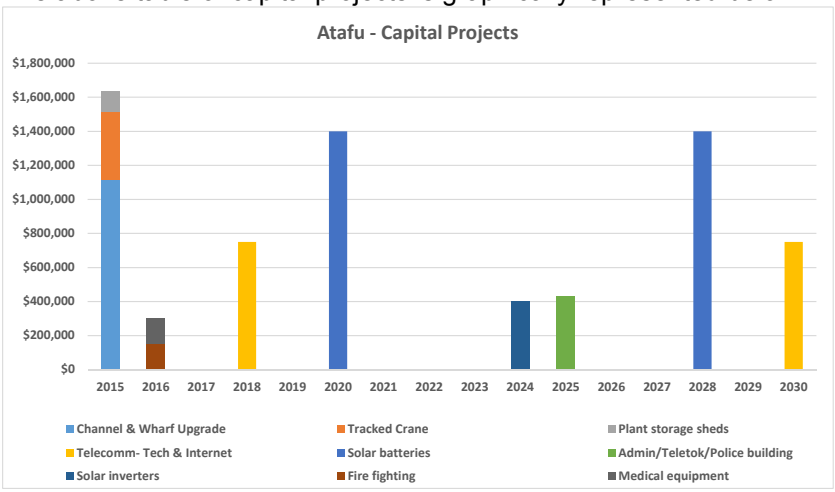
The viability of changing roofing materials should be investigated (**IP 1**).

A1.10.5 Capital Projects

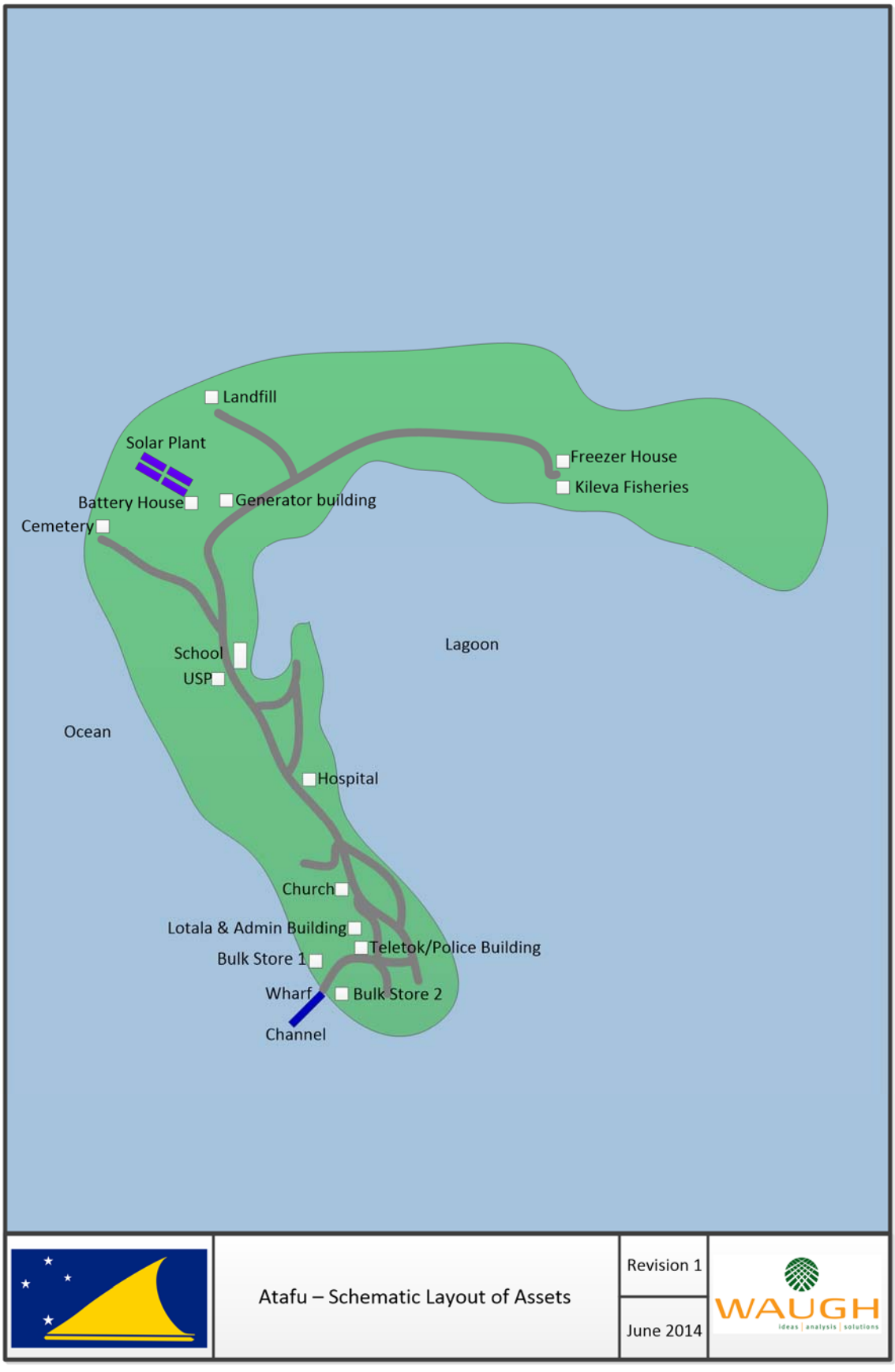
The following Capital Projects are planned and are based on expected renewals:

Year	What	Costs
2015	Channel & Wharf upgrade	$1,115,000
	Tracked crane	$400,000
	Shed storage for plant & bulk fuel	$120,000
2016	Fire fighting	$100,000
	Medical Equipment	$150,000
2018	Telecommunication – Technical & Internet Equipment	$750,000
2020	Energy – Solar Batteries	$1,400,000
2025	Replace Admin/Teletok/Police Building	$430,000
2024	Energy –Inverters	$400,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$750,000

The above table of capital projects is graphically represented below:



A1.11 Atafu Schematic



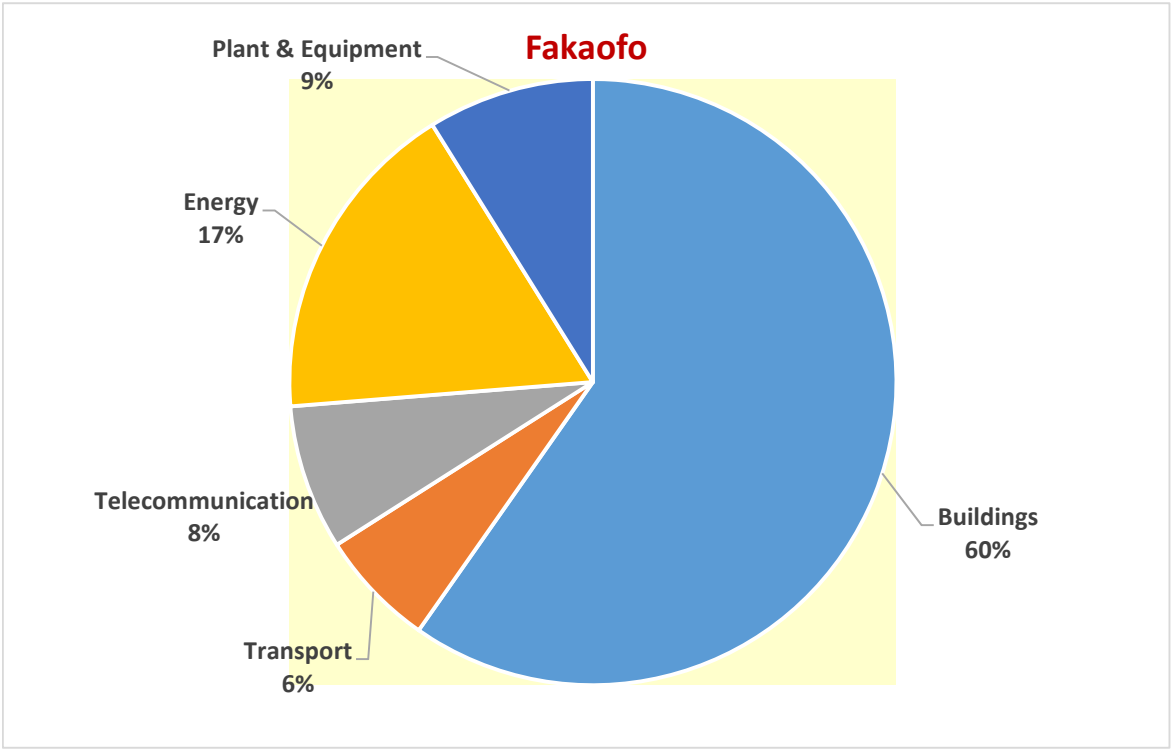
A2 Atoll - Fakaofo

A2.1 Overview

Description			Quantity/Detail	Replacement Value (NZ$)
Population served			515	
Assets	**Buildings**	Health	Hospital & Doctor's residence	$772,500
		Education	New School, Fika, Old School buildings	$2,142,000
		Public & Administration	Meeting house, administration, Papa, Churches and associated buildings, Food distribution area, cemetery buildings	$3,087,800
		Storage facilities	Bulk Stores, Freezer	$433,950
		Guest houses	5	$701,000
		Channels	2	$450,000
		Wharves	Main wharves & School wharves(Fale & Fenua Fala)	$2,321,400
		Seawalls	1.15 kilometre	$1,610,000
		Solid waste	1 Landfill	-
			Solid waste facility	$24,000
	Transport	Charter boats	Charter boat (share between Tokelau atolls)	-
		Ship to Shore	4 Barges	$476,000
		Boats	7	$276,000
		Roads & Streetlights	2.3 kilometres & 90	$456,000
	Telecom	Building	1 x Communications building & Manager's residence	$290,250
		Equipment	Satellite dishes & solar panels, etc.	$165,000
			Technical & Internet	$850,000
		Cable	3.8 kilometres	$190,000
	Energy	Building	3	$594,900
		Solar Panels	1,584	$400,000
		Batteries	428	$1,400,000
		Inverters	77	$470,000
		Generators	4	$213,000
		Cable	4 kilometres	$200,000
		Fuel	Bulk fuel storage	$86,400
	Plant & Equipment		31	$1,714,000
	Grand Total			**$19,324,200**

Note: Water and sewerage systems are included in building data

A graphical representation of the Fakaofo asset value distribution is shown below:



This shows that the assets with the greatest value is Buildings and Energy totalling 77% of the total asset value. However, this does not indicate the criticality of the asset e.g. Telecommunication is a critical asset but only a small percentage of the total asset value.

A2.2 Key Issues

Issue	Description	Mitigation
Health & Safety	Channel	Planned upgrades of the channel and wharf
	Wharf	
	Cargo handling	Planned procurement of new tracked crane
	Fire fighting	Investigate options and procure firefighting equipment
Materials	Roofs	Investigate different roof materials and viability
Storage	Facilities & materials	A logistics champion
Solid waste	Improvements	Implement the Solid waste Action Plan
Solar Plant	Batteries, Inverters, Panels	Maintain as per operation and maintenance manuals
Plant & Equipment	Maintenance	Resolve maintenance issues
	Storage	Provide more storage facilities

A2.3 Buildings

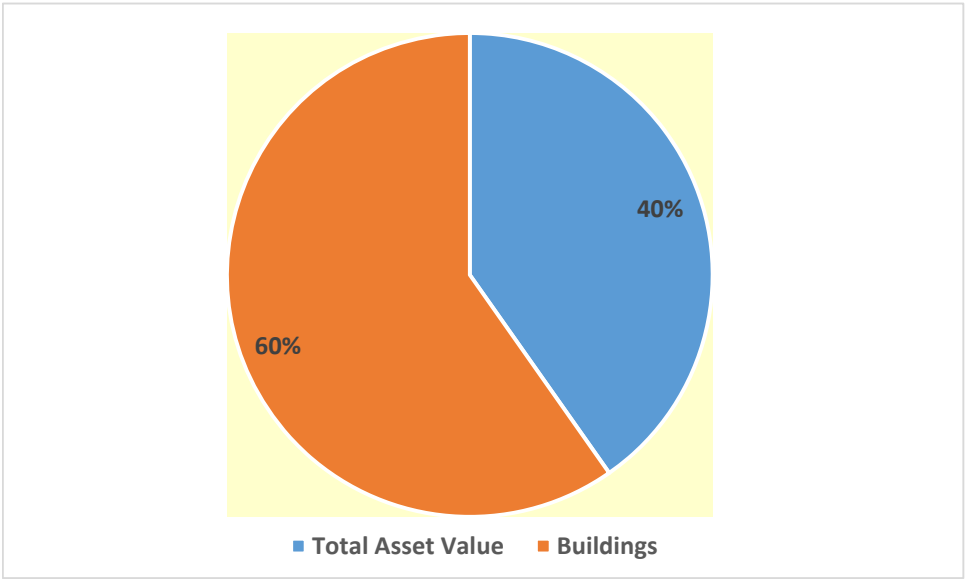
The buildings can be grouped into:

- Health
- Education
- Public & Administration
- Storage facilities
- Guest houses
- Channels
- Wharves

- Seawalls
- Solid waste

There are other buildings e.g. generator building, battery building, but these are grouped under Energy or Telecommunications.

As shown below the Buildings make up 60% of the Total Fakaofo Asset Value.



The majority of roofs in Tokelau are corrugated iron. Corrugated iron/steel roofs are lightweight, easy to handle, easy to install and low cost compared to other roofing materials. However, the disadvantage is that steel roofs are susceptible to rust and corrosion. In a harsh marine environment such as Tokelau the expected lives of steel roofs are significantly affected. In general unpainted steel roofs in New Zealand have an expected life of 20 years, but in Tokelau that expectation is halved to 10 years.

Under New Zealand conditions pre-painted steel is expected to last up to 35 years and aluminium up to 55 years. Rough order costings indicate that pre–painted steel roofing are approximately 12% more expensive than unpainted steel and aluminium are 63% more expensive than unpainted steel. Using these materials in Tokelau conditions may extend the life of the roofs to 17 or 25 years. The viability of changing roofing materials should be investigated (**IP 1**).

A2.3.1 Health Buildings

The Health Buildings consist of the Hospital Buildings (Fanuafala Hospital) and the doctor's residence both located on Fenua Fala.
The Hospital Buildings consist of five separate concrete structures joined by a concrete walkway/verandah. This concrete walkway contains underground water storage. The five structures each has its own purpose:

1. Male ward
2. Female ward
3. Doctor's office, surgery, administration office, dentistry
4. Laundry, toilets &
5. Storage

The hospital buildings also has a large concrete water tank (underground) and five free standing polyethylene water tanks.

The doctors residence is located next to the hospital and consists of a timber framed weatherboard structure. Water storage is to a concrete water tank within the foundation and to a free standing polyethylene water tank.

The Fakaofo Hospital is programmed for replacement during 2015 at a cost of $1M and included in the Capital Projects.

A2.1.3.1 Condition

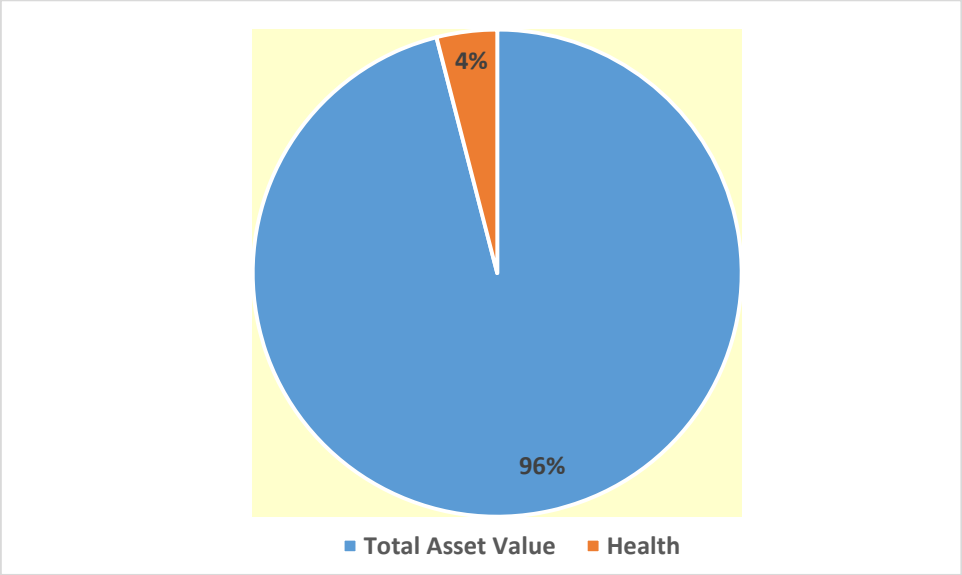
The condition of the Hospital building and Doctor's residence are deemed to be condition grade 4, poor with major maintenance work to preserve the facility.

A2.2.3.1 Lifecycle

It is evident that the hospital and doctor's residence have been maintained since its construction in the mid 1970's. However, if maintenance is neglected and specific issues not addressed the structures may require a higher level of maintenance and may result if potential failure. Specific maintenance issues include repair of spalling in the foundation, walls and footpaths, repair of timber balustrades and replacement of floor tiles. The concrete water tanks are leaking and requires remedial action. The doctor's residence require repairs to holes in the floor, repairs to walls, weatherboards, and window frames and repairs to spouting and reconnecting spouting to the water tank. The gas bottle supplying gas to the stove is housed within the kitchen next to the stove which is not safe practice. Storage of gas cylinders shall be in accordance with AS/NZS 1596 - "The storage and handling of LP Gas".

During the site visit it was noted that there was a general lack of beds and proper screens to conduct medical examination in privacy within the wards.

As shown below the Health Buildings make up 4% of the Total Fakaofo Asset Value.



A2.3.2 Education Buildings

The Education Buildings are located on Fenua Fala and consist of:

1. New School building
2. Old School Building- Fika
3. Old School building - Library
4. Old School Building double storey
5. Old School Building – 2
6. Old School Building – 3

The buildings are a mix of concrete and timber framed weatherboard with corrugated iron roofs. The buildings construction date range from 1983 to 2013. Water storage is a mix of concrete tanks forming part of the foundation and free standing polyethylene tanks. Roof water is collected in the tanks.

A2.1.3.2 Condition

The condition of the Education buildings are considered to be the following condition grades:

- New School building – condition grade 1, excellent to very good
- Old School Buildings- Fika, Library, Double Storey, Building 3 – condition grade 2, good mostly expected minor routine maintenance work plus a few extras
- Old School building 2 - condition grade 3, fair with some larger maintenance work needed

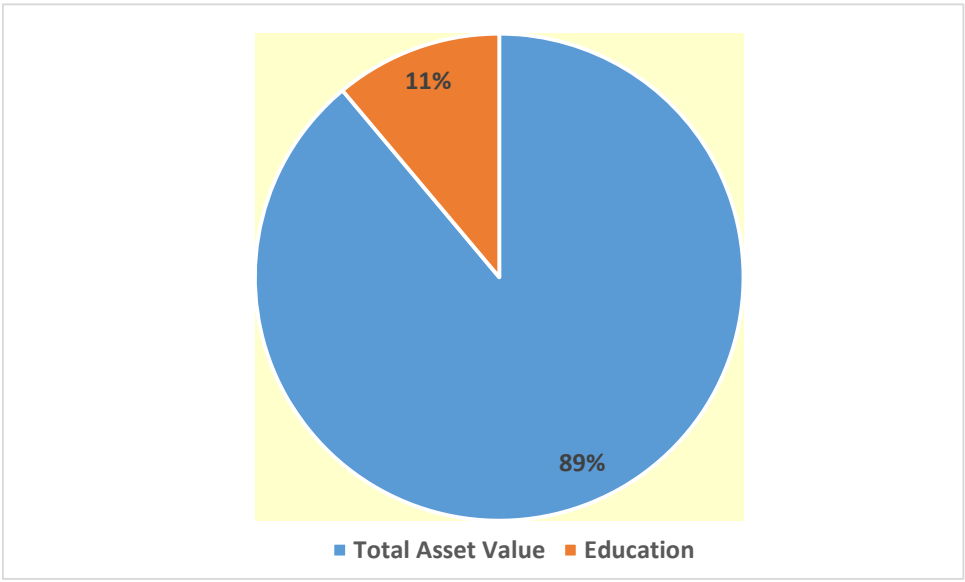
At the time of the site visit renovations were taking place at Old School Building 3 with the floor being retiled.

A2.2.3.2 Lifecycle

It is evident that the older education buildings have been maintained since its construction in the mid 1980's. However, if maintenance is neglected and specific issues not addresses the structures may require a higher level of maintenance and may result in potential failure. It was also observed that the plumbing was not completed at the new school building with water draining to ground when taps are used inside the building. Specific maintenance issues observed include:

- Old School building – Double Storey and Building 2
  - Repair broken ply
- Old School building 3
  - Repair concrete column damage
- New School building
  - Complete plumbing

As shown below the Education Buildings make up 11% of the Total Fakaofo Asset Value.



A2.3.3 Public and Administration Buildings

The Public and Administration Buildings consist of:

1. Fale Fono – meeting house
2. Administration building
3. Papa
4. Church Congregational (Fenua Fala)
5. Minister's residence (Fenua Fala)

6. Church Congregational – Hall/Residence (Fale)
7. Church Congregational – Minister's house (Fale)
8. Church Congregational – Dining house (Fale)
9. Church Congregational – Office (Fale)
10. Church Congregational – Sunday School (Fale)
11. Church Congregational – under restoration (Fale)
12. Church Catholic (Fale)
13. Church Catholic – Residential compound (Fale)
14. Food distribution area
15. Cemetery house (Catholic)
16. Cemetery Fale (Congregational)

Police and Justice needs have been met within public and administration buildings. It is noted that as result of Tokelau cultural practice and Taupulega administration, there is no requirement for separate justice facilities. Resulting from this no allowance has been in this plan for such facilities.

The buildings are a mix of concrete, timber frame and weatherboard with corrugated iron roofs. The construction dates for the buildings range from 1930's to 2014. The buildings are spread across the different Motu of Fale, Fenua Fala and the cemetery motu. Water storage is a mix of concrete tanks forming part of the foundation and free standing polyethylene tanks. Roof water is collected in the tanks.

A2.1.3.3 Condition

The Fale Fono meeting house and Church buildings are prime examples of well-maintained structures. Although these buildings were constructed at different times it is evident that these buildings are highly valued by the Tuapalega and the community and this is reflected in the upkeep of the buildings.

The condition of the Public and Administration buildings are considered to be the following condition grades:

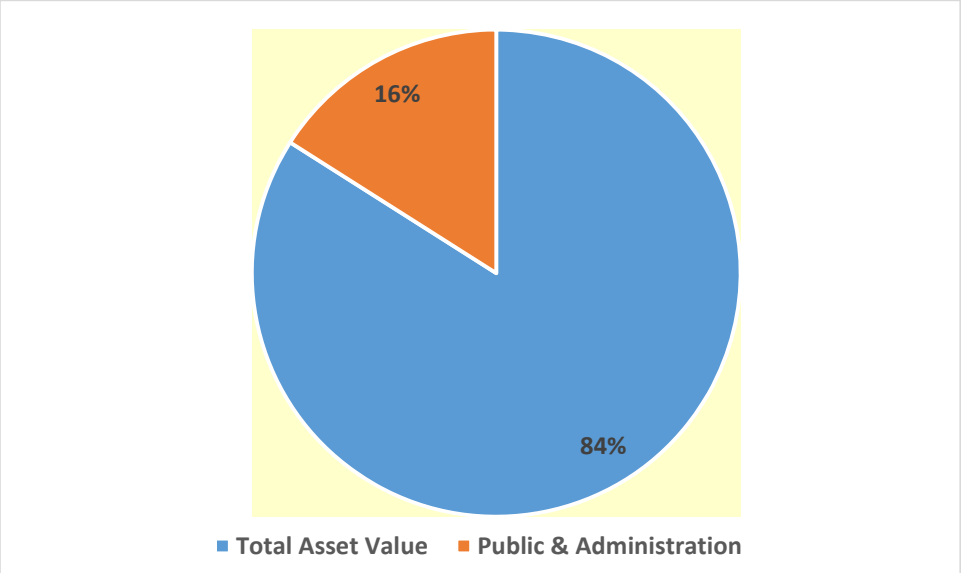
- Congregational Church (under restoration) – future condition grade 1, excellent to very good
- Fale Fono, Administration building, Congregational Church (Fenua Fala), Cemetery house (Catholic), Catholic residential compound, Catholic Church, Church Congregational -Minister's house, Dining house, Office, Sunday School, Hall/Residence, Food preparation area – condition grade 2, good mostly expected minor routine maintenance work plus a few extras
- Cemetery Fale (Congregational)- condition grade 3, fair with some larger maintenance work needed
- Minister's residence (Fenua Fala) –condition grade 4 - poor with major maintenance work to preserve the facility
- Papa – condition grade 5, very poor with failure imminent

A2.2.3.3 Lifecycle

It is evident that the majority of the Public and Administration buildings have received a high level of maintenance, but the Minister's residence (Fenua Fala) have not received the same level of maintenance. If maintenance is neglected and specific issues not addressed these structures may require a higher level of maintenance and may result if potential failure. The Papa building is very exposed in its location with no protection against the harsh marine environment and have been neglected. The Papa building is in a basic state of disrepair and will need replacement and possible relocation.

Specific maintenance issues are noted with in the Asset Register and include repair spalling on concrete, maintenance of window frames, repair weatherboards, replace missing tiles, repair piles and repair internal walls, etc. .

As shown below the Public and Administration Buildings make up 16% of the Total Fakaofo Asset Value.



A2.3.4 Storage Facilities

The Storage facilities consist of:

1. Bulk Store small & Public toilets (Fale)
2. Bulk Store (Fale)
3. Freezer house
4. Bulk Store (Fenua Fala)

The buildings range from large steel framed bulk stores to concrete structures to basic timber framed weatherboard structures. The construction dates for the buildings range from 1985 to 2002.
There are one fuel storage facility that is grouped under Energy.

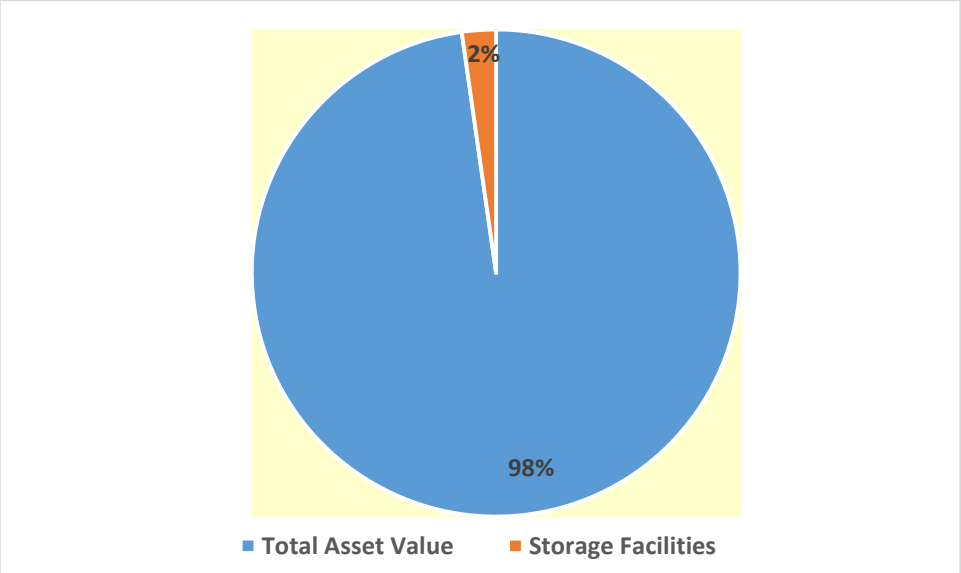
A2.1.3.4 Condition

The Bulk Store (small), Freezer house and Bulk Store (Fenua Fala) are considered to be condition grade 2, good mostly expected minor routine maintenance work plus a few extras. The Bulk Store (Fale) is considered condition grade 4, poor with major maintenance work to preserve the facility.

A2.2.3.4 Lifecycle

The Bulk Store (small), Freezer house and Bulk Store (Fenua Fala) have been maintained over the years, but the Bulk Store (Fale) require major maintenance as significant issues were observed. These include leaking roof and significant rust and corrosion on the steel frames and trusses. The leaking roof results in water leaking onto building materials stored within the shed negating the main purpose of the facility. The steel frame and trusses need reinforcement to extend the life of the asset.

As shown below the Storage Facilities make up 2% of the Total Fakaofo Asset Value.



A2.3.5 Guest houses

There are five guest houses, two on Fale and three on Fenua Fala. The two, Hakava and Matamatanga, guest houses on Fale are both timber frames with weatherboard cladding on top of concrete structures. The Hakava guest house sits on top of the food distribution area. The date of construction is estimated to be 1985.

The three guest houses at Fenua Fala were constructed during 2013 and are timber frame weatherboard cladded structures on top of 1.8 metre high concrete piles. This raised structure prevents storm surge inundation of the guest houses during a cyclonic event.

A2.1.3.5 Condition

The condition of the guest houses are considered to be condition grade 2, good mostly expected minor routine maintenance work plus a few extras.

A2.2.3.5 Lifecycle

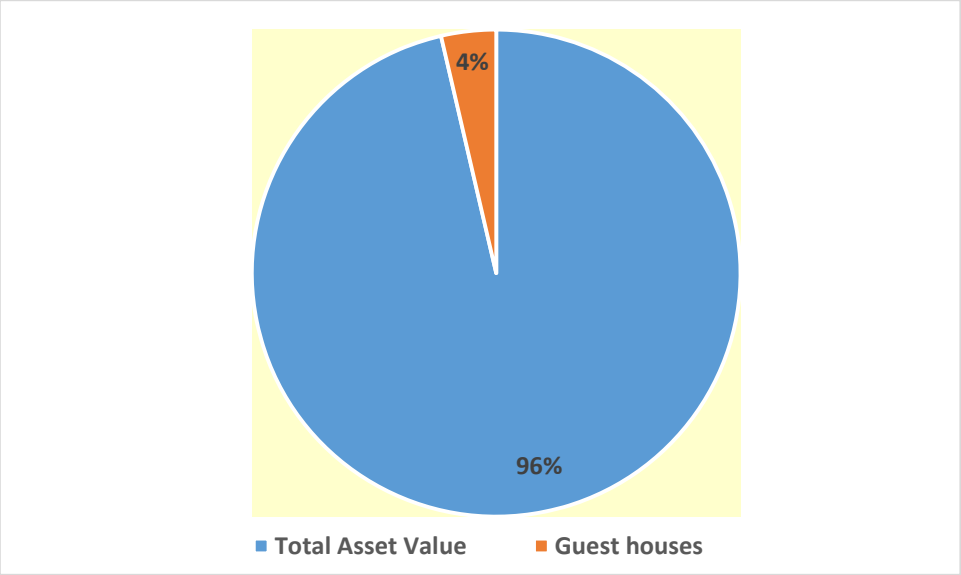
Spalling of concrete and exposed reinforcing were observed at the Hakava and Matamatanga guest houses (Fale). This will require remedial action and some minor maintenance is required on window frames.

The three new guest houses on Fenua Fale are new, but the quality of workmanship is questioned. It is important that construction of new buildings and renovations are performed to accepted standards (**IP 3**). The observation at the three new guest houses include but are not limited to:

1. Electrical connections (plugs) located under the house on concrete pillars
    a. Ingress Protection Rating?
    b. Residual Current Device?
    c. Height above ground level (storm surge inundation)
2. Floor joists
    a. Cut and joined between supports
3. Sub standard tiling
4. Double kitchen sink with only one basin able to be used due to basic static tap ware
5. Gap at toilet outlet

As a result the expected lives of the three guest houses are significantly reduced.

As shown below the Guest houses make up 4% of the Total Fakaofo Asset Value.

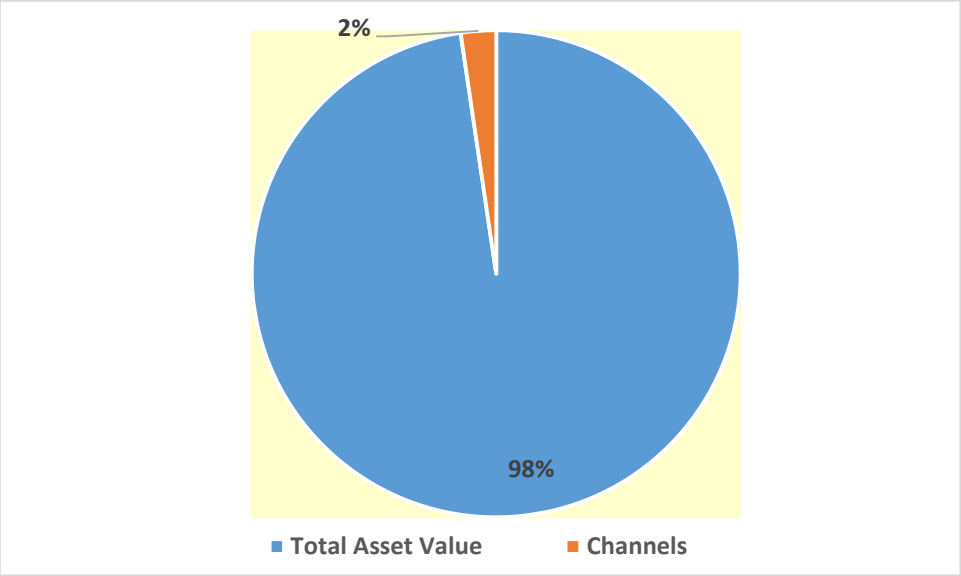


A2.3.6 Channels

There are two channels at Fakaofo. The channel at Fale is approximately 170 metres long and approximately 12 to 10 metres wide. The depth at low tide is approximately 0.8metres on average. The channel at Fenua Fale is small channel that is used when the sea conditions are too rough to use the main channel Fale. The Fenau Fale channel is approximately 190 metres long and very narrow approximately 8 metres in most parts.

There are no significant issues associated with the channel at Fale. The channel at Fenua Fale is too narrow, and widening and channel markers is required. Some dredging is required at Fale to ensure adequate depth and installation of two channel markers (**IP26**). Refer to Section 3.3.7 and the Spiire report.

As shown below the channel make up 2% of the Total Fakaofo Asset Value.



A2.3.7 Wharves

There are four wharves at Fakaofo:

1. At Fale
    a. The main wharf

   b. The school wharf
2. At Fenua Fale
   a. The secondary wharf/jetty
   b. The school wharf

At Fale the main wharf is a concrete wharf structure of approximately 7 metres wide and 14 metres long extending from the shore. Underneath the wharfs' concrete top there is evidence of aggressive erosion occurring. The erosion is particularly bad directly underneath where the wharf crane is situated and need immediate attention. Fenders to protect the barge and bollards to tie the barge were installed during March 2014.

The school wharf is located on the lagoon side at the food distribution area and Hakava guest house. It is a mass concrete structure covering approximately 160m^2. From this wharf the school barge transports pupils and residents to Fenua Fale.

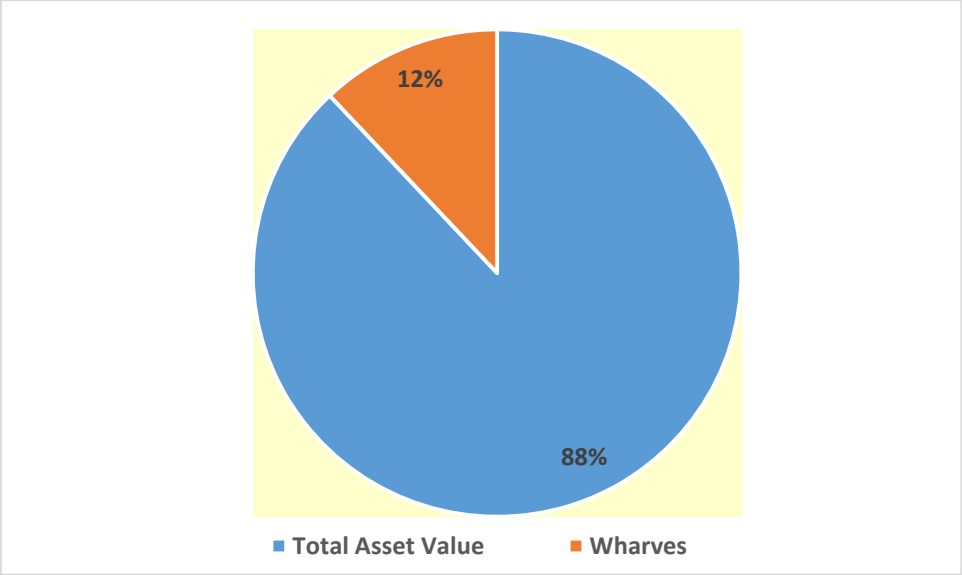
At Fenua Fale the secondary wharf/jetty is a mass concrete structure on top of the coral. It is approximately 60 metres long and 3 metres wide submerged during high tide.

The school wharf is approximately 40 metres long and located on the lagoon side of Fenua Fale. This is the drop off and collection point for the school barge transporting pupils and residents between Fale and Fenua Fala.

The Tokelau Ship to Shore Project: Onshore Infrastructure Options and Environmental Impact Assessment (June 2014) propose (**IP26**):

- Fale – main wharf
  - Removing part of the hardstand to create a sheltered berth
  - Improve turning efficiency
  - Extending the hardstand area to the north
  - Constructing a wall to provide protection against larger waves
  - Wave energy dissipation structures
  - Constructing a ramp
- Fenua Fale – secondary wharf
  - Extending the hardstand area
  - Raising the wharf level
  - Raising the access road level
  - Constructing a wall to provide protection against larger waves
  - Wave energy dissipation structures

As shown below the Wharf make up 12% of the Total Fakaofo Asset Value.



A2.3.8 Seawalls

There is approximately 1,000 metres of seawall on Fale and 150 metres of seawall on Fenua Fala. There are a range of different types of seawall construction on Fakaofo. These include but are not limited to:

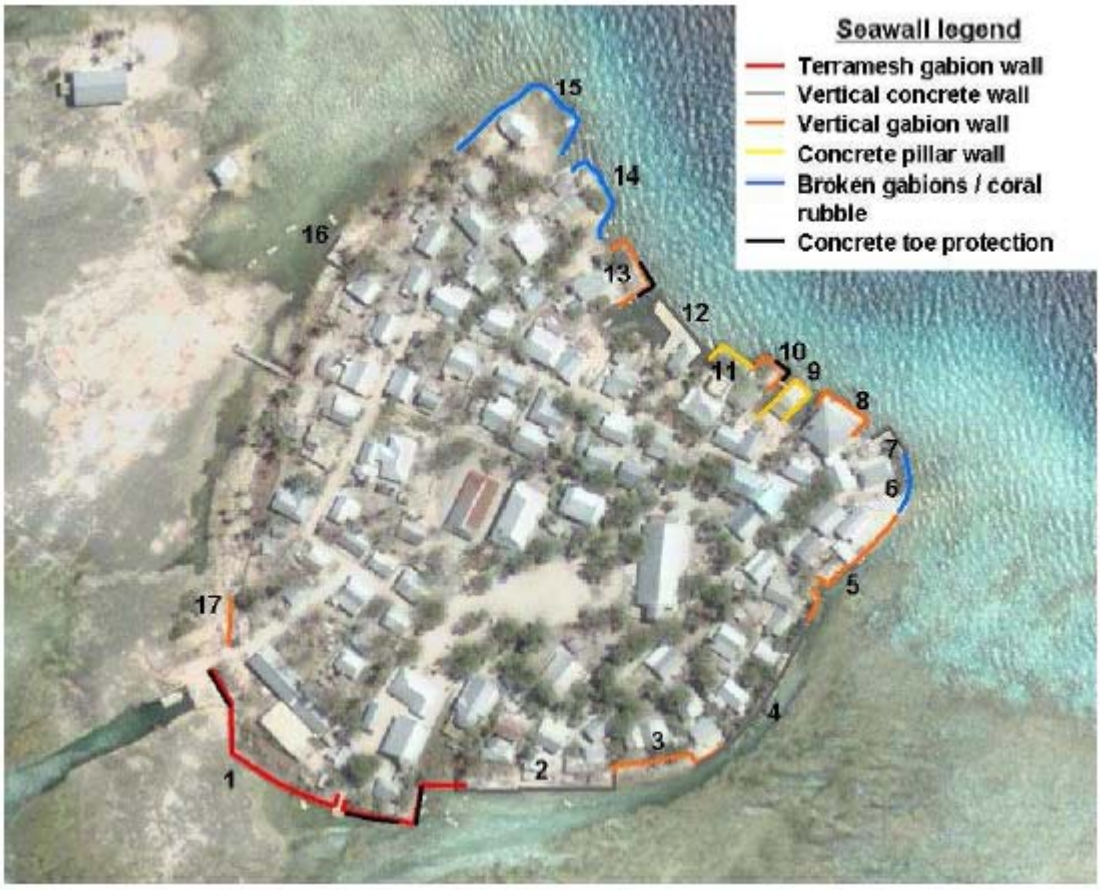
- Gabion baskets filled with coral rocks
- Gabion baskets filled with coral rock and covered with a cement/concrete layer
- Stacked coral blocks
- Mass concrete

On Fenua Fala there is only one seawall, mass concrete structure, approximately 150 metres long on the lagoon side providing protection for the school buildings.

Seawall on Fenua Fala

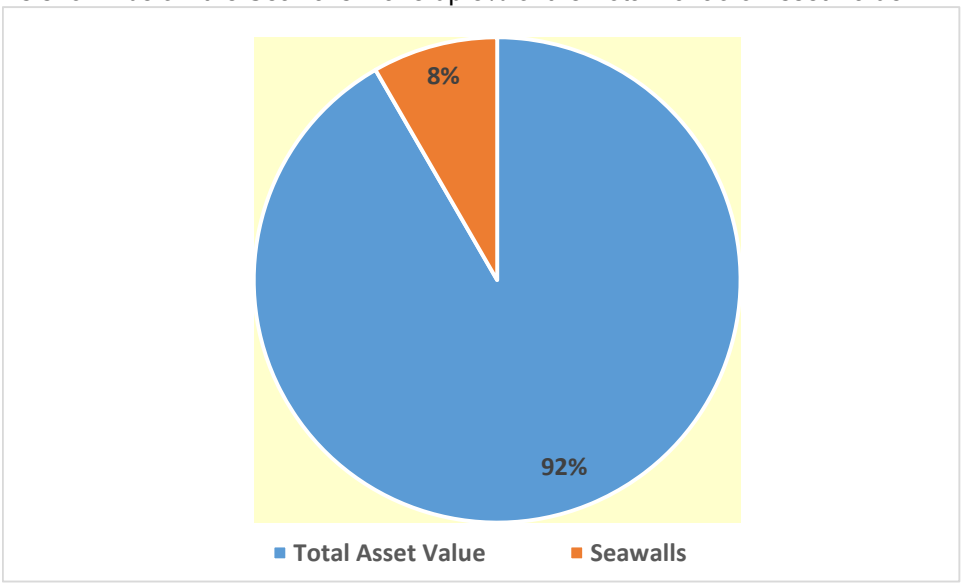
The report "Reducing the Risks of Cyclone storm surge inundation on the atolls of Tokelau – Fakaofo (2005)" details the existing coastal defences and provides a range of options for future risk management

of storm surge inundation. The figure below taken from this report shows the extent of seawalls on Fale.



The condition of the seawalls are in various states of repair, but in general the seawalls are considered to be in a condition grade 2, good.

As shown below the Seawalls make up 8% of the Total Fakaofo Asset Value.



A2.3.9 Solid Waste

The Solid Waste Facility is a timber frame weatherboard structure and houses the can crusher. At this facility the recyclables are sorted, crushed and baled. Recyclables include aluminium cans, plastic containers and glass. In general the area appear to be reasonably organised. Due to time constraints of the site visit the landfill was not visited.

Kitchen and yard waste are well managed by feeding to the pigs or placing in banana patches. There is also a chipper/shredder to improve the management of green waste.

The waste collection system generally operates well with two to three times weekly collection.

The Integrated Waste Management, Water and Sanitation Review and Action Plan 2010 states:

The quantity of household solid waste generated on Fale was estimated by the waste collectors to be equivalent to twelve 120-litre bins each collection day, which equates to about 225 cubic metres annually. Assuming an average bulk density of the waste of 150 kilogram per cubic metre1, then the estimated weight of waste generated from Fale is approximately 34 tonnes annually. Given a population of about 250 people, the resulting estimated daily waste generation rate is about 0.4 kilogram per person. Unfortunately, no estimates were obtained from the collectors in Fanuafala, however, the annual waste generation is likely to be similar to that of Fale (34 tonnes).

It was reported that plastic PET bottles are banned from Fakaofo and none could be observed in the waste stream during this visit.

Kitchen and yard waste is generally well managed by feeding it to the pigs or putting it in banana patches. This avoids a lot of problems such as odours and leachate at the dumpsite. A new shredder for green waste was also being commissioned and will be made available to residents to chip "green" waste to mulch, which can then be used to improve gardens. This system of management works well, since very little, if any, organics could be observed in the waste stream – residents should therefore be encouraged to continue this practice.

The waste collection and sorting system operates well in Fale with each household having a plastic bin that is emptied three times a week, while in Fanuafala, old 45 gallon metal drums cut in half are still used. In Fale, aluminium cans and beer bottles are separated and sent to Fanuafala for processing, plastics and other 'burnable' waste are separated and burnt on the reef at low tide, while all other waste is transported by boat to Fanuafala for disposal in the dumpsite. On Fanuafala, the aluminium cans and bottles are baled and shipped to Samoa under a Memorandum of Understanding (MOU) signed with the Government of Samoa in 2007. All other waste goes to the dumpsite.
It was observed during the sorting process in Fale that the workers did not wear gloves or other protective equipment, and consequently this may expose them to unnecessary health risks.
Although the recycling system operates well, some quantity of aluminium cans was observed in the dumpsite and also around the community as litter. This could be a signal of a lack of awareness or apathy.

During the consultations, members of the community were concerned that the aluminium cans were not being shipped to Samoa regularly. It was explained by the Director of the Department of Economic Development, Environment and Natural Resources (DEDNRE) that due to the low purchase price for the scrap aluminium in Samoa (20 Sene per kilo) the decision was taken to stockpile the aluminium cans until negotiations for a better purchase price were concluded. This concern was later repeated in consultations on the other two atolls, and is a sign that regular communication has not been taking place between DEDNRE, the Taupulega and the communities.

Fakaofo Atoll has one main dumpsite situated in Fanuafala, close to a temporary classroom and an existing piggery. The site is located inland some distance away from the shoreline in a forested area which offers some protection from heavy winds and cyclones. There is evidence of open burning at the site, and the waste is also covered periodically by galvanized sheet metal.

Medical waste generated is mainly comprised of sharps which are buried on the hospital grounds, dressings which are openly burnt in a metal container, and the expired drugs and used ampoules are

taken to Samoa for disposal. This system is based on the good, but informal, relationship that exists between both Countries' health authorities. During the consultations, it was revealed that the Government of Tokelau was seeking to formalise this arrangement with the Samoan government through a formal MOU.

Bulky waste includes derelict vehicles and boats, metal drums, damaged water storage tanks, and whiteware goods such as refrigerators and washing machines, all of which were observed in Fakaofo. There is currently no collection program for this kind of waste, which would quickly fill up the dumpsite and consume valuable space. Consequently most of this waste type is usually abandoned in various locations throughout the atolls and left to become potential hazards during cyclones. There is a general practice of holding a clean-up week before the cyclone season in order to secure any large bulky items which could be blown around and cause damage during a cyclone.

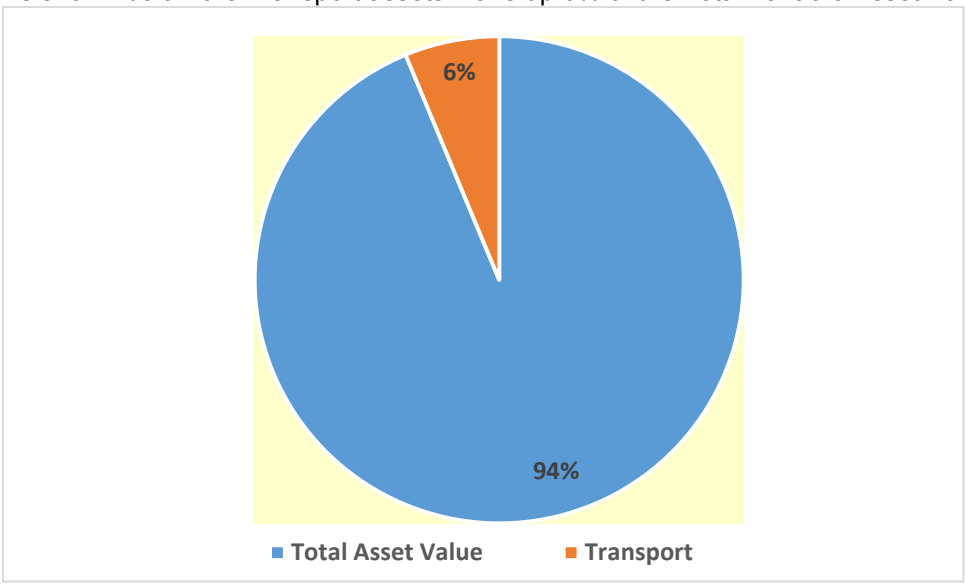
It is important to implement the Solid Waste Action Plan (**IP 7**).

A2.4 Transport

The Transport service consist of:

- Tokelau Samoa link
- Ship to shore
- Boats
- Roads and street lights

As shown below the Transport assets make up 6% of the Total Fakaofo Asset Value.



A2.4.1 Tokelau Samoa link

Tokelau's only transport link with the rest of the world is the shipping service between Tokelau and Samoa. This is currently a chartered service provided by the Government of Tokelau, but a government owned ship is being constructed at the time of writing this Plan.

Each of the atolls are dependent on this Tokelau Samoa shipping service for passengers, cargo, medical and emergency evacuations.

Samoa Shipping Co vessels are used for additional charters not only to transport passengers during peak travelling times between Apia and Tokelau, but also when large orders of supplies for government/village projects are required or when there are national activities which necessitate moving large groups between atolls.. Additional charters have averaged 10 – 12 per annum over the period

2005 -2010. The GT500 SOLAS Ferry (under construction at the time of writing this Plan) is included as a transport asset under Apia.

A2.4.2 Ship to Shore

None of the three Tokelau atolls has any seaport, due to the particularly steep drop off from each atoll's fringing coral reefs into very deep water. In the absence of harbour/port facilities motor powered barges provide a ship to shore transfer service. This is a very basic service which will always be significantly reliant upon a combination of local skills, and available technology and its maintenance.

Ship-to-shore safety issues were highlighted in the MFAT Internal Audit on Maritime Safety wherein a range of recommendations were made. The Tokelau Ship to Shore Project: Onshore Infrastructure Options and Environmental Impact Assessment (June 2014) propose procurement of a tracked crane (**IP27**) which will be fit for purpose and aligned with proposed channel and wharf upgrades.

There are two operational barges on Fakaofo. One large performing the main ship to shore duties and the school barge transporting pupils daily and residents daily between Fale and Fenua Fale. The Large barge is powered by two 60hp Yamaha outboard motors and the school barge by 2 40hp Yamaha outboard motors.

The condition of the barges are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed. The barges are used in a harsh environment and as such the expected lives of the barges are low.

At the time of writing a new barge was near delivery to Fakaofo. The new barge is deemed to be a significant improvement on the existing barges.

A2.4.3 Boats

There are a number boats owned by the Taupulega on Fakaofo. These include a hospital boat, a solid waste management boat, pontoons and fishing boats.

The condition of the boats are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed.

A2.4.4 Roads and Streetlights

There are approximately 0.6km of roads on Fale and 1.7km of roads on Fenua Fale totalling 2.3km on Fakaofo. All the formed roads consist of rolled crushed coral. Traffic is very light, mainly pedestrian and golf carts. While the heaviest vehicles that use the roads are light trucks and tractors. Heavy loads are limited to the transport of fuel from the wharf to the bulk fuel storage facility. The crushed coral is free draining and there is little evidence of water damage despite the frequency of heavy rain.

The key maintenance activity is the filling in of the few potholes and ruts that develop, preferably as soon as they are first noticed. There is some evidence that where potholes have been filled there has not been sufficient attention paid to compacting the fill material. In the places where there are water table drains (shallow drainage channels) these need to be kept clean and free of debris.

There are approximately 90 streetlights, each streetlight is fitted with a sensor which switch the streetlight on during low light conditions.

The overall condition of the Fakaofo roads and streetlights are deemed to be condition grade 2, good.

A2.5 Water and Sanitation

Water and Sanitation assets have been included in the asset register with Buildings and consist of water tanks attached to public buildings and private houses, and septic tanks, septic cells also attached to public buildings and private houses.

There are some remaining lagoon toilets in service, which are small timber and corrugated iron structures. No allowance for the replacement of these structures has been made in this plan.

There are no reticulated water or sewer systems in Tokelau.

Each atoll has a desalination plant for use in times of drought. These have been included in the Plant and Equipment assets.

In May 2010 the Government of Tokelau received the 'Integrated Waste Management, Water and Sanitation Review and Action Plan,' by SPREP and Parsons Brinkerhoff. This report completed a comprehensive review of water and sanitation issues, and provided a large number of recommendations.

The recommendations from the May 2010 report should be completed by Government of Tokelau (**IP 32**).

In particular in relation to this AMP the following recommendations are highlighted:

1. Complete the PACC+ installation programme
2. Complete household water tank installation
3. Maintain the Desalination Plant (and periodically test run)
4. Undertake a community options and feasibility report for appropriate sewerage management systems (**IP 33**)
5. Instigate and continue regular water sampling, wastewater sampling and lagoon water sampling to track any issues and build an evidence base for further action

These items have also been included as appropriate in the AMP service levels.

Sewerage management systems will require further study (**IP 33**), and it is likely any solutions will require further expenditure. This potential expenditure has not been added to this AMP, as the solutions are unknown at this stage, and could range from the status quo through to reticulated and managed sewerage treatment systems. Any additional costs for this will need to be added to future revisions of this AMP.

A2.6 Telecommunication

The Telecommunication assets consist of:

- Communications Building
- Teletok Manager's residence
- Equipment
- Telecomm Cable

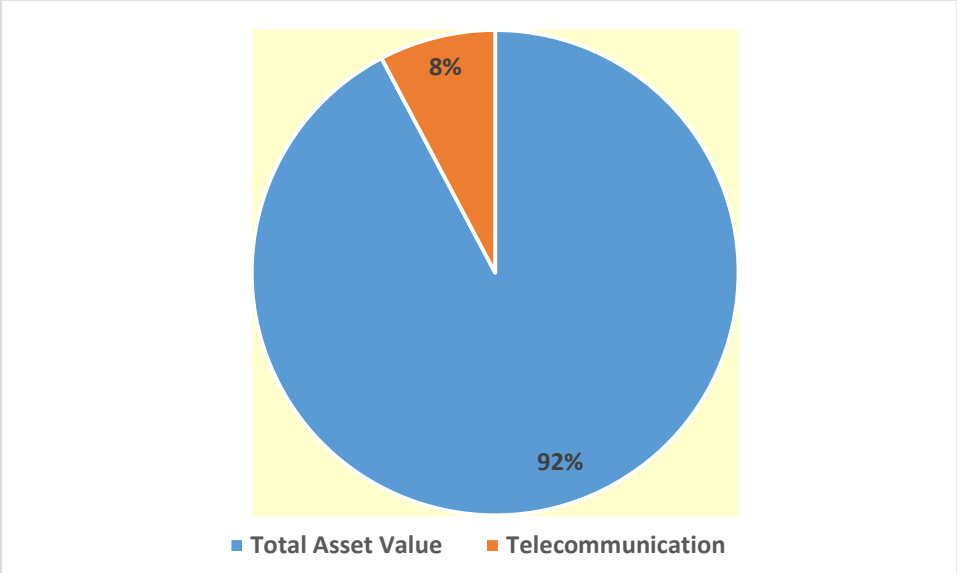
The Communications building is a concrete building and weatherboard building on a raised concrete foundation containing the water tank. This raised concrete foundation prevents storm surge inundation of the telecommunication equipment, housed within the building, during a cyclonic event. The equipment housed within the Communications building consist of modems, exchange, switches, equipment racks and air conditioning. The Teletok Manager's residence is located next to the Communications building and consists of a timber framed weatherboard structure (upper level) atop a concrete structure (lower level).

The other telecommunication equipment consists of:

- 3 Satellite dishes
- Solar panels
- Radio mast
- Technical & Internet equipment

The condition of the telecommunication assets are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed.

As shown below the Telecommunication assets make up 8% of the Total Fakaofo Asset Value.



A2.7 Energy

The Energy assets consist of:

- Buildings
- Solar Panels
- Batteries
- Generators
- Power cable
- Fuel

The buildings consist of the battery house (on Fenua Fale where the solar power batteries and inverters are housed), the generator house (on Fenua Fale where the generators are housed), the backup generator building (on Fale where the backup generator is housed and the bulk fuel storage (on Fale where the fuel is stored) and the solar plant fence (on Fenua Fale).

The solar panels are 230 Watt Sunrise panels. The panels are certified to the IEC 61701 Standard – Salt mist corrosion testing of photovoltaic (PV) modules. There are eleven clusters, each cluster consisting of 144 panels. Each cluster has two connection configurations, one for the panels connected to the string inverters, and one for the panels connected to the DC charge controllers. The panels are mounted on aluminium frames which are bolted into concrete foundations. The anodized aluminium frames were chosen above galvanised steel or stainless steel due to its low weight and low cost and proven performance in harsh marine environments. The panels are tilted to 12° allowing for self-cleaning during rainstorms. However, regular manual cleaning is required.

The batteries are installed in the battery house. Each PV cluster in the Tokelau systems includes a 48V battery bank to store surplus PV energy generated during the day for use at night or periods of low light. The battery banks are composed of two strings of 24 batteries, and have a storage capacity of 288 kWh. They have been sized to provide enough storage to last 1.5 – 2 days without any solar input before the backup generator is turned on.

The battery cells are flooded lead-acid and require regular topping up with distilled water as their electrolyte levels reduce when being charged. A deionizer is installed in the battery room. Rainwater is collected in a tank, and then pumped through the deioniser to be used in topping up the batteries.

Lead-acid batteries are sensitive to being discharged for extended periods of time. An alarm is triggered when the state of charge of the batteries drops below 60%. This alarm notifies the system operators to turn on the backup generators. If the state of charge drops below 30%, the battery inverters disconnect the loads from the PV system, which means that the island loses power (unless the backup generator is running). The batteries have an expected useful life of 8-10 years if properly maintained. Note, however, that the lifetime of a battery is defined as being 80% of its original capacity. Batteries can still be used beyond their rated life, though at a reduced capacity (<80%) and only for a limited amount of time as their usable capacity decreases rapidly after their end of life.

The batteries are located in a room separate from the inverters, as hydrogen gas is produced by the batteries during the charging process and there is a risk of explosion caused by a spark from electronic equipment. The battery room is well-ventilated to evacuate any hydrogen gas that is produced, although the catalytic combiner caps should minimize the amount of hydrogen gas released.

The battery inverters are SMA's Sunny Island 5048. They control the current flow to and from the batteries, and form the grid (i.e. set the voltage and frequency of the grid) when the generator is not active. Each cluster is composed of three battery inverters, with one battery inverter as master and the other two as slaves. The battery inverters are covered by a 10-year warranty.

The string inverters are SMA Sunny Boy 3000 inverters. The string inverters convert the DC electricity from the panels into AC electricity that is injected into the power grid. The string inverters are covered by a 10-year warranty.

There are three generators housed in the generator building near the battery building and PV array. The generators were once the sole source of electricity, but are now used as backup for the solar power system. The generators have to be manually switched on when required. This could be automated, but the manual approach keeps the operators actively involved, keeps them familiar with the system and signals issues with the system i.e. awareness of continual generator power required.

The generators are:

Make	Model	Hz	kVA	kW

At the time of the site visit no access was available to the generator room to obtain details and it was not clear which generators were operational.

The system is monitored by SMA's Sunny Web Box data monitoring systems. There are three on each atoll, monitoring the battery inverters and charge controllers, the string inverters, and a small solar radiation measuring device on the array. The Web Boxes upload their data to the SMA Sunny Portal website, for remote monitoring and analysis.

Two touchscreen computers (one in the inverter room and one at the powerhouse) and custom monitoring software were installed with each system to provide operators with a live feed of solar production, charge/discharge currents to and from the batteries, generator production, solar radiation and the loads on the grid. The computers allow access to the Web Boxes so that operators can change system parameters on the battery inverters and the string inverters. The computers are sealed against the environment and are not fan-cooled, so do not have fans to fail.

There is also an additional mobile generator, MPMC MTG 100CS (50Hz, 100KVA), located in the Mobile Generator Building on Fale.

The power cable is estimated to be approximately 4 kilometres long.

The fuel consists of diesel, petrol and kerosene stored in the bulk fuel storage facilities.

A2.1.7.1 Condition

The Generator house, Battery house and fencing is considered to be condition grade 2, good. The bulk fuel store are considered to be a condition grade 4, poor with major maintenance work to preserve the facility.

The PV arrays, batteries and inverters are considered condition grade 1, excellent to very good. The fixed generators are considered to be condition grade 3, fair with some larger maintenance work needed, and the mobile generator is considered to be condition grade 2, good.

A2.2.7.1 Lifecycle

The Bulk fuel store has a number of maintenance issues including significant spalling and exposed and corroded reinforcing at the nib wall, roof leaking, holes in the corrugated iron cladding and significant rust and corrosion on the steel framing.

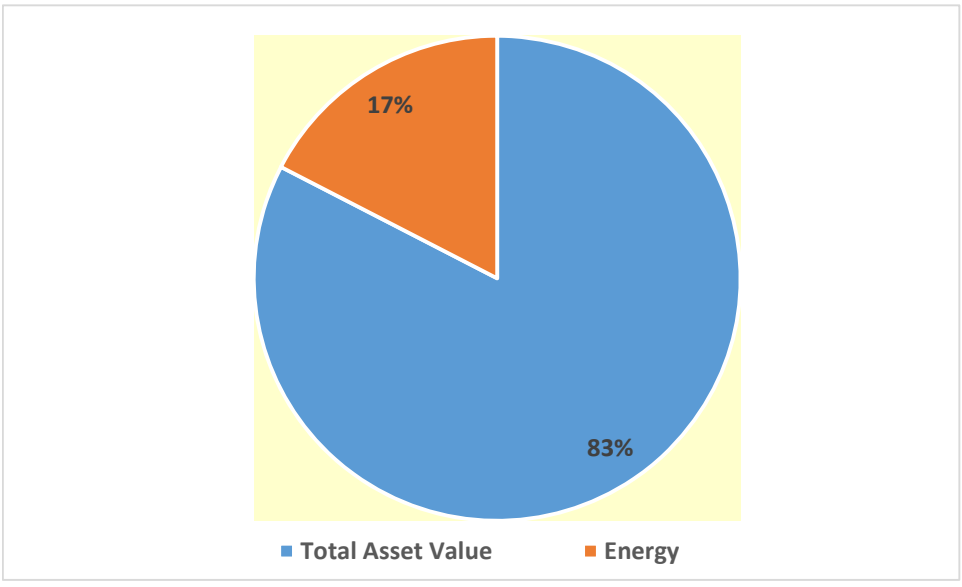
The bulk storage of fuel on Fakaofo is a cause for concern as this facility is in close proximity of houses and pose a high risk. During the site visit the following issues were noted:

- Close proximity to houses
- Lack of appropriate ventilation
- Significant presence of fuel fumes
- Lack of signage

Refer to Section 8.5.1. The bulk fuel storage on all the atolls require significant safety improvements and/or relocation to ensure risks are minimised and can be appropriately managed (**IP 30**) and this is included in the Capital Projects.

Cleaning of the battery house gutters to minimise the contamination of roof collected water will prevent dirt and debris clogging the deionizer. The solar panels will require regular cleaning and monitoring of the foundations and fastenings. Cleaning is best performed after rain events or early morning and late afternoon when the panels are cool and damp. Water levels in batteries will require regular checking and topping up with deionized water when required. Checking the State of Charge of batteries and system alarms and regular charging of batteries to ensure the batteries reach their expected lives (**IP 9**). The generators are three different generators creating maintenance issues as each will require different parts etc. Standardising to one type and size of generator will greatly enhance maintenance and operational status of the backup power supply (**IP 10**).

As shown below the Energy assets make up 17% of the Total Fakaofo Asset Value.



A2.8 Plant and Equipment

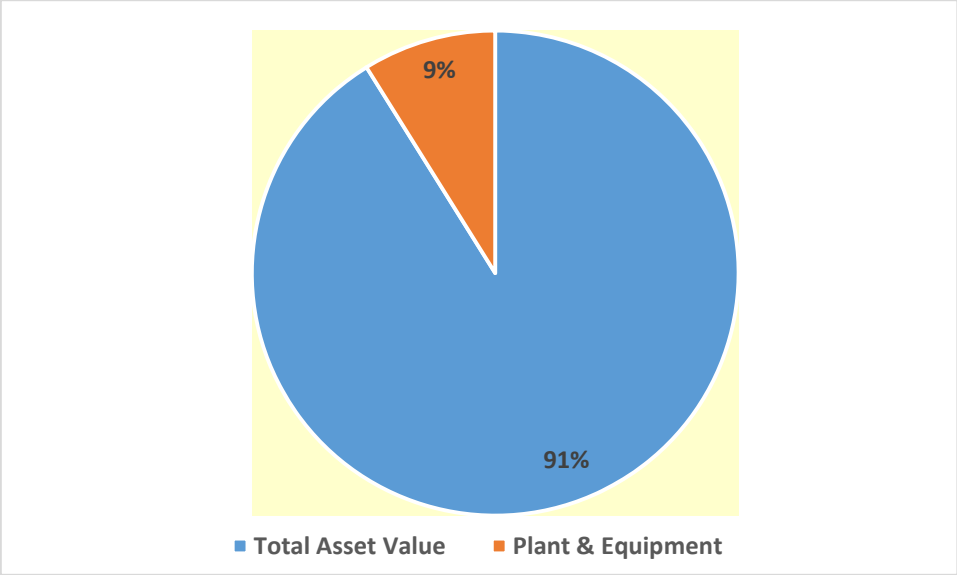
There are significant number of various plant and equipment on Fakaofo. The most significant plant and equipment are tabled below:

Plant	Manufacturer	Size/Model
Excavator	Caterpillar	12 tonne
Excavator	Caterpillar	4 tonne
Excavator	Caterpillar	3 tonne
Excavator	Caterpillar	2 tonne
Tractor crane x 2	ACE	12 tonne
Wharfe crane	Palfinger	
Tractor	John Deere	5075E
Village freezer		
Truck	Mitsubishi	3 tonne Canter
Truck	Isuzu	3 tonne
Forklift	Hyster	5 tonne
Forklift	Mitsubishi Grendia	3.5 tonne
Desalination plant	AMPAC	
Trailer	Coombridge & Alexander	
Wood chipper	Vermeer	
Compressor	Atlas Copco	XAS97
Pneumatic hammer	Tiger	
Concrete mixers		
Quad bike	Yamaha	
Miscellaneous equipment	Fridges, freezers, stoves	
Office equipment	Administration & EDNRE	
Medical equipment	Defibrulator, etc.	

The condition of the plant and equipment range from condition grade 1, excellent to 5, very poor. A range of maintenance issues (**IP 11**) were observed including but not limited to:

Plant	Issue
Desalination plant	Perform regular test runs to confirm operational status
Tractor crane	Brake lining issues. Retrofit to make operational
Wharf crane	Not working. Requires remedial action

As shown below the Plant & Equipment assets make up 9% of the Total Fakaofo Asset Value



A2.9 Data Confidence

The confidence in data for the assets is detailed in the table below:

Asset	Component	Confidence
Buildings	Attributes	2
	Condition	2
	Performance	2
Transport	Attributes	2
	Condition	2
	Performance	2
Channel	Attributes	3
	Condition	3
	Performance	3
Wharf	Attributes	3
	Condition	3
	Performance	3
Seawalls	Attributes	3
	Condition	3
	Performance	3
Solid Waste	Attributes	2
	Condition	2
	Performance	2
Telecommunication	Attributes	2
	Condition	2
	Performance	2

Asset	Component	Confidence
Energy	Attributes	2
	Condition	2
	Performance	2
Plant & Equipment	Attributes	2
	Condition	3
	Performance	3

Where

Score	Description	Definition
1	Accurate	100%
2	Minor inaccuracies	± 5%
3	50% estimated	± 20%
4	Significant data estimated	± 30%
5	All data estimated	± 40%

The above is confidence scores are from the New Zealand Infrastructure Grading Guidelines 1999.

A2.10 Financials

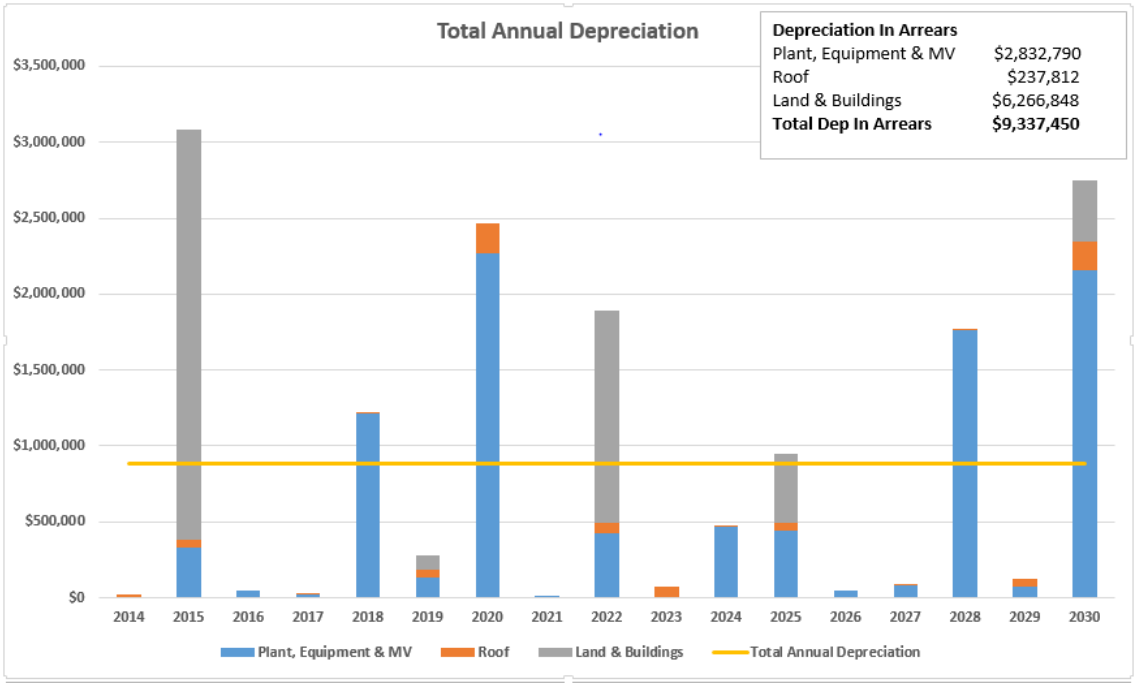
A2.10.1 Asset Valuations

No formal documented asset valuation has been performed. This Asset Management Project developed the Asset Register and this Asset Management Plan.

The newly created Asset Register and associated values are based on the best information available – in many cases this was minimal, resulting in "global best guess" estimates being made. It is envisaged that over time much more accurate, detailed and reliable information on assets will be collected, meaning that regular and more reliable asset values can be developed and incorporated into the Asset Register providing the basis for a more robust Asset Valuation.

A2.10.2 Depreciation

There has been limited accrual accounting with the current practice is mainly cash based accounting which results in replacement/renewal cost of an asset only being recognised when it wears out. This places unnecessary pressure of funding mechanisms and no consideration for lifecycle management. Tokelau should consider implementation of accrual accounting (depreciation) where the costs is spread over the life of the asset. Depreciation/decline in service potential is thus provided on a straight line basis. The required annual depreciation component for all Fakaofo assets amount to $840,000.



It should be noted that as there has been limited accrual accounting to date and most of the assets partway through their expected lives there is a portion of depreciation in arrears e.g. an asset has an estimated value of $100 with a 10 year life. Therefore the annual depreciation component is $10 each year over 10 years. But the asset is already 3 years old and no depreciation has been collected. As a result there is a depreciation arrears of $30 (3 year x $10) which needs to be collected prior to the asset reaching the end of its expected life. The depreciation arrears for Fakaofo assets amount to $9,337,450. The Tokelau Infrastructural Replacement Fund has a balance of $1,350,000 at 30 June 2014 for all of Tokelau's infrastructural assets.

A2.10.3 Operation & Maintenance

The Taupulega (Village Council of Elders), General Fono (National Assembly) and the Council for the Ongoing Government (Executive Government) of Tokelau are the principal administration institutions of governance in Tokelau. The Taupulega provides policy direction at the village level whereas the General Fono provides all policy direction at the national level.

The public service sector implement government policies. The public service sector delivers services within the constraints of the allocated budgets.

The Tokelau Public Service refers to two levels of service:

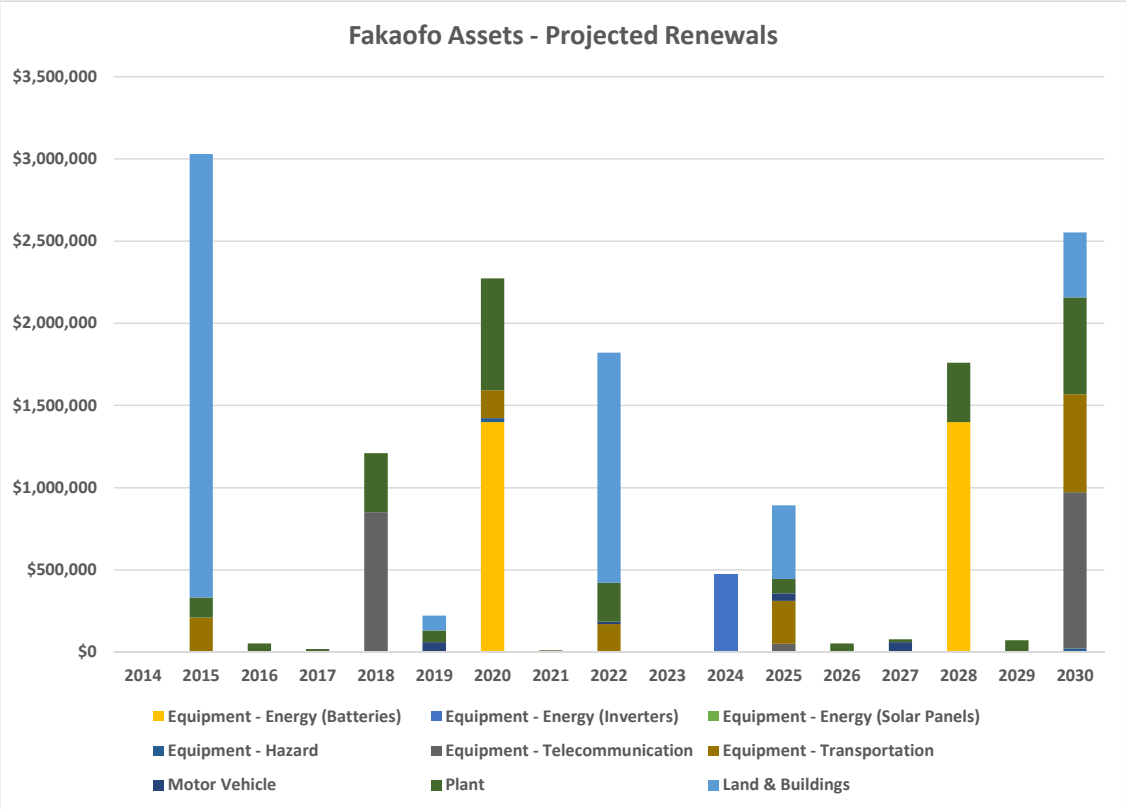
1. those services provided at the national level, under the coordination of the General Manager, Apia, are the Departments of -
    a. Finance,
    b. Health,
    c. Education,
    d. Economic Development,
    e. Transport and Support Services,
    f. Energy and the Office of the Council for Ongoing Government and
2. the services provided at the village level, under the management of the respective village General Manager (Director or Coordinator) include staff who work in the
    a. school,
    b. hospital,
    c. Information Technology support services,
    d. co-operative store,
    e. finance,
    f. FM radio,

g. general village workers and
h. the traditional workforce

The Taupulega on each atoll has responsibility for all the public assets on the atoll including public buildings, schools, storage facilities, transport and wharves. The operation and maintenance of these facilities are a major part of the Taupulega's responsibilities and a substantial part of its annual budget. Operation and Maintenance costs is estimated at $170,000 per year.

A2.10.4 Renewals

No formal Renewal Plan exists for the assets in Tokelau. The following shows the renewal requirements for the Fakaofo assets based on the expected useful lives within the asset register.



The most significant renewals projected in the above graph include but are not limited to:

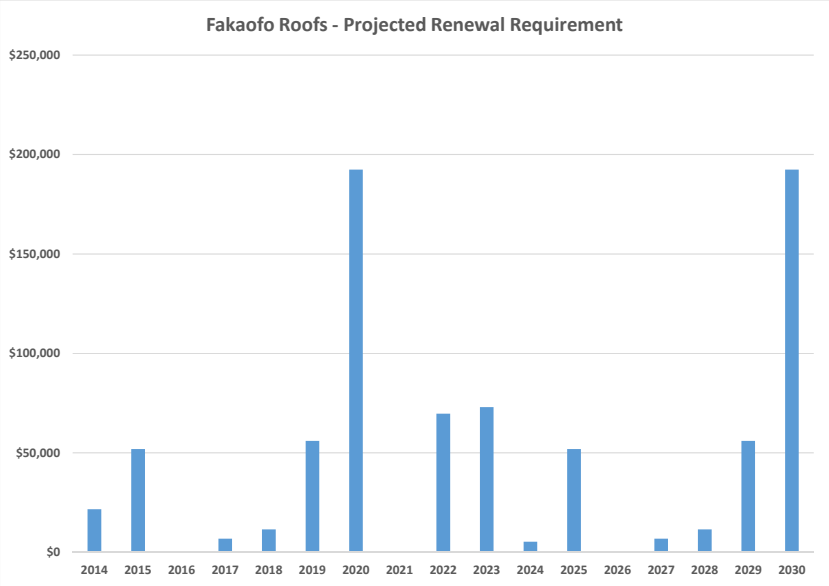
- Wharves
- Church
- Telecommunication (technical & internet) equipment
- Seawalls
- Energy – Batteries & Inverters
- Various buildings

It is important to note that this is projected replacement and not planned replacement. This means that these are theoretical replacements required, based purely on the expected useful lives of the assets within the asset register. Asset condition assessments may extend or decrease expected useful lives affecting an actual planned renewal programme. It is therefore important that Tokelau develop a Renewal Plan (**IP 24**)

Building Roofs

The majority of roofs in Tokelau are corrugated iron and staff interviews suggest that the expected lives of the corrugated iron/steel roofs are severely affected the a harsh marine environment. In general, unpainted steel roofs in New Zealand have an expected life of 20 years, but in Tokelau that expectation is halved to 10 years.

Taking the estimated size of each corrugated iron roof and estimated installation date and using an estimated replacement cost of $55/m^2 a projected roof renewal requirement was developed. This requires a total of $807,000 for roof renewals over the next 15 years with an average of $54,000 per year. This should be funded out of the building depreciation component.



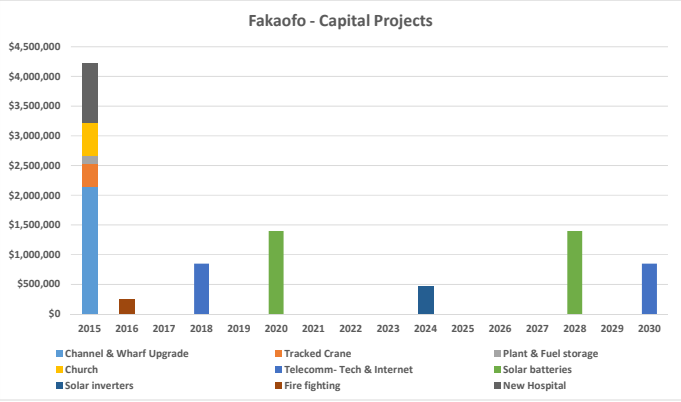
The viability of changing roofing materials should be investigated (**IP 1**).

A2.10.5 Capital Projects

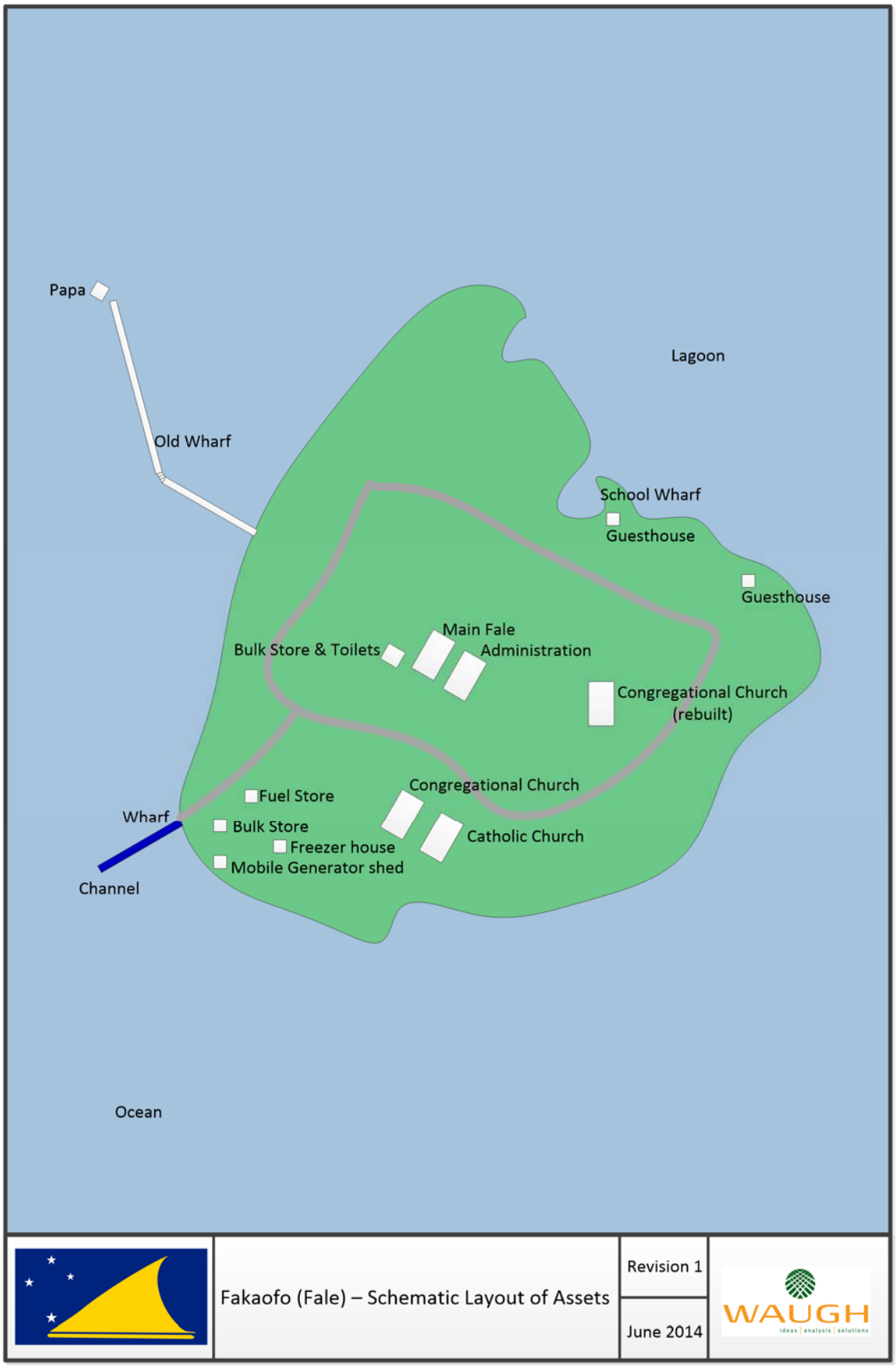
The following Capital Projects are planned and are mainly based on expected renewals:

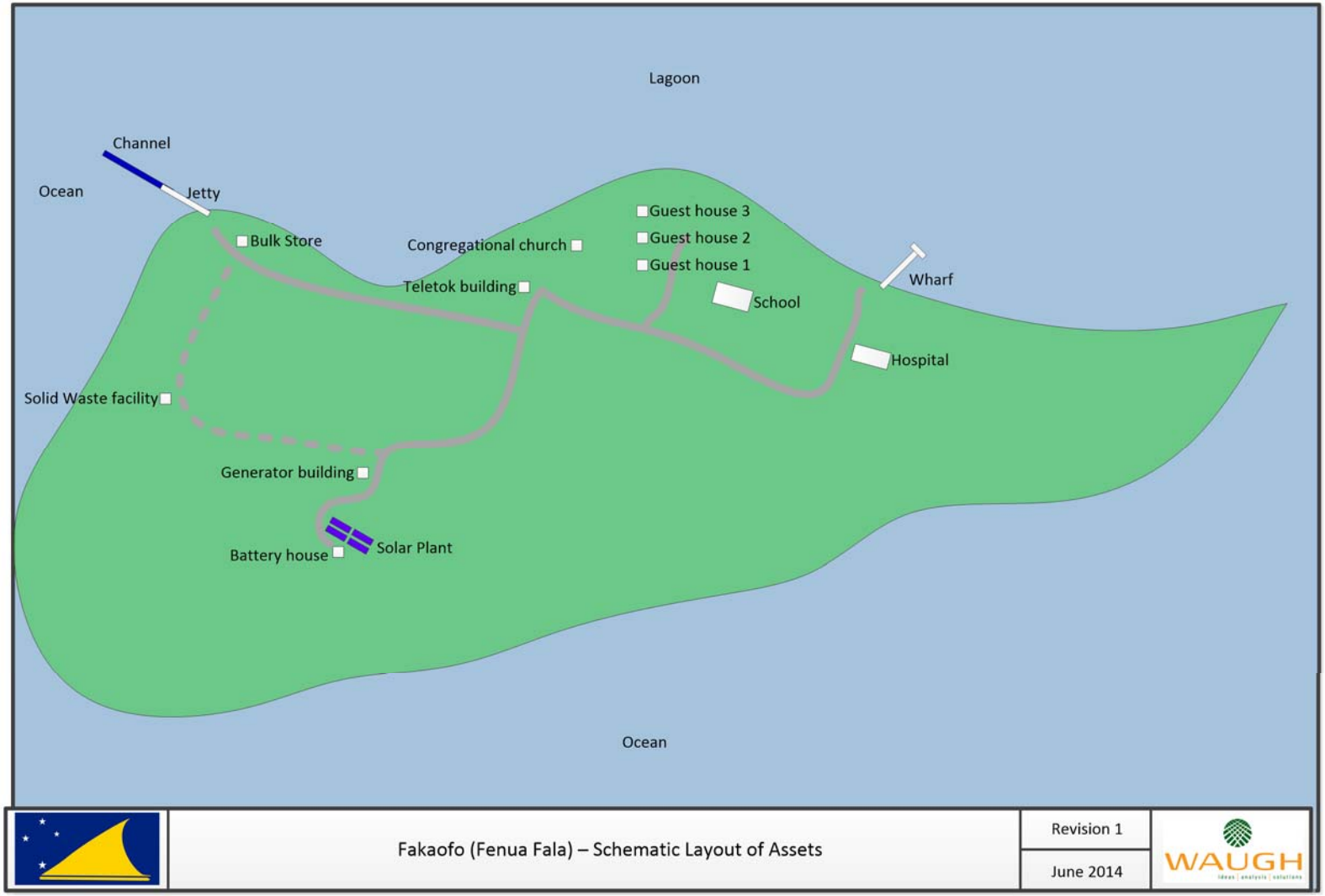
Year	What	Costs
2015	Channel & Wharf upgrade	$2,137,000
	Tracked crane	$400,000
	Shed storage for plant & bulk fuel	$120,000
	Church Replacement	$563,000
2016	Fire fighting	$200,000
2018	Telecommunication – Technical & Internet Equipment	$850,000
2020	Energy – Solar Batteries	$1,400,000
2024	Energy –Inverters	$470,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$850,000

The above table of capital projects is graphically represented below:



A2.11 Schematics




Lagoon
Channel
Ocean
Jetty
Bulk Store
Congregational church
Guest house 3
Guest house 2
Guest house 1
Teletok building
School
Wharf
Hospital
Solid Waste facility
Generator building
Battery house
Solar Plant
Ocean
Fakaofo (Fenua Fala) – Schematic Layout of Assets
Revision 1
June 2014
WAUGH

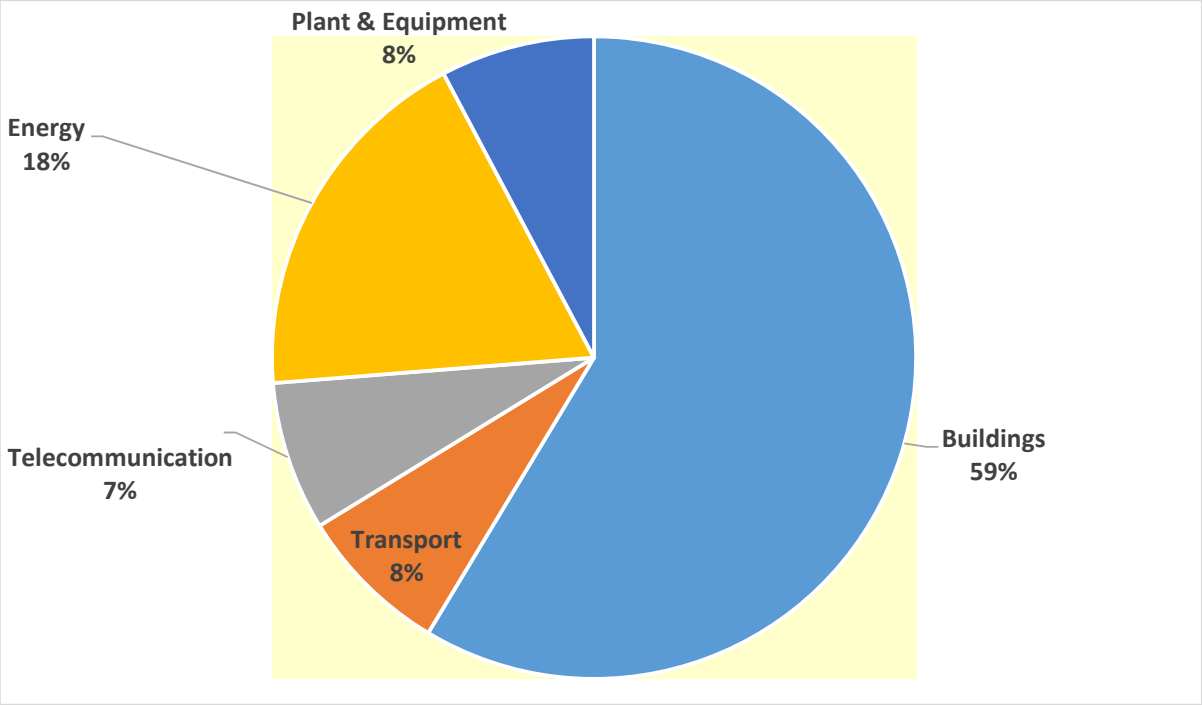
A3 Atoll - Nukunonu

A3.1 Overview

Description			Quantity/Detail	Replacement Value (NZ$)
Population served			410	
Assets	**Buildings**	Health	Hospital & Doctor's residence	$1,008,250
		Education	Pre-Primary, School, USP, Toilets, 2 houses	$1,684,050
		Public & Administration	Church, Meeting house, EDNRE, Falepa, Women's Centre, Workshop, Promenade, Church houses	$2,656,500
		Storage facilities	Bulk Stores, Freezer, Co-Op	$511,950
		Guest houses	3	$176,250
		Channels	1	$300,000
		Wharves	1 x Main wharf	$1,262,000
		Seawalls	0.8 kilometre	$800,000
		Solid waste	1 Landfill	-
			Solid waste facility	$36,000
	Transport	Charter boats	Charter boat (share between Tokelau atolls)	-
		Ship to Shore	2 Barges	$190,000
		Boats	3	$271,000
		Roads & Streetlights	2.8 kilometres & 45	$426,000
		Bridge		$210,000
	Telecom	Building	1 x Communications building	$15,000
		Equipment	Satellite dishes & solar panels, etc.	$165,000
			Technical & Internet	$800,000
		Cable	2 kilometres	$100,000
	Energy	Building	3	$276,900
		Solar Panels	1,152	$300,000
		Batteries	384	$1,300,000
		Inverters	56	$350,000
		Generators	4	$213,000
		Cable	2.1 kilometres	$105,000
		Fuel	Storage sheds	$120,800
	Plant & Equipment		33	$1,114,210
	Grand Total			**$14,391,910**

Note: Water and sewerage systems are included in building data

A graphical representation of the Nukunonu asset value distribution is shown below:



This shows that the assets with the greatest value is Buildings and Energy totalling 76% of the total asset value. However, this does not indicate the criticality of the asset e.g. Telecommunication is a critical asset but only a small percentage of the total asset value.

A3.2 Key Issues

Issue	Description	Mitigation
Health & Safety	Channel	Planned upgrades of the channel and wharf
	Wharf	
	Cargo handling	Planned procurement of new tracked crane
	Fire fighting	Investigate options and procure firefighting equipment
Materials	Roofs	Investigate different roof materials and viability
Storage	Facilities & materials	A logistics champion
Solid waste	Improvements	Implement the Solid waste Action Plan
Solar Plant	Batteries, Inverters, Panels	Maintain as per operation and maintenance manuals
Plant & Equipment	Maintenance	Resolve maintenance issues
	Storage	Provide more storage facilities

A3.3 Buildings

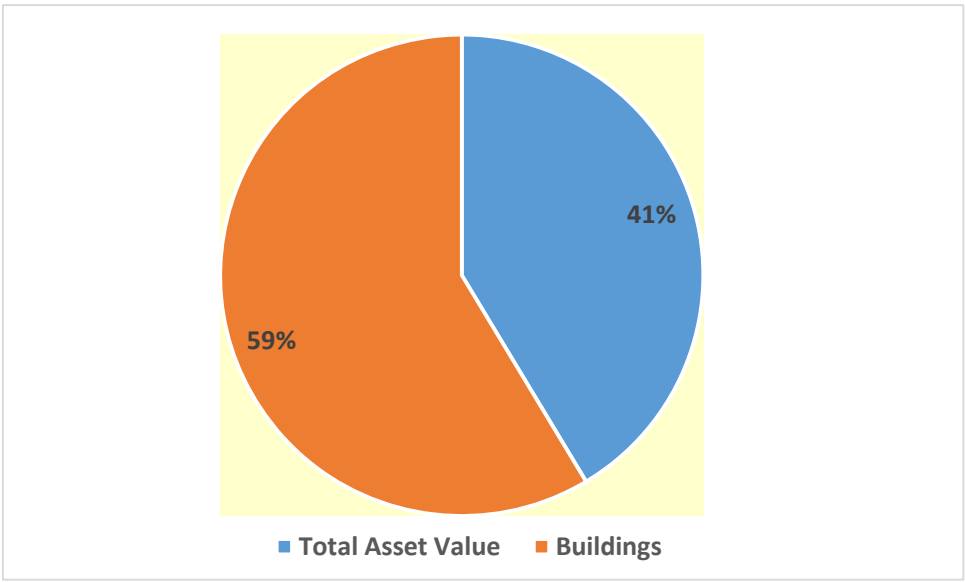
The buildings can be grouped into:

- Health
- Education
- Public & Administration
- Storage facilities
- Guest houses
- Channel
- Wharf

- Seawalls
- Solid waste

There are other buildings e.g. generator building, battery building, but these are grouped under Energy or Telecommunications.

As shown below the Buildings make up 59% of the Total Nukunonu Asset Value.



The majority of roofs in Tokelau are corrugated iron. Corrugated iron/steel roofs are lightweight, easy to handle, easy to install and low cost compared to other roofing materials. However, the disadvantage is that steel roofs are susceptible to rust and corrosion. In a harsh marine environment such as Tokelau the expected lives of steel roofs are significantly affected. In general unpainted steel roofs in New Zealand have an expected life of 20 years, but in Tokelau that expectation is halved to 10 years.

Under New Zealand conditions pre-painted steel is expected to last up to 35 years and aluminium up to 55 years. Rough order costings indicate that pre–painted steel roofing are approximately 12% more expensive than unpainted steel and aluminium are 63% more expensive than unpainted steel. Using these materials in Tokelau conditions may extend the life of the roofs to 17 or 25 years. The viability of changing roofing materials should be investigated (**IP 1**).

A3.3.1 Health Buildings

The Health Buildings consist of the Hospital Buildings (St Joseph's Hospital new and old) and the doctor's residence.

The new Hospital Buildings consist of three separate concrete structures, two joined by a concrete walkway/veranda. The two structures joined by the walkway form the hospital, while the third structure house the emergency generator (38kW Deutz) for the hospital. The foundations of the buildings contains the water storage. At the time of writing this Plan the new hospital buildings were still unoccupied. Practical issues needs to be addressed before the new hospital can be operational. The new hospital contains new medical equipment i.e. autoclave steriliser, Mini X Ray, X-Ray top and surgical table, wheel chairs, etc. These medical equipment is yet to be used.

The old hospital is located next to the new hospital buildings. The old hospital consists of a single structure housing the wards, surgery, offices, examinations room, dentistry, toilets, etc.

The Doctors residence is located next to the hospital and consists of a timber framed weatherboard structure. Water storage is in three polyethylene tanks.

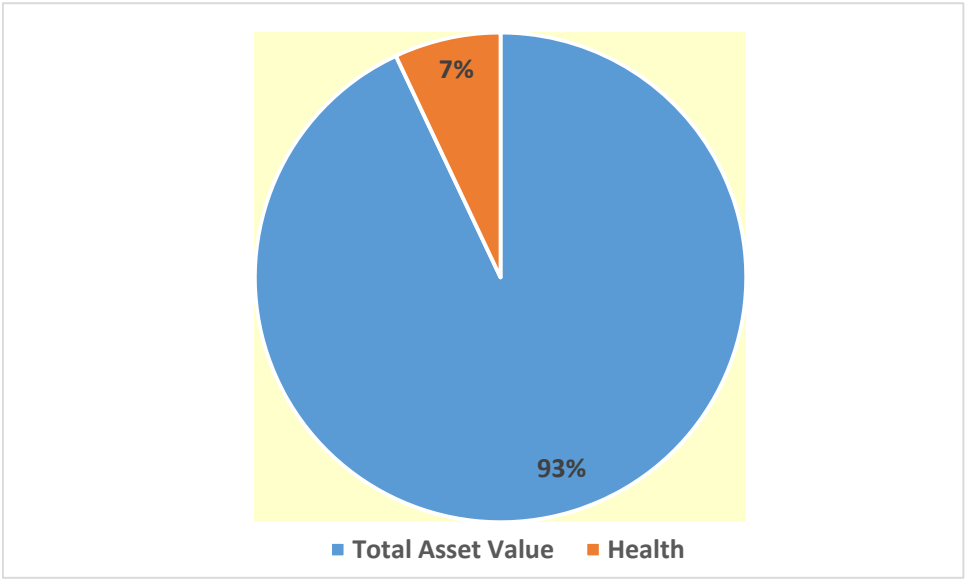
A3.1.3.1 Condition

The condition of the new St. Joseph's Hospital building are deemed to be condition grade 1, excellent to very good. However, the plumbing requires fixing and there are also ventilation issues that needs to be resolved. The old hospital buildings and doctor's residence are deemed to be condition grade 3, fair with some larger maintenance work needed. There are signs of significant maintenance required e.g. at the doctor's residence there is spalling at the foundation and the facia boards and spouting require attention.

A3.2.3.1 Lifecycle

It is evident that the hospital and doctor's residence have been maintained since its construction in the mid 1970's. However, if maintenance is neglected and specific issues not addresses the structures may require a higher level of maintenance and may result if potential failure. Specific maintenance issues include repair of foundation spalling, facia boards, window frames and spouting, and painting of the doctor's residence. The old hospital requires maintenance on the balustrade, veranda posts, facia boards, window frames, interior and exterior painting. .

As shown below the Health Buildings make up 7% of the Total Nukunonu Asset Value.



A3.3.2 Education Buildings

The Education Buildings consist of:

1. Pre-Primary building (David Lange)
2. School Building- Main block
3. School Building – Administration block
4. School Building – Koia block
5. School Building – Kaimako
6. Principal's house & Carpentry class
7. USP Building
8. School Toilets
9. Department of Education – guest house

The buildings are a mix of concrete and timber framed weatherboard with corrugated iron roofs. Apart from the Kaimako (2007) and the guest house (2009), all of the buildings are estimated to have a construction date of mid 1980's. Water storage is a mix of concrete tanks forming part of the foundation and free standing polyethylene tanks. Roof water is collected in the tanks.

The Nukunonu School is programmed for replacement during 2015 at a cost of $1M and included in the Capital Projects.

A3.1.3.2 Condition

The condition of the Education buildings are considered to be the following condition grades:

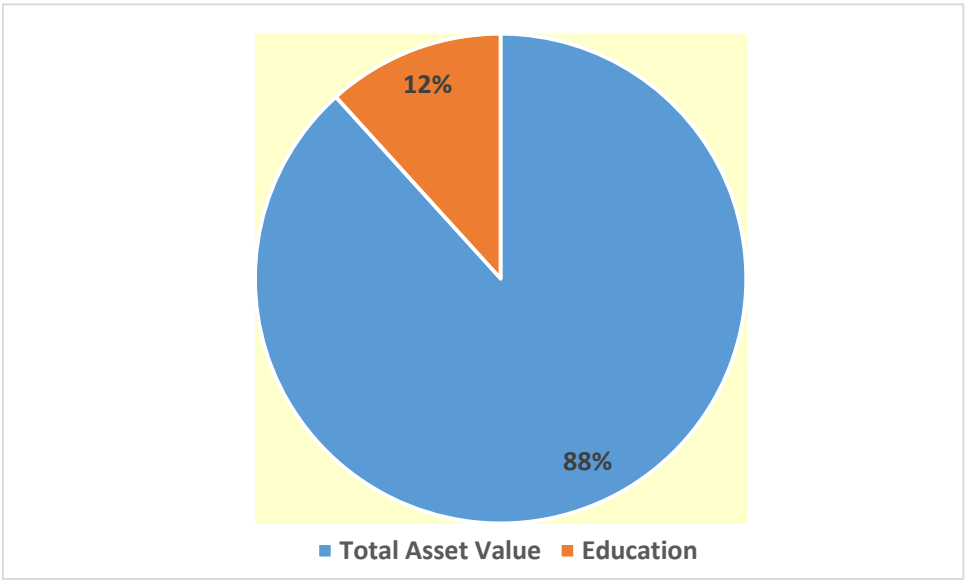
- Department of Education guest house – condition grade 1, excellent to very good
- School building, Administration block, Kamaiko, Principal's house/Carpentry class, and Toilets – condition grade 2, good mostly expected minor routine maintenance work plus a few extras
- School building, Main block, Koia, David Lange, and USP- condition grade 3, fair with some larger maintenance work needed

A3.2.3.2 Lifecycle

It is evident that the older education buildings have been maintained since its construction in the mid 1980's. However, if maintenance is neglected and specific issues not addresses the structures may require a higher level of maintenance and may result in potential failure. Specific maintenance issues observed include:

- School building, Main block,
  - Repair concrete pitting (foundation)
  - Tile floor
  - Repair structural beams
  - Maintain window frames
- School building Koia,
  - Repair holes in roof
  - Repair and maintain weatherboards, window frames and doors
- David Lange,
  - Repair and maintain window frames
- USP
  - Repair spalling in foundation
  - Repair and maintain weatherboards and window frames

As shown below the Education Buildings make up 12% of the Total Nukunonu Asset Value.



A3.3.3 Public and Administration Buildings

The Public and Administration Buildings consist of:

1. Talikilagi meeting house
2. Administration building

3. Promenade
4. Church
5. Church houses
6. Police
7. Finance
8. EDNRE building
9. Women's Centre (Fatupaepae)
10. Village Unu
11. Falepa
12. Workshop

Police and Justice needs have been met within public and administration buildings. It is noted that as result of Tokelau cultural practice and Taupulega administration, there is no requirement for separate justice facilities. Resulting from this no allowance has been in this plan for such facilities.

The buildings are a mix of concrete, timber framed weatherboard with corrugated iron roofs. The construction dates for the buildings range from 1930's to 2012. The buildings are all in relative close proximity of another and forms the heart of Nukunonu. Water storage is a mix of concrete tanks forming part of the foundation and free standing polyethylene tanks. Roof water is collected in the tanks.

A3.1.3.3 Condition

The Talikilagi meeting house (albeit new), Administration building, Fatupaepae and Church are prime examples of well-maintained structures. Although these buildings were constructed at different times it is evident that these buildings are highly valued by the Taupulega and the community and this is reflected in the upkeep of the buildings.

The condition of the Public and Administration buildings are considered to be the following condition grades:

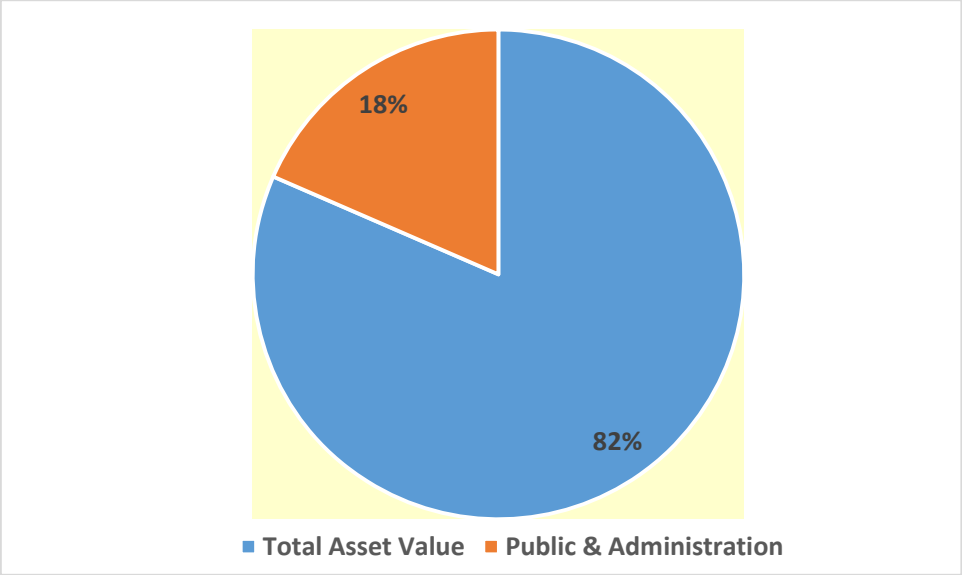
- Talikilagi meeting house – condition grade 1, excellent to very good
- Administration building, Promenade, Police, Finance, Fatupaepae, EDNRE, Church, Monsignor's house, Church house (lagoon) – condition grade 2, good mostly expected minor routine maintenance work plus a few extras
- Workshop, Church house, Village Unu- condition grade 3, fair with some larger maintenance work needed
- Falepa – condition grade 5, very poor with failure imminent

A3.2.3.3 Lifecycle

It is evident that the majority of the Public and Administration buildings have received a high level of maintenance, but the workshop, Church house and Village Unu have not received the same level of maintenance. If maintenance is neglected and specific issues not addressed these structures may require a higher level of maintenance and may result if potential failure. The Falepa building have received replacement of steel frames with timber, but as this does not provide the same structural integrity as steel it is only temporary in nature and the building is in a basic state of disrepair and will need replacement.

Specific maintenance issues are noted with in the Asset Register and include repair spalling on concrete and maintenance of window frames.

As shown below the Public and Administration Buildings make up 18% of the Total Nukunonu Asset Value.



A3.3.4 Storage Facilities

The Storage facilities consist of:

1. Co-op store
2. Freezer house
3. Bulk Store (next to Falepa)
4. Bulk Storage (next to Finance)

The buildings range from large steel framed bulk stores to concrete structures to basic timber framed weatherboard structures. The construction dates for the buildings range from 1965 to 2010. Water is collected into the concrete water storage tank within the foundation at the Co-op store.

There are two fuel storage facilities that is grouped under Energy.

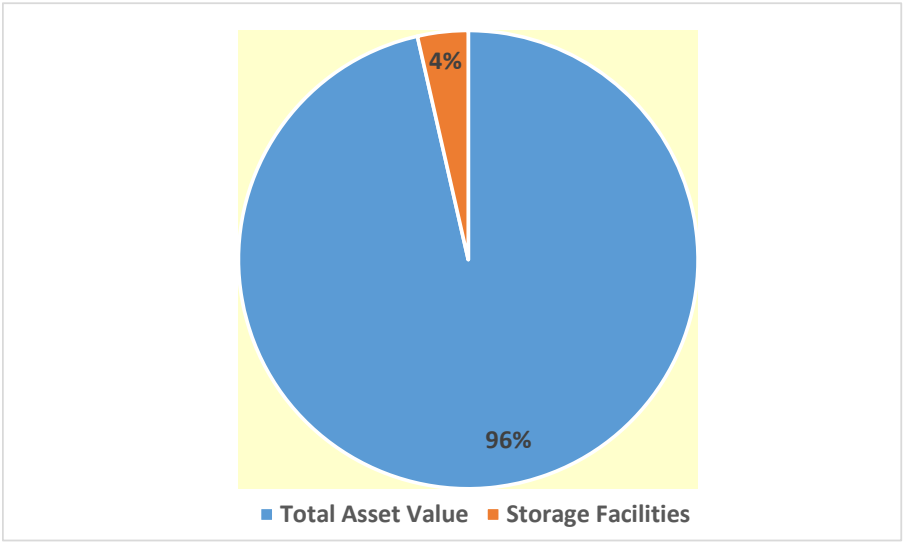
A3.1.3.4 Condition

The Co-op store is considered condition grade 1, excellent to very good. The Freezer building is deemed condition grade 3, fair with some larger maintenance work needed. The two Bulk stores are considered condition grade 4, poor with major maintenance work to preserve the facility.

A3.2.3.4 Lifecycle

The Co-op store is another example of a well maintained facility displaying pride and ownership of the asset. However, maintenance of the bulk storage facilities have been neglected, but in some respects there are signs of significant maintenance to keep the asset operational. Significant portions of the steel framing in the Bulk Store (next to Falepa) have been replaced with timber in an attempt to keep the structure operational. However, the structural integrity may be compromised.

As shown below the Storage Facilities make up 4% of the Total Nukunonu Asset Value.



A3.3.5 Guest Houses

There are three guest houses. All three are timber framed structures with tow cladded in weatherboard and one cladded in an asbestos cement cladding. The dates of construction is estimated to be mid 1970's to mid-1980's. .

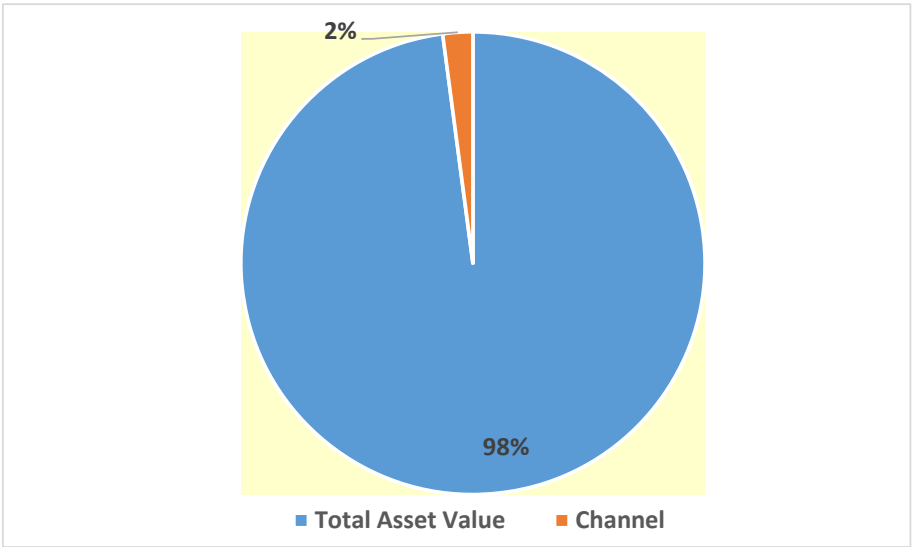
The condition of the guest house 1 is deemed to be condition grade 3, fair with some larger maintenance work needed. There is significant maintenance required to raise the condition of the guest house. The condition of the guest house 2 is deemed to be condition grade 4, poor with major maintenance work to preserve the facility. The condition of the guest house 3 is deemed to be condition grade 5, very poor with failure imminent.

Specific maintenance issues are contained within the Asset Register.

A3.3.6 Channels

The channel is approximately 150 metres long and approximately 10 to 12 metres wide in most parts. The depth at low tide is approximately 0.8metres on average. The channel is very exposed to the sea. The channel is subject to frequent sedimentation and will require regular dredging (**IP26**). Refer to Section 3.3.7 and the Spiire report.

As shown below the channel make up 2% of the Total Nukunonu Asset Value.



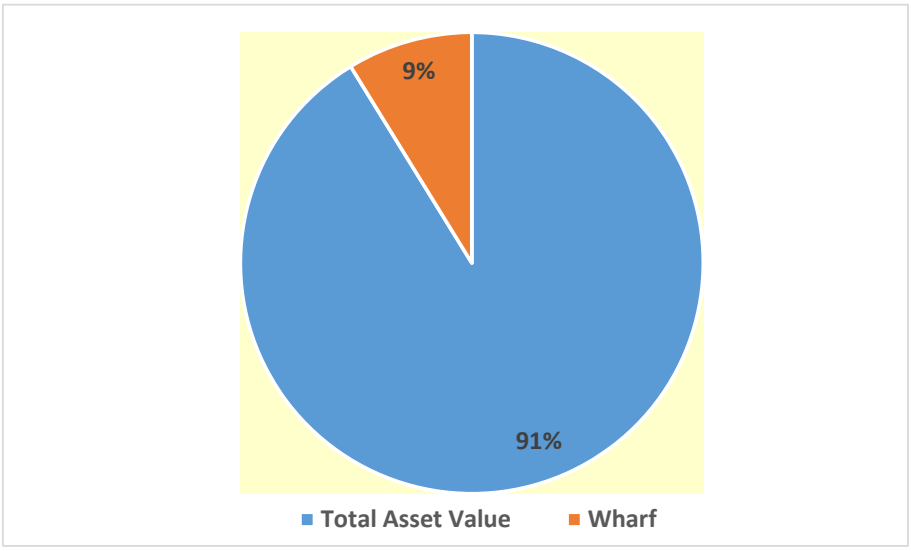
A3.3.7 Wharf

There is concrete wharf structure of approximately 7 metres wide and 25 metres long extending from the shore. The wharf face is being undermined by the sea and is in poor condition. The old wharf structure is adjacent to the main wharf which is more like a ramp and is also suffering from bad erosion. Fenders to protect the barge and bollards to tie the barge were installed during March 2014.

The Tokelau Ship to Shore Project: Onshore Infrastructure Options and Environmental Impact Assessment (June 2014) propose (**IP26**):

- A hardstand area of 14.3m x 7m
- A piled bridge access 6m wide x 37m connecting the wharf to land
- A wall to provide protection against larger waves
- Wave energy dissipation structures
- Repair of the upper section of the existing ramp

As shown below the Wharf make up 9% of the Total Nukunonu Asset Value.



A3.3.8 Seawalls

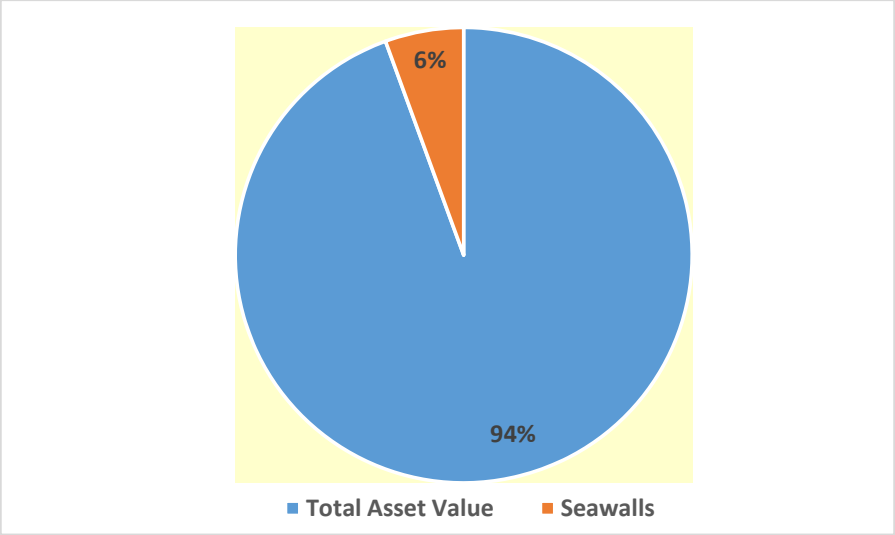
There is approximately 200 metres of seawall on the ocean side and 600 metres of seawall on the lagoon side on Nukunonu. There are a range of different types of seawall construction on Nukunonu. These include but are not limited to:

- Gabion baskets filled with coral rocks
- Gabion baskets filled with coral rock and covered with a cement/concrete layer
- Stacked coral blocks
- Mass concrete

The report “Reducing the Risks of Cyclone storm surge inundation on the atolls of Tokelau – Nukunonu (2005)” details the existing coastal defences and provides a range of options for future risk management of storm surge inundation. The figure below taken from this report shows the extent of seawalls on Nukunonu.

The condition of the seawalls are in various states of repair, but in general the seawalls are considered to be in a condition grade 2, good.

As shown below the Seawalls make up 6% of the Total Nukunonu Asset Value



A3.3.9 Solid Waste

The Solid Waste Facility is a timber frame weatherboard structure and houses the can crusher. At this facility the recyclables are sorted, crushed and baled. Recyclables include aluminium cans, plastic containers and glass. In general the area appear to be reasonably organised. Due to time constraints of the site visit the landfill was not visited.

Kitchen and yard waste are well managed by feeding to the pigs or placing in banana patches. There is also a chipper/shredder to improve the management of green waste.

The waste collection system generally operates well with collection two to three days per week.

The Integrated Waste Management, Water and Sanitation Review and Action Plan 2010 states:
The waste collection system operates well (twice per week) and the aluminium can recycling program at the community recycling centre on the atoll is effective. However, there is still an issue of littering with cans and plastic bottles.

The remaining waste, which included disposable nappies, is placed in multiple pits beside the road at Mulifenua and then they are burnt. This practice may be polluting groundwater, air, and nearby ocean. In general the size and placement of the pits is random and the usage of the land is not maximized. It is estimated that there may be over 20 pits spread over a relatively wide area, as well as other areas of scattered rubbish.

The waste quantity estimated from Nukunonu is between 3 to 6 truckloads every week. It was not possible to observe the waste collection process during the visit, and hence it is difficult to provide a more accurate estimate of the waste quantity. However, given the similarity between the atolls in Tokelau, it is suggested that the same waste generation rate in Fakaofo can be applied to Nukunonu. Given that the populations are roughly the same for each atoll (approximately 500 people), and then the waste estimate is also expected to be roughly the same at 68 tonnes.

Small quantities of medical waste are generated by the hospital and these are burnt on the hospital grounds or on the reef at low tide. The ashes and residual material then become marine litter at high tide. Small amounts of expired drugs and used ampoules are taken to Samoa.

Bulky waste on Nukunonu includes derelict vehicles, metal drums, derelict boats and boat engines, and white goods such as refrigerators and washing machines. This kind of waste can be seen at the dumpsite and in some areas of the community. There is no management system in place for recycling or exporting bulky waste.

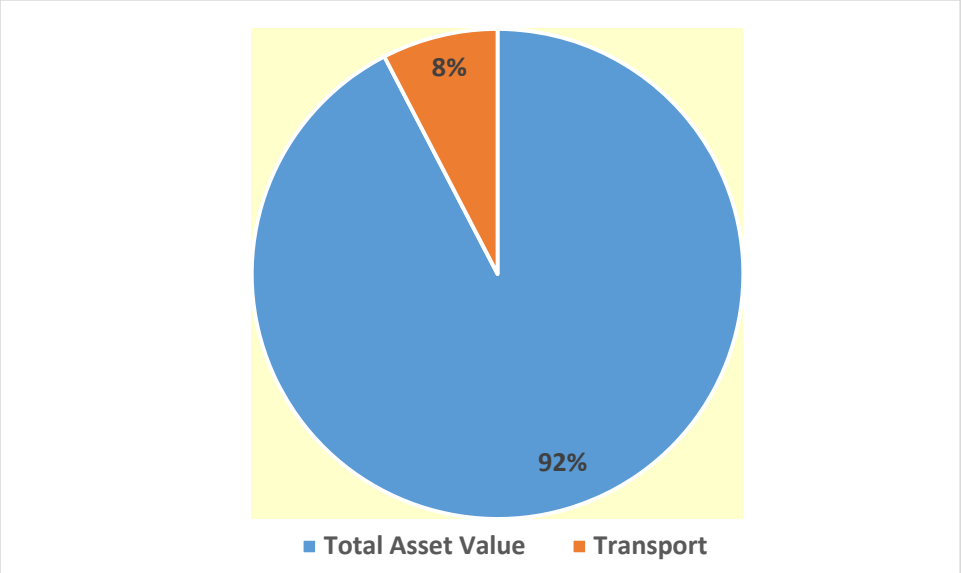
It's important to implement the Solid Waste Action Plan (**IP 7**).

A3.4 Transport

The Transport service consist of:

- Tokelau Samoa link
- Ship to shore
- Boats
- Roads and street lights

As shown below the Transport assets make up 8% of the Total Nukunonu Asset Value.



A3.4.1 Tokelau Samoa Link

Tokelau's only transport link with the rest of the world is the shipping service between Tokelau and Samoa. This is currently a chartered service provided by the Government of Tokelau, but a government owned ship is being constructed at the time of writing this Plan.

Each of the atolls are dependent on this Tokelau Samoa shipping service for passengers, cargo, medical and emergency evacuations.

Samoa Shipping Co vessels are used for additional charters not only to transport passengers during peak travelling times between Apia and Tokelau, but also when large orders of supplies for government/village projects are required or when there are national activities which necessitate moving large groups between atolls.. Additional charters have averaged 10 – 12 per annum over the period 2005 -2010. The GT500 SOLAS Ferry (under construction at the time if writing this Plan) is included as a transport asset under Apia.

A3.4.2 Ship to Shore

None of the three Tokelau atolls has any seaport, due to the particularly steep drop off from each atoll's fringing coral reefs into very deep water. In the absence of harbour/port facilities motor powered barges provide a ship to shore transfer service. This is a very basic service which will always be significantly reliant upon a combination of local skills, and available technology and its maintenance.

Ship-to-shore safety issues were highlighted in the MFAT Internal Audit on Maritime Safety wherein a range of recommendations were made. The Tokelau Ship to Shore Project: Onshore Infrastructure Options and Environmental Impact Assessment (June 2014) propose procurement of a tracked crane (**IP27**) which will be fit for purpose and aligned with proposed channel and wharf upgrades.

There are two operational barges on Nukunonu. One large and one medium sized barge. The Large barge is powered by two 40hp Yamaha outboard motors.

The condition of the barges are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed. The barges are used in a harsh environment and as such the expected lives of the barges are low.

At the time of writing a new barge was near delivery to Nukunonu. The new barge is deemed to be a significant improvement on the existing barges.

A3.4.3 Boats

There are three fishing boats owned by the Taupulega on Nukunonu.
The condition of the boats are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed.

A3.4.4 Roads and Streetlights

There are approximately 2.8km of roads on Nukunonu. All the formed roads consist of rolled crushed coral. Traffic is very light, mainly pedestrian and golf carts. While the heaviest vehicles that use the roads are light trucks and tractors. Heavy loads are limited to the transport of fuel from the wharf to the bulk fuel storage facility. The crushed coral is free draining and there is little evidence of water damage despite the frequency of heavy rain.

The key maintenance activity is the filling in of the few potholes and ruts that develop, preferably as soon as they are first noticed. There is some evidence that where potholes have been filled there has not been sufficient attention paid to compacting the fill material. In the places where there are water table drains (shallow drainage channels) these need to be kept clean and free of debris.

There are approximately 45 streetlights each fitted with a sensor which switch the streetlight on during low light conditions.

The overall condition of the Nukunonu roads and streetlights are deemed to be condition grade 2, good.

A3.4.5 Nukunonu Bridge

The Nukunonu Bridge is a reinforced concrete structure connecting Nukunonu motu with Motuhaga motu. The bridge is an important community lifeline as the hospital is located on Mothaga motu and most other community assets and houses are on Nukunonu motu.

Nukunonu Bridge

There are significant concrete spalling and corrosion to exposed reinforcement in the underside of the bridge deck, the beams and bridge piers/columns. A superficial assessment estimates that if no remedial action is done the bridge life is less than 5 years and pose a significant risk to the community.

Spiire (via Neil Buchanan), with preliminary assessment by their structural engineers have provided advice as follows:

Having reviewed the photos from the site inspection. We are of the opinion that it will not be cost effective to repair the concrete spalling to the bridge spans as we believe that the exposed reinforcing steel has lost to much sectional area.

The spalling to the bridge piers is repairable by treating the current corrosion and installing additional steel with additional concrete to provide adequate cover.

It is not possible at this stage to determine the effect of the current deterioration on the load capacity of the bridge and hence risk of failure. We would need details of the span lengths and section dimension along with reinforcement sizes and spacings to be able to calculate the loadings.

Spiire verbally advised Waugh Infrastructure Management that as a precautionary measure (until detailed assessments can be made) the bridge should only be used by light traffic – light vehicles, light trucks, no heavy loads

A replacement deck should be considered as a short term priority. The simplest way of doing this would be to remove the current deck, repair the existing piers and install new precast deck beams. These would be either double tee units or hollow core beams fabricated off site and transported to the Atoll. This will give the best quality control on the deck elements.

Remedial work may extend the life 10 to 15 years, although this needs further assessment.

Suggested remedial works are listed in the Spiire comments above. The expected remaining life of the bridge is dependent on conditions and use of the bridge. However, it is a **high priorit**y to engage a professional registered structural engineer to conduct a comprehensive condition assessment prior to any remedial works are done (**IP 28**).

A3.5 Water and Sanitation

Water and Sanitation assets have been included in the asset register with Buildings and consist of water tanks attached to public buildings and private houses, and septic tanks, septic cells also attached to public buildings and private houses.

There are some remaining lagoon toilets in service, which are small timber and corrugated iron structures. No allowance for the replacement of these structures has been made in this plan.

There are no reticulated water or sewer systems in Tokelau.

Each atoll has a desalination plant for use in times of drought. These have been included in the Plant and Equipment assets.

In May 2010 the Government of Tokelau received the 'Integrated Waste Management, Water and Sanitation Review and Action Plan,' by SPREP and Parsons Brinkerhoff. This report completed a comprehensive review of water and sanitation issues, and provided a large number of recommendations.

The recommendations from the May 2010 report should be completed by Government of Tokelau (**IP 32**).

In particular in relation to this AMP the following recommendations are highlighted:

1. Complete the PACC+ installation programme
2. Complete household water tank installation
3. Maintain the Desalination Plant (and periodically test run)
4. Undertake a community options and feasibility report for appropriate sewerage management systems (**IP 33**)
5. Instigate and continue regular water sampling, wastewater sampling and lagoon water sampling to track any issues and build an evidence base for further action

These items have also been included as appropriate in the AMP service levels.

Sewerage management systems will require further study (**IP 33**), and it is likely any solutions will require further expenditure. This potential expenditure has not been added to this AMP, as the solutions are unknown at this stage, and could range from the status quo through to reticulated and managed sewerage treatment systems. Any additional costs for this will need to be added to future revisions of this AMP.

A3.6 Telecommunication

The Telecommunication assets consist of:

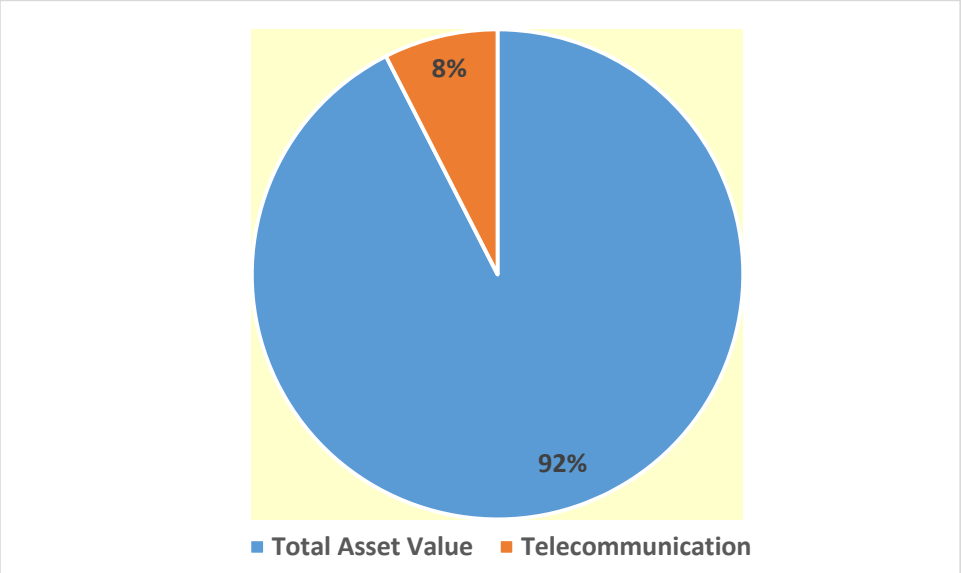
- Communications Building
- Equipment
- Telecomm Cable

The Communications building is a James Hardie Bondor structural insulated panel kitset building on a 1.8m raised concrete foundation. This raised concrete foundation prevents storm surge inundation of the telecommunication equipment, housed within the building, during a cyclonic event. The equipment housed within the Communications building consist of modems, exchange, switches, equipment racks and air conditioning. The other telecommunication equipment consists of:

- 3 Satellite dishes
- Solar panels
- Radio mast
- Technical & Internet equipment

The solar panel at the Communications building had one damaged panel and this will need replacement. The condition of the telecommunication assets are deemed to be condition grade 2, good to 3, fair with some larger maintenance work needed.

As shown below the Telecommunication assets make up 8% of the Total Nukunonu Asset Value.



A3.7 Energy

The Energy assets consist of:

- Buildings
- Solar Panels
- Batteries
- Generators
- Power cable
- Fuel

The buildings consist of the battery house (where the solar power batteries and inverters are housed), the generator house (where the generators are housed), the bulk fuel storage (a concrete building next to the Freezer house and a carport type building next to the generator house) and the solar plant fence. The solar panels are 230 Watt Sunrise panels. The panels are certified to the IEC 61701 Standard – Salt mist corrosion testing of photovoltaic (PV) modules. There are eight clusters, each cluster consisting of 144 panels. Each cluster has two connection configurations, one for the panels connected to the string inverters, and one for the panels connected to the DC charge controllers. The panels are mounted on aluminium frames which are bolted into concrete foundations. The anodized aluminium frames were chosen above galvanised steel or stainless steel due to its low weight and low cost and proven performance in harsh marine environments. The panels are tilted to 12° allowing for self-cleaning during rainstorms. However, regular manual cleaning is required.

The batteries are installed in the battery house. Each PV cluster in the Tokelau systems includes a 48V battery bank to store surplus PV energy generated during the day for use at night or periods of low light. The battery banks are composed of two strings of 24 batteries, and have a storage capacity of 288 kWh. They have been sized to provide enough storage to last 1.5 – 2 days without any solar input before the backup generator is turned on.

The battery cells are flooded lead-acid and require regular topping up with distilled water as their electrolyte levels reduce when being charged. A deionizer is installed in the battery room. Rainwater is collected in a tank, and then pumped through the deioniser to be used in topping up the batteries.

Lead-acid batteries are sensitive to being discharged for extended periods of time. An alarm is triggered when the state of charge of the batteries drops below 60%. This alarm notifies the system operators to turn on the backup generators. If the state of charge drops below 30%, the battery inverters disconnect the loads from the PV system, which means that the island loses power (unless the backup generator is running). The batteries have an expected useful life of 8-10 years if properly maintained. Note,

however, that the lifetime of a battery is defined as being 80% of its original capacity. Batteries can still be used beyond their rated life, though at a reduced capacity (<80%) and only for a limited amount of time as their usable capacity decreases rapidly after their end of life.

The batteries are located in a room separate from the inverters, as hydrogen gas is produced by the batteries during the charging process and there is a risk of explosion caused by a spark from electronic equipment. The battery room is well-ventilated to evacuate any hydrogen gas that is produced, although the catalytic combiner caps should minimize the amount of hydrogen gas released.

The battery inverters are SMA's Sunny Island 5048. They control the current flow to and from the batteries, and form the grid (i.e. set the voltage and frequency of the grid) when the generator is not active. Each cluster is composed of three battery inverters, with one battery inverter as master and the other two as slaves. The battery inverters are covered by a 10-year warranty.

The string inverters are SMA Sunny Boy 3000 inverters. The string inverters convert the DC electricity from the panels into AC electricity that is injected into the power grid. The string inverters are covered by a 10-year warranty.

There are three generators housed in the generator building near the battery building and PV array. The generators were once the sole source of electricity, but are now used as backup for the solar power system. The generators have to be manually switched on when required. This could be automated, but the manual approach keeps the operators actively involved, keeps them familiar with the system and signals issues with the system i.e. awareness of continual generator power required.

The generators are:

Make	Model	Hz	kVA	kW

At the time of the site visit no access was available to the generator room to obtain details and it was not clear which generators were operational.

The system is monitored by SMA's Sunny Web Box data monitoring systems. There are three on each atoll, monitoring the battery inverters and charge controllers, the string inverters, and a small solar radiation measuring device on the array. The Web Boxes upload their data to the SMA Sunny Portal website, for remote monitoring and analysis.

Two touchscreen computers (one in the inverter room and one at the powerhouse) and custom monitoring software were installed with each system to provide operators with a live feed of solar production, charge/discharge currents to and from the batteries, generator production, solar radiation and the loads on the grid. The computers allow access to the Web Boxes so that operators can change system parameters on the battery inverters and the string inverters. The computers are sealed against the environment and are not fan-cooled, so do not have fans to fail.

There is also an additional mobile generator, Cummins 6BT5.9-G1 (92kW), located near to the Bulk Store and Falepa building. This can be used to power telecommunications systems during emergency events.

There is an old generator building near the Falepa building which house an old Lister generator (not operational). The building is a concrete structure with a corrugated iron roof and contains large amounts of empty beer bottles. This structure can be reinstated to a functional facility if maintained properly i.e. refit a new door and windows, paint and maintain.

The power cable is estimated to be approximately 2.1 kilometres long.

The fuel consists of diesel, petrol and kerosene stored in the bulk fuel storage facilities. Refer to Section 8.5.1 Key Risk Items.

A3.1.7.1 Condition

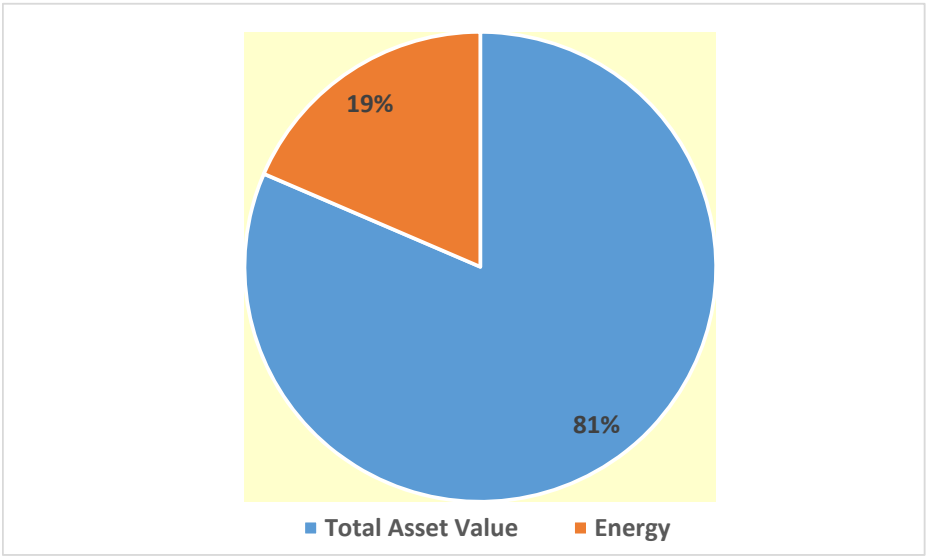
Apart from the bulk fuel store and old generator building which are considered to be a condition grade 3, all the other buildings are considered condition grade 2, good.

The PV arrays, batteries and inverters are considered condition grade 1, excellent to very good. The fixed generators are considered to be condition grade 3, fair with some larger maintenance work needed, and the mobile generator is considered to be condition grade 2, good.

A3.2.7.1 Lifecycle

Apart from the aforementioned issues identified with the old generator building no other specific maintenance issues were noted at the Energy buildings. Cleaning of the battery house gutters to minimise the contamination of roof collected water will prevent dirt and debris clogging the deionizer. The solar panels will require regular cleaning and monitoring of the foundations and fastenings. Cleaning is best performed after rain events or early morning and late afternoon when the panels are cool and damp. Water levels in batteries will require regular checking and topping up with deionized water when required. Checking the State of Charge of batteries and system alarms and regular charging of batteries to ensure the batteries reach their expected lives (**IP 9**). The generators are three different generators creating maintenance issues as each will require different parts etc. Standardising to one type and size of generator will greatly enhance maintenance and operational status of the backup power supply (**IP 10**).

As shown below the Energy assets make up 19% of the Total Nukunonu Asset Value.



A3.8 Plant and Equipment

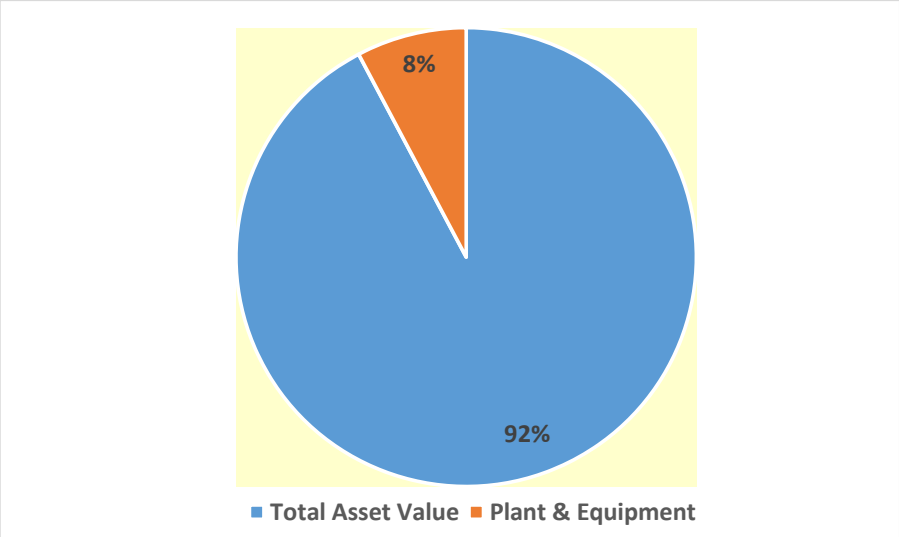
There are significant number of various plant and equipment on Nukunonu. The most significant plant and equipment are tabled below:

Plant	Manufacturer	Size/Model
Excavator	Caterpillar	2 tonne
Tractor crane	ACE	12 tonne
Wharfe crane	Palfinger	
Tractor	John Deere	5075E
Village freezer		
Truck	Mitsubishi	3 tonne Canter
Truck	Nissan	3 tonne
Forklift	JVC	5 tonne
Desalination plant	AMPAC	
Trailer x 2	Coombridge & Alexander	
Van		
Wood chipper	Vermeer	
Mini loader	Bobcat	
Compressor	Atlas Copco	XAS97
Pneumatic hammer	Tiger	
Concrete mixers		
Quad bike	Honda	
Miscellaneous equipment	Fridges, freezers, stoves	
Office equipment	Administration & EDNRE	
Medical equipment	Mini Xray, Defibrillator, etc.	

The condition of the plant and equipment range from condition grade 1, excellent to 5, very poor. A range of maintenance issues (**IP 11**) were observed including but not limited to:

Plant	Issue
Village freezer	Not operational. Make operational
Desalination plant	Perform regular test runs to confirm operational status
Tractor crane	Brake lining issues. Retrofit to make operational
Wharf crane	Requires power to point of installation. Never been used

As shown below the Plant & Equipment assets make up 8% of the Total Nukunonu Asset Value.



A3.9 Data Confidence

The confidence in data for the assets is detailed in the table below:

Asset	Component	Confidence
Buildings	Attributes	2
	Condition	2
	Performance	2
Transport	Attributes	2
	Condition	2
	Performance	2
Channel	Attributes	3
	Condition	3
	Performance	3
Wharf	Attributes	3
	Condition	3
	Performance	3
Seawalls	Attributes	3
	Condition	3
	Performance	3
Solid waste	Attributes	2
	Condition	2
	Performance	2
Telecommunication	Attributes	2
	Condition	2
	Performance	2

Asset	Component	Confidence
Energy	Attributes	2
	Condition	2
	Performance	2
Plant & Equipment	Attributes	2
	Condition	3
	Performance	3

Where

Score	Description	Definition
1	Accurate	100%
2	Minor inaccuracies	± 5%
3	50% estimated	± 20%
4	Significant data estimated	± 30%
5	All data estimated	± 40%

The above is confidence scores are from the New Zealand Infrastructure Grading Guidelines 1999.

A3.10 Financials

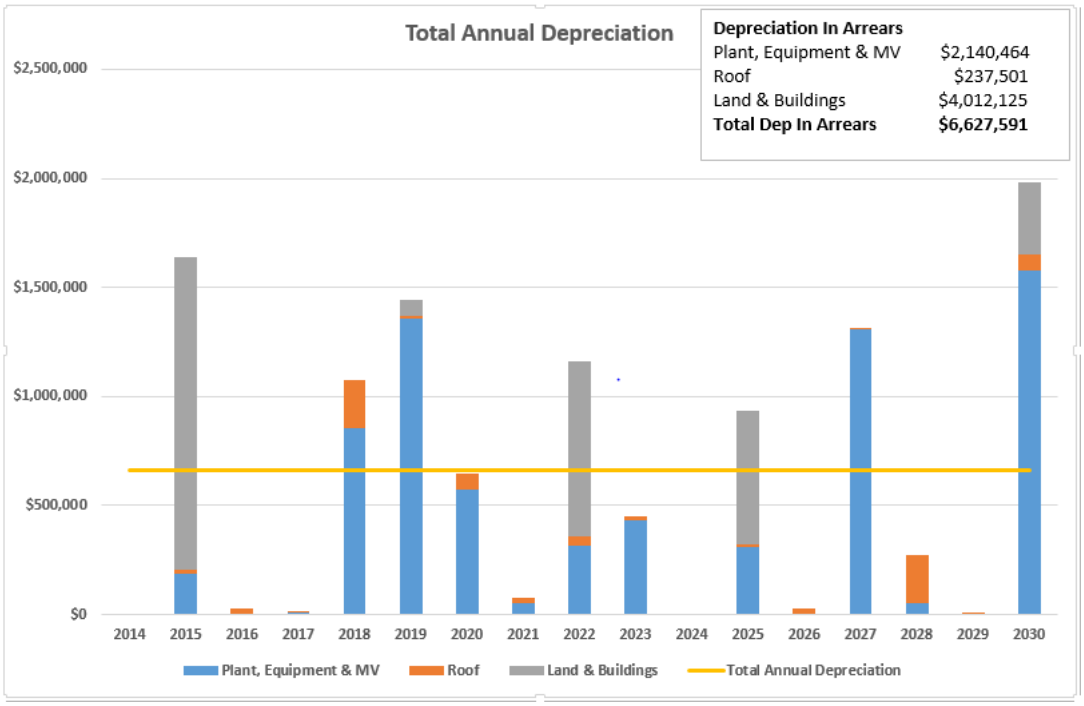
A3.10.1 Asset Valuations

No formal documented asset valuation has been performed. This Asset Management Project developed the Asset Register and this Asset Management Plan.

The newly created Asset Register and associated values are based on the best information available – in many cases this was minimal, resulting in "global best guess" estimates being made. It is envisaged that over time much more accurate, detailed and reliable information on assets will be collected, meaning that regular and more reliable asset values can be developed and incorporated into the Asset Register providing the basis for a more robust Asset Valuation.

A3.10.2 Depreciation

There has been limited accrual accounting with the current practice mainly cash based accounting which results in replacement/renewal cost of an asset only being recognised when it wears out. This places unnecessary pressure of funding mechanisms and no consideration for lifecycle management. Tokelau should consider implementation of accrual accounting (depreciation) where the costs is spread over the life of the asset. Depreciation/decline in service potential is thus provided on a straight line basis. The required annual depreciation component for all Nukunonu assets amount to $619,000.



It should be noted that as there has been limited accrual accounting to date and most of the assets partway through their expected lives there is a portion of depreciation in arrears e.g. an asset has an estimated value of $100 with a 10 year life. Therefore the annual depreciation component is $10 each year over 10 years. But the asset is already 3 years old and no depreciation has been collected. As a result there is a depreciation arrears of $30 (3 year x $10) which needs to be collected prior to the asset reaching the end of its expected life. The depreciation arrears for Nukunonu assets amount to $6,627,591. The Tokelau Infrastructural Replacement Fund has a balance of $1,350,000 at 30 June 2014 for all of Tokelau's infrastructural assets.

A3.10.3 Operation & Maintenance

The Taupulega (Village Council of Elders), General Fono (National Assembly) and the Council for the Ongoing Government (Executive Government) of Tokelau are the principal administration institutions of governance in Tokelau. The Taupulega provides policy direction at the village level whereas the General Fono provides all policy direction at the national level.

The public service sector implement government policies. The public service sector delivers services within the constraints of the allocated budgets.

The Tokelau Public Service refers to two levels of service:

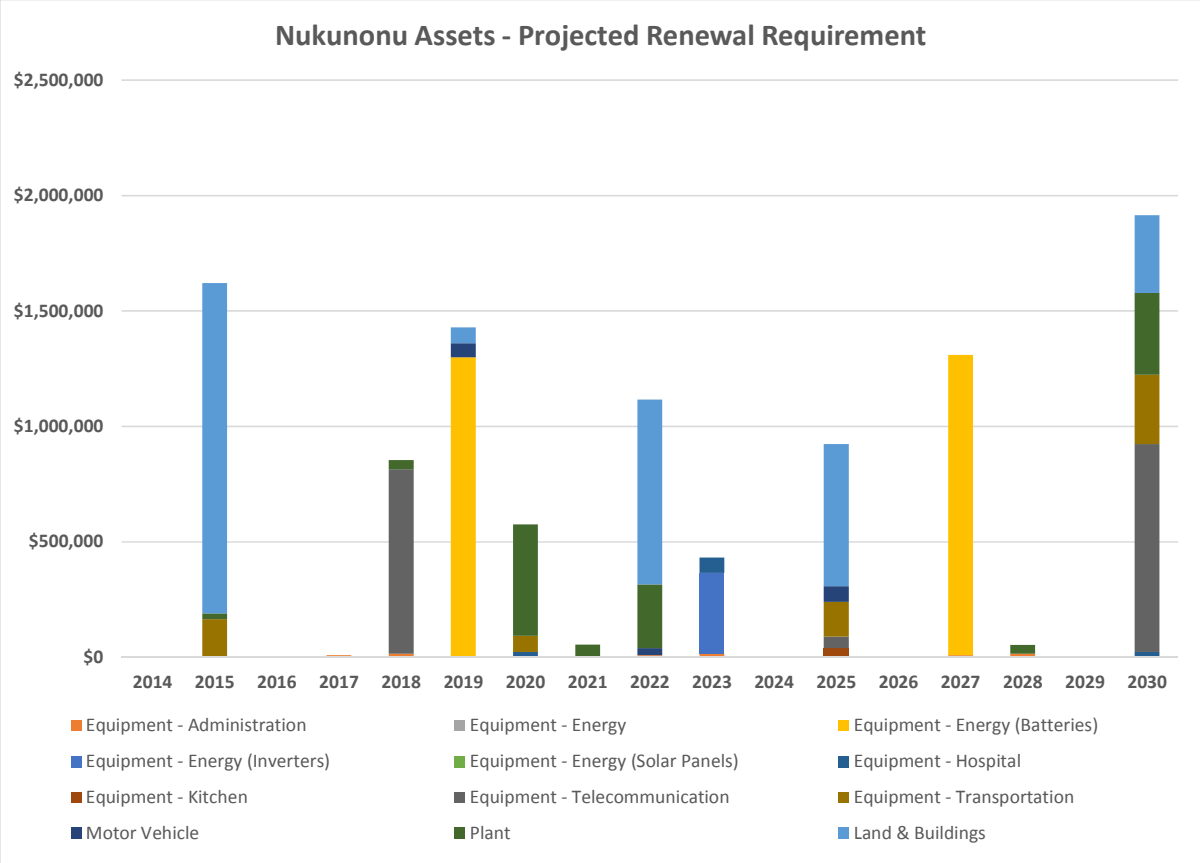
1. those services provided at the national level, under the coordination of the General Manager, Apia, are the Departments of -
    a. Finance,
    b. Health,
    c. Education,
    d. Economic Development,
    e. Transport and Support Services,
    f. Energy and the Office of the Council for Ongoing Government and
2. the services provided at the village level, under the management of the respective village General Manager (Director or Coordinator) include staff who work in the
    a. school,
    b. hospital,
    c. Information Technology support services,
    d. co-operative store,
    e. finance,
    f. FM radio,

g. general village workers and
h. the traditional workforce

The Taupulega on each atoll has responsibility for all the public assets on the atoll including public buildings, schools, storage facilities, transport and wharves. The operation and maintenance of these facilities are a major part of the Taupulega's responsibilities and a substantial part of its annual budget. Operation and Maintenance costs is estimated at $128,000 per year.

A3.10.4 Renewals

No formal Renewal Plan exists for the assets in Tokelau. The following shows the renewal requirements for the Nukunonu assets based on the expected useful lives within the asset register.



The most significant renewals projected in the above graph include but are not limited to:

- Wharves
- Telecommunication (technical & internet) equipment
- Seawalls
- Energy – Batteries & Inverters
- Various buildings

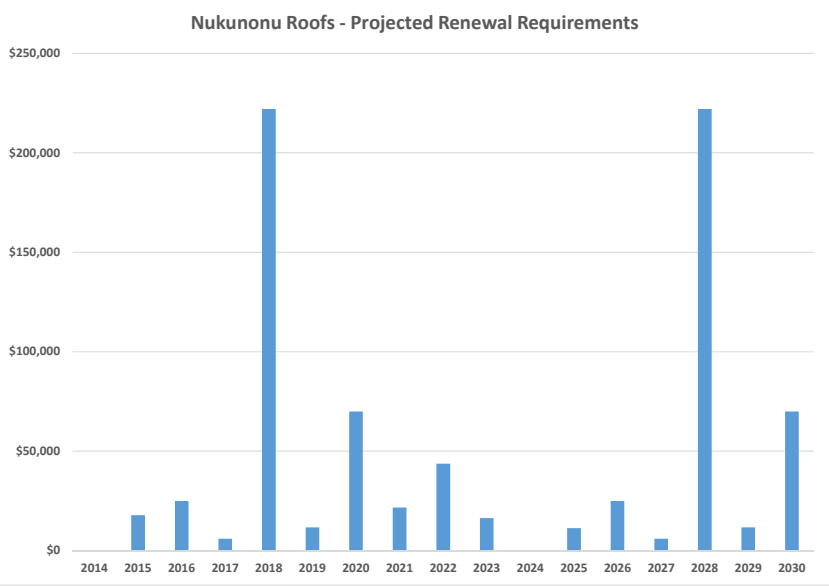
It is important to note that this is projected replacement and not planned replacement. This means that these are theoretical replacements required, based purely on the expected useful lives of the assets within the asset register. Asset condition assessments may extend or decrease expected useful lives affecting an actual planned renewal programme. It is therefore important that Tokelau develop a Renewal Plan (**IP 24**).

Building Roofs

The majority of roofs in Tokelau are corrugated iron and staff interviews suggest that the expected lives of the corrugated iron/steel roofs are severely affected the a harsh marine environment. In general,

unpainted steel roofs in New Zealand have an expected life of 20 years, but in Tokelau that expectation is halved to 10 years.

Taking the estimated size of each corrugated iron roof and estimated installation date and using an estimated replacement cost of $55/m^2 a projected roof renewal requirement was developed. This requires a total of $780,000 for roof renewals over the next 15 years with an average of $52,000 per year. This should be funded out of the building depreciation component.



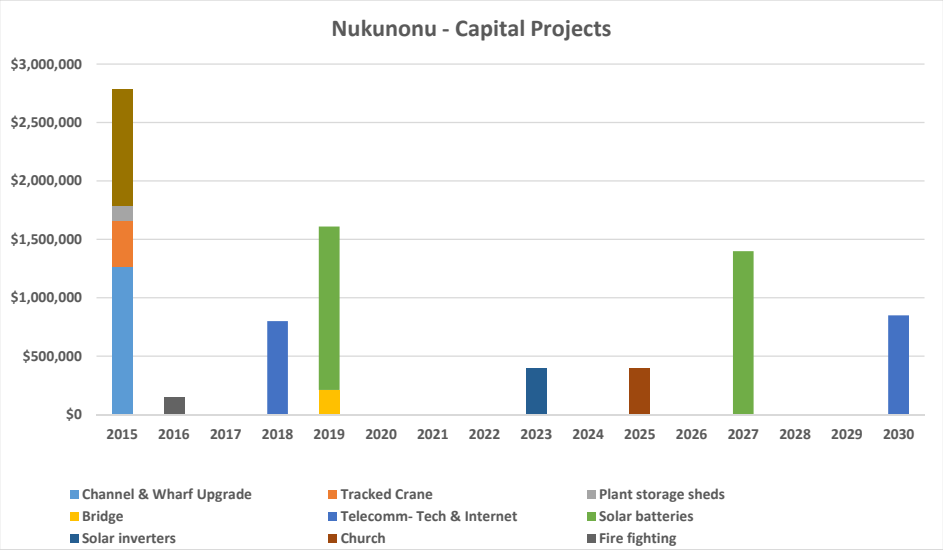
The viability of changing roofing materials should be investigated (**IP 1**).

A3.10.5 Capital Projects

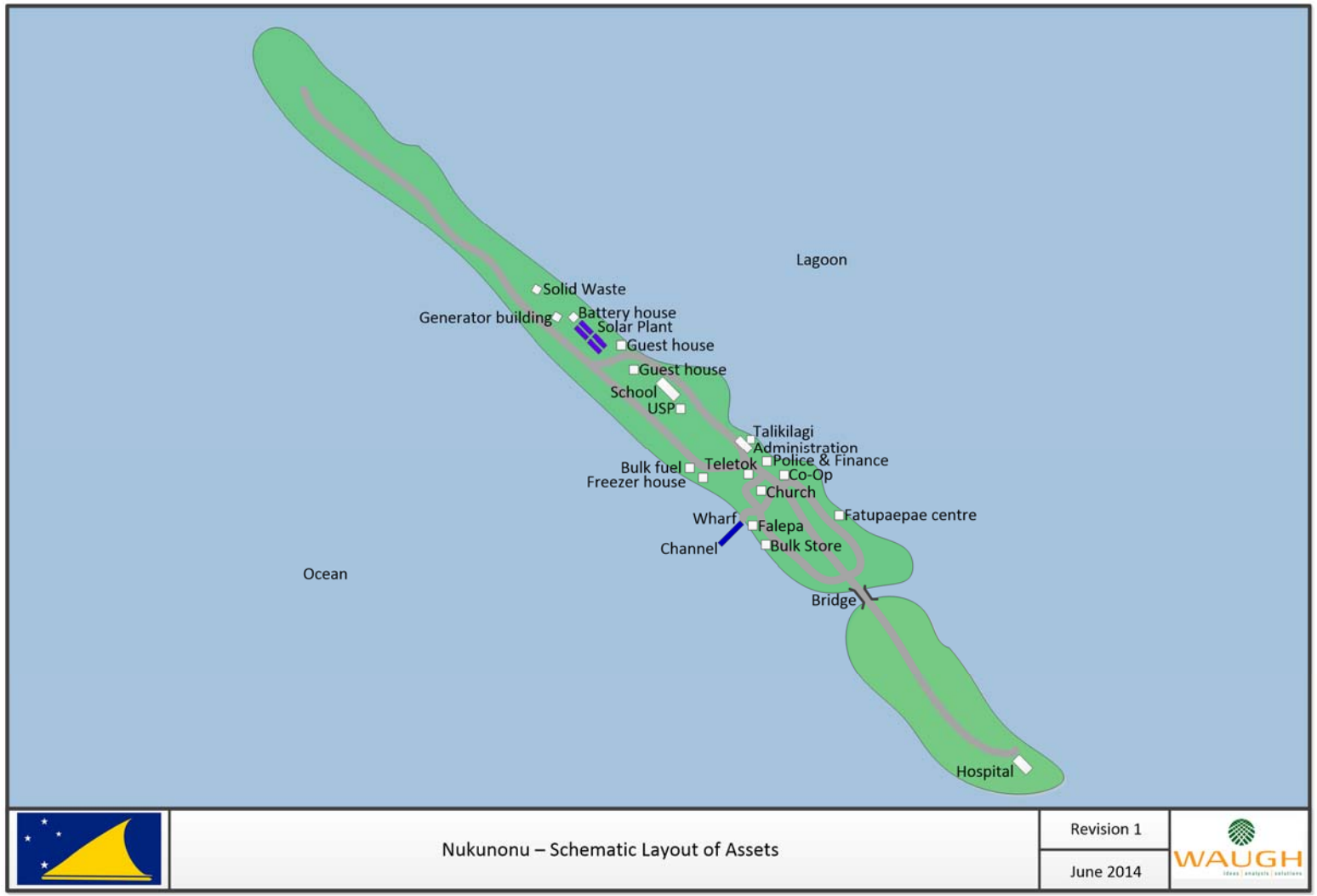
The following Capital Projects are planned and are mainly based on expected renewals:

Year	What	Costs
2015	Channel & Wharf upgrade	$1,262,000
	Tracked crane	$400,000
	Shed storage for plant & bulk fuel	$120,000
2016	Fire fighting	$100,000
2018	Telecommunication – Technical & Internet Equipment	$800,000
2019	Replace Bridge	$210,000
2020	Energy – Solar Batteries	$1,400,000
2024	Energy –Inverters	$400,000
2025	Replace/Renew Church	$395,000
2028	Energy – Solar Batteries	$1,400,000
2030	Telecommunication – Technical & Internet Equipment	$850,000

The above table of capital projects is graphically represented below:


Nukunonu - Capital Projects
$3,000,000
$2,500,000
$2,000,000
$1,500,000
$1,000,000
$500,000
$0
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Channel & Wharf Upgrade
Tracked Crane
Plant storage sheds
Bridge
Telecomm- Tech & Internet
Solar batteries
Solar inverters
Church
Fire fighting

A3.11 Nukunonu Schematics

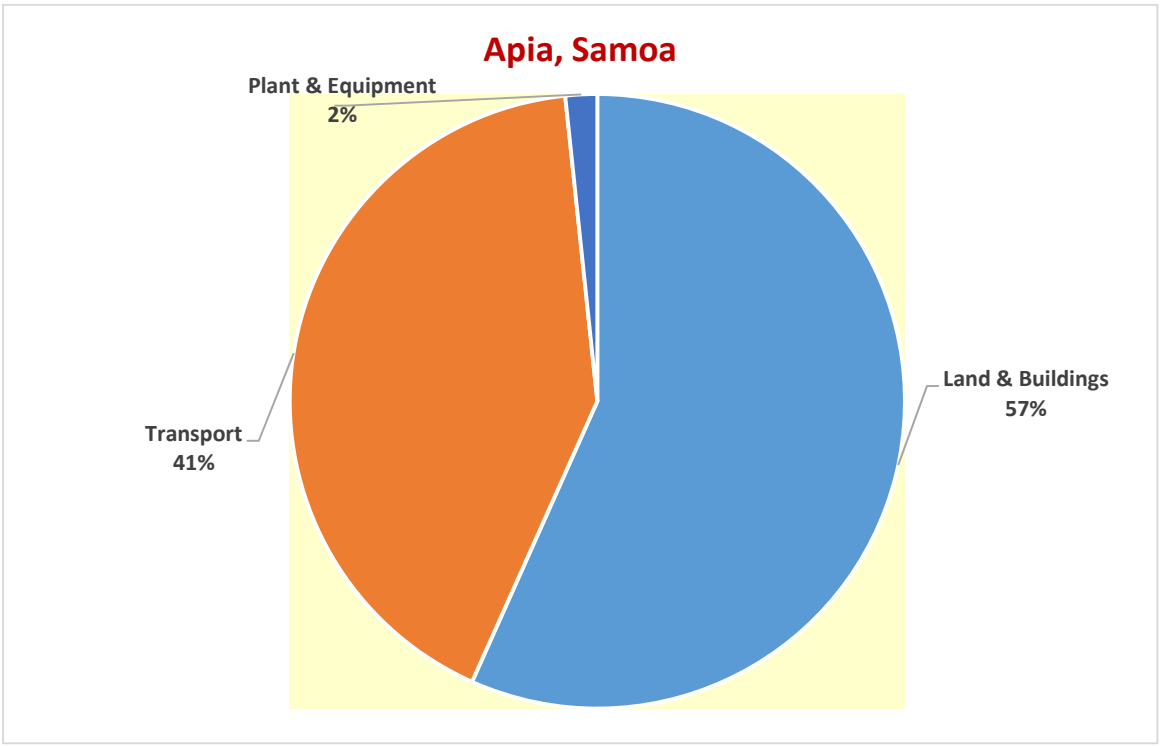


A4 Apia, Samoa

A4.1 Overview

Description			Quantity/Detail	Replacement Value (NZ$)
Population served				
Assets	**Buildings**	Health		
		Education		
		Public & Administration	Admin	$17,011,703
		Storage facilities		
		Guest houses		
		Channels		
		Wharves		
		Seawalls		
		Solid waste		
	Transport	Tokelau Samoa link		$12,500,000
		Ship to Shore		
		Boats		
		Roads & Streetlights		
	Telecom	Building		
		Equipment		
		Cable		
	Energy	Building		
		Solar Panels		
		Batteries		
		Inverters		
		Generators		
		Fuel		
	Plant & Equipment			$501,800
	Grand Total			**$30,013,503**

A graphical representation of the Apia asset value distribution is shown below:



This shows that the Apia assets consist mainly of Land and Buildings and the inclusion of the ferry vessel (under construction) also adds a significant portion to the total asset value.

A4.2 Key Issues

There are no known key issues for the Apia assets. However, the ferry vessel is a critical asset in providing a lifeline link for Tokelau to the rest of the world.

A4.3 Buildings

The buildings consist of Public Administration buildings and house the various Government Departments i.e. Health, Education, Transport, EDNRE and Finance.

A4.4 Transport

The Transport service in Apia, Samoa consist of the Tokelau Samoa link.

Tokelau's only transport link with the rest of the world is the shipping service between Tokelau and Samoa. This is currently a chartered service provided by the Government of Tokelau, but a government owned ship is being constructed at the time of writing this Plan. The vessel will be the first purpose built SOLAS (Safety of Live at Sea) passenger ship serving Tokelau, carrying up to 60 passengers in addition to 50 tonnes of cargo and supplies. The 270 nm voyage between Tokelau and Apia, Samoa will take just under 24 hours at the design speed of 11.5 knots. The vessel is also fitted with a crane for loading/unloading. The procurement of this vessel is included in the Capital Projects at a cost of $12.5M in the 2015 year.

Each of the atolls are dependent on this Tokelau Samoa shipping service for passengers, cargo, medical and emergency evacuations.

Samoa Shipping Co vessels are used for additional charters not only to transport passengers during peak travelling times between Apia and Tokelau, but also when large orders of supplies for government/village projects are required or when there are national activities which necessitate moving large groups between atolls.. Additional charters have averaged 10 – 12 per annum over the period 2005 -2010.

A4.5 Plant and Equipment

The plant and equipment in Apia, Samoa consists mainly of vehicles for transporting public service staff from the various government departments in the execution of their duties. The plant and equipment also contains some furniture and fixtures e.g. office fit outs, carpets, and office furniture.

A4.6 Data Confidence

Due to time limitations the asset in Apia, Samoa was viewed and as a result the condition data and performance data is assumed. The confidence in data for the assets is detailed in the table below:

Asset	Component	Confidence
Buildings	Attributes	5
	Condition	5
	Performance	5
Transport	Attributes	5
	Condition	5
	Performance	5
Plant & Equipment	Attributes	5
	Condition	5
	Performance	5

Where the confidence grade relates to the following definitions.

Score	Description	Definition
1	Accurate	100%
2	Minor inaccuracies	± 5%
3	50% estimated	± 20%
4	Significant data estimated	± 30%
5	All data estimated	± 40%

The above is confidence scores are from the New Zealand Infrastructure Grading Guidelines 1999.

A4.7 Financials

A4.7.1 Asset Valuations

No formal documented asset valuation has been performed. This Asset Management Project developed the Asset Register and this Asset Management Plan.

The newly created Asset Register and associated values are based on the best information available – in many cases this was minimal, resulting in “global best guess” estimates being made. It is envisaged that over time much more accurate, detailed and reliable information on assets will be collected, meaning that regular and more reliable asset values can be developed and incorporated into the Asset Register providing the basis for a more robust Asset Valuation.

A4.7.2 Depreciation

There has been limited accrual accounting with the current practice being cash based accounting which results in replacement/renewal cost of an asset only being recognised when it wears out. This places unnecessary pressure of funding mechanisms and no consideration for lifecycle management. Tokelau should consider implementation of accrual accounting (depreciation) where the costs is spread over the life of the asset. Depreciation/decline in service potential is thus provided on a straight line basis. The required annual depreciation component for all Apia assets amount to $490,000.

A4.7.3 Operation & Maintenance

The Taupulega (Village Council of Elders), General Fono (National Assembly) and the Council for the Ongoing Government (Executive Government) of Tokelau are the principal administration institutions of governance in Tokelau. The Taupulega provides policy direction at the village level whereas the General Fono provides all policy direction at the national level.

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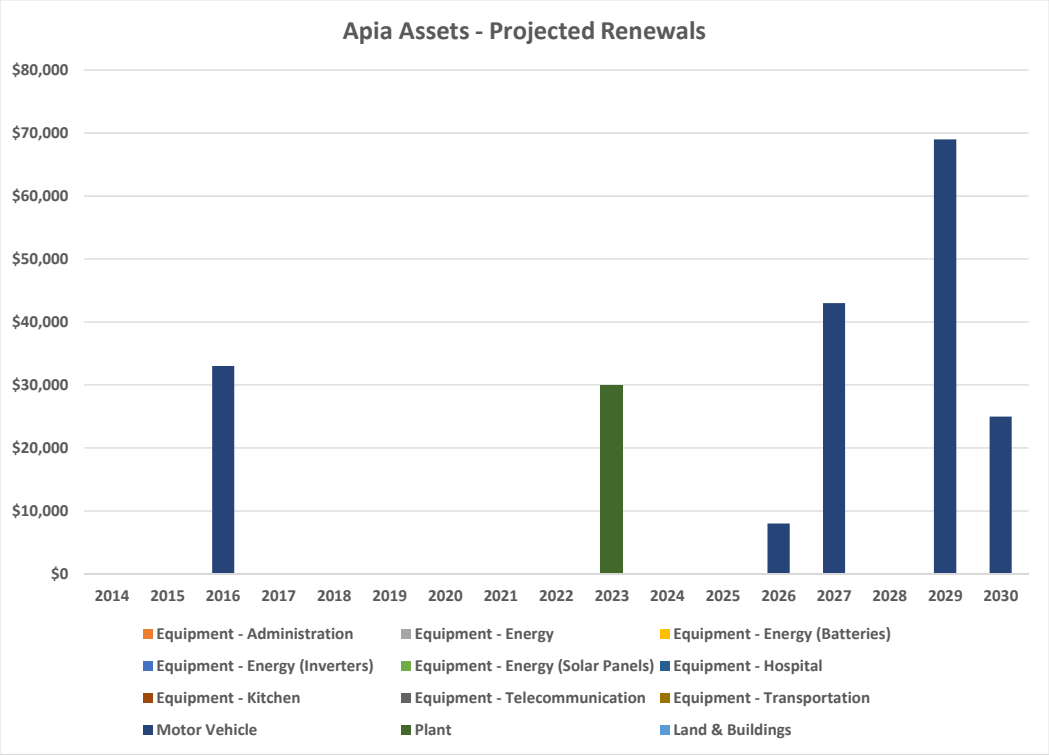
    d. Economic Development,
    e. Transport and Support Services,
    f. Energy and the Office of the Council for Ongoing Government and
2. the services provided at the village level, under the management of the respective village General Manager (Director or Coordinator) include staff who work in the
    a. school,
    b. hospital,
    c. Information Technology support services,
    d. co-operative store,
    e. finance,
    f. FM radio,
    g. general village workers and
    h. the traditional workforce

The Taupulega on each atoll has responsibility for all the public assets on the atoll including public buildings, schools, storage facilities, transport and wharves. The operation and maintenance of these facilities are a major part of the Taupulega's responsibilities and a substantial part of its annual budget.

A4.7.4 Renewals

No formal Renewal Plan exists for the assets in Tokelau. The following shows the renewal requirements for the Apia assets based on the expected useful lives within the asset register.



The most significant renewals projected in the above graph are motor vehicles and plant.

It is important to note that this is projected replacement and not planned replacement. This means that these are theoretical replacements required, based purely on the expected useful lives of the assets within the asset register. Asset condition assessments may extend or decrease expected useful lives affecting an actual planned renewal programme. It is therefore important that Tokelau develop a Renewal Plan (**IP 24**).

A4.7.5 Capital Projects

Apart for the procurement of the GT500 SOLAS Ferry (under construction at the time of writing this Plan) at an estimated costs of $12.5M there are no other significant capital projects planned for Apia assets.

B SCENARIOS

B1 Air Service

During the site visit numerous references were made to the potential development of an air service to improve Tokelau's transport link to the rest of the world. As a result this part of the AMP takes a snapshot look at the implications of an air service in Tokelau and considers the following items:

- Background
- Location
- Development costs
- Lifecycle costs
- Impacts

B1.1 Background

The issue of an airstrip, or three airstrips, is seen by some as highly desirable, especially for emergency use, to support administration, medical evacuations and tourism.

The Tokelau Infrastructure Study 2001 states
'*There are currently no air services to Tokelau. The mainstay of Tokelau transport for both freight and passengers has been a shipping service linking the atolls to Apia. In the 1960's this ran with a frequency of 1 to 2 trips per year. The number of annual visits has steadily increased to 10 trips per year in 1995, monthly in 1996 and is currently around 20 trips per year.*

Between 1949 and 1967 the Royal New Zealand Air Force provided a regular and emergency air service to Tokelau using flying boats from a base in Fiji. This ended with the replacement of the flying boats with the land-based Orion aircraft. Other attempts were made to introduce an amphibian aircraft service but these proved uneconomic and a service provider could not be located.'

B1.2 Location

This could be a very polarising subject as three airstrips will be a significant financial cost while one airstrip will only provide a significant benefit to one atoll, while the other two atolls will still be dependent on a sea link service.

B1.3 Development Costs

The construction of an airstrip will require significant development costs. The Tokelau Infrastructure Study 2001 provides the following development costs for an airstrips in Tokelau.

Atoll	Construction Costs	Maintenance Costs
Atafu	$1,379,140	$10,400/year
Fakaofo	$1,733,693	$11,884/year
Nukunonu	$1,420,143	$10,400/year

The above figures were have been inflation adjusted to show 2014 figures. However, these figures do appear very optimistic when compared to recent wharf upgrade estimates at approximately $1M per wharf which are upgrades to existing facilities. Whereas the construction of an airstrip will be a new project in totality.

Best guess estimates would suggest that the construction of an airport would be as follows:

Item	Costs
Establishment	$2,000,000
Construction	$5,000,000
Equipment	$3,000,000
Total	**$10,000,000**

B1.4 Lifecycle Costs

In addition to the significant capital costs in establishing an airport there is the lifecycle costs of managing and operating an air service. The following table lists the lifecycle costs:

Item	Costs/Year
Management	$100,000
Operation & Maintenance	$400,000
Depreciation	$333,333
Total	**$833,333**

B1.5 Impacts

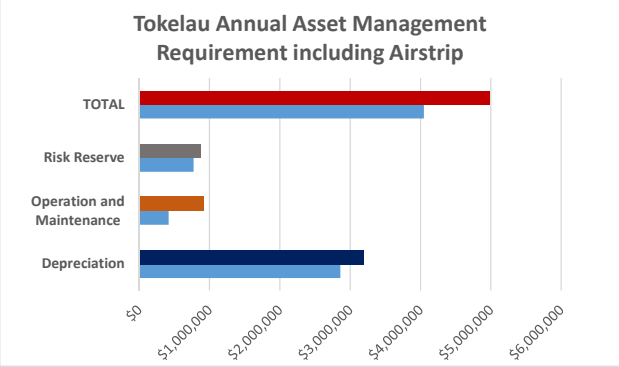
The development, management and operation of an airport and air service will have significant impacts including but not limited to:

- There is little possibility of recovering the costs of an airstrip development, lifecycle and air travel from the users. Therefore it will have to be a heavily subsidised service.
- Increase in work opportunities
- Increase in population movement
- Increased potential for demographic changes
- Increase in tourist activity
- Increased potential of unwanted elements and illegal goods

Apart from the initial capital project costs the future annual Asset Management Requirement will increase from $4.05M to

Asset Management Component	Costs
Natural Events – Risk Reserve	$871,000
Operation and Maintenance	$920,000
Depreciation	$3,191,000
TOTAL	**$4,982,000**

This shows an increase of $932,000 say $1M annually extra.



B2 Telecommunication

The following information on potential options to improve the Telecommunication service is a summary of a draft report 'Telecommunications in Tokelau' (June 2014). This provides some insight on future options and future financial implications.

B2.1 Quick Summary

Capital items (may be an imperfect tabulation of discussion of the main report but is indicative)

Issue	Options and Considerations	Suggested Costing (US$ Million)
International Connectivity	Hawaiki, (poss 2-3 yrs start, $5-15M +0.5Mp.a.,20 Yrs life) O3B, (1yr start, $1.5M +0.8Mp.a., 7 yr life) Kacific (poss 2-3 yrs start, 0.4M +0.5Mpa, 7 Yrs life) TNZI (0.3 Yr start, $0.1M +0.15Mp.a., 7 Yrs life)	0.10 (assuming TNZI)
Fixed phone services	Remediation already contracted. ($0.11M+ , 7Yrs life)	0.11
Mobile Phone services	3G +Towers (0.4 Yr start, $1.0M, 7/ 20 Yrs life) (3G phones have Sat Nav (SOLAS), FM radio)	1.00
SKYTV	Central core /island, (0.3 Yr start, $.06M total, 7 yrs life) Cable distribution (1Yr start, 0.16M, 7/20 Yr life) ADSL / 3G distribution (0.3Yr start, $0.06M, 7/20 Yr life)	0.36
Radio Broadcast service	Central broadcast studio (0.3 Yr start, $0.10M total, 7 yrs life) ADSL/ 3G I'net radio (0.3 Yr start, $.06M total, 7 yrs life) FM each island (0.3 Yr start, $0.1M total, 7 yrs life)	0.16
Equipment Rooms	Equipment rooms include equipment not in use, aged batteries and poor layout. Removal and Refurbishment required	0.15

Non Capital / Institutional (indicative)

New legislation	No extant legislation. Suitable non restrictive telecom legislation	0.25
Monopoly Regulator	No discernible mechanism for competition, monopoly regulator as a surrogate, suitable tools staff and skills	0.45
Teletok Reformation	Revisit of founding legislation, governance, business structure and business methodologies	0.30
New Services	Studies re M-Paisa (mobile money, Education/ Health)	0.10

B2.2 Observations

B2.2.1 Market

The GNI of Tokelau is about NZ$ 23 Million, and for countries of similar GNI/ Capita the national telecommunications spend is around 5% of GNI. On this basis the prospective total telecommunications spend is about NZ$1.1 million. Current Gross revenues of Teletok are about NZ$1.12 of which about half is derived from the national subscriber base. This indicates opportunity for revenue growth subject to perceived subscriber value. The availability of services discussed in this document have the prospect of increasing GNI which clearly benefits the community but also multiplies telecommunications revenues which enable introduction of further services.

Consumers all want mobile service, Sky TV, reliable Internet (ADSL) and lower prices for international calls (the major traffic).

B2.2.2 Regime

The circumstances of Tokelau (small market in a geography that is costly to service) are such that there is no discernible mechanism for introduction of competition.

A regulated monopoly regime is possible but both the legislation and the institution of the PMU would need to be bolstered to drive an effective and efficient ICT industry.

Coupled with a monopoly regulator, the legislation could include provisions that revoke the exclusivity and permit entry of other service providers where a niche presents. The absence of exclusivity additionally encourages the main provider.

If a private or partly private monopoly were considered, the primary legislation would need to be revised and developed. Additionally the terms of the monopoly would need to be closely negotiated.

B2.2.3 Legislation and Sector Governance

There is no general telecom legislation, the only telecom related legislation relates to the formation of Teletok as a SOE in 1996.

The legislation seems to prohibit borrowings so all growth / development needs to be funded from earnings.

Teletok is to operate as break even enterprise which limits opportunity for self funded replacement of network plant or introduction of new services.

The legislation establishes an exclusivity for Teletok which limits opportunity for niche operators and independent entry to the market.

The legislation specifies the Board of Teletok in a manner that does not permit commercial liberties and drivers.

There is no legislation about spectrum, relying on past New Zealand oversight arrangements which are not geographically relevant to Tokelau.

B2.2.4 Operator Governance

Teletok is a SOE and governed by a Board that is the Council of Ongoing Government. This arrangement ties Teletok to Government perspectives rather than Commercial imperatives.

The Teletok Board structure does not formally include financial, market or technological perspectives. The absence of such perspectives limits the commercial focus of the SOE.

Teletok as a corporation is in sound financial condition. It carries no debt under a provision of the TTC Act that it may not borrow to finance its operations.

The outgoing CEO has been the CEO since Teletok formation in 1997. While apparently guiding the operator successfully within the constraints of market size /no borrowing/ international dealings, the arrangements are overly dependent on the person of the CEO.

The future of Teletok is prospectively difficult as about half of its revenues come from international sources that are not as sure as subscriber revenues. The internationally sourced funds have made the current state of services provision possible at current prices.

B2.2.5 Network

Current fixed network switching equipment was installed in 1996 and is no longer supported (the manufacturer is defunct). An upgrade of the fixed network switching equipment (by Challenge Networks) is in train.

Satellite dishes are showing deterioration and are ready for replacement. Expansion for improved performance is in train with the attendant benefit of replacing deteriorated satellite dish antennas.

Most of the Teletok telecommunications plant is relatively modern (refer to network diagrams at Annex A and photos of equipment room at Annex C in the original report). Telecommunications plant (MSAN - used for ADSL) is modern and capable of easy expansion for new services.

In ground cable is sound but underutilised and fit for expanded use. Restoration of SKY TV service may be achieved by a new cable system, ADSL delivery or incorporation into the mobile network (or a mixture of the last two). All require a central antenna system and further analysis.

Development of telecommunications services and the framework with which to manage the sector will require a new injection of funding (in the region of $2-3million for the national segment and a special arrangement for the international segment.

The national satellite network capacity is apparently inadequate and results in poor service and lost revenue. International connectivity would need to be enhanced for the provision of the range of services sought at the Taupulega meetings.

There is a compelling case for simplification of the network (e.g. by abandonment of the wire line PSTN and migration to mobile network only) as a measure to drive down costs. However this would need to be considered in relation to best arrangements to address customer needs. Should this path be chosen retirement of the fixed network could be staged.

A mobile network is clearly a need for voice communications and Internet.

A modern mobile network (3G or 4G) is suitable for integration of services such as Internet radio, Video on Demand (for SKY TV) emergency message communications and Safety of Life at Sea.

A mobile telecommunications system would lend itself to easy co-existence with a local FM broadcast service if that were preferred as a means of ensuring redundant emergency communications to the community.

A public prepaid Internet service (WiFi) would be an advantage for citizens not ready for a mobile based service.

B2.2.6 International Connectivity

Tokelau satellite international connectivity is inadequate. Expansion based on the existing plant is technically and administratively straightforward but at increased operating costs.

Alternative providers (O3B, Hawaiki and Kacific) would be very attractive if the capital and at least first few years direct costs could be covered.

A sizeable investment in redevelopment would be required to achieve the outcomes desired of Government.

B2.3 Current Telecommunication Infrastructure

Replacement of the PABX is most urgent and already underway the Contracted price for this replacement is about US$110K. The life of this new infrastructure could be expected to be 7-10 years.

In ground telephone cable seems sound. Cable capacity presently much greater than that which is in use. Cable should be further exploited. Expected cable life from 2014, 20+ years.
In premises cabling may need refurbishment

Separately, the existing main dish antennas are being replaced with slightly larger units which is fortuitous as the existing units are showing deterioration and a refurbishment / replacement program would be required. The replacement program is understood to be linked to the TNZI program to improve the form of satellite service to permit direct island to island communications (in lieu of the need to connect from island to NZ and then back to the other island – such ‘two hop’ format make conversation difficult and limits data communications).

The current back up links supplied by PacTel (now SpeedCast) are reported to be under performing and should be addressed to restore full performance. This could be addressed in concert with other telecommunications development works.

International connectivity needs to be expanded. The approximately even spread of population warrants similar connectivity for each island. Microwave linking of the islands is impractical (distances too great). Options include

- expansion of TNZI service (immediately possible subject to costs (current capacity could be doubled for an additional NZ$0.185 million p.a.), assets life 5-7 years.
- O3B service (about 1 year set up) capital cost US$1.2 - 1.5 million and ongoing US$0.72 -0.96 million p.a. and assets life 5-7 years.
- Kacific satellite service (subject to that project proceeding in about 2016) capital US$0.3 million and operating cost of US$0.3 million per year and assets life 5-7 years; or
- Hawaiki cable (subject to that project proceeding in about 2016) at a capital cost of US$5-10 million (or more for a connection to each island) and operating costs of total US$ 0.54 million per year and assets life 20 years.

The last three will provide vastly more capacity than Tokelau is likely to require into the foreseeable future.

The existing MSAN equipment (*multiservice access node* which connects different subscriber services (phone, ADSL, Video on demand, internet radio) to the various core network components that provide these various services and which is presently only used for ADSL services- are underutilised, adequate and will be slightly expanded as part of the PABX change out. The existing MSANs have capability and capacity for expansion for new services. They should be retained. They have a prospective further life of about 5 years.

Other Telecommunications plant on the island is relatively minor capital value and is mostly fully depreciated

The country needs a 3G mobile network (4G is better but the handsets are 8-12 times more expensive and 3G will be adequate). The 3G core network components would connect through the MSAN equipment to access satellite connectivity, for calls between fixed and mobile networks and for various Internet based services that might be delivered by the mobile network. A suitable 3G mobile network, including towers would cost about US$1 million. The towers would have life of about 20 years and the 3G network equipment about seven years. Fortuitously, many 3G handsets incorporate both Satellite Navigation (SOLAS) and an FM radio.

The country has recently lost access to SKYTV and replacement of the previous individual satellite services with suitable individual satellite services is not practical (dish is too big, cannot be roof mounted). The only practical solution is a central large antenna and reticulation of the signal. This can be either by installing a community coaxial cable (to be laid underground) or delivered via ADSL/ 3G. Delivery by ADSL (video on demand home service) /3G (video on the move but small number of simultaneous users) is probably more workable. Any approach will require central and distribution systems. A large central dish antenna and ancillary electronics on each island would cost about US$15K per island. Life of such equipment will be about seven years. A cable based distribution solution would cost about US$60Kper island. An ADSL /3G distribution system would use existing phone cables so central and user equipment would total about US$30K per island.

Atafu used to have an FM radio service and the communities were keen to have such a service. A practical service could be delivered by either an FM transmitter on each island linked to a central broadcast studio by satellite, or by the mobile phone network. A separate FM system could be considered if over dependence on the telecoms network were seen as a risk to information provision during an emergency. Both systems could use the same towers if two systems were required and a broadcast studio for assembly of broadcast material would be required for either approach. An adequate broadcast studio and relevant material gathering electronics would about less than US$100K (assuming suitable building space can be separately provided) and each island transmitter system about US$30-

35K with an asset life of 5-7 years. Conveniently most 3G mobile phones already incorporate an FM radio which could provide independence in the event of electricity loss. Incorporation of the service into the ADSL / 3G mobile network (Internet radio) could be less expensive than separate FM transmitters. Capital cost would be about US$50K total.

This discussion is a general summary of the report content as provided by the author of the report - Telecommunications in Tokelau (June 2014).

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