



## Community Impact Report

### Measuring the Impact the Tonga Pacific Adaptation to Climate Change Water Project



United Nations Development Programme

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Government of Australia



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### **Disclaimer:**

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### **Front cover image:**

Siosi'ana Fanua and family from Kolovai have their photo taken in front of their new water tank provided by the PACC project.

## Executive Summary

Tonga is one of fourteen countries taking part in the five year United Nations Development Program Global Environment Fund Pacific Adaptation to Climate Change (PACC) programme. The objective of the Tonga PACC project is to increase resilience to climate change impacts through the implementation of demonstration adaption measures to improve water security in the Hihifo district of Tongatapu. The main water security improvement measures involved the upgrading of the village water supply (public water system) and these improvements were completed in April 2014.

Thirty representatives including household residents, resort owners and Town Officers in the Hihifo district were surveyed in May 2014 to inform this community impact assessment. An analysis of the survey data finds that the water security component of the Tonga PACC project has delivered some immediate positive benefits to households in the six target villages of Hihifo. The main benefit noticed was that the water supply was now more reliable and this has led to high levels of satisfaction with the village water supply and the PACC project as a whole. Whilst the reliability of the village water supply was the main noted improvement delivered by the PACC project, it was also the most reported reason for dissatisfaction with the village water supply, especially in the more remote villages further away from the main water source. Whilst the reliability of the village water supply has improved, there is room for future improvement to ensure there is a constant supply of water delivered all day, every day to every household. Continual fine tuning and fault resolution processes are hoped to resolve outstanding issues and increase the reliability of the water supply.

The analysis found evidence that the improved village water supply has also resulted in improvements to sanitation in homes and shared community facilities. Tourist resorts also acknowledged the future benefits (reduced costs) they would experience during drought events as a result of not having to cart in large volumes of water. Future cost savings and improved revenue collection were also noted as future anticipated benefits from the Town Officers. Recipients of rainwater tanks were extremely grateful and noticed the immediate benefits of more convenient access to drinking water. These households and the neighbouring households they would normally borrow water from have also increased their resilience to drought events. The analysis found no major gender imbalances in the distribution of benefits and impacts delivered by the PACC project.

An opportunity was identified for a future project to conduct a household leak audit to minimise wastage of the village water supply and fresh water lens. The analysis found that only a minimal amount of community education on climate change and water security was delivered by the PACC project. The low levels of climate change knowledge is something that should be addressed by the PACC project or a future capacity building project. Without a true appreciation for the number and scale of projected climate change impacts, it will be difficult for the communities to fully appreciate the benefits that the Tonga PACC project has delivered. An abbreviated list of recommendations from the impact assessment are documented below with additional details provided in the Conclusion section of this report.

### Abbreviated recommendations:

1. Improved communication planning for projects to avoid misunderstandings
2. Fault recording and resolution system to be implemented to resolve outstanding issues
3. Cost effective demand-side management should be included in future water projects
4. Continue rainwater tank installations in future water projects
5. Community capacity building on climate change impact awareness needs addressing

## Introduction

The Pacific Adaptation to Climate Change (PACC) project in Tonga focused on increasing the climate resilience of communities in the Hihifo district through improved water security. This community impact report will document the findings from a community impact assessment survey conducted in six villages of the Hihifo district of Tongatapu in May 2014. The objective of the community impact assessment survey is to determine what impact the Tonga PACC project has had on lives of people living in the Hihifo district. Whilst the Tonga PACC project also included components focused on mainstreaming climate change into Government policy, this report will only focus on the impacts of the climate change resilience demonstration projects focused on water security.

## Background

The United Nations Development Program Global Environment Fund PACC project is a five year USD 13M programme of action, which began implementation in February 2009 with financing from the Special Climate Change Fund. The project is executed by the Secretariat of the Pacific Regional Environmental Programme (SPREP), who work directly with fourteen National Implementing Partners (typically government entities based in each of the countries that are part of the project). Since June 2011, an additional USD7.8M of Australian Government funding had been utilized to complement and add value to the on-going PACC project. Australia's contribution will build on existing project delivery mechanisms established through the PACC in order to facilitate the replication and up-scaling of practical adaptation measures and strengthen overall implementation of the project through increasing assistance for the programme support and knowledge management activities.

The programme supports participating countries through 3 closely interrelated outcomes aiming at (1) integrating climate change and disaster risks into national and sectoral strategies, (2) implementing on-the-ground demonstration measures in pilot communities, and (3) raising awareness on Climate Change matters and capturing and communicating project experiences and lessons learnt.

Tonga is one of the fourteen Pacific countries participating in the PACC Programme. Tonga's national lead agency for PACC is the Ministry of Lands, Environment, Climate Change and Natural Resources. The Tonga PACC Project in collaboration with key stakeholders will help to increase the climate resilience of communities in the Hihifo district through improving water security. The main outputs and deliverables of the PACC project to date include:

- Amendments to the existing National Water Bill to include climate change considerations
- New National Water Policy for Tonga drafted
- Completion of a socioeconomic assessment and vulnerability assessment on water resources
- Completion of design for new village water supply system
- Construction of six new bore holes to extract water and monitor water quality.
- Installation of five new solar powered water pumps and two diesel pumps
- Installation of new treatment plant for underground bore water to increase water quality
- Installation of three 45,000 litre community water tanks to store ground water and supply the six villages of Hihifo.
- Installation of one raised 22,500 litre head tank to supply additional water pressure to remote villages
- Installation of one raised 5000 litre head tank to supply Foui village

- Installation of 21.81 kilometres of new water pipe to connect the water supply to the six villages

The Ministry of Lands, Environment, Climate Change and Natural Resources, Government of Tonga, contracted the services of Mr Martin Pritchard to design, implement and report on the community impacts of the Tonga PACC project.

## Research Methodology

The community impact assessment report was informed by a community impact survey issued to 30 households in the six villages of Hihifo.

### Survey sampling and sample size

The survey sampling method and sample size used was limited by a number of factors documented below in the constraints section. The original goal was to select a minimum of five households from each village, however, this approach was varied for a number of reasons. Firstly, the PACC project did not make any large contribution to the village of Ha'avakatolo and Fo'ui, as these villages have their own water supply system and it was upgraded approximately 5 years ago. These two villages did benefit from water meters, new rainwater tanks and solar pumps. Secondly, initial surveys revealed that some households in Ha'atafu were reporting less favourable outcomes from the project and thus it was thought more beneficial to investigate further in this village. Finally, whilst most households were selected at random, there were occasions where the research team targeted households that had received rain water tanks through the PACC project so the impact of the new rainwater tanks could be assessed.

The survey team also selected survey participants to ensure there would be a fairly even representation from both men and women and some tourist resorts were also deliberately targeted to determine what impacts the project has had on local businesses. Additionally, several Town Officers were also deliberately targeted as they are tasked with representing their community and were thought to be good sources of information. The deliberate targeting of some households who received rain water tanks and Town Officers may introduce some positive bias into the results. Whilst the sample size selected (30 households) was too low to be considered a representative sample, the feedback collected from households still provides a useful indication of what impact the project has delivered. Table 1 below documents the number of surveys issued to households in each village.

*Table 1. Survey sample*

Villages	Total number of households*	Sample size (# households)	Sample size as percentage of total households in village
Kolovai	390	7	2%
Fo'ui	124	4	3%
Ha'avakatolo	84	1	1%
Ahau	44	4	9%
Kanokupolu	83	5	6%
Ha'atafu	53	9	17%

\* Data taken from 2010 Pacific Community focussed Integrated Disaster Risk Reduction Project and 2006 Tongan Census.

## Survey Design

The community impact survey focused on determining the impacts of the water security component of the Tonga PACC project. It is too early for the community to notice any impact from the PACC Tonga climate change mainstreaming component and the coastal protection component was still being implemented at the time of the survey.

The Tonga PACC project conducted a socio-economic assessment and associated report<sup>1</sup> in 2011. A vulnerability assessment<sup>2</sup> on water resources in Tongatapu was also conducted by PACC in the early inception stage of the project. These reports were reviewed and used to inform the context for the impact survey. Some questions from the socio-economic survey were reproduced in the impact survey to allow for a pre and post-program comparison, however, care needs to be taken in such a comparison given the small survey sample size. The PACC Tonga country project logframe matrix was also reviewed and additional questions were added to the survey to collect data to inform some of the indicators that were present in the logframe matrix. Some additional knowledge test questions were added to the survey to assess existing knowledge on climate change impacts and identify gaps that can be addressed by future projects. The survey included a mixture of multiple choice and short open-ended questions to capture both quantitative and qualitative data. The survey was translated into Tongan, and tested and refined over the first two days of delivery. The survey was issued by the Tonga PACC Project Officer and the consultant, with questions delivered face-to-face by the PACC project officer. Survey questions are documented in Appendix 1 and a summary survey report is documented in Appendix 2.

## Constraints

The survey design, methodology and implementation was limited by a number of constraints that are outlined below:

- **Budget and time.** The Tonga PACC project had allocated sufficient funds to conduct an impact assessment, however, the funding could only support four days work to design and implement the survey. This time constraint limited the number of participants that could be included in the survey sample.
- **Language.** Not all community members are fluent in English and thus it was both necessary and culturally appropriate to have the Tonga PACC project office conduct interviews to obtain the answers to the survey questions. Interviewing participants in the local Tongan language also reduces the likelihood of misinterpretation of questions and responses. The need to use Tongan language and the interview technique limited the ability of the consultant to conduct interviews.
- **Culture.** In Tonga there is cultural tendency to be polite and respectful. This can sometimes come at the expense of being openly frank and honest with negative feedback which may result in only positive feedback being captured. After reviewing the survey responses, the consultant believes that this constraint was limited.
- **Timing.** The community impact survey was issued only two months after the components of the project had been delivered. Given this small amount of time after project completion, the project was still resolving several project implementation issues whilst the impact survey was being conducted. The presence of these issues may negatively impact upon the community perception and impacts. The implementation issues can be summarised as:
  - **Faulty equipment** – One solar pump and one community head water tank were in need of repair which impacted upon the delivery of water to one village.

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<sup>1</sup> Sione Faka'osi, S., Takau, L., 2011, Hihifo Pilot Site Socio-Economic Assessment Report, Ministry of Environment and Climate Change, Government of the Kingdom Tonga

<sup>2</sup> "Vulnerability Assessment on Water Resources Report under the PACC Project", Ministry of Environment and Climate Change, Government of the Kingdom Tonga

- **System fine tuning** - Water pumping timing to recharge community head tanks was still being finetuned to ensure adequate pressure was in the system at all times to supply remote villages. This resulted in some households not having the desired water pressure or a reliable water supply.
- **households not hooked up to water meter**– Whilst all homes have a water meter connected to the new Village Water Supply on their property, not all homes had connected the water meter to their household water system. It was the responsibility of households to connect their home to the new water meters installed in their properties. This means that now all household will have fully experienced the benefits of the new Village Water Supply system.

## Community impact assessment results

### About the households

The community impact survey captured feedback from a relatively even distribution of men (16) and women (14) representing their households. This distribution ensures that any gender specific impacts are more likely to be detected. There was also a fairly even distribution of age groups represented between 31 and 51+ (see Table 2). Data collected indicates that most households have a large number of residents staying in the home with the most common response being seven people (see Table 3)

*Table 2. Age of household representatives*

Age group	Number of household representatives
<18	0
18-30	4
31-40	10
41-50	10
51+	6

*Table 3. Number of people living in the home.*

Number of people living in the home	Number of households	Percentage of households (survey responses)
1	1	3%
2	2	7%
3	3	10%
4	4	13%
5	3	10%
6	4	13%
7	5	<b>17%</b>
8	2	7%
9	2	7%
10	0	0%
11	0	0%
12	3	10%
>12	1	3%

All households had a rainwater tank on their property and nearly all of these tanks were installed in the past before the PACC project was implemented. Most (29) households currently obtain their drinking water from their own household rainwater tank whilst a small number (2) either relied solely or partially on their neighbours rain water tank or bottled water. No households used the upgraded village water supply delivered by the PACC project as their main source of

drinking water. Most (19) households have not changed they way they access water in the past five years, although some (11) have changed from using either their neighbour's rainwater tank or an old cement tank to a new rainwater tank attached to their home.

### Satisfaction with the village water supply

Most (24) households were connected to the upgraded village water supply. In this instance 'connected', was defined as the household having a connection between the water meter and their home. A household was also considered connected if they were accessing the village water supply directly from the tap on their water meter and carrying it into the home.

**"We are not yet connected, but friends say new system is more reliable", Fo'ui household**

Figure 1 Satisfaction with village water supply (May 2014)



Whilst issuing the survey we encountered three households who were connecting their homes on the day of the survey or had intentions to connect the following week. For these households the survey was issued too early to determine the full impacts on the household.

Overall, twenty one (70%) of all households were satisfied (7) or very satisfied (14) with the upgraded village water supply system (see Figure 1). This is a positive reflection on community perception with the improved system. However, not everyone was satisfied with nearly one quarter (6) households indicating they were unsatisfied and one household indicating they were very unsatisfied.

The main reason for dissatisfaction was linked to the village water supply being unreliable. Some household representatives reported that the water did not run all the time. As mentioned earlier in the report, the PACC Tonga project was resolving some implementation issue including low water pressure.

**"Sometimes turn on tap and water does not run, but it runs later in the day", Ha'atafu household**

**"The village water supply is not running every day. It is better than the old system but still not reliable", Ahau household**

**"Improvements are good most of the time, but not all of the time", Fo'ui household**

**"At the start of the new water system, it was OK, but in last week for half a day, every day, there is no water", Kanokupolu household.**

In some cases it was difficult to determine if participants were reflecting upon the improved or old village water supply system and thus the result may not be reflective of the outcomes of the PACC project. Some households were also dissatisfied because they mistakenly thought that the implementation contractor (through the PACC project) was going to connect their household to the newly installed water meter. When they discovered that their household was not connected, their expectation was not met and this resulted in the expressed dissatisfaction. This misunderstanding can be explained by a lack of communication either between the contractor, town officer or PACC project team and the household.

Due to the small sample size of the community impact survey, caution must be given when comparing results with other datasets. However, the analysis has compared the results from the community impact survey results with the 2011 socio-economic survey. The findings from the comparison present a mixed picture. The 2011 socio-economic survey reported very high levels of dissatisfaction with village water supply for Ha'atafu and Fo'ui (100% and 90%) (see Appendix 2). The 2014 impact survey results showed a large improvement in satisfaction for households from these villages with five of seven households in Ha'atafu now satisfied or very satisfied and two of four households in Fo'ui satisfied or very satisfied. This increase in satisfaction can be largely attributed to the upgraded water supply being more reliable. The comparison of results for Kanokupolu also reveals a small positive shift in satisfaction, however, results for Ahau and Kolavai could be generally be described as unchanged.

*Figure 2. Akosita Rakisiica's son from Ha'atafu digging a new trench to connect their home to the new village water supply water meter*



### **Benefits and impacts of the improved village water supply**

Twenty of the thirty households reported noticing improvements in the village water supply and these improvements were largely (19 households) associated with improved reliability of the system (see Table 4). Other households (5) reported that there was stronger water pressure and two households were connected to the village water supply for the first time by the PACC project. Gender disaggregated results reveal no significant difference in the types of benefits noticed by men or women which indicates that the project delivered equal benefits for both genders.

**"We now use water for cooking straight from the [village water supply] tap instead of using our tank water. Very satisfied.", Kanokupolu household recently connected to the water supply for the first time**

**Table 5 Village water supply improvements**

Improvements	Number of households
<b>More reliable source of water</b>	<b>19</b>
<b>Good water pressure</b>	<b>5</b>
<b>Improved water quality</b>	<b>2</b>
<b>PACC project connected our home to Village water supply</b>	<b>2</b>
<b>Other</b>	<b>5</b>

Whilst a large number of households acknowledged improvements in the village water supply, very few were able to document how these improvements had impacted upon their lives. This may be due to the limited time (2 months) that the new system has been operating. The real benefits from the improvements to the village water supply will likely not be experienced until there is a drought or water shortage which results in households relying on the village water supply as their main source of water instead of their household rainwater tank.

**“Our toilet now fills with water. Before it did not always fill.”, Fo’ui household**

Of those household reporting impacts from the improvements to the village water supply, the most common responses were:

- No longer travel to collect water which saves time (3 households)
- Being able to water the vegetable garden more (2 households)
- There is more water for drinking in the rainwater tank as households now use the village water supply for other non-drinking purposes in the home.
- Households know how much water they are using by looking at the water meter. In the future this will help them save water and reduce their water bill as they will only get charged for what they use. (2 households)
- Sometimes drink water from the village water supply as it is more convenient.
- The toilet in the household now fills up and makes life easier. In the past the household needed to cart buckets of water to flush the toilet.

*Figure 3. Salesi Naati’s children show how the village water supply is accessed in their home in Ha’atafu*



Tourist resorts also reported some additional positive impacts. In times of drought, resorts have had to purchase trucked-water from the Government of Tonga. This is a considerable cost to their business and sometimes the water truck is broken down and resorts are left reliant on the fire brigade to supply water. For resorts, the more reliable supply of higher quality water from the village water supply will enable them to meet the water supply needs of their business in times of drought without going to extraordinary lengths and cost.

*Figure 4 Household in Ahau, who accessed water straight from the water meter in home in Ha'atafu*



#### **Improvements to shared public services**

Men and women who use the local Church in Kanokupolu are enjoying the benefits from the upgrade to the village water supply. The toilets in the church are now filling with water and flushing properly which greatly improves sanitation and amenity (smell) now that the site is connected to village water supply. Men who often host Kava circles at the site next door also benefit from the improved service. Before the PACC water system upgrade, buckets of water had to be carted to flush the toilet when it did not fill.

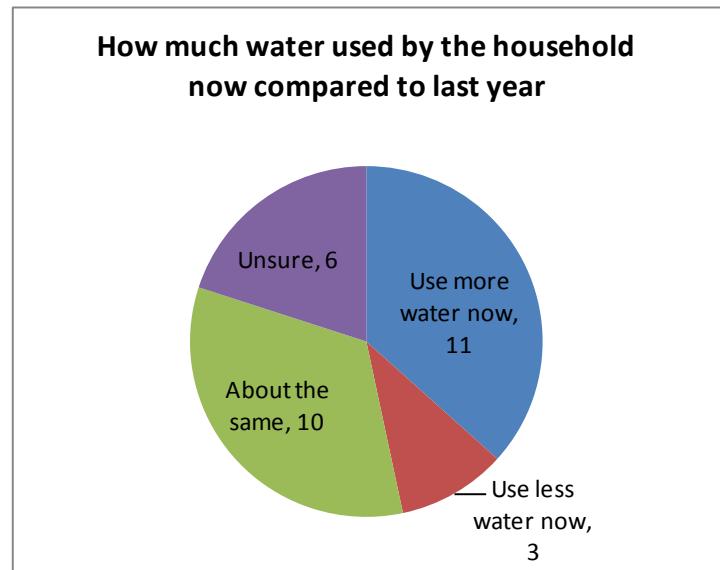
Members of the Hihifo Village Water Committee also reported that they perceived future benefits from the new water system. Firstly, the solar pumps would reduce their water pumping costs by between TOP\$500 to TOP\$600 per month per bore. These reduced costs should reduce the overall cost of water to households, making the bill payment affordable. Currently there are many households who do not pay their water bill because it is considered too high or because no water was supplied and yet a flat rate pricing system still required them to pay a water bill.

## Water Consumption

When asked how much water households were consuming now compared to last year, one third (11) reported using more water and another third reported using about the same amount of water. If the one third of households using more water is representative of the broader population, then this could pose a longer term issue for the sustainability of the village water supply as it may have implications for extraction rates from the limited fresh water lens resource.

Only three households reported using less water which would indicate that no demand-side water consumption minimisation measures have been adopted. This finding is backed-up by comments from the PACC project team who indicated that only minimal public education initiatives had been implemented in the project. This low number could also be explained if households were already doing everything possible to save water, making additional savings difficult.

*Figure 5. Water consumption*



## Leaks

Only three households reported that a leak was present in their tank, pipe or household appliance, whilst six households were unsure. One Town Officer approximated that around 60% of households in his village had a current leaking toilet or shower. Combined, these results indicate that an opportunity exists for future projects to conduct household leak audits to reduce water wastage as part of a demand-side management strategy to minimising water extraction.

## Tank cleaning

Seven households reported having cleaned their rainwater tank in the past 6 months and a further nine households had cleaned theirs within the last two years which is also a reasonable timeframe. Another seven were unsure when it was last cleaned. These results indicate that most households are taking a proactive approach to looking after and maintaining their rainwater tanks.

### Awareness of the PACC project

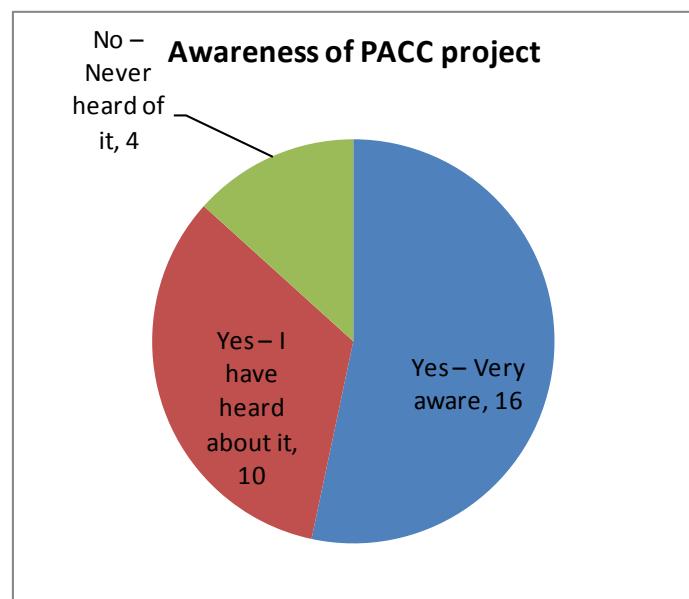
Just over half of households surveyed (16) were very aware of the PACC project and a further 10 had heard about it. Only 4 had never heard of it which indicates that during the project's five year history there had been some communication with nearly all households.

### Water education events

Only ten of the thirty households had attended any education events on the topic of water over the past two years. Of those ten, five reported attending an event that could be linked to the PACC project. This aligns with comments from the PACC project team that indicated that only a small number of water education events and activities were conducted. At the events, participants recalled being told about:

- How to connect their home to the village water supply (2 households)
- To report leaks to the village water committee (2 households)
- The proposed system to charge for and collect payment for the village water system
- Saving water
- Water sanitation

*Figure 6. Awareness of PACC project*

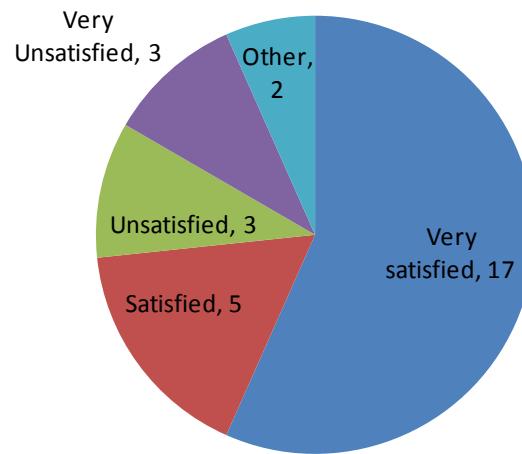


### Satisfaction with PACC project achievements

Overall, twenty two of the thirty households surveyed were satisfied (5) or very satisfied (17) with what the PACC project had achieved. However, six were either unsatisfied (3) or very unsatisfied (3). Dissatisfaction was generally due to the issues discussed earlier in this report in relation to dissatisfaction with the village water supply. One household indicated very mixed feelings. On one hand they were very grateful for the funding and opportunity to upgrade of the village water supply, yet on the other, they were very disappointed with the quality of work produced by the implementation contractor, both in terms of poor communication with households about the process to connect their home to the new water supply and also in terms of quality of work. Gender

*Figure 7 Satisfaction with PACC project achievements*

### Satisfaction with PACC project achievements



disaggregated results reveal no significant difference in level of satisfaction with the PACC project which indicates that the overall project impact and benefits of the project were not biased towards any one gender.

### Climate change general knowledge

A general knowledge question on the impacts of climate change on Tonga was asked to determine what knowledge gaps exist. The analysis finds that there is a great need for more education on climate change impacts. The very low number of households (1) reporting increased droughts and reduced rainfall highlights the need for more education. The high level of response for 'more extreme rainfall events' can be explained through the first hand experience over the past two years where some severe (not seen before) flooding occurred.

*Table 6 Climate change impacts*

Climate change impact	Number of households
More extreme rainfall events	25
Increased temperature	7
Sea level rising	5
Increased temperature (increased evaporation)	3
More cyclones & storm surge events	3
More flooding	3
Changing of the seasons (off-season) where fruits are ripening at unusual times	3
Less rainfall	1
More frequent droughts	1
Salt water contaminates water supply (fresh water lens)	1
Erosion	1
Coral bleaching	1

### New rainwater tanks

Overall, thirty new rainwater tanks were installed by the Tonga PACC project. Town officers were given the responsibility for selecting the most in-need households to receive the rainwater tanks. As mentioned in the methodology, the survey directly targeted some households that received rainwater tanks so that the impact of the tanks on the household could be assessed. Overall, eight households surveyed had a new rainwater tank installed by the PACC project.

### Rainwater tanks made a positive difference for households

Households expressed great appreciation for their rainwater tanks. New tank recipients noted that they now had a convenient source of rainwater for drinking and appreciated not needing to travel to their neighbours home to collect water.

There was a very high degree of satisfaction with the new rainwater tanks and observations of the households that received tanks validate that needy<sup>3</sup> households were selected. For most households it was the first time they had a rainwater tank on their property. Having a working rainwater tank meant that residents did not need to travel to their neighbours home to collect water, making this simple task of obtaining drinking water much more convenient. This also has flow on impacts for the neighbour who will now have more rainwater to share with their household thus increasing the number of days they will have rainwater in drought conditions. One of the homes that received a tank indicated that an additional six households also used the new tank to collect drinking water. Whilst this diminishes the immediate drought proofing benefit of the one household, it adds to increasing the overall water security of the village. The fact that seven homes are now sharing this one rainwater tank demonstrates an opportunity to continue to increase water security through the installation of new tanks to needy households.

Figure 8. Family from Ha'atafu are pleased with their water tank, however, the village water supply does not always provide running water to their property.



Neuma F nau from Fo'ui is happy that the new rainwater tank will provide water for their extended family of 12 living in the home.



There were some minor issues experienced with the new rainwater tanks. Two households reported that there were initially leaks in the tap fittings and another household reported rust in the tank tap fitting. All these issues were quickly resolved.

<sup>3</sup> Household had a high number of people living in the home. Household did not have a functioning rainwater tank before the PACC project. Based on appearance, households appeared to be comprised of low socio-economic residents.

## Conclusion

The community impact assessment finds that the water security component of the Tonga PACC project has delivered some immediate benefits to households in the six target villages of Hihifo. The main benefit noticed was that the water supply was now more reliable and this has led to high levels of satisfaction with the village water supply and the PACC project as a whole. Whilst the reliability of the village water supply was the main noted improvement delivered by the PACC project, it was also the most reported reason for dissatisfaction with the village water supply, especially in the more remote villages further away from the main water source. These findings combined with comments from household representatives lead the analysis to conclude that whilst the reliability of the village water supply has improved, there is room for future improvement to ensure there is a constant supply of water delivered all day, every day to every household. It is hoped that the initial fine tuning and fault resolution process will continue to resolve any outstanding issues and increase the reliability of the water supply.

The analysis found evidence that the improved village water supply has also resulted in improvements to sanitation in homes and shared community facilities. Tourist resorts also acknowledged the future benefits (reduced costs) they would experience during drought events as a result of not having to cart in large volumes of water. Future cost savings and improved revenue collection were also noted as future anticipated benefits from the Town Officers. Recipients of rainwater tanks were extremely grateful and noticed the immediate benefits of more convenient access to drinking water. These households and the neighbouring households they would normally borrow water from have also increased their resilience to drought events, that are likely to be more severe as a result of climate change. The analysis found no major gender imbalances in the distribution of benefits and impacts delivered by the PACC project.

It was noted that the impact assessment was conducted very soon after the implementation of the new village water supply and that it may take some time for communities to appreciate the full benefits from the project. Given the increased access to water (households connected for the first time) and increased reliability of the water supply, it is logical to conclude that the communities in the six villages now have increased water security. Additionally, when climate change impacts cause drought events to occur more frequently and intensely, these communities will be less vulnerable to the impacts as a result of being able to rely on the upgraded village water supply to meet their basic water needs. An opportunity was also identified for a future project to conduct a household leak audit to minimise wastage of the village water supply and fresh water lens, which will enhance the vulnerability reduction benefit of the project.

The analysis found that only a minimal amount of community education on climate change and water security has been delivered by the PACC project. The low levels of climate change knowledge demonstrated by household representatives is something that should be addressed by the PACC project or a future capacity building project. Without a true appreciation for the number and scale of projected climate change impacts, it will be difficult for the communities to fully appreciate the benefits that the Tonga PACC project has delivered.

## **Impact assessment recommendations**

### **1. Improved communication planning for projects**

This includes improved communication activities to maximise the number of households attending events where project information is disseminated, as well as improved communication about roles and responsibilities of different stakeholders such as contractors and households. This would reduce the number of households that expected the contractor to connect the water meter to the household.

## **2. Fault recording and resolution**

The PACC project should create a register of issues and faults that can be monitored and dealt with to ensure the issues with water supply reliability can be addressed in a timely manner with appropriate technical, human and financial resources.

## **3. Demand-side management should be included**

It is important for water supply projects to also include demand-side management strategies at the user level. Improving water supply can lead to increased demand, as convenience and reliability of supply is improved. This can increase the overall consumption and put pressure on the water supply source, which can negatively impact households in the longer term. Demand-side management strategies may include improved communication planning about water use minimisation in the home and garden, as well as direct engagement with households to detect and repair leaks.

## **4. Continue rainwater tank installations**

Given the immediate positive impacts delivered through the installation of rainwater tanks to needy and vulnerable households, the continuation of this intervention should be considered by future projects.

## **5. Community capacity building**

There is a need to increase community awareness about climate change and its predicted future impacts on Tonga and their lives. Either the PACC project or future project should address this current knowledge gap and may also wish to extend into strategies for coping with climate change impacts at the household and community level.

## Appendices

# Tonga PACC Community Impact Survey

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## Introduction:

Summary of PACC project

Summary of why we are conducting the survey (Who, why, what next)

Survey number:		Gender:	M/F
Village:		Age:	< 18, 18 – 30, 30 – 40, 40 – 50, 50+
Name:		# people in the home	

## Questions for general community members

1. How do you currently obtain your household **drinking water**? (select all that apply)

*'Oku anga fefe hono ma'u 'a ho'o vai inu ki 'api ni. (Fili e founga hono ma'u)*

- Our Household rainwater tank (*Mei he 'emau tangike vaii pe*)
- Neighbour's rainwater tank (*Mei he tangi ke vai 'a e kaunga'api*)
- Community rainwater tank (*Mei he sim ape vai fakakolo*)
- Village tap water (main water supply) (*Mei he vai tepi 'a e kolo*)
- Buy bottled water (*Fakatau vai*)
- Other \_(*To e 'iai ha founga*)\_\_\_\_\_

2. Has the way you obtain drinking water changed in the last year?

*Kuo liliu nai e founga hono ma'u ho'o vai inuu he ta'u 'e nima kuo hili?*

- Yes ('IO)
- No – Go to Q4 (*Kapau 'oku 'ikai hiki ki he Fehu'i 4*)
- Unsure – Go to Q4 (*Kapau 'oku 'ikai mahino hiki ki he Fehu'i 4*)

3. How did you obtain drinking water last year?.

*Na'e anga fefe ho'o ma'u vai inu he ta'u 5 kuo hili?*

- Household rainwater tank (*Tangike vai pe sima vai 'i 'api ni*)
- Community rainwater tank (*Sim ape tangike fakakolo*)
- Village tap water (main water supply) (*Ko e tepi vai 'a e kolo (Vai fakakolo)*)
- Buy bottled water (*Fakatau vai*)
- Other \_(*To e 'iai ha founga*)\_\_\_\_\_

4. Is your household connected to the main water supply?

*'Oku hoko ho 'api ni ki he vai fakakolo)*

- Yes ('lo)
- No – Go to Q11 (*'Ikai hiki ki he Fehu'i 11*)

5. What is your general perception of the village water supply services (main water supply)?

*Ko e ha nai ha'o vakai fakalukufua ki he vai ko 'eni 'oku mou ma'u vai mei ai. (Vai fo'ou)*

- Very satisfied – Go to Q7 (*'Oku fakafiemalie 'aupito hiki ki he fehu'i 7*)
- Satisfied – Go to Q7 (*Fakafiemalie pe (Hiki ki he fehu'i 7)*)
- Unsatisfied (*Ta'e fakafiemalie*)
- Very Unsatisfied (*Matu'aki ta'efakafiemalie*)

6. What are the main causes of village water problems?

*Ko e ha fua e ngaahi tupu'anga e palopalema ho'omou vai fakakolo*

- Technical issues (*Ngaahi palopalema fakatekinikale*)
- The village water committee (*Ko e Komiti Vai 'a Hihifo*)
- People not paying (*Ko e 'ikai ke totongi vai*)
- Poor water pressure (*kovi e malohi e vaili*)
- Poor water quality (*'uli e vai.*)
- Unreliable water supply (*Ikai ke fa'a lele ma'u pe 'a e vai.*)
- Other (*Toe 'iai ha 'uhinga*) \_\_\_\_\_

7. Have you noticed any improvements to the main water supply over the past year?

*Kuo fakatokanga'i nai ha liliu ho'omou ma'u'anga vai he ta'u kuo hili?*

- Yes (*'Io*)
- No – Go to Q10 (*'Ikai hiki ki he fehu'i 10*)
- Unsure – Go to Q10 (*'Ikai ke mahino hiki ki he fehu'i 10*)

8. What improvements have you noticed as a result of PACC project?

*Ko e ha fua e ngaahi fakalakalaka kuo ke fakatokanga'I he lava 'a e ngaeue 'a e poloseki koeni?*

- PACC project connected our home to Village Water Supply (Ne toki hoko 'e he Poloseki PACC emau tepi vai ki he vai faka kolo.)
  - Reliable source of water (24x7) *Falala'anga he 'oku lele houa 24 he 'aho 'e fitu*
  - Water quality appears better *'Oku melie ange e vaili.*
  - Good water pressure *Lelei pe malohi e vaili*
  - Others *Toe 'iai ha 'uhinga*
- 
- 
-

9. How have these improvements impacted **you and your household (men, women, children)?**  
(prompt if unsure Select all that apply )

*Ko e ha nai ha kaunga 'a e ngaahi fakalakalaka ko e 'eni kiate koe pea pehe foki ki he kakai I 'api ni.?*

- no longer travel to collect drinking water      ( 'Ikai te u to e 'alu ke 'utu vai)
  - no longer boil water before drinking      ( 'Ikai ke to e fakalili e vai pea toki inu)
  - we now drink main water supply instead of tank water (*Inu mei he vai tepi kae 'ikai mei he tangikee vai.*)
  - Others      (Toe 'iai ha 'uhinga)

10. Think about the amount of water that your household uses now compared to two years ago.

How much water does your household use?

*Fakaukau ange ki he lahi 'o e vai 'oku ngaue'aki ho 'api ni 'o fakatauhua ki he ta'u e 2 kuo hili. Ko e ha e lahi e vai 'oku ngaue 'aki ho 'api.*

- Use more water now (*Lahi ange he taimi ni*)
  - Use less water now (*Si'isi'i ange he taimi ni*)
  - About the same (*Mei tatau pe*)
  - Unsure ('Ikai ke u fakapapau'i)

11. Is there any leaking pipes, taps or running toilets in your house at the moment?

*'Oku ke fakatokangi nai ha paipa mama pe 'i he saoa pe toilet i 'api ni he lolotonga ni?*

- Yes ('lo)
  - No ('ikai)
  - Unsure ('ikai ke fakapapau'i)

12. Does your household have a rainwater tank?

*'Oku 'iai nai ha'a mou tangike vai*

- Yes ('lo)  
 No – Go to Q14 ('Ikai hiki ki he fehu'i 14)

13. When was the last time you cleaned your rainwater tank?

*Na'e fufulu fakamuimui ho'o tangike vai pe sima vai?*

## PACC Awareness

14. Were you aware of the Pacific Adaption to Climate Change (PACC) water project that has been making improvements to the water supply in Hihifo?

*'Oku ke 'ilo pe 'a e poloseki ko 'eni 'a e PACC na'a ne fakahoko hono fakalele'i ho'omou ma'u'anga vai?*

- Yes – Very aware ('Io 'ilo lelei kiai)
- Yes – I have heard about it ('Io fanongo pe ai)
- No – Never heard of it ('Ikai te'eki keu fanongo au ai)
- Unsure ('Ikai keu fakapapau'i)

15. In the past two years have you attended any community events, training or heard information about maintaining your rainwater tank, saving water or managing water in your household or community?

*'I he tau 2 kuohili kuo ke kau ki ha fakataha'anga fakakolo 'oku nau 'oatu ai ha ngaahi fakamatala ki hono ngae fakapotopoto 'aki homou vai fakakolo pe koe homou sima vai?*

- Yes ('Io)
- No ('Ikai)
- Unsure ("ikai keu fakapapau'i)

16. Can you remember any key messages from the training or information?

*Oku ke manatu'i nai ha fekau mahu'inga mei ai?*

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17. Thinking about the PACC water project, are you satisfied with what it has achieved?

Ko e ha nai ho fakakaukau ki he poloseki vai koeni, oku fakafiemalie nai 'enau taumu'a ngae?

- Very satisfied (*fakafiemalie 'aupito*)
- Satisfied (*fakafiemalie pe*)
- Unsatisfied (*ta'efakafiemalie pe*)
- Very Unsatisfied (*ta'efakafiemalie 'aupito*)

18. Can you list some of the impacts that climate change will have on Tonga's ?

Kataki 'o lisi mai 'a e ngaahi uesia 'oku fakatupunga 'e he feliuliuki e 'Ea?

- Reduced rainfall (Si'i ange e 'oha)
  - Increased extreme rainfall events (lahi ange taimi 'oha lovai)
  - Increased drought (Loloange taimi la'ala'aa)
  - Increased sea level rise (To e ma'olunga ange tah)
  - Increased cyclone and storm surge events (Toe lahi ange 'a e 'afaa moe aake e tah)
  - Salt water contamination of fresh water lens (Toe konokona pe taitai ange vai 'i lolofonua)
  - Increased temperature resulting in increased evaporation (Toe ma'olunga ange mafana 'a e 'Ea pea tor lahi ange 'a e molia 'a e vai (mao)
  - Others (Toe 'iai ha me'a kehe)
- 
- 
- 

### **Additional questions for people with new or improved household rainwater tank from PACC project**

19. What impact has the rainwater tank had on your life and your household (men, women, children)?

*Ko e ha nai ha lelei 'a e tangi ke vai kuo foaki atu mo'ou pea pehe foki ki he kakai kotoa l 'api ni?.*

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20. Have you had any issues or difficulties with your rainwater tank?

*Kuo 'iai ha palopalema ki'i ho'o tangike vai?*

- Yes ('lo)
- No – Go to end ('Ikai ko 'ene 'osi ia)

21. Please explain what difficulties

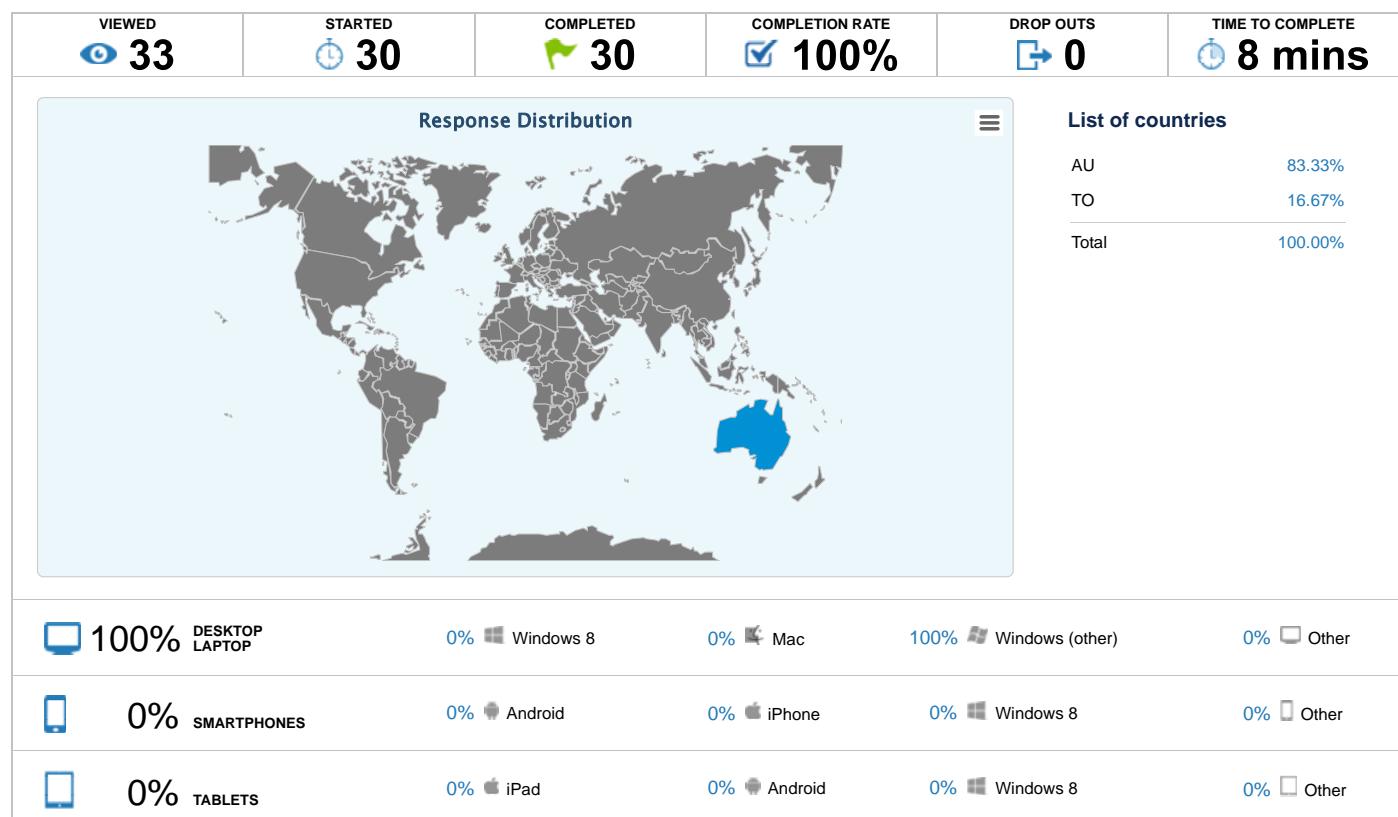
*Kataki 'o fakamatala'i mai mu'a e ngaahi faingata'a pe ko e palopalema ki'ho'o tangike vai.?*

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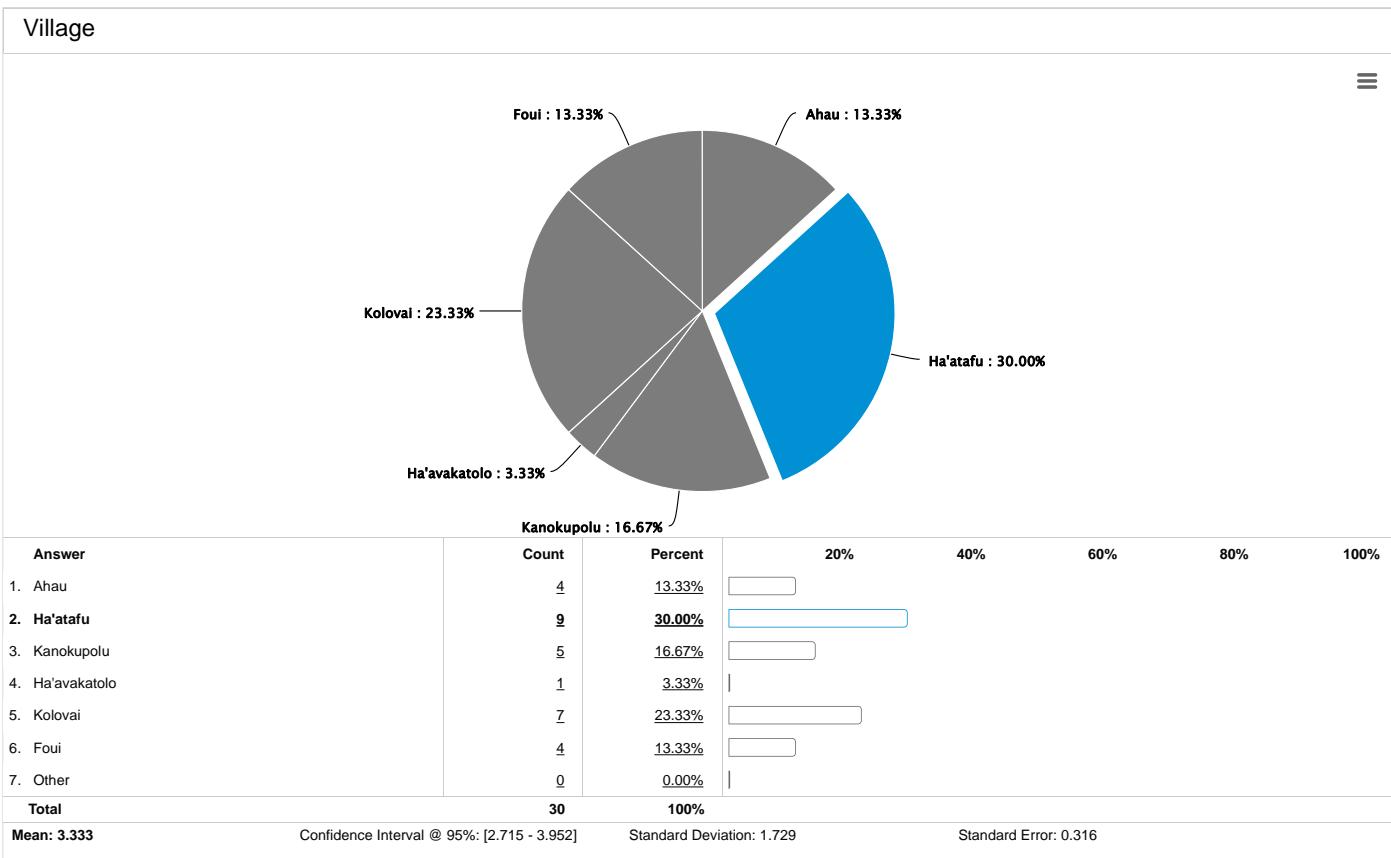
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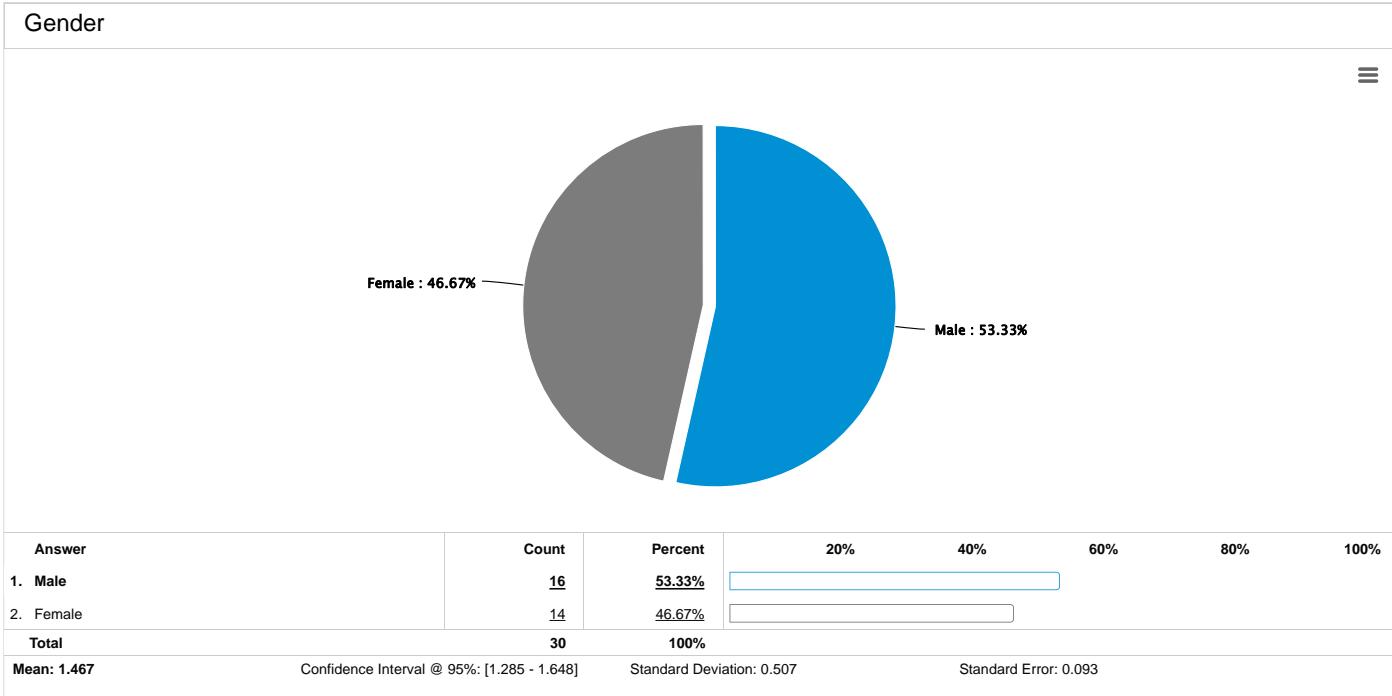
## Survey Report: Tonga Community Impact Survey

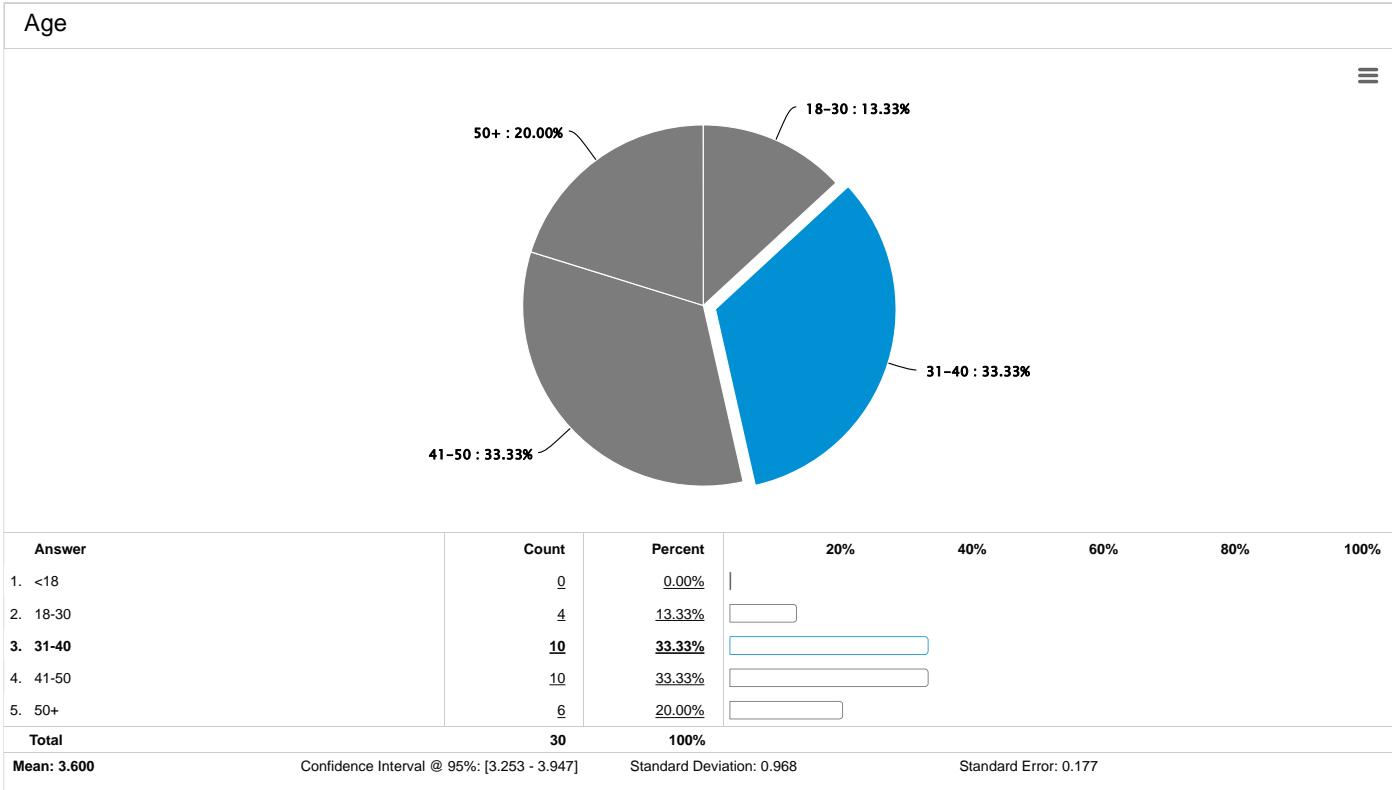


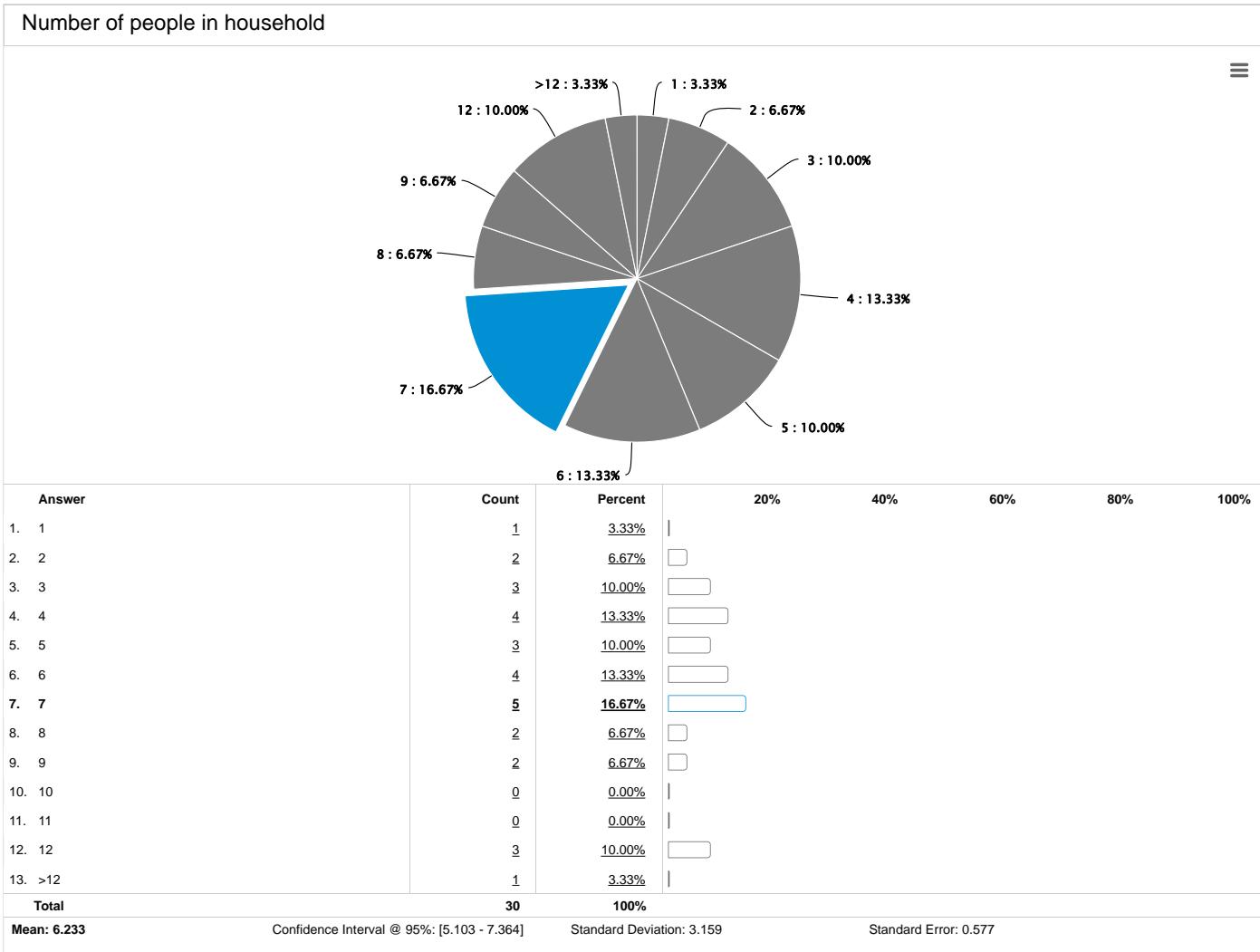
Survey number		
12147315	05/27/2014	1
12147414	05/27/2014	2
12147456	05/27/2014	3
12147517	05/27/2014	4
12147572	05/27/2014	5
12278053	06/10/2014	6
12278077	06/10/2014	8
12278096	06/10/2014	9
12278146	06/10/2014	10
12278227	06/10/2014	11
12278258	06/10/2014	12
12278308	06/10/2014	13
12278355	06/10/2014	15
12278433	06/10/2014	16
12278466	06/10/2014	17
12278510	06/10/2014	18
12278610	06/10/2014	19
12278714	06/10/2014	20
12278794	06/10/2014	21
12279346	06/10/2014	22
12279385	06/10/2014	23
12279443	06/10/2014	24
12284797	06/10/2014	25
12284857	06/10/2014	7
12285374	06/10/2014	14
12285416	06/10/2014	26
12285496	06/10/2014	27
12285601	06/10/2014	28
12286532	06/10/2014	29
12286661	06/10/2014	30



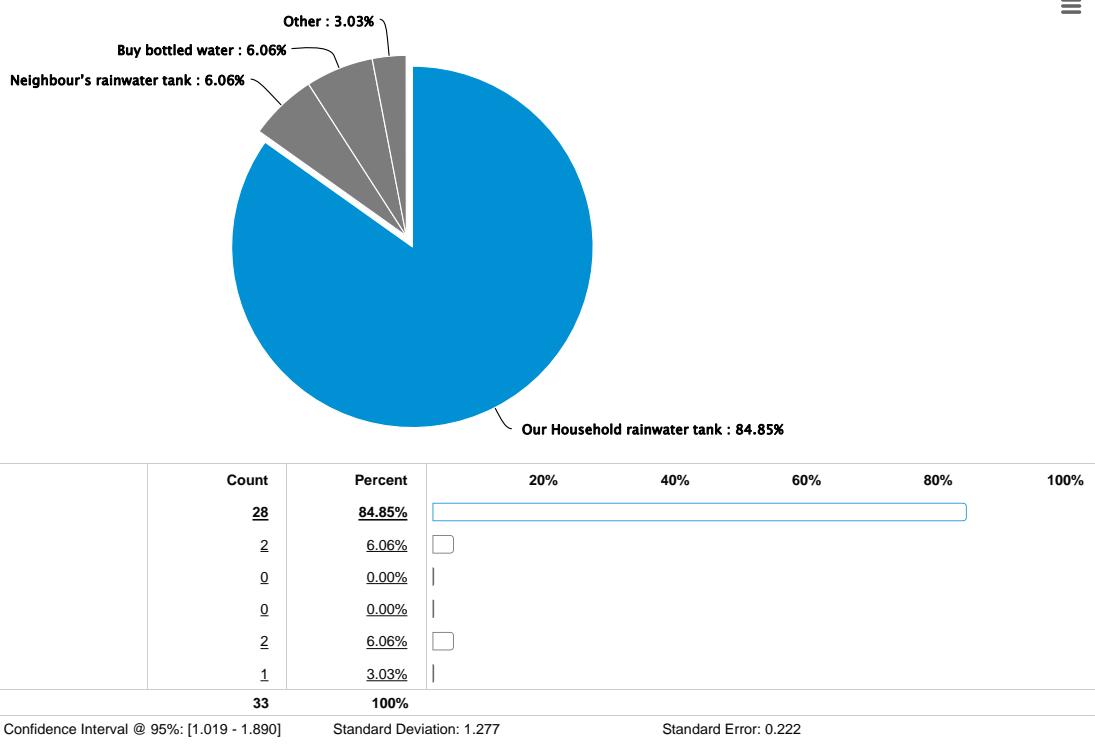
Name		
12147315	05/27/2014	Siosiana Famua
12147414	05/27/2014	<a href="http://questionpro.com/t/AI5JeZRFCI">http://questionpro.com/t/AI5JeZRFCI</a>
12147456	05/27/2014	Moinga Tonga
12147517	05/27/2014	Hola Paea - Ha'atafu Beach Resort
12147572	05/27/2014	Ti Rulcana
12278053	06/10/2014	Marian Tukualu
12278077	06/10/2014	Uoni Uta'atu
12278096	06/10/2014	Saia Nafu
12278146	06/10/2014	Poasi Kilsimas
12278227	06/10/2014	Matamoana Malakai
12278258	06/10/2014	Salesi Naati
12278308	06/10/2014	Masiv Tauiaki
12278355	06/10/2014	Henilieta Sole
12278433	06/10/2014	Akosita Rakisiica & son Sen Jose
12278466	06/10/2014	Finau Moala
12278510	06/10/2014	Sione Taltolo
12278610	06/10/2014	Katlinia Marupuna - VWC member
12278714	06/10/2014	Kitiona Vaioleti
12278794	06/10/2014	Taipaleti Kakato
12279346	06/10/2014	Kouosi Lomu - Fou'i Town Officer
12279385	06/10/2014	Soana Kaumavae
12279443	06/10/2014	Pelenaise Fukofuka
12284797	06/10/2014	Neuma Fnau
12284857	06/10/2014	Nenisi Tani
12285374	06/10/2014	???
12285416	06/10/2014	Katou
12285496	06/10/2014	Palu Koloa
12285601	06/10/2014	Mele
12286532	06/10/2014	Mele Sila
12286661	06/10/2014	Taani Akau'ola







## 1. How do you currently obtain your household drinking water? (select all that apply)

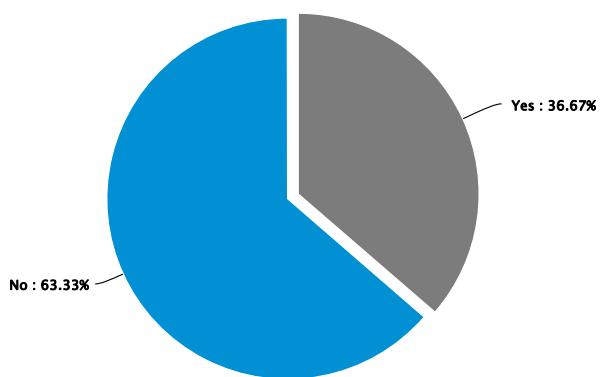


## 1. How do you currently obtain your household drinking water? (select all that apply) - [Text Data for Other]

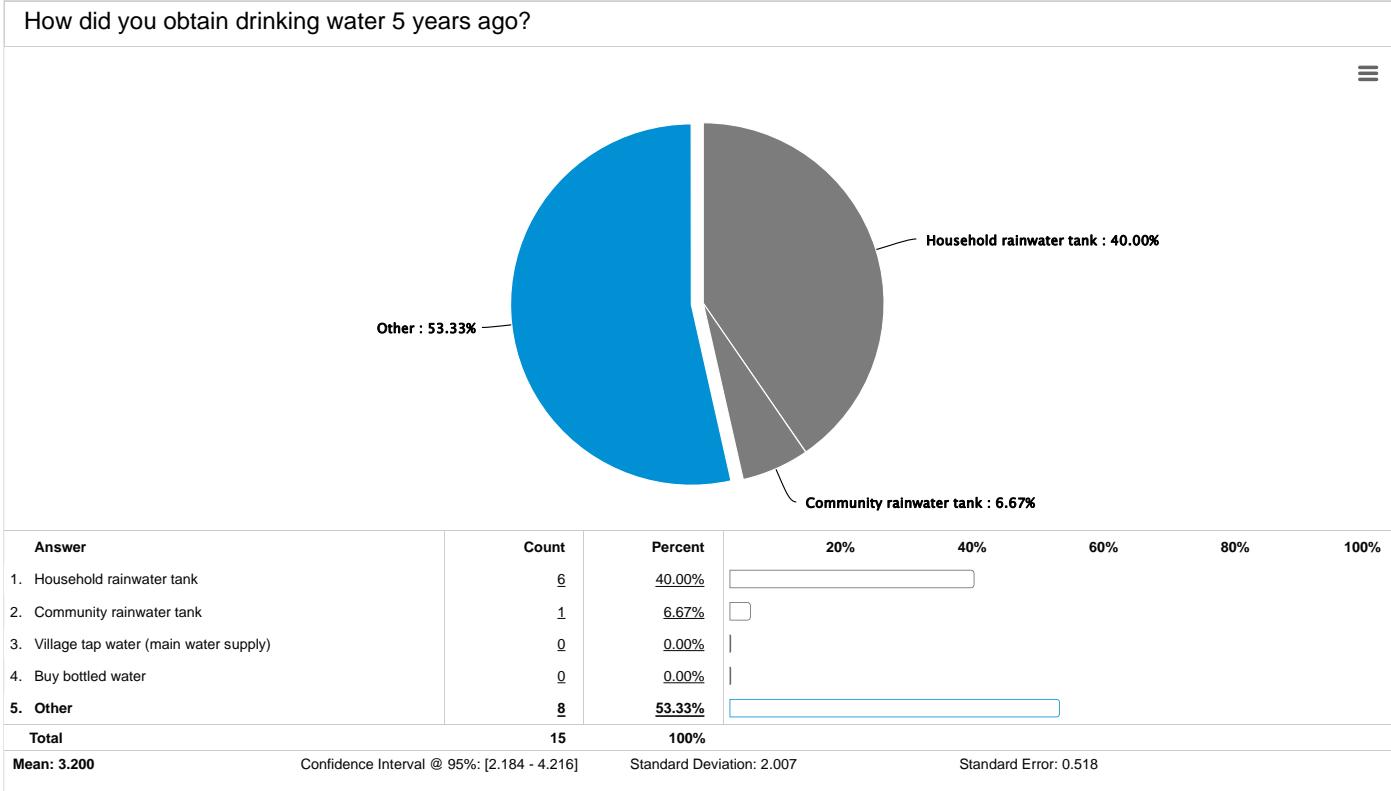
12278355 06/10/2014 has 2 tanks. 17 people in home

## Has the way you obtain drinking water changed in the last year?

≡



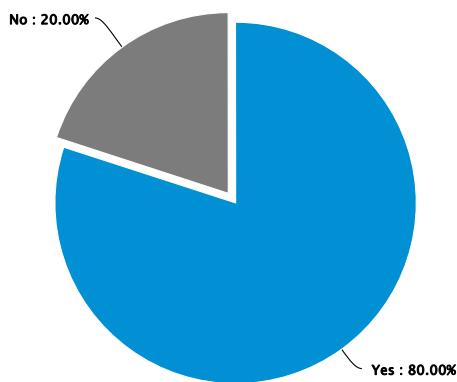
Answer	Count	Percent	20%	40%	60%	80%	100%
1. Yes	11	36.67%					
2. No	19	63.33%					
3. Unsure	0	0.00%					
<b>Total</b>	<b>30</b>	<b>100%</b>					
<b>Mean: 1.633</b>		Confidence Interval @ 95%: [1.458 - 1.809]			Standard Deviation: 0.490		Standard Error: 0.089



How did you obtain drinking water 5 years ago? - [Text Data for Other]

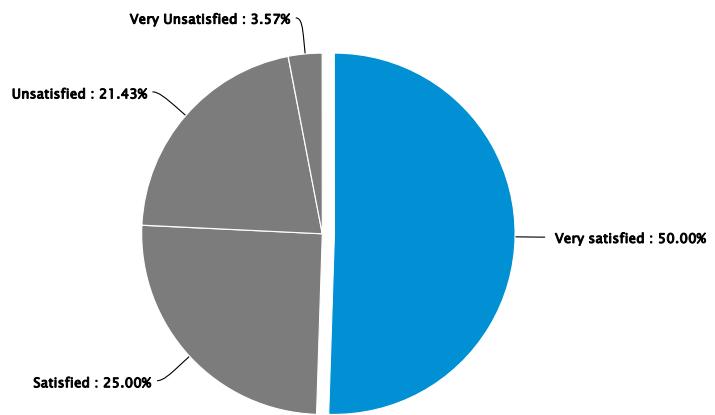
12147315	05/27/2014	old cement tank
12147414	05/27/2014	Neighbours rainwater tank
12279385	06/10/2014	Neighbours tank
12279443	06/10/2014	Neighbour and church
12284797	06/10/2014	Neighbours rain tank
12284857	06/10/2014	Had a rainwater tank on other land, but had to travel to fetch water
12285374	06/10/2014	Neighbours tank
12285496	06/10/2014	Neighbours tank

Is your household connected to the main water supply?



Answer	Count	Percent	20%	40%	60%	80%	100%
1. Yes	24	80.00%	<div style="width: 80%; background-color: #0070C0;"></div>				
2. No	6	20.00%	<div style="width: 20%; background-color: #C0C0C0;"></div>				
<b>Total</b>	<b>30</b>	<b>100%</b>					
<b>Mean: 1.200</b>		Confidence Interval @ 95%: [1.054 - 1.346]			Standard Deviation: 0.407		Standard Error: 0.074

What is your general perception of the village water supply services (main water supply)?

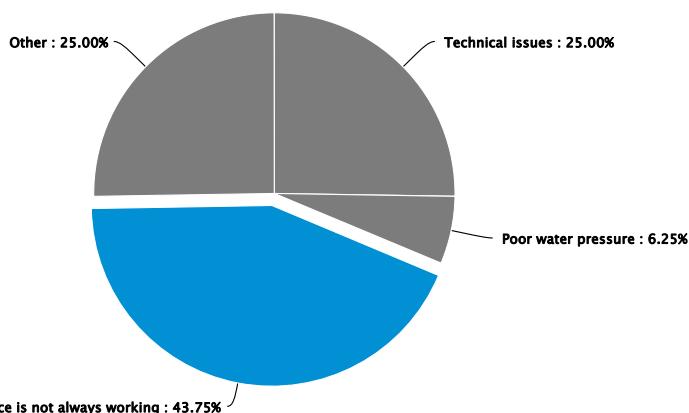


Answer	Count	Percent	20%	40%	60%	80%	100%
1. Very satisfied	14	50.00%	<input type="text" value="50.00"/>				
2. Satisfied	7	25.00%		<input type="text" value="25.00"/>			
3. Unsatisfied	6	21.43%			<input type="text" value="21.43"/>		
4. Very Unsatisfied	1	3.57%				<input type="text" value="3.57"/>	
Total	28	100%					

Mean: 1.786      Confidence Interval @ 95%: [1.446 - 2.125]      Standard Deviation: 0.917      Standard Error: 0.173

## What are the main causes of village water problems?

≡

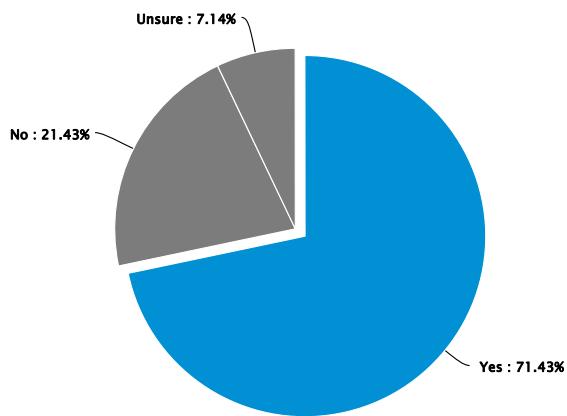


Answer	Count	Percent	20%	40%	60%	80%	100%
1. Technical issues	4	25.00%	<input type="checkbox"/>				
2. The village water committee	0	0.00%					
3. People not paying	0	0.00%					
4. Poor water pressure	1	6.25%	<input type="checkbox"/>				
5. Poor water quality	0	0.00%					
<b>6. Unreliable - Service is not always working</b>	<b>7</b>	<b>43.75%</b>	<input checked="" type="checkbox"/>				
7. Other	4	25.00%	<input type="checkbox"/>				
<b>Total</b>	<b>16</b>	<b>100%</b>					
Mean: 4.875	Confidence Interval @ 95%: [3.690 - 6.060]	Standard Deviation: 2.419	Standard Error: 0.605				

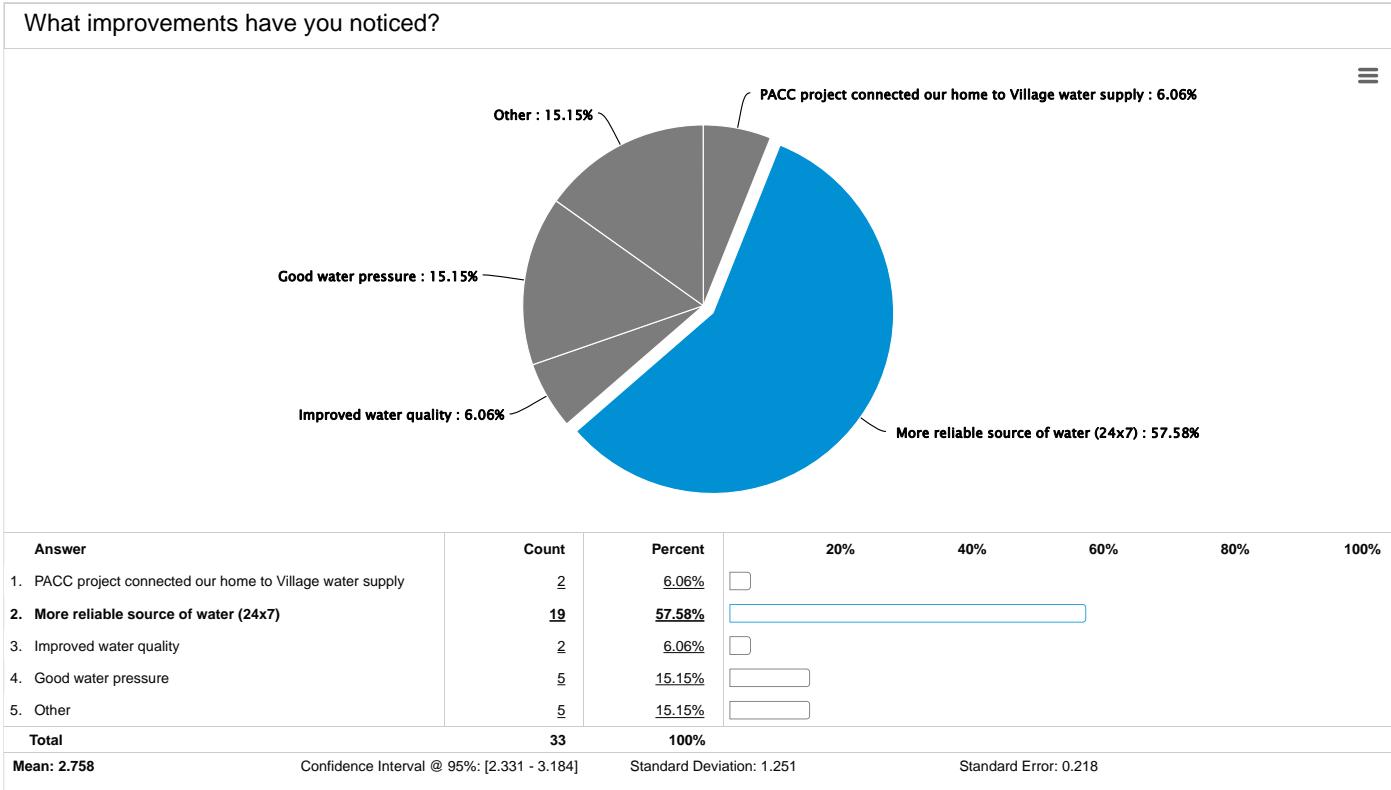
## What are the main causes of village water problems? - [Text Data for Other]

12147517	05/27/2014	Sometimes no water, recently
12278227	06/10/2014	Thought that PACC would connect the home
12278433	06/10/2014	They want PACC to connect their home to water meter
12278610	06/10/2014	Timing of pumping to meet demand

Have you noticed any improvements to the main water supply over the past year?



Answer	Count	Percent	20%	40%	60%	80%	100%
1. Yes	20	71.43%	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. No	6	21.43%	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Unsure	2	7.14%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Total</b>			<b>20%</b>	<b>40%</b>	<b>60%</b>	<b>80%</b>	<b>100%</b>
<b>Mean: 1.357</b>		Confidence Interval @ 95%: [1.127 - 1.587]			Standard Deviation: 0.621		Standard Error: 0.117

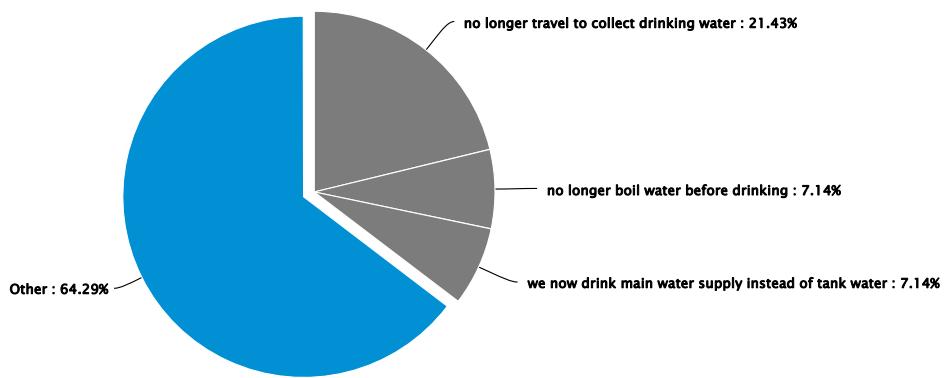


What improvements have you noticed? - [Text Data for Other]

12147517	05/27/2014	Sometimes turn on tap and water does not run, but it runs later in the day.
12278146	06/10/2014	Local Church flushing toilets are now connected to main water supply and has improved hygiene & smell and enjoyment of the facility - Church & Kava circles
12278355	06/10/2014	VWS is not running every day. Better but still not reliable.
12278433	06/10/2014	Friends say new system is more reliable
12278466	06/10/2014	Improvements are good most BUT NOT ALL of the time

## How have these improvements impacted you and your household (men, women, children)?

≡

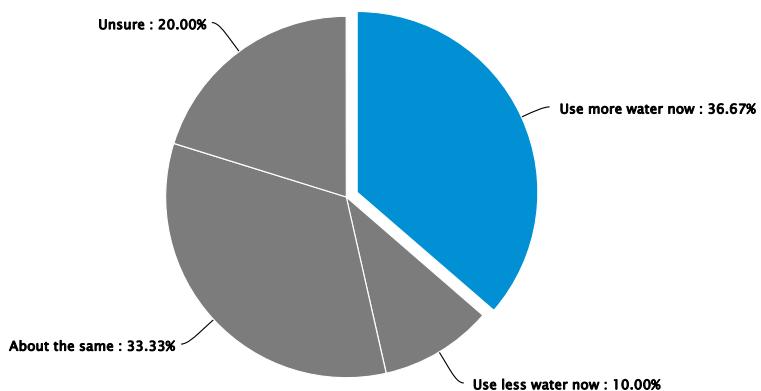


Answer	Count	Percent	20%	40%	60%	80%	100%
1. no longer travel to collect drinking water	3	21.43%	<input type="text"/>				
2. no longer boil water before drinking	1	7.14%	<input type="text"/>				
3. we now drink main water supply instead of tank water	1	7.14%	<input type="text"/>				
4. Other	9	64.29%	<input type="text"/>				
<b>Total</b>	<b>14</b>	<b>100%</b>					
Mean: 3.143	Confidence Interval @ 95%: [2.466 - 3.820]	Standard Deviation: 1.292			Standard Error: 0.345		

## How have these improvements impacted you and your household (men, women, children)? - [Text Data for Other]

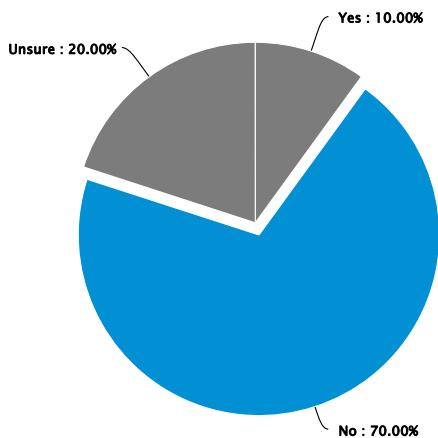
12147315	05/27/2014	Watering the garden
12147517	05/27/2014	Resort has had to order water from Government in the past when rainwater runs out and Village water supply is not working. Have not had to do that recently. Reduced cost of operations.
12278227	06/10/2014	more water for drinking as can use main line water for other household use
12278355	06/10/2014	With the new water meter, we will know how much water we are using and only pay for that water. Hopefully lower water bill.
12278466	06/10/2014	Toilet now fills - Before it did not always fill.
12278610	06/10/2014	Sometimes drink the main VWS Use VWS for garden Solar water pump will help reduce cost of running pumps.I
12284857	06/10/2014	Use water for cooking straight from the tap for tank water. Very satisfied. Meter will help save water
12285496	06/10/2014	Now water vegetable garden
12286532	06/10/2014	Should increase standard of living, but there were issues with the work done by the contractor. Having water in the home will improve health issues. It will also help improve social relations within the home between men and women. Water is an essential part of life, therefore this project is very important.

Think about the amount of water that your household uses now compared to two years ago. How much water does your household use?



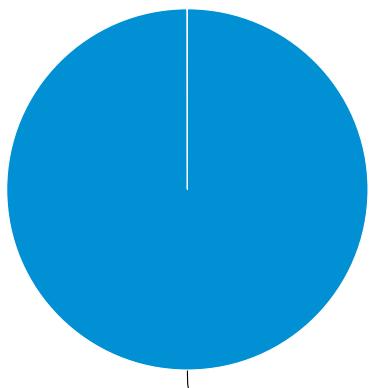
Answer	Count	Percent	20%	40%	60%	80%	100%
1. Use more water now	11	36.67%	<input type="text" value="36.67"/>				
2. Use less water now	3	10.00%		<input type="text" value="10.00"/>			
3. About the same	10	33.33%		<input type="text" value="33.33"/>			
4. Unsure	6	20.00%		<input type="text" value="20.00"/>			
<b>Total</b>	<b>30</b>	<b>100%</b>					
Mean: 2.367	Confidence Interval @ 95%: [1.941 - 2.792]	Standard Deviation: 1.189					Standard Error: 0.217

## 16. Are you aware of any leaking pipes, taps or running toilets in your house?



Answer	Count	Percent	20%	40%	60%	80%	100%
1. Yes	3	10.00%	<input type="text"/>				
2. No	21	70.00%		<input type="text"/>			
3. Unsure	6	20.00%			<input type="text"/>		
<b>Total</b>	<b>30</b>	<b>100%</b>					
<b>Mean: 2.100</b>	Confidence Interval @ 95%: [1.904 - 2.296]		Standard Deviation: 0.548		Standard Error: 0.100		

Does your household have a rainwater tank?



Answer	Count	Percent	20%	40%	60%	80%	100%
1. Yes	30	100.00%					
2. No	0	0.00%					
<b>Total</b>	<b>30</b>	<b>100%</b>					

**Mean: 1.000**

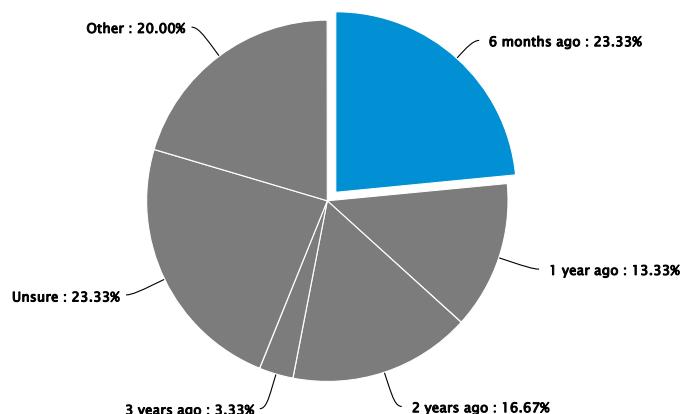
Confidence Interval @ 95%: [1.000 - 1.000]

Standard Deviation: 0.000

Standard Error: 0.000

## When was the last time you cleaned your rainwater tank?

≡

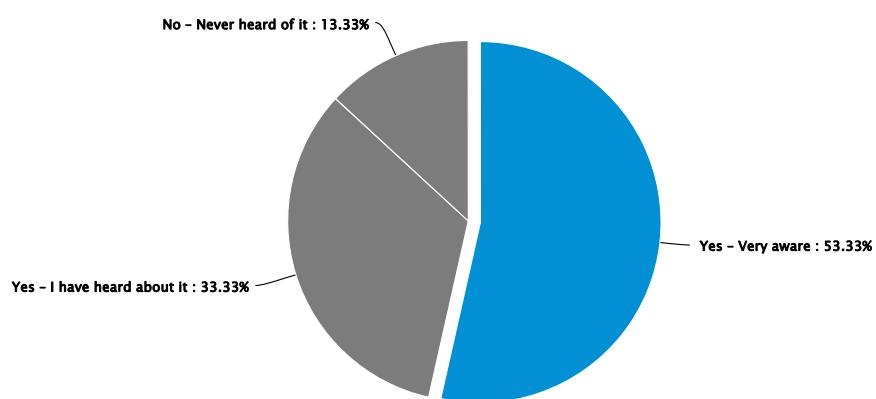


Answer	Count	Percent	20%	40%	60%	80%	100%
1. 6 months ago	7	23.33%	<input type="text"/>				
2. 1 year ago	4	13.33%		<input type="text"/>			
3. 2 years ago	5	16.67%			<input type="text"/>		
4. 3 years ago	1	3.33%				<input type="text"/>	
5. 4 years ago	0	0.00%					<input type="text"/>
6. 5 years ago	0	0.00%					<input type="text"/>
7. > 5 years ago	0	0.00%					<input type="text"/>
8. Unsure	7	23.33%		<input type="text"/>			
9. Other	6	20.00%			<input type="text"/>		
<b>Total</b>	<b>30</b>	<b>100%</b>					
Mean: 4.800		Confidence Interval @ 95%: [3.599 - 6.001]		Standard Deviation: 3.357		Standard Error: 0.613	

## When was the last time you cleaned your rainwater tank? - [Text Data for Other]

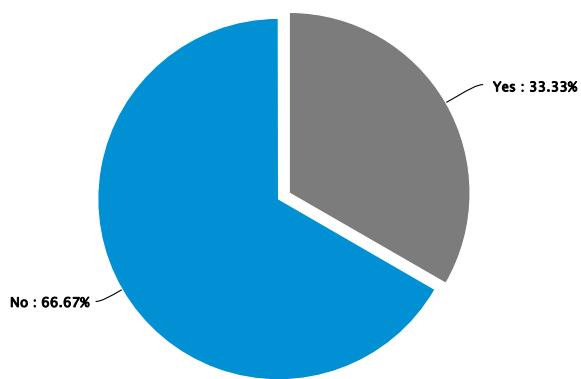
12147414	05/27/2014	new tank N/A
12279385	06/10/2014	New tank - no need to clean yet
12279443	06/10/2014	New tank no need to clean yet
12284857	06/10/2014	when it becomes empty
12285496	06/10/2014	new tank - not needed
12286661	06/10/2014	when it is empty

Were you aware of the Pacific Adaption to Climate Change (PACC) water project that has been making improvements to the water supply in Hihifo?



Answer	Count	Percent	20%	40%	60%	80%	100%
1. Yes – Very aware	<u>16</u>	<u>53.33%</u>					
2. Yes – I have heard about it	<u>10</u>	<u>33.33%</u>					
3. No – Never heard of it	<u>4</u>	<u>13.33%</u>					
4. Unsure	<u>0</u>	<u>0.00%</u>					
<b>Total</b>	<b>30</b>	<b>100%</b>					
Mean: 1.600	Confidence Interval @ 95%: [1.341 - 1.859]	Standard Deviation: 0.724			Standard Error: 0.132		

In the past two years have you attended any community events, training or heard information about maintaining your rainwater tank, saving water or managing water in your household or community?

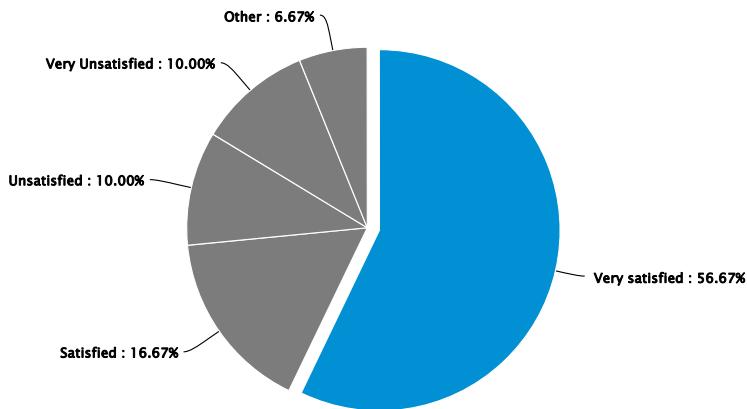


Answer	Count	Percent	20%	40%	60%	80%	100%
1. Yes	10	33.33%					
2. No	20	66.67%					
3. Unsure	0	0.00%					
<b>Total</b>	<b>30</b>	<b>100%</b>					
Mean: 1.667	Confidence Interval @ 95%: [1.495 - 1.838]	Standard Deviation: 0.479					Standard Error: 0.088

## Can you remember any key messages from the training or information?

12147315	05/27/2014	
12147414	05/27/2014	How to connect to the Village water supply and what items are needed.
12147456	05/27/2014	
12147517	05/27/2014	
12147572	05/27/2014	
12278053	06/10/2014	
12278077	06/10/2014	
12278096	06/10/2014	
12278146	06/10/2014	
12278227	06/10/2014	
12278258	06/10/2014	
12278308	06/10/2014	Community meeting - to report any leaks to Village Water Committee.
12278355	06/10/2014	How to keep water clean
12278433	06/10/2014	
12278466	06/10/2014	About the collection of bill payment for the VWS system
12278510	06/10/2014	
12278610	06/10/2014	
12278714	06/10/2014	
12278794	06/10/2014	Saving water to keep fresh water lens volume high
12279346	06/10/2014	
12279385	06/10/2014	
12279443	06/10/2014	
12284797	06/10/2014	
12284857	06/10/2014	
12285374	06/10/2014	How to connect the water meter to the home. What to buy and how to do it.
12285416	06/10/2014	
12285496	06/10/2014	To report bank any problems with water supply to town officer.
12285601	06/10/2014	
12286532	06/10/2014	
12286661	06/10/2014	Don't waste water - save water when washing the clothes and dishes.

Thinking about the PACC water project, are you satisfied with what it has achieved?



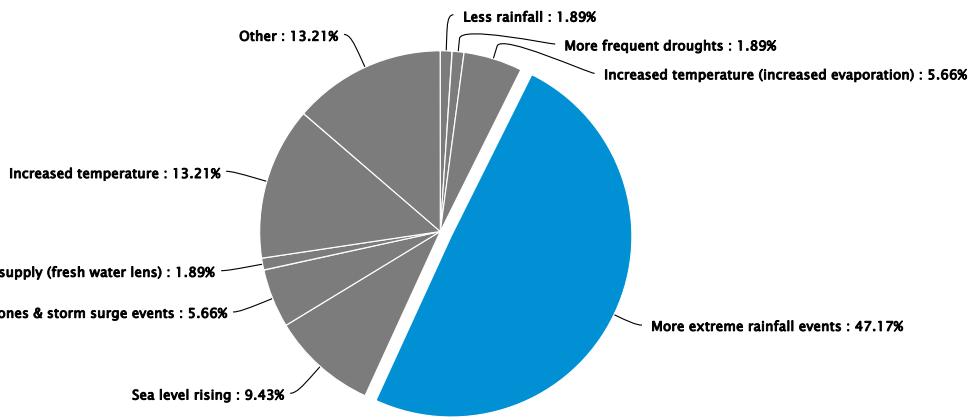
Answer	Count	Percent	20%	40%	60%	80%	100%
1. Very satisfied	17	56.67%	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Satisfied	5	16.67%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Unsatisfied	3	10.00%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Very Unsatisfied	3	10.00%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Other	2	6.67%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total	30	100%					

Mean: 1.933      Confidence Interval @ 95%: [1.464 - 2.403]      Standard Deviation: 1.311      Standard Error: 0.239

Thinking about the PACC water project, are you satisfied with what it has achieved? - [Text Data for Other]

12279346	06/10/2014	Split. There are many things that need improving, but PACC has also delivered some good things.
12279385	06/10/2014	n/a

Can you name some of the impacts that climate change will have on Tonga's water supply?

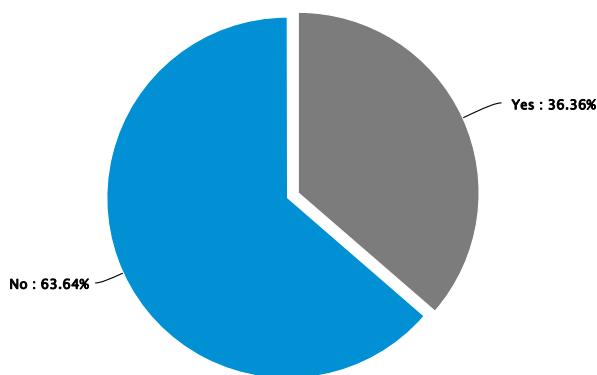


Answer	Count	Percent	20%	40%	60%	80%	100%
1. Less rainfall	1	1.89%					
2. More frequent droughts	1	1.89%					
3. Increased temperature (increased evaporation)	3	5.66%					
4. <b>More extreme rainfall events</b>	<b>25</b>	<b>47.17%</b>					
5. Sea level rising	5	9.43%					
6. More cyclones & storm surge events	3	5.66%					
7. Salt water contaminates water supply (fresh water lens)	1	1.89%					
8. Increased temperature	7	13.21%					
9. Other	7	13.21%					
<b>Total</b>	<b>53</b>	<b>100%</b>					
Mean: 5.302			Confidence Interval @ 95%: [4.724 - 5.879]		Standard Deviation: 2.145		Standard Error: 0.295

Can you name some of the impacts that climate change will have on Tonga's water supply? - [Text Data for Other]

12278355	06/10/2014	flood
12278510	06/10/2014	Seasons are changing - fruit production changes
12278714	06/10/2014	Different virus on fruit. Different seasons
12278794	06/10/2014	changing seasons
12279346	06/10/2014	Flooding of buildings already experienced.
12285374	06/10/2014	Flooding
12285601	06/10/2014	increased erosion, coral bleaching

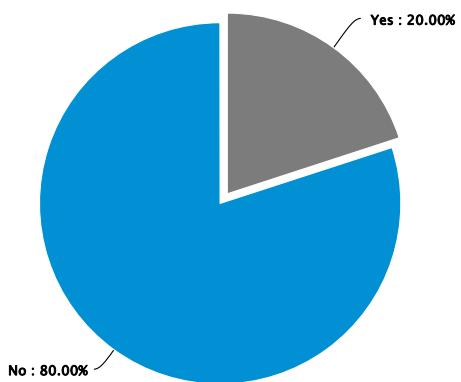
Did your household gain a new or improved rainwater catchment from the PACC project?



Answer	Count	Percent	20%	40%	60%	80%	100%
1. Yes	8	36.36%					
2. No	14	63.64%					
Total	22	100%					
Mean: 1.636	Confidence Interval @ 95%: [1.431 - 1.842]			Standard Deviation: 0.492	Standard Error: 0.105		

What impact has the rainwater tank had on your life and your household (men, women, children)?		
12147315	05/27/2014	Used for drinking water only Additional storage capacity for drought and large household
12147414	05/27/2014	refer back to survey - can't read. Think it is don't need to get water from neighbours home. More convenient.
12147456	05/27/2014	
12147517	05/27/2014	
12147572	05/27/2014	
12278053	06/10/2014	
12278077	06/10/2014	
12278096	06/10/2014	
12278146	06/10/2014	
12278227	06/10/2014	
12278258	06/10/2014	
12278308	06/10/2014	
12278355	06/10/2014	
12278433	06/10/2014	
12278466	06/10/2014	
12278510	06/10/2014	
12278610	06/10/2014	
12278714	06/10/2014	
12278794	06/10/2014	More drinking waer.
12279346	06/10/2014	
12279385	06/10/2014	Easier, more convenient. 6 other households also use water from the tank, thus benefiting other families in the village. No longer need to bother the neighbour & walk over.
12279443	06/10/2014	Having own tank means don't need to go to neighbour - convenient.
12284797	06/10/2014	Makes life easier. Easier to get water from a tap instead of borrowing water from neighbour.
12284857	06/10/2014	
12285374	06/10/2014	
12285416	06/10/2014	
12285496	06/10/2014	Now have close source of drinking water. Better health. Very satisfied - nice job.
12285601	06/10/2014	
12286532	06/10/2014	
12286661	06/10/2014	

Have you had any issues or difficulties with your rainwater tank?



Answer	Count	Percent	20%	40%	60%	80%	100%
1. Yes	2	20.00%	<input type="text"/>				
2. No	8	80.00%		<input type="text"/>			
Total	10	100%					
Mean: 1.800	Confidence Interval @ 95%: [1.539 - 2.061]			Standard Deviation: 0.422	Standard Error: 0.133		

Please explain what difficulties		
12147315	05/27/2014	There was a leak in pipe on installation, this was fixed.
12147414	05/27/2014	
12147456	05/27/2014	
12147517	05/27/2014	
12147572	05/27/2014	
12278053	06/10/2014	
12278077	06/10/2014	
12278096	06/10/2014	
12278146	06/10/2014	
12278227	06/10/2014	
12278258	06/10/2014	
12278308	06/10/2014	
12278355	06/10/2014	
12278433	06/10/2014	
12278466	06/10/2014	
12278510	06/10/2014	
12278610	06/10/2014	
12278714	06/10/2014	
12278794	06/10/2014	The tap fitting started to rust very soon after installation, but this was repaired. now all good
12279346	06/10/2014	
12279385	06/10/2014	
12279443	06/10/2014	
12284797	06/10/2014	
12284857	06/10/2014	
12285374	06/10/2014	
12285416	06/10/2014	
12285496	06/10/2014	
12285601	06/10/2014	
12286532	06/10/2014	
12286661	06/10/2014	

## Comments/Suggestions:

12147414	05/27/2014	Unsure why not satisfied - Could be more a personal dispute with project staff rather than a project issue.
12147456	05/27/2014	Meter has been installed. House not yet connected to meter. Unsure why not.
12147517	05/27/2014	- Home & resort data captured.
12147572	05/27/2014	Not re: this survey, but it would appear that some people in community do not attend village water committee meetings or events where their news is shared. Maybe some confusion over whos responsibility it is connect to main water water to home. ALSO - Plastic covers for water meters are often installed above ground and risk blowing away during storm events.
12278053	06/10/2014	Vakalou Beach Resort owner. In past, before PACC, have had to use the fire brigade to cart water in as Govt water truck broke down. The resort has large on-site rainwater storage 35000 x 3 + 10000 x 3. Rumor that one of the resorts is over-extracting water from main line and causing water shortage. Suggested that there were leaks in the main line and that 'testing' of the main line should have occurred before the trench was filled in. re: PACC project. Is still waiting to see any improvements.
12278077	06/10/2014	
12278096	06/10/2014	At the start of the new water system, it was OK, but in last week for half a day, every day, there is no water. Reports that the project may not be at fault, but the contractor.
12278146	06/10/2014	
12278227	06/10/2014	Low VWS satisfaction mostly linked to house not being connected by PACC. Photo of meter.
12278258	06/10/2014	Photo of Nata's & children with running water tap
12278308	06/10/2014	Rainwater tank has a leak. Noted that other people they know are now connected to the VWS for the first time because of PACC. Before these homes were not connected.
12278355	06/10/2014	Was worried VWC would not know how to look after new system
12278433	06/10/2014	Family was connecting home to main water line the day of interview. Son was digging trench. - Pic.
12278466	06/10/2014	
12278510	06/10/2014	
12278610	06/10/2014	Interview conducted at VWS main tank site with raised platform. Pics
12278714	06/10/2014	Not connected yet, but has meter at the home. Is very happy. This will be the first time to be connected to the main VSW. Will mean he has more drinking water. Last longer during drought. Pics of sitting & pointing
12278794	06/10/2014	Pic of tank & man
12279346	06/10/2014	There was a great need to improve the VWS. Not having water 24 x 7 for a long time. Problem was between 10pm and 6am when pumps not running. Their existing water line is now ~5 years old. There are many leaks in peoples' toilet cistern (~60%) due to the build up of salt in the flush valve. Showers also leak. Salt builds up b/c of high salinity and b/c water would stop running and salt settles. Most homes too poor to replace cistern. Cannot just replace a part. 1 Drum of diesel per month to fuel pump @ ~\$600 for 5 weeks. Elect would only cost \$300 for 5 weeks. Would have liked to see PACC pay for installation of electric mains to pump site and replace pumps with elect. Feels there is a high risk that solar pumps will break down. Fears cost of repairs and lack of skills to repair. 95% of homes in Fouli are connected the VWS. There is a shortage of water meters. Only 33 meters left over to do 2 villages. No meter installed for any home in Fouli. When original survey was done, they under counted. Tech experts from Australia / staff from Nuku'alofa did survey - supposed to be with locals, but not sure if this occurred. Survey needed to be more accurate. Some homes technically in Kolavai, but very closely located to Fouli are still not connected to either the main VWS or Fouli's water supply. Town officer has expressed view that they will look after and connect these homes if provided with materials. Town officer does regular monthly inspection / of homes to check for leaks. Hihifo water committee. Some people have raised issues, but PACC does not listen or take action. Issues raised at last meeting were not addressed or discussed again at next meeting. Not all town officers shared their issues and concerns (Culture). Issue of the broken head tank. Contractor to repair. Worried that overflowing water will weaken foundation of remaining old tank. Mention that 1 village only received 1 x household tank b/c the T.O did not understand the selection requirements and selected hh who already had a tank. Maybe a communications issue.
12279385	06/10/2014	
12279443	06/10/2014	pic x 3 - 2 women + pipe / rust fitting
12284797	06/10/2014	
12284857	06/10/2014	Family way away when PACC project was implemented, thus not aware
12285374	06/10/2014	Would have been better if contractor had contacted households before they started work.
12285416	06/10/2014	
12285496	06/10/2014	
12285601	06/10/2014	VWS is only working sometimes. Photo - women with broom
12286532	06/10/2014	Wants to thank the donor for their support and investment in Tonga's water supply. Noted main line leak at Able Tasman landing site Chairman for the Village Water Committee. Raises questions through the district officers. Also chair of Womens' Committee Photo by PACC sign by road.
12286661	06/10/2014	

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### Appendix 3. Level of satisfaction with village water supply

Table. Level of satisfaction with village water supply by village as at May 2014

Village	Level of Satisfaction (number of households)			
	Very satisfied	Satisfied	Unsatisfied	Very unsatisfied
Ahau	1	1	2	
Ha'atafu	2	5	1	1
Kanokupolu	2	1	2	
Ha'avakatolo	1			
Kolovai	6	1		
Fo'ui	2	1	1	
<b>Total</b>	<b>14</b>	<b>9</b>	<b>6</b>	<b>1</b>

Figure 2011 Satisfaction with village water supply by village (shows as a percentage)

