



Contract No. TMV-CFS.001/2014 Te Mato Vai Detailed  
Design for Stage 2  
*Water Tariff Report*

February 2015



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# 1. Introduction

The Te Mato Vai project is a partnership between the Governments of the Cook Islands, New Zealand and the People's Republic of China to rehabilitate and upgrade the water supply system for Rarotonga. The Cook Islands Government is considering options for covering for the costs of the water supply system once the on-going project is completed. Payment options include user pays, allocating funds from the central budget or some combination of these. A study has been undertaken to investigate payment options, particularly the scale and scope of the tariff that would be required for a user pays option. The results of this study are presented in this report.

The report focuses on the recovery of operating costs for the upgraded water supply system. Some alternatives are presented for the proposed tariff and tariff rates and their respective potential impacts are discussed.

Some residents of Rarotonga are used to paying for part of their water consumption, either through the purchase of bottled drinking water, payment for tanker deliveries when needed or investing in their own facilities for collecting and storing locally harvested water. Water charges are also not new in the Cook Islands. The Government Gazette of 11 July 1907 notified the introduction of a water charge of five shillings per household and a minimum of £1 per compound per year for water from the newly completed water supply system. Rates were adjusted over the years. The Rarotonga Waterworks Ordinance 1960 introduced a tariff of £3<sup>1</sup> for household and £6 businesses and other users, payable annually in advance on 1 April each year. The domestic water fee was repealed in 1972, but the fee for other customers has never been repealed although it has not been collected for many years. Those taking water from the public system have therefore not paid for water for over 40 years.

## 2. Why Charge for Water ?

While water is often seen as freely provided by nature – and therefore should not be charged for – providing clean water to households and businesses requires infrastructure for the collection, storage and treatment of water and its distribution to consumers. This infrastructure may be relatively simple or highly complex, depending on the size of the community to be served, the nature of the available water resources and the level of service required.

In any community the cost of the water supply system must be paid for. There are various ways in this may be done:

- it can be paid for by the whole community, through either local or national taxes, in which case consumers do not pay anything directly, but only through the taxes they pay, and the water is “free”. This is the payment method currently used in the Cook Islands.
- it can be paid for through a fixed annual charge paid to the agency responsible for providing water. In this case the charges are typically the same for all customers, or for all members of each class of customers (e.g. households, businesses, etc.). This type of charge, added to local property taxes, is still used by some smaller local bodies in

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<sup>1</sup> A simple way to provide a rough indication of the value of this amount in current terms is to adjust by the change since 1960 in the consumers' price index. A CPI series for the period is not available for the Cook Islands, but the CPI series for New Zealand (assuming it will not be too dissimilar) has increased 21.4 times between mid 1960 and mid 2014. So £3 in 1960 would be “equivalent” to \$128 per year now.

New Zealand, and the water charges that were in force in Rarotonga until 1972 were also of this type.

- it can be paid for by charging customers directly for the water they consume: the more consumed, the higher the cost. In this case the water consumption of each customer is metered, meters are read at regular intervals and charges are calculated according to the volume consumed in the billing period.
- water may also be paid for through some combination of the above methods.

Water is a scarce resource and its availability is not unlimited. The resource therefore needs to be managed to ensure that, as far as possible, water is available to those who need it when they need it. In Rarotonga this is important because rainfall patterns and limited water storage options mean that supply cannot always be guaranteed for all users 24 hours a day, 7 days a week, 52 weeks in each year.

When water is paid for through taxes and the national budget, as it is now in Rarotonga, there is no link between what each household and business (all taxpayers) is paying for water and the amount that each consumes. Water appears to be free so everyone uses it as if it really is free, when in fact it isn't free at all. This will inevitably lead to greater consumption that is really necessary.

With a fixed annual charge, although everyone knows they are paying for water the charge is a fixed amount and those using little water pay the same as those using very large volumes. Again, there is no link between how much you use and how much you pay so paying in this way easily leads to over-use as households and businesses seek to use all the water they consider they are paying for. In Rarotonga, where the water resource is limited, especially during dry periods, the risk that some households and businesses will not receive any water at all is increased. Paying for water in this way can end up being unfair for some consumers.

It is only with the setting up of a water tariff with specified charges for water consumed that a link is established between how much water each consumer uses and how much is paid. Charging directly for water consumed has a number of key advantages over other methods of payment:

- first of all it creates an incentive for consumers to modify their use of water to what they really need – i.e. it promotes conservation of the water resource and facilitates demand management
- secondly, those who use only small volumes of water do not subsidise those who use large volumes (which is the case if charges are fixed and possible if costs are met wholly through the tax system)
- because everyone pays according to what they use it is more fair for all water users than other payment systems.

For Rarotonga, it is likely that the cost of upgrading the water supply system and the cost of operating the system will be divided between taxpayers and water users with the capital costs of the upgrading being met from Government's revenues (i.e. by taxpayers) and the operating costs being met by a charging users for the water they use. A tariff to cover operating costs of the water system is the subject of this report.

# 3. The Present Situation

## 3.1 Current Supply and Demand

### 3.1.1 Supply

Records of daily volumes supplied from each source for the period from March to November 2014 give an average daily availability of water to the system of 8,500 m<sup>3</sup>, although with significant seasonal variation. This average of 8,500 m<sup>3</sup> per day been used in the subsequent analysis.<sup>2</sup>

### 3.1.2 Water Demand – Households

A network of meters was installed at household, commercial and institutional premises in early 2014. These and have been providing data on consumption since about March/April 2014. Twenty-three of these meters were installed at households and although the sample is very small (0.7% of the 3,154 households recorded on Rarotonga in the 2011 census) the data collected provides an indication of household consumption. The summary data is shown in the table. There is considerable variation between households, partly reflecting the size of the households (which varied between 2 and 11 persons, with an average of 3.6) but also reflecting seasonal variations. Households with tanks connected to their roofs are likely to take less water from the system during the rainy season.

**Table 1 Per Capita Daily Consumption – Metered Households (litres)**

	March	April	May	July
Minimum	138	93	71	59
Maximum	1109	959	875	883
Average	540	423	355	287

The average daily per capita consumption from the data in the table is 400 litres per capita per day (lpcd). This average daily consumption is therefore used as the starting point for estimating total household consumption and the tariff rates for this consumption.

### 3.1.3 Water Demand – Tourist Sector

Tourism is a major industry on Rarotonga, with the number of tourists on the island at any time being equivalent to about 30% of the resident population.

The metering programme included three hotels, including Edgewater which is the largest tourist hotel and resort on the island. While this sample represents only a very small proportion of all the hotels, motels and guest houses on the island it does represent around 25% of the total number of room nights.

Many hotels and resorts – especially the larger ones – have on-site storage that is fed by the water supply system as well as rainwater collected from the roofs of their buildings in order to ensure sufficient supply for guests, given the inability of the existing system to guarantee adequate supplies 24 hours a day, 7 days every week. Edgewater Resort has storage capacity of 5,000 m<sup>3</sup> and 6 other resorts have between 90 m<sup>3</sup> and 190 m<sup>3</sup> each.<sup>3</sup> The combined total

<sup>2</sup> However, the determination of tariff rates depends on volumes sold (i.e. demand) not on supply, subject to the obvious constraint that volume sold cannot exceed the supply in the system.

<sup>3</sup> These resorts are Crown Beach, Sunrise Beach, Little Polynesia, Pacific, Rarotongan and Manuia.

storage of these 7 resorts is 5,850 m<sup>3</sup>. These resorts also have their own treatment facilities to treat the water before it goes to their in-house reticulation systems.

Information from Edgewater and Pacific Resorts indicate that their average water usage (for all uses) is about 300 litres per guest and 275 litres per guest, respectively. To derive a total daily consumption for the tourist sector a per person daily consumption of 300 litres is used.<sup>4</sup> This is for water used in the respective hotels and resorts. Additional tourist related consumption in restaurants and other locations is covered by other commercial consumption.

The data in the table shows the number of tourists visiting the Cook Islands during the last 4 years. Based on past arrivals during the 4<sup>th</sup> quarter, it is likely that the total arrivals for 2014 will be similar to 2011 in which case the average monthly number of visitors for these years will be about 9,800.

**Table 2: Tourist Arrivals**

Year	Tourist Arrivals	Monthly Average	Average Stay (days)
2011	113,114	9,426	10
2012	122,384	10,199	10
2013	121,158	10,096	11
2014 (3 quarters)	80,023	8,891	10

Source: Statistics Office, Migration Statistics, September 2014

Tourists visiting the Cook Islands stay on average for 10 days. The average number of tourists in the country at any one time is around 3,265 (i.e. one third of the monthly average, disregarding the small number who may be visiting other islands at any time). Based on consumption of 300 litres per day per tourist then the average daily tourist demand is 980 m<sup>3</sup> – say 1,000 m<sup>3</sup>. Some of this demand is met by resorts own rainwater collection, especially in the larger establishments, but the many small hotels and motels presumably have quite limited storage capacity.

For the purposes of initial estimation, it is assumed that 25% of water for tourists is supplied from rain water collected by the respective hotels and resorts. This is an assumption and is not at present supported by specific data and for that reason alternative, lower, percentages are also considered in the analysis.

### 3.1.4 Water Demand – Other Commercial

Other commercial connections include all commercial businesses apart from hotels and resorts. This includes shops, offices, industries, restaurants and so on. Some of these, but not many, will have relatively high water consumption but most of them will have low consumption.

The metering programme implemented during 2014 included 5 commercial connections, including companies engaged in bottled water production, seafood, construction and restaurants and tourist entertainment. These companies had an average daily consumption of 4.45 m<sup>3</sup> and are relatively large consumers of water, but not typical of all commercial connections on the island. Even within this small group, the restaurant had daily consumption of only 1.5 m<sup>3</sup>.

<sup>4</sup> It is possible that water consumption in smaller hotels and motels is different from that in the larger establishments due, for example, to a smaller number of guests sharing common facilities such as swimming pools, less water being used for gardens, and other reasons.

To estimate daily consumption from the commercial sector it is assumed in the interim that there are 500 connections in the sector with an average daily consumption of 0.5 m<sup>3</sup>.

### **3.1.5 Water Demand - Institutional**

One government office, one community meeting house and three schools were included in the metering program. Consumption at the government office average 75 litres per person per day for the 146 employees working there.

Three secondary schools were included in the program, and based on 2013 school enrollment data, these schools had a total of 882 pupils. From the metered consumption data, per pupil daily consumption averaged 13 litres and varied from 1.4 to 100 litres. These numbers are based on 7 days a week but the average is almost 19 litres if consumption on only 5 days per week is considered. These consumption levels seem very low, especially the 1.4 litres per pupil for Tereora College and may not be a sound basis on which to estimate tariffs. For working purposes an average consumption of 40 litres per pupil per day is assumed, but further investigations are needed to obtain more reliable data and to identify the reasons for the wide variations in usage

Total school enrolment in Rarotonga schools in 2013 was 2,699.

With regard to government offices and institutions, the MFEM Building, where an estimated 146 people work, was recorded with an average daily consumption of 11 m<sup>3</sup> or 75 litres per person on a 7 day a week basis. (This amounts to 105 litres per person if only 5 working days are considered.)

Based on data from the 2014-15 Budget Book, the total staff of government agencies and SOEs is as follows:

Total government employees	1,885
Staff of SOEs	263
Total government and SOEs	2,148
Less Island government staff	-359
Less teachers	-267
Less Island councils staff & Aitukaki Power Supply	-70
Less deduction for staff based on other islands	-50
Total Rarotonga staff	1,392

Teachers are excluded from the above estimate to avoid double counting with the provision for schools. A number of agencies have staff on other islands so a small deduction has been made to allow for this.

The consumption will of course vary among agencies. For example, hospital and health centres, the airport, Punanga Nui market and perhaps one or two other agencies are likely to have higher than average water consumption.

For the whole government and institutional sector an overall average consumption per day (for 7 days per week) an average consumption of 52 litres per person per day is used (40 litres for schools and 75 litres for government agencies).

### **3.1.6 Water Demand – Agriculture**

Five agricultural enterprises have been included in the metering programme. These include the two Wigmore Farms connections and Tupapa Hydroponic. Total daily demand for the 5 connections was 24.4 m<sup>3</sup> which is unlikely to reflect the overall demand for crop and livestock production.

The overall quantity of water used for agriculture and livestock is uncertain. Previous studies have mentioned daily demand of up to 4,500 m<sup>3</sup>, but without substantiation. It is also likely that some of the consumption by households is used for household vegetable plots and livestock.

The Census of Agriculture 2011 found that of 3,154 households on Rarotonga, 1,883 were not engaged at all in any agricultural activity. Of those that were engaged in agriculture, 698 had only minor activities, 333 were engaged only in subsistence activities and 240 households had fruit and vegetable crop production classified as commercial.

With regard to livestock, the census found that 698 Rarotonga households owned livestock, with the most common animals being pigs (5,219), goats (1,211) and chickens (12,549). One hundred and eighty-five cattle and 4 horses were also recorded, but these will not be significant for water consumption. A total of 622 households owned pigs (average 8.6 per household) but with a third of the total number belonging to 53 households each having more than 20 pigs. Pigs require between 10 and 30 litres per day, with lactating sows requiring the most. Goats, except for lactating does, have low water requirements.

The daily water requirement for pigs at an average 20 litres per head comes to 104 m<sup>3</sup>, the goats and chickens require considerably less. Some of the total water requirement may come directly from streams, rainwater or other sources and not from the water supply system, but a daily requirement of 100 m<sup>3</sup> can be taken as indicative of the requirements. Where livestock is kept at or close to the owners' homes, their water requirement will certainly be supplied from the household connection and is included in the estimate of household consumption. Larger livestock holdings kept away from the home presumably tap into separate connections (or will in future).

The Census of Agriculture 2011 gives the following crop areas for Rarotonga:

annual vegetables and fruit	50 acres	(20.2 ha)
root crops	117.6 acres	(47.6 ha)
tree crops	184.1 acres	(74.5 ha)

These are areas in definable plots rather than small scale backyard production. Of the root crops 30.5 ha was reported to be planted in various types of taro, although almost 28 ha was planted in wet raised beds. Of the fruit trees, 16.3 ha was planted in papaya and 28.5 ha in banana, both crops with relatively high water requirements. For both the taro and the fruit trees a significant portion of total water requirements may be met by rainfall.

A detailed estimate of water requirements for these crops could be made based on rainfall and crop water requirement data but this is beyond the scope of the present report.

Taking into account the above factors, an amount of 500 m<sup>3</sup> per day is included as the base case in the tariff calculation. This is intended to represent water for livestock and agriculture from dedicated connections and does not include water from household connections that is used for livestock and small scale vegetable and other crop production. This volume is at best indicative. The volume of water that is actually used for agriculture and livestock is one of the significant unknowns in the present system and additional data needs to be collected about this use so that it is possible to make a better determination of what tariff rates will be required for all classes of consumers.

### **3.2 Water Leakage**

A survey of customer side leakage was carried out for TMV during 2014.<sup>5</sup> The survey included 150 connections: 50 from among those with meters installed in March this year, 50 from an ICI

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<sup>5</sup> Customer Side Leakage Project, Leak Survey Data Analysis. Water Loss and Pressure Management Pty. Ltd., November 2014.

group of 130 customers with meters and 50 (40 domestic and 10 commercial/institutional) selected in conjunction with the National Council of Women. The results of the survey and testing carried out for the study indicate that the level of customer side leakage is relatively low and not a significant source of loss of water. The report therefore suggests that with the introduction of water meters and water tariffs the majority of customers will not have to address serious leakage issues in order to avoid unnecessary water charges. However, there are some reservations about this conclusion and it may be that customer side leakage is higher and more widespread than the report suggests.

There is also leakage in the system from the mains and distribution network itself but most of this is expected to be addressed as the ring and feeder mains are replaced.

### **3.3 Current Payments for Water**

Paying for water is not unknown on Rarotonga and the introduction of payments for water supply is not something entirely new. Due to shortages in the supply system or low pressure at certain times, some households and businesses may sometimes have to arrange for a water tanker to supply water. Current prices for this service are \$60 for 5 m<sup>3</sup> from ICI and up to \$85 for 2 m<sup>3</sup> from private sector operators.

Some households also buy bottled water for drinking, which can cost up to \$7 for 19 litres. According to the 2011 census data 1,213 households (38%) on Rarotonga named bottled or bought water as their source of drinking water. The remaining households all used tap water, filtered tap water or rainwater for drinking, which may involve a cost if the water is boiled before drinking. Since 2011 more community taps with UV filters providing free drinking water have been set up and have replaced other sources of drinking water for many households.

Some of these costs may continue even with the upgraded system, which will not provide treated water, at least initially. The purchase of bottled drinking water may not be much reduced and the need for tanker services may still exist during any extended periods of drought.

## **4. Water Supply System Costs**

### **4.1 Capital Costs**

The capital cost of the upgrade of the Rarotonga water supply system, including the ring mains, trunk mains, intakes, storage tanks, access roads, metering and associated works is estimated to be just under \$60 million. This cost is funded by a loan from the government of China, a grant from the New Zealand government and Cook Islands government funds. It is not the intention of the government to recover the capital costs of the system upgrade directly from water users, but to subsidise users by paying for capital costs from the annual budget. Recovering capital costs through the water tariff would significantly affect the rates that would have to be applied. Financing costs are also not included in the tariff calculation.<sup>6</sup>

### **4.2 Operating Costs**

The water tariff is intended to recover full operating costs only. This includes staff costs, operating and maintenance costs for the water supply system, and office and administration

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<sup>6</sup> Including interest costs (i.e. on the Chinese ExIm loan) would add about \$0.16 per m<sup>3</sup> on average to the tariff rates in the tables in the following sections. Since the interest cost will decline as the loan is repaid, some or all of this cost could be included in subsequent tariff revisions, once the payment system is established.

costs The operating costs used assume that the system will be operated by a newly established water SOE. Covering these costs from a user pay tariff will mean that government will be able to re-allocate the funds currently used to pay for the operation of the water supply system (about \$800,000 per year) to other uses.

The capital costs of setting up the SOE are not included in the tariff estimate, but an estimate for depreciation of office equipment, vehicles and system monitoring equipment is included.

Operating costs for the SOE are estimated at \$1.41 million per year, in 2014 prices, of which staff costs account for \$855,000.

## 5. Criteria for Tariff Design

The proposed water tariff has been designed using the following criteria:

- no recovery of capital costs through the tariff
- full recovery of operational costs through the tariff
- tariff rates should foster demand management and the efficient use of the available resource
- the tariff is based on monthly billing for all customers
- the tariff options are calculated on a break-even basis,<sup>7</sup> with no dividend or return paid to government (at least in the short to medium term) as this would be tantamount to a charge for capital cost recovery
- four classes of water customer :
  - households
  - commercial (i.e. all businesses)
  - institutional and government (government offices, schools, etc.)
  - agriculture
- the tariff is structured as a single part tariff – i.e. there are only charges per volume of water used and no fixed per connection charges. For each consumer category, a single rate is applied for all water consumed
- the tariff for households includes a free fixed monthly allocation of water (the same for all regardless of household size) and then a flat per m<sup>3</sup> rate.

An alternative two part tariff design could be estimated for consideration if data were available on the number of connections in each customer category, but this information is not available.

Rising price blocks for water are particularly not included in the domestic tariff because these would penalise larger households, especially given that the mandated free allocation is fixed for all households. (Setting the free allocation on a per capita basis would be complicated to manage and could be subject to abuse.)

With regard to the four customer categories, it is noted that commercial customers have been divided into tourist and non-tourist businesses. This is chiefly to facilitate tariff calculations because the demand of the tourist sector can be estimated based on the number of tourists,

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<sup>7</sup> The actual calculations are based on small annual surpluses of around 5% of revenue to provide a small financial buffer for the SOE. Annual adjustments of tariff rates would take accumulated surpluses into account.

rather than relating it specifically to the relevant connections. Specific numbers are not available for non-tourist commercial connections. While this includes some industrial and other businesses that are relatively large consumers of water (for which details are available from the metering programme that has been in place during this year) the great majority are shops, offices, restaurants and other businesses that will mostly have very low water consumption.

Government and institutional connections are separated out in the tariff calculations, but the rates applied to this group are the same as for commercial customers. This is a small group of customers, taking perhaps 3% or 4% of total daily water consumption, so applying a lower tariff rate than the commercial rate would not have a significant impact on water company revenues.

Once a water tariff is in place, the applicable rates would be re-calculated at regular intervals (every one or two years) to ensure revenues continue to cover costs and to take into account any changes in consumption patterns within or between customer categories.

## 6. Proposed Tariff

### 6.1 Introduction

Rates for the water tariff, structured as described above, have been estimated for a period of 10 years from their anticipated introduction in 2017 (2016 for commercial customers, assuming water meters are in place by then). These rates depend on the assumptions made about the level of consumption by each of the customer categories. Since the levels of consumption are not certain, and highly uncertain in the case of agriculture in particular, tariff rates proposed here cannot be regarded as in any sense definitive. Rather, setting final tariff rates for implementation will depend on gaining more information about how much water is actually consumed by each category.

### 6.2 Data Projections

#### 6.2.1 Operating Costs

The estimated operating costs for the proposed water SOE amount to \$1,414,362 per year in 2014 prices. The main elements of these costs are shown in the table (additional details are given in the tables in Appendix A ).

Some SOE costs could be reduced by sharing functions with other SOEs, notably with TAU. This could include establishing a common meter reading, billing and revenue collection system, the sharing of some back office financial and administrative functions and perhaps other functions.

**Table 3: Estimated SOE Operating Costs (2014)**

Item	Amount (\$)
Staff	855,362
SOE Board	5,000
Office & administration	176,500
Training & capacity building	25,000

Depreciation	64,500
System maintenance	352,500
<b>TOTAL</b>	<b>1,414,362</b>

- Notes: 1) Office and administration includes meter readers and billing and collection costs.  
2) System maintenance is estimated at 0.75% of source, trunk and ring mains capital costs.

These are costs for 2014. To project operating costs to future years - to 2017 the expected start year for charging for water and subsequent years – most cost items have been adjusted by 2% per year to take into account inflation. The average annual change in the CPI in the Cook Islands since 2009 has been about 1.7% per year. An annual adjustment of 2% is slightly above this recent trend, but years of higher inflation have occurred in the earlier 2000s.

No inflation adjustment has been applied for audit costs, training and capability development, depreciation and system maintenance.

### **6.2.2 Population and Households**

The Demographic Profile of the Cook Islands produced by the Statistics Office based on the 2011 census data has three projections for population growth – high, medium and low. The Statistics Office considers the high growth scenario unlikely and prefers the medium growth scenario as the most likely. It is therefore used to estimate the population of Rarotonga in future years.

Furthermore, the average household size on Rarotonga at the 2011 census was 3.5 persons. This is used to estimate the number of households in each year and it is assumed that 95% of households are connected to the water supply system. This was the proportion of households that reported being connected to the public water supply system in the census.

As noted above, the tariff provides for each household to receive an allocation of water for which there will be not charge. This allocation has been based on a specified daily allowance for a household of 4 persons. Different levels for the daily allocation have been considered and are further discussed below. According to the last census, 72% of households on Rarotonga have 4 persons or fewer.

### **6.2.3 Other Categories**

Between 2009 and 2013, the number of tourists visiting the Cook Islands grew at an average 4.6% per year, although as noted above, the numbers for the first 3 quarters of 2014 suggest that the total this year is likely to be less than the last two years. In the tariff calculation, the volume of water consumed by the tourist sector is assumed to grow at only 2% per year, allowing for variable growth over time as well as the pressure towards more efficient use of water that water prices are expected to induce.

For other commercial customers and government and institutions, no change in water consumption over time has been assumed. This is generally consistent with the low anticipated population growth, although growing tourist numbers may lead to some increase consumption by restaurants.

Agricultural consumption is assumed constant over time since it is very much an unknown. Whether or not the level assumed in the calculations is realistic needs to be determined through future data collection efforts.

### 6.3 Unaccounted for Water

Based on average daily production of 8,500 m<sup>3</sup> per day given by the monitoring data collected during this year, and on the consumption levels derived for the various customer categories, the level of unaccounted for water is 32% if agricultural consumption is 500 m<sup>3</sup> per day or 27% if agriculture takes 1,000 m<sup>3</sup> per day.

However, actual daily production varies significantly according to the season. In July 2014, for example, the average daily production for the month was 9,563 m<sup>3</sup> per day. With the “average” consumption levels used for each of the categories, this would imply unaccounted for water of 35% during July.

**Table 4: Estimated Water Consumption and Unaccounted for Water**

Category	Base Case (m <sup>3</sup> )	Alternative Case (m <sup>3</sup> )
Average daily water production	8,500	8,500
Domestic	4,050	4,050
Commercial – tourism	750	750
Commercial – other	250	250
Government & institutions	192	192
Agriculture	500	1,000
Unaccounted for water (m <sup>3</sup> )	2,758	2,258
Unaccounted for water (%)	32%	27%

### 6.4 Tariff Rates

Tariff rates have been estimated for a number of alternative cases. The “base” case, with which others are compared, has a free allowance for households of 300 litres per household per day and agricultural consumption is 500 m<sup>3</sup> per day.

It will be seen later that the level of the free allocation for households has a significant effect on the rates required to be paid by the commercial categories.

The following table shows the average tariff rates, applicable to all categories, that would be required to cover operating costs (without any surplus) for several alternative levels of free household allocation and for the years 2014 and 2017. These are for reference only.

**Table 5: Average Tariffs for Selected Household Free Allocations (\$/m<sup>3</sup>)**

Household free allocation	2014	2017
None	0.673	0.682
200 litres/day	0.751	0.762
300 litres/day	0.798	0.809
400 litres/day	0.851	0.863

If agricultural consumption is actually 1,000 m<sup>3</sup> per day instead of 500 the tariffs in the table above would be 7% to 10% lower than those given.

Tariff rates have been estimated for the three levels of daily household free allocation and for agriculture consumption at 500 and 1,000 m<sup>3</sup> per day. These are shown in the following two tables. For the rates in these tables, the domestic tariff, applicable for all consumption above the free allocation, are set firstly at the average tariff rate required in 2017 if there were no free allocation, and secondly at 10% above this level. The agriculture rate is set 10% or 20% above the respective domestic level and the commercial rate is then set so that there is a small surplus of revenue over operating costs of about 4.5% to 5%. In effect, agriculture and commerce are assumed to cross-subsidise domestic consumption.

**Table 6: Tariff Rates for Various Household Free Allocations and Agricultural Consumption 500 m<sup>3</sup>/day (\$/m<sup>3</sup>)**

Category	Household Free Allocation		
	200 litres/day	300 litres/day	400 litres/day
Domestic <sup>1)</sup>	0.682	0.682	0.682
Agriculture	0.750	0.750	0.750
Commercial	1.140	1.300	1.475
Domestic <sup>2)</sup>	0.682	0.682	0.682
Agriculture	0.818	0.818	0.818
Commercial	1.120	1.290	1.450
Domestic <sup>3)</sup>	0.750	0.750	0.750
Agriculture	0.825	0.825	0.825
Commercial	0.920	1.110	1.290
Domestic <sup>4)</sup>	0.750	0.750	0.750
Agriculture	0.890	0.900	0.900
Commercial	0.890	1.070	1.260

Notes: 1) Domestic rate set at average tariff rate for no free allocation, agriculture rate is domestic +10%, commercial rate set to generate revenue surplus between 4.5% and 5% of operating costs.

2) As 1), but agriculture is domestic +20%

3) Domestic set 10% above average rate for no free allocation, agriculture rate is domestic +10%, commercial rate set to generate specified surplus. Rates aligned where commercial rate below specified agriculture rate.

4) As 3), but agriculture is domestic +20% (except for 200 litres/day free allowance where reduced to match commercial rate.)

**Table 7: Tariff Rates for Various Household Free Allocations and Agricultural Consumption 1,000 m<sup>3</sup>/day (\$/m<sup>3</sup>)**

Category	Household Free Allocation		
	200 litres/day	300 litres/day	400 litres/day
Domestic <sup>1)</sup>	0.682	0.682	0.682
Agriculture	0.750	0.750	0.750
Commercial	0.840	1.000	1.170
Domestic <sup>2)</sup>	0.682	0.682	0.682
Agriculture	0.800	0.818	0.818
Commercial	0.800	0.950	1.110
Domestic <sup>3)</sup>	0.726	0.750	0.750
Agriculture	0.726	0.795	0.825
Commercial	0.726	0.795	0.950

Notes: 1) Domestic rate set at average tariff rate for no free allocation, agriculture rate is domestic +10%, commercial rate set to generate revenue surplus between 4.5% and 5% of operating costs.

2) As 1), but agriculture is domestic +20% (except for 200 litres/day free allowance where reduced to match commercial rate.

3) Domestic set 10% above average rate for no free allocation, agriculture rate is domestic +10%, commercial rate set to generate specified surplus. Rates aligned where commercial rate below specified agriculture rate.

It is clear from the above tables that a lower level of free allocation for households results in lower rates for the commercial sector. A bigger impact occurs from the level of sales to agriculture. The shift from 500 to 1,000 m<sup>3</sup> per day reduces the commercial tariff rates by between 20% and 30%. It is obvious that the more water sold the lower the tariffs will need to be. While consumption by agriculture is the big uncertainty in the data, the estimates of consumption for all categories are based on limited metering data and, in the case of tourist consumption on information on per capita consumption provided by a small number of resorts.

If the number of households connected to the system were only 90% of the total, then the commercial rates applicable in the initial case in each of Tables 6 and 7 (with 300 litres per day free allocation for households) would be \$1.40 and \$1.12, respectively. Similarly, if average household consumption reduced to 300 litres per person per day, and in this case assuming a free allocation of 200 litres per household per day, the commercial rates required for the initial cases above would be \$1.70 and \$1.38 per m<sup>3</sup>, respectively. If households made water savings at this level, however, an adjustment in the rates for all customer categories would most probably be required.

For the tourism sector, variations in the proportion of water supplied from resorts' own rain water collection will affect the commercial tariff rate. If the proportion is only 20%, instead of the 25% assumed above, then the commercial tariff for the first option in Table 6, above, with 300 litres per day free domestic allocation would be \$1.24 per m<sup>3</sup> instead of \$1.30 and \$1.28 per m<sup>3</sup> if the proportion of rain water is only 15%; if the proportion is 30% instead of 25%, then the commercial tariff rate in this case would be \$1.35 per m<sup>3</sup>. If agricultural consumption is 1,000

m<sup>3</sup> per day and with the 300 litres free allocation, the commercial tariff rate increases or decreases by about \$0.05 for each 5% increase or decrease in the percentage of water supplied from rain water.

In selecting a free allocation level for households, it will be necessary to balance the benefit for households with the corresponding subsidy burden placed on the other customer categories.

## 6.5 Impact for Households

Two rates are used in the above calculations for domestic consumption above the free allocation. According to 2011 census data, the average household size on Rarotonga is 3.5. The following table shows the cost per month for a households of 4 persons and 8 persons based on current average consumption of 400 lpcd and the various free allocations. Seventy-two percent of households (2,265) on Rarotonga have 4 persons or fewer and 97% have 8 persons or fewer. There are 786 households with 5 to 8 persons.

**Table 8: Cost of Water for Households (400 lpcd) (\$/month)**

Household Size	Domestic Tariff (\$/m <sup>3</sup> )	Household Free Allocation		
		200 litres/day	300 litres/day	400 litres/day
4 persons	0.682	28.64	26.60	24.55
	0.750	31.50	29.25	27.00
8 persons	0.682	61.38	59.33	57.29
	0.750	67.5	65.25	63.00

If we take 2% as an acceptable cost of water as a maximum proportion of household income<sup>8</sup> then for a free allocation of 300 litres per day, the cost of water will be below 2% for all households of 4 persons with income above \$15,960 per year for the lower tariff rate and above \$17,550 per year for the higher rate. For the household of 8 persons, the corresponding household incomes are \$35,598 and \$37,800 per year.

Unfortunately, data on household incomes, in contrast to individual incomes, has not been available. At the time of the last census 69% of the population over 15 were employed, with an average 1.64 employed persons per household, and that the average annual income was \$17,695. However, 39.4% of those employed reported incomes of less than \$10,000.

Without household data it is difficult to assess how many households are likely to have water costs above about 2% of household income, but for small and average households it is probably not many. Households most likely to face water bills significantly above this level, given the above rates, would be larger households with a high proportion of dependents.<sup>9</sup>

For comparison, the table below shows monthly water costs at the given tariff rates if households reduced daily consumption to 200 lpcd.

<sup>8</sup> International aid agencies usual rule of thumb is that the cost of water should not exceed 5% of household income, but this is usually for poor households in countries with much lower per household incomes than in the Cook Islands.

<sup>9</sup> Since the numbers are not likely to be large, it may be possible to identify individual households for which the tariff would impose hardship and apply mitigating measures (to be decided). However, this would require regular monitoring.

**Table 9: Cost of Water for Households (200 lpcd) (\$/month)**

Household Size	Domestic Tariff (\$/m <sup>3</sup> )	Household Free Allocation		
		200 litres/day	300 litres/day	400 litres/day
4 persons	0.682	12.28	10.23	8.18
	0.750	13.50	11.25	9.00
8 persons	0.682	28.64	26.60	24.55
	0.750	31.50	29.25	27.00

## 7. Conclusions

This report makes no specific proposal for tariffs for Te Mato Vai. This is because data on present consumption of water in Rarotonga is limited in several key areas, notably for crops and livestock, but also for all other categories of consumer. As has been shown, variations in water consumption have a significant impact on the tariff rates that will need to be applied for the costs of operating the system to be recovered.

Further data collection is needed in order to reduce the data gaps so that a more reliable set of tariff rates can be determined prior to actual implementation of payments for water.

Full recovery of the water supply system operating costs will allow government to reallocate some \$800,000 per year currently used to run the system to other important uses.

An indication of the impact of water charges on households is given above. With regard to financial impacts, commercial customers may be several groups. Many commercial customers (shops, commercial offices, etc.) are only low volume consumers of water and water charges are likely to be only a very minor addition to business costs. The largest commercial customers are the tourist accommodation enterprises, some of which consume very large volumes of water each month. However, the rates indicated above suggest that the commercial tariff may well be in the range of \$0.80 to \$1.30 per m<sup>3</sup>. Since per capita consumption in hotels is around 300 litres per person per day, this implies an additional cost of between \$0.24 and \$0.39 per guest per day. While these figures are certainly only indicative and it is acknowledged that the tourism market in the Pacific is highly competitive, it would be difficult to argue that these costs will make a significant difference to overall operating costs for these enterprises. Businesses most likely to be affected by water charges are those for which water is a significant process input – a fish processor, a commercial laundry or similar businesses.

For both domestic and commercial customers, the cost of water can be mitigated by adopting various water saving measures, such as ensuring there are no leaks on the customer side of the meter, installing water saving appliances and so on. Promoting more efficient use of water is one objective of introducing water tariffs and investment in water saving facilities is encouraged.

There is a risk that the charging for water will modify consumer behaviour so as to reduce the revenues of the water SOE. below the cost recovery level. The most obvious way in which this might happen would be if households were to invest significantly in connecting up existing tanks to roofs to collect rain water and in purchasing more tanks. The costs for households of doing this need to be assessed to give some idea of what this risk might be. Domestic tariffs may need to be set so as to compete effectively with this option for households.

It is recommended that the tariff should be single part tariff with a single rate block for each category, except for the domestic tariff which will have two blocks (an initial zero rated block and then a flat rate for all consumption above this block level). A tariff of this type will be more equitable for small and large customers and will maximise the incentive to use water more efficiently. Multiple price blocks for each category, if rising, would only penalise households with many members and the important tourist industry.

In setting tariff rates, it will be necessary to balance the concerns of domestic customers about the need to pay anything at all for water and the concerns of business, and undoubtedly crop and livestock producers, that paying for water will just be additional business cost with no compensating improvement in service.

## **8. Disclaimer**

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# Appendices



## Appendix A – Tariff Estimates

Te Mato Vai: Estimate of Water Tariffs for Rarotonga										
				2014	2015	2016	2017	2018	2019	2020
<b>Water Supply Customers</b>										
Cook Islands Population - low estimate <sup>1)</sup>				14,494	14,338	14,186	14,021	13,859	13,698	13,539
Cook Islands Population - medium estimate <sup>1)</sup>				15,010	15,022	15,031	15,036	15,040	15,045	15,049
Rarotonga Population - low estimate <sup>2)</sup>				10,291	10,281	10,275	10,257	10,239	10,222	10,204
Rarotonga Population - medium estimate <sup>2)</sup>			1.0%	10,657	10,772	10,887	10,999	11,112	11,226	11,342
Number of households - low estimate				3,072	3,069	3,067	3,062	3,056	3,051	3,046
Number of households - medium estimate				3,181	3,216	3,250	3,283	3,317	3,351	3,386
Average persons per household <sup>3)</sup>			3.35							
Domestic connections - low estimate			95%	2918	2916	2914	2909	2904	2899	2894
Domestic connections - medium estimate <sup>4)</sup>			95%	3022	3055	3087	3119	3151	3183	3216
Commercial connections										
Government offices, schools, health centres, etc										

					2014	2015	2016	2017	2018	2019	2020
<b>Average Water Consumption</b>	<b>m3</b>	<b>No./%</b>	<b>growth</b>	<b>m3/day - 2014</b>	<b>annual consumption</b>						
Domestic	0.400			4,050	1,478,126	1,494,076	1,510,027	1,525,561	1,541,234	1,557,046	1,573,135
- free allocation	0.100	4		1,209	441,212	446,030	450,702	455,374	460,046	464,718	469,536
- other domestic				2,841	1,036,914	1,048,046	1,059,325	1,070,187	1,081,188	1,092,328	1,103,599
Commercial - tourist sector <sup>5)</sup>	1000	75%	2.0%	750	279,225	284,810	290,506	296,316	302,242	308,287	314,453
Commercial - other <sup>6)</sup>	0.500	500	0.0%	250	91,250	91,250	91,250	91,250	91,250	91,250	91,250
Government, schools, medical centres, etc. <sup>7)</sup>	0.052	4091	0.0%	213	77,647	77,647	77,647	77,647	77,647	77,647	77,647
Agriculture (volume uncertain)			0.0%	1000	365,000	365,000	365,000	365,000	365,000	365,000	365,000
Total consumption				6,262	2,291,248	2,312,783	2,334,430	2,355,774	2,377,374	2,399,230	2,421,485
Average daily production				8,500	3,102,500	3,102,500	3,102,500	3,102,500	3,102,500	3,102,500	3,102,500
Unaccounted for Water				2,238	811,252	789,717	768,070	746,726	725,126	703,270	681,015
Unaccounted for Water - %				26%	26%	25%	25%	24%	23%	23%	22%
<hr/>											
<b>Operating Costs</b>			<b>inflation <sup>9)</sup></b>		<b>(base)</b>						
<i>Personnel</i>											
Staff (see detail in xxxx)			2.0%		855,362	872,469	889,919	907,717	925,871	944,389	963,277
SOE Board			0.0%		5,000	5,000	5,000	5,000	5,000	5,000	5,000
<i>Office and administration</i>											
Office supplies & maintenance			2.0%		7,500	7,650	7,803	7,959	8,118	8,281	8,446
Electricity			2.0%		20,000	20,400	20,808	21,224	21,649	22,082	22,523
Audit			0.0%		2,000	2,000	2,000	2,000	2,000	2,000	2,000
Communications			2.0%		15,000	15,300	15,606	15,918	16,236	16,561	16,892
Vehicle operation & maintenance (2 vehicles)			2.0%		12,000	12,240	12,485	12,734	12,989	13,249	13,514
Meter reading (2 meter readers)			2.0%		60,000	61,200	62,424	63,672	64,946	66,245	67,570
Billing & collection costs			2.0%		60,000	61,200	62,424	63,672	64,946	66,245	67,570
Staff capacity building & travel			0.0%		5,000	5,000	5,000	5,000	5,000	5,000	5,000
Training and capacity building (on-going)			0.0%		20,000	20,000	20,000	20,000	20,000	20,000	20,000
Depreciation (office equipment and vehicles) <sup>10)</sup>			0.0%		64,500	64,500	64,500	64,500	64,500	64,500	64,500
<i>Subtotal Office and administration</i>					201,500	204,990	208,550	212,179	215,884	219,663	223,515
<hr/>											
<i>Water Supply Sources and Distribution Network</i>											
System maintenance <sup>11)</sup>			0.75	0%	352,500	352,500	352,500	352,500	352,500	352,500	352,500
TOTAL					1,414,362	1,434,959	1,455,969	1,477,396	1,499,255	1,521,552	1,544,292

	annual rate change	2014	2015	2016	2017	2018	2019	2020
<b>Tariff (\$/m<sup>3</sup>)</b>	<b>0.0%</b>							
Domestic								
- free allocation		0	0	0	0	0	0	0
- other domestic		0.750	0.750	0.750	0.750	0.750	0.750	0.750
Commercial - tourist sector		0.800	0.800	0.800	0.800	0.800	0.800	0.800
Commercial - other		0.800	0.800	0.800	0.800	0.800	0.800	0.800
Government, schools, medical centres, etc.		0.800	0.800	0.800	0.800	0.800	0.800	0.800
Agriculture		0.800	0.800	0.800	0.800	0.800	0.800	0.800
<b>Revenue <sup>12)</sup></b>								
Domestic								
- free allocation		0	0	0	0	0	0	0
- other domestic		860,413	869,665	879,000	888,023	897,150	906,381	915,738
Commercial - tourist sector		223,380	227,848	232,405	237,053	241,794	246,630	251,562
Commercial - other		73,000	73,000	73,000	73,000	73,000	73,000	73,000
Government, schools, medical centres, etc.		62,118	62,118	62,118	62,118	62,118	62,118	62,118
Agriculture		146,000	146,000	146,000	146,000	146,000	146,000	146,000
<b>Total Revenue</b>		<b>1,364,910</b>	<b>1,378,631</b>	<b>1,392,523</b>	<b>1,406,193</b>	<b>1,420,061</b>	<b>1,434,128</b>	<b>1,448,417</b>
Net revenue		-49,452	-56,328	-63,446	-71,203	-79,194	-87,424	-95,875
Net surplus - %		-3.5%	-3.9%	-4.4%	-4.8%	-5.3%	-5.7%	-6.2%
<b>Notes:</b>								
1) Based on projections in Cook Islands Demographic Profile 2006-2011								
2) At the 2011 population census, the Rarotonga population was 70.6% of the national total. This percentage (71%) has been applied to the projected national population to derive the Rarotonga population in each year. This may under-estimate the Rarotonga population as a proportion of the total over time.								
3) Average persons per household for Rarotonga from 2011 census								
4) Assumes 95% of households connected.								
5) Estimated average daily consumption by tourists is 980 - 1,000 m3; this is adjusted for assumed supply from hotel collection of rainwater.								
6) Number of connections is estimated; to be adjusted when actual number available.B22								
7) Based on school enrolments of 2699 in 2013 plus 1,392 government and other agency staff.								
8) Included for reference only. Previous capital costs are treated as sunk costs and capital costs of the upgrade are not included in the tariff calculation								
9) Average change in the CPI for the period 2009 to 2013 was about 1.7%								
10) Depreciation on a) 2 vehicles at \$35,000 each, b) computer hardware, software, printers, servers, etc at \$150,000 c) system monitoring equipment, loggers etc. at \$100,000								
11) Not including labour costs, which are part of staff costs.								
12) Commercial customers from 2016; domestic and agriculture from 2017.								



# Appendix B – Estimate of SOE Staff Costs

Water Supply Cook Islands SOE Proposed Personnel and Personnel Budget													
Job Titles	No.	Role	SP10 Points	Band	Salary Range <sup>a)</sup>			Personnel Budget				Total Cost (max range)	Salaries Used <sup>d)</sup>
					Min - 85%	Mid - 100%	Max - 115%	Salary <sup>b)</sup>	Super <sup>c)</sup>	Total Salary	Total Cost		
Chief Executive Officer	1		1125	P	69,512	80,652	92,733	104,848	5,242	110,090	110,090	126,581	126,581
Personnel Assistant to CEO	1	supervisory	298	F	16,860	19,835	22,811	25,786	1,289	27,075	27,075	31,137	27,075
General Administration	1	clerical	124	A	9,125	10,271	11,417	13,352	668	14,020	14,020	15,584	14,020
<b>Manager, Finance and Customer Services</b>	1	managerial	594	K	34,104	40,123	46,141	52,160	2,608	54,768	54,768	62,982	62,982
Customer Service / Public Relations	3	customer services	187	C	11,160	13,130	15,098	17,069	853	17,922	53,767	61,826	53,767
Human Resources & Safety Officer	1	HR	286	F	16,860	19,835	22,811	25,786	1,289	27,075	27,075	31,137	27,075
Corporate Reporting, Procedures, Sector Liaison	1	risk and compliance	354	G	19,381	22,801	26,221	29,641	1,482	31,123	31,123	35,792	31,123
Budget and Finance	1	management accounting	498	J	29,664	34,899	40,134	45,369	2,268	47,637	47,637	54,783	47,637
Stores	1	storeman	198	C	11,160	13,130	15,098	17,069	853	17,922	17,922	20,609	17,922
<b>Manager, Asset Management</b>	1	managerial	619	K	34,104	40,123	46,141	52,160	2,608	54,768	54,768	62,982	62,982
<i>Water Supply O&amp;M Unit Head</i>	1	supervisory	507	J	29,664	34,899	40,134	45,369	2,268	47,637	47,637	54,783	47,637
Water Treatment Plant Management	1	non-supervisory	324	G	19,381	22,801	26,221	29,641	1,482	31,123	31,123	35,792	31,123
Networks O&M (pipelines)	4	field worker	152	B	9,728	11,445	13,161	14,879	744	15,622	62,490	71,859	62,490
Networks O&M (connections)	4	field worker	152	B	9,728	11,445	13,161	14,879	744	15,622	62,490	71,859	62,490
<i>Technical Services Unit Head</i>	1	supervisory	597	K	34,104	40,123	46,141	52,160	2,608	54,768	54,768	62,982	54,768
Systems Planning, Design and Project Management	2	planning / project management	404	H	22,274	26,205	30,135	34,067	1,703	35,770	71,540	82,269	71,540
Asset Management, Records, Performance & Risk Management	2	asset management	272	F	16,860	19,835	22,811	25,786	1,289	27,075	54,150	62,274	54,150
<b>TOTAL</b>	<b>27</b>										<b>822,443</b>	<b>945,231</b>	<b>855,362</b>

Notes:

a) Public Service Commission salary scale. Salary ranges reflect levels of competence for the position.

b) These salaries were set in 2006. Mid range salaries have been adjusted to reflect changes in the consumer price index which has a base of December 2006 = 100. In September 2014 the CPI stood at 130.23

c) Superannuation contributions are calculated at 5% of salaries (but NZ GSF members require a higher employer contribution of 12.1%)

d) Salaries based on maximum of salary range for CEO and two managers and on mid salary range for all other staff.

e) Meter readers (2) are not included here as SP10 points information not available. They are included with Administration expenses

## Appendix C – Miscellaneous Data

**Table 10: Number of Households by Size of Household**

Size of Household	Cook Islands	Rarotonga <sup>1)</sup>
1	784	566
2	991	715
3	708	511
4	655	473
5	518	374
6	310	224
7	164	118
8	97	70
9	59	43
10	29	21
11	25	18
>11	32	21
Total	4372	3154

Note: 1) Number of households for Rarotonga estimated by pro-rating from national data.

GHD

Level 3, 27 Napier Street

Freemans Bay

T: 64 9 370 8000 F: 64 9 370 8001 E: akllmail@ghd.co.nz

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# A Note on Revised Tariff Rates

The original tariff estimates did not include any costs for water treatment. The revised tariff rates in the following tables have been estimated, in the same way as in the original tariff report, but with an estimate for the cost of alum for coagulation included.

This note should be read in conjunction with Section 6 of the original tariff report. The tables below have the same table numbers, with the addition of “-A”, as the corresponding tables in the original report.

## Cost of Alum

The annual cost of alum as a coagulant is based on dosing rates of 60 gm/m<sup>3</sup> during 120 days per year and an average rate of 10 gm/m<sup>3</sup> for the remaining 245 days. Alum costs \$650 per ton in New Zealand and it is assumed that with transport and GST the cost in Rarotonga will be \$1,000 per ton. The estimate of the annual cost is given in the following table. Since there are many uncertainties around the actual level that will be required the total has been rounded up to \$10,000 per year for each 1,000 m<sup>3</sup>/day of production. For the average daily production of 8,500 m<sup>3</sup> this means the additional cost of alum will be \$85,000 per year.

The addition of coagulant will increase the costs used in the original tariff calculations by 5.7%.

### Cost of Alum for 1,000 m<sup>3</sup>

Dosage	kg/day	days/year	kg/year	Annual Cost
60 gm/m <sup>3</sup>	60	120	7,200	\$7,200
10 gm/m <sup>3</sup>	10	245	2,450	\$2,450
Totals		365	9,650	\$9,650

## Impact of the Additional Costs on Tariff Rates

Table 5-A shows the revised overall average tariff rates required to cover costs for the various free household allocations considered in the analysis. By comparison with the corresponding Table 5 in the tariff report it will be seen that the cost of alum increases these rates by between 3.7 cents/m<sup>3</sup> for the no free allocation case to 4.8 cents/m<sup>3</sup> for the free allocation of 400 litres per day for each household. As noted in the tariff report these average tariff rates are for reference only.

**Table 1-A: Average Tariffs for Selected Household Free Allocations (\$/m<sup>3</sup>)**

Household free allocation	2014	2017
None	0.710	0.719
200 litres/day	0.794	0.803
300 litres/day	0.843	0.853
400 litres/day	0.899	0.909

The impact of these increased costs is also relatively small on the rates required when agricultural consumption is assumed to be 500 m<sup>3</sup>/day. For all the cases considered (see Table 6-A) the increase for domestic tariff rates is either 3.7 cents/m<sup>3</sup> or 4.1 cents/m<sup>3</sup>. The tariff for agricultural consumption would increase by between 4.1 and 5.9 cents/m<sup>3</sup> and for the commercial sector rates increase by between 5.0 and 7.0 cents/m<sup>3</sup>.

The increase in tariff rates required when agricultural consumption is assumed to be 1,000 m<sup>3</sup>/day (Table 7-A) are within the same ranges as for the 500 m<sup>3</sup>/day case. The general conclusions in the tariff report with regard to the actual level of agricultural consumption and its impact on tariff rates for all sectors are not changed.

**Table 2-A: Tariff Rates for Various Household Free Allocations and Agricultural Consumption 500 m<sup>3</sup>/day (\$/m<sup>3</sup>)**

Category	Household Free Allocation		
	200 litres/day	300 litres/day	400 litres/day
Domestic <sup>1)</sup>	0.719	0.719	0.719
Agriculture	0.791	0.791	0.791
Commercial	1.200	1.350	1.550
Domestic <sup>2)</sup>	0.719	0.719	0.719
Agriculture	0.863	0.863	0.863
Commercial	1.170	1.350	1.520
Domestic <sup>3)</sup>	0.791	0.791	0.791
Agriculture	0.870	0.870	0.870
Commercial	0.960	1.160	1.350
Domestic <sup>4)</sup>	0.791	0.791	0.791
Agriculture	0.849	0.949	0.949
Commercial	0.949	1.120	1.310

Notes: 1) Domestic rate set at average tariff rate for no free allocation, agriculture rate is domestic +10%, commercial rate set to generate revenue surplus between 4.5% and 5% of operating costs.

2) As 1), but agriculture is domestic +20%

3) Domestic set 10% above average rate for no free allocation, agriculture rate is domestic +10%, commercial rate set to generate specified surplus. Rates aligned where commercial rate below specified agriculture rate.

4) As 3), but agriculture is domestic +20% (except for 200 litres/day free allowance where reduced to match commercial rate.)

**Table 3-A: Tariff Rates for Various Household Free Allocations and Agricultural Consumption 1,000 m<sup>3</sup>/day (\$/m<sup>3</sup>)**

Category	Household Free Allocation		
	200 litres/day	300 litres/day	400 litres/day
Domestic <sup>1)</sup>	0.719	0.719	0.719
Agriculture	0.791	0.791	0.791
Commercial	0.880	1.060	1.240
Domestic <sup>2)</sup>	0.719	0.719	0.719
Agriculture	0.840	0.863	0.863
Commercial	0.840	0.995	1.170
Domestic <sup>3)</sup>	0.764	0.791	0.791
Agriculture	0.764	0.830	0.870
Commercial	0.764	0.830	1.000

Notes: 1) Domestic rate set at average tariff rate for no free allocation, agriculture rate is domestic +10%, commercial rate set to generate revenue surplus between 4.5% and 5% of operating costs.

2) As 1), but agriculture is domestic +20% (except for 200 litres/day free allowance where reduced to match commercial rate.

3) Domestic set 10% above average rate for no free allocation, agriculture rate is domestic +10%, commercial rate set to generate specified surplus. Rates aligned where commercial rate below specified agriculture rate.

If the number of households connected to the system were only 90% of the total, then the commercial rates applicable in the initial case in each of Tables 6 and 7 (with 300 litres per day free allocation for households) would be \$1.46 and \$1.16, respectively. Similarly, if average household consumption reduced to 300 litres per person per day, and in this case assuming a free allocation of 200 litres per household per day, the commercial rates required for the initial cases above would be \$1.78 and \$1.47 per m<sup>3</sup>, respectively. If households made water savings at this level, however, an adjustment in the rates for all customer categories would most probably be required.

## 1.1 Impact for Households

The table below shows the revised estimates of monthly water bill for households of 4 or 8 persons with the various free allocation levels. The increases in monthly bills compared with the estimate in the tariff report are shown in brackets below the monthly amount for each case.

As noted in the tariff report, 72% of households (2,265) on Rarotonga have 4 persons or fewer and 97% have 8 persons or fewer. There are 786 households with 5 to 8 persons.

**Table 4-A: Cost of Water for Households (400 lpcd) (\$/month)**

Household Size	Domestic Tariff (\$/m <sup>3</sup> )	Household Free Allocation		
		200 litres/day	300 litres/day	400 litres/day
4 persons	0.719	30.20 (1.56)	28.04 (1.44)	25.88 (1.33)
	0.791	33.22 (1.72)	30.85 (1.60)	28.48 (1.48)
8 persons	0.719	64.71 (3.33)	62.55 (3.22)	60.40 (3.11)
	0.791	71.19 (3.69)	68.82 (3.57)	66.44 (3.44)