Business Case

Improving Water Security on Drop Island

November 2015

Acronyms

CDB	Caribbean Development Bank
DBS	Dohar Broadcasting Services
ECD	Eastern Caribbean Dollar
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HD	High Definition
HTS	Helen Television Systems
IDP	International Development Partner
imp gallon	Imperial gallon
IWaSP	International Water Stewardship Programme
IWRM	Integrated Water Resources Management
LoI	Letter of Intent
mgd	Mega gallon per day
MoA	Ministry of Agriculture
MoU	Memorandum of Understanding
MWASC	Miko Water and Sewerage Company Inc.
NRW	Non-Revenue Water
PPP	Public Private Partnership
PRV	Pressure Reducing Valve
PSI/F	Pounds per Square Inch/Feet
PVC	Polyvinyl Chloride
USD	United States Dollar
VPC	Video Production Company
WRMA	Water Resource Management Agency

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Executive Summary

This business case outlines how the 'Drop Island[1] Water Stewardship Partnership' will address current water security risks in the Castle area in the south of Drop Island. The drafting of the business case followed a thorough consultative process involving founding partners and a wide group of stakeholders and a review of water sector assessment reports.

The 'Drop Island Water Stewardship Partnership' is comprised of a the Miko Water and Sewerage Company Inc.– MWASC, the Bebida Ltd. and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), through its International Water Stewardship Programme (IWaSP).

Despite high rainfall, there are not enough storage facilities and associated water infrastructure in place in the Castle area to secure sufficient potable water throughout the year. The lack of water security is highlighted during intense torrential downpours occurring over short periods, extended dry periods (drought conditions) and other extreme weather events. This situation is anticipated to worsen based on climate change predictions for the Caribbean region. Investments in treated water storage facilities and other infrastructure for vulnerable rural communities are critically needed to build climate resilience and improve water security, especially for the Trigo, Caté Riveaux and Apaya communities.

The planned water infrastructure enhancements, in spite of their rather limited financial scope, will have clear socio-economic benefits to the above communities. They will also complement a large water supply project to upgrade the water supply infrastructure for the Castle area for which the Government of Drop Island has secured financing from the Caribbean Development Bank (CDB).

The anticipated outcomes proposed as part of this business case are an improved living standard of the respective communities and an improved climate resilient water supply system. The proposed infrastructure investments are based on the premise of a reduction of non-revenue water to 20% and - if possible - a recovery of the costs.

Based on the options analysis and costs and benefits of the proposed interventions, limited funds available, and recognition that further investigations will have to be carried out to determine the precise infrastructure needs for the Caté Riveaux and Apaya options before they can be implemented, it is recommended to start with the Trigo option.

[1] The names of the island and all places as well as all dates have been changed throughout to protect the anonymity of IWaSP partners. Any resemblance to other places is entirely accidental.

1 Description of the service needs

1.1 Water security challenges in the Castle area

Castle is located in the relatively flat coastal south of Drop Island and faces challenges associated with potable water availability. Despite high rainfall, there are not sufficient measures in place to secure potable water throughout the year, especially in the case of intense torrential downpours occurring over short periods, extended dry periods (drought conditions) and other extreme hydro-meteorological weather events. Climate change projections for Drop Island and the greater area based on Regional Climate Models predict this situation to worsen, resulting in the following impacts:

- Changes in surface and groundwater systems;
- Changes in water quality;
- Increased flooding;
- Increased droughts;
- Changes in water temperature;
- Changes in water chemistry;
- Increased water erosion and sedimentation; and
- Decreased freshwater availability due to saltwater intrusion.

Water security challenges are also related to the current old - and in some cases underdeveloped - water augmentation and supply systems. There is a backlog of maintenance of water supply infrastructure and inadequate investment in climate resilient infrastructure with the following consequences:

- High intensity long duration rainfall and extreme hydro-meteorological events or torrential rains compromising the country's raw water intake and treatment system;
- Flooding hazards associated with storms and intense torrential downpours damage the pipe network (mainly the raw water lines) and result in public water supply interruptions;
- Extended dry periods result in a low flow rate of the raw freshwater streams which reduce water availability resulting in a common occurrence of rationing and interruptions in the public supplies; and
- Compromised water quality due to sediment influx in periods of heavy rains and potential for contamination due to pressure drops in prolonged, dry periods.

1.2 Strategic imperative or outcome to address water security challenges

Water security is a top priority for Drop Island. To break the cycle of recurring water security challenges in Castle, a 'Castle Water Supply Redevelopment Plan' was commissioned by the Ministry of Finance, Security and Economy (MoFSE) which was jointly financed by the Caribbean Development Bank (CDB) and a GIZ-implemented program.

The underlying study points to a number of recommended interventions including:

- Water source augmentation through the upgrade of raw water intakes, relocation to higher elevations and increased abstraction;
- Increase the efficiency, effectiveness and capacity of water treatment facilities from 1.8 to 4.8 million gallon per day (mgd) to meet current and projected future (2033) demands;
- Leak detection and repair (replacement as needed) for raw water and treated water pipe network and distribution lines to reduce Non-Revenue Water (NRW);
- Enhance the treated water storage capacities for the supply of water to communities in and around the Castle area by the replacement of the 300,000 imp gallon storage tank which is in a state of disrepair, and installation of new storage tanks;
- Supplement existing treated water storage tanks in communities and provide buffer capacities that will reduce the incidence of disruptions in the public supplies during periods of drought, extreme weather events and disasters.

This study forms the basis for the Seventh Water (Drop Island Water Supply Redevelopment) Project – Drop Island. However, due to limited finances, the project cannot address all of the recommended interventions proposed by the MoFSE redevelopment study. Yet, investments in treated water storage facilities and other infrastructure of vulnerable, rural, communities (especially Trigo, Caté Riveaux and Apaya) are critically needed to build climate resilience and improve water security. These water infrastructure enhancements will have tangible benefits to the respective communities in terms of safeguarding potable water supply. They shall also complement the focal Castle Water Supply Redevelopment Project.

1.3 Drop Island Water Stewardship Partnerships' role in addressing water security challenges

In July 2015, the Miko Water and Sewerage Company Inc. (MWASC), the Bebida Ltd. and GIZ, through its International Water Stewardship Programme (IWaSP), signed a Letter of Intent (LoI) to establish a water stewardship partnership aimed at further improving water security for the Castle area and surroundings (see Annex I). Currently, a follow-up Memorandum of Understanding (MoU) is being developed, which includes details of the Drop Island water stewardship partnership. In summary, the partnership aims to:

- Identify short term no regret measures to improve water security in the Castle area;
- Collectively secure sustainable water supply for the community and industries located in the south of Drop Island in the long run; and
- Actively seek the engagement of communities and organizations, and other industries and water users in the region.

Within the context of the partnership, a rapid risk appraisal of hazardous events was carried out through a multi-stakeholder meeting in Castle on 30 August 2015 and measures related to buffering and resilience (e.g. treated water storage) were confirmed as the highest priority to mitigate water risks in the Castle area (see Tables below). Other measures to mitigate water risks relate to education and awareness, and to regulation and enforcement.

A key requirement established by all partners is that whatever intervention is going to be carried out, it must have immediate tangible impact on the ground. To ensure this impact is easily understood, a comprehensive communication plan that engages stakeholders must be in place too (see Annex II).

Outcome Group Discussions on Risk Assessment and Identification of Measures to mitigate Risks

Hazardous Event	Risk	Measures to mitigate the risk	
		Group 1	Group 2
Disruption of water supply systems and wastewater treatment facilities during extreme flood disasters	Very High	1. Resilience of water distribution system 2. Buffering (Building of buffer storage). 3. Redundancy.	1. To invest in more storage water facilities of treated water 2. More investment in portable water treatment plants 3. Investment in more robust equipment or facilities that could withstand disasters
Insufficient potable water for human consumption	High to Very High	1. Increase Storage capacity 2. Increase Raw water intake 3. Encourage and educate on Rainwater Harvesting	1. Increase distribution to households to include trucking
Economic losses due to pipe leakages	Moderate to Very High	1. Develop a Phase Replacement program 2. Build Resilience in the network. 3. Educate consumers – awareness, reporting, etc. 4. Conduct a Water Balance 5. Improve Quality Control and Monitoring 6. Standardization of Methods and Materials 7. Installation of Pressure regulators	1. Consumers and MWASC to be more vigilant in terms of detecting leaks and reporting 2. Investment in rebuilding poor and old systems 3. Possible investment in GIS system for efficiency 4. Construction companies to work with MWASC for preventative measures
Slow implementation of adaptation measures to climate variability and climate change	Very High	1. Reforestation 2. Education 3. Implementation of Watershed Management Plan (include River bank stabilization) 4. Increase water catchment areas. Resilience.	1. Government/ministry to take a more proactive approach to developing mitigating measures and incentivising and legislating for instance tax breaks on rain water harvesting, fines on industries disposing of unwarranted water waste. 2. Public education, role of the MoA in helping farmers exercise good farming practices
Increased costs for pre-treatment of water to obtain desired water quality	High to Very High	1. Relocate intakes 2. Enforce law 3. Compulsory acquisition of surrounding lands with source of pollution 4. Effective Zoning	1. Reforestation, minimize or irradiate activities that affect MWASC's intake. 2. Develop partnerships, soft MOU's with stakeholders and other businesses to cushion costs needed for pre-treatment. 3. Preservation of water shed 4. The use of Rain water harvesting for non-portable consumption for e.g. irrigation

Outcome Group Discussions on Risk Assessment and Identification of Measures to mitigate Risks

Hazardous Event	Risk	Measures to mitigate the risk	
		Group 1	Group 2
Supply of poor quality water to industries / breweries	Moderate to Very High	1. Buffer Storage 2. Network resilience 3. Education	1. Government to provide incentivizes industries investing in treatment facilities. 2. Responsible agencies to run frequent water testing measures to ensure MWASC's water quality production is always of the required standard
Competing demands for water for domestic water supply and / or industry applications	Very High	1. Education	1. Increasing Rain Water Harvesting , for example, farmers building reservoirs or ponds on farms for irrigation purposes 2. Better farming practices 3. Policy/regulation to guide users to invest in rain Water Harvesting (fines, etc.)
Wrong pricing of water	Low to Very High	1. Education- to reduce water consumption 2. Reduce water loss in distribution systems 3. Develop Regulatory framework 4. Investigate measures to reduce consumption.	1. Ensure enforcement, public announcements as a reminder
Inadequate treatment of wastewater resulting in poor quality discharge of effluent resulting in harm to the environment	Very High		1. Tax penalties, fines etc. 2. Policy/regulation 3. Public education 4. Enforcement 5. New businesses to demonstrate water waste systems for approval.
Pollution of water sources due to inadequate regulation	Very High	1. Establish and implement Regulatory framework.	2. Regulation 3. Public education 4. Fines, Tax penalties

2 Options Analysis and Evaluation

A second multi-stakeholder water partnership meeting that took place in Castle on 3 October 2015, confirmed the critical need for additional treated water storage tanks and supplementary infrastructure for the vulnerable communities of Trigo (option 1), Caté Riveaux (option 2) and Apaya (option 3). The need for additional storage is related to operational needs but also to provide a level of resilience (buffer storage capacity) in cases of short term low flow conditions or temporary supply problems from weather events that may or may not be caused by climate related impacts.

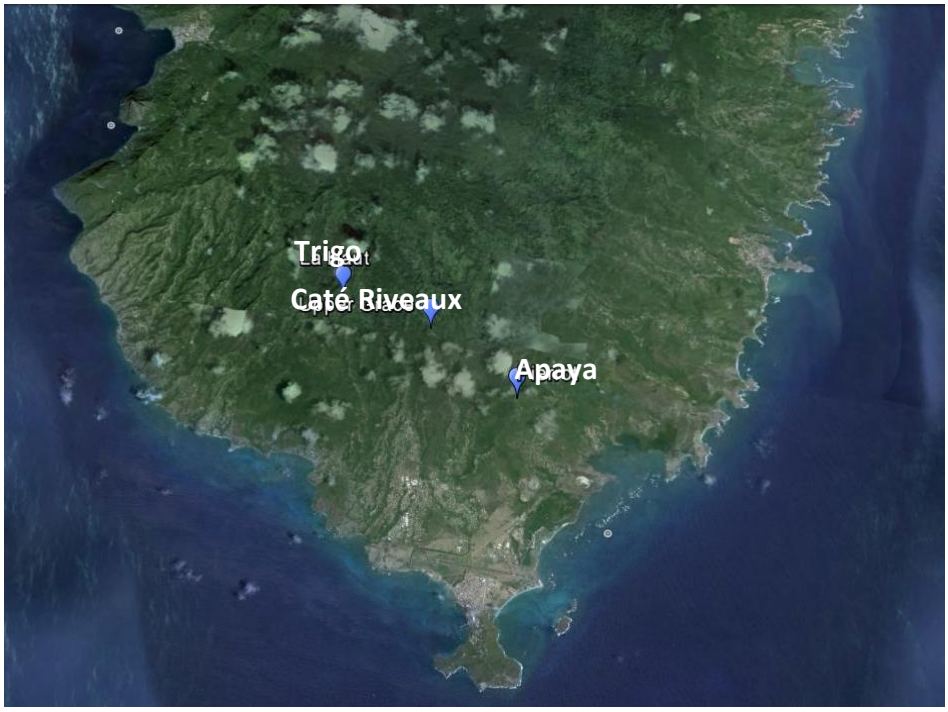


Figure 2.1: Location of Trigo, Caté Riveaux and Apaya

2.1 Presentation of the options

For each of the three options the size of the treated water storage was determined based on the following assumptions:

- Securing treated water storage in addition to existing storage up to the year 2033
- Annual population growth of 1.3%
- Water use/capita/day of 90 litres[2]
- Storage buffer of up to 3 days in cases of water supply breakdown

In addition, calculations were carried out for the following scenarios:

- Treated water storage needs in addition to existing storage assuming non-revenue water of the distribution network of 20 to 50%
- Maximum permissible non-revenue water of the mains and distribution network for treated water storage tanks of different sizes

Note that the above operational needs do not include fire flow delivery considerations due to the significant capital cost required for upgrades of the water supply system of the three communities.

[2] In 2012/13 billed water was 54, 66 and 69 litres/capita/day for Trigo, Caté Riveaux and Apaya respectively (MWASC)

2.1.1 Option 1: Trigo

The Trigo service area provides domestic water supply to 1,269 inhabitants (2013) over a total service area of 324 hectares (Figure 2.2). The distribution piping mainly consists of 100mm diameter PVC. The Trigo service area ranges in elevation from 257 m amsl, at the existing Trigo storage tank, to 125m amsl at the Chinango Pump Station, which supplies the Trigo storage tank. The Donaire system which feeds the Trigo community, is interrupted several times a month for 24 to 48 hours as a result of clogged intake, turbid water or low flow.

Given the existing storage of 227 m^3 (= 50,000 imp gallon), the additional treated water storage needed - when there is no leakage, nor illegal use from the distribution network - would be 47,583 imp gallon[3] in the year 2033. However, the size of the additional treated water storage tank also depends on the amount of non-revenue water including leakage (NRW) from the distribution network. Assuming that 20% is the absolute economic cut-off point or the acceptable upper level for non-revenue water in the year 2033, additional storage of ~75,000 imp gallon[4] would be adequate. Figure 2.3 shows the threshold value for non-revenue water, or maximum permissible non-revenue water, from the main and distribution network in the course of time below which the water supply to the community is secured for storage tanks ranging from 50,000 to 100,000 imp gallon.

A leak detection and leak reduction programme analogous to the one started in January 2015 in the north of Drop Island by the GIZ program (incl. water balance study) shall be put in place by MWASC to ensure that the threshold value for non-revenue water is not exceeded, and preferably such that it is reduced soonest to the acceptable figure of 20%.

To achieve the service standards in Trigo, the following infrastructure is recommended (MoFSE; MWASC):

- Installation of 1 – 100mm diameter Pressure Reducing Valve (PRV) and 1 – 50mm diameter PRV
- Installation of necessary PRV's at service connections
- Jockey pump to service the southern quadrant of Pressure Zone #1
- One 4"bulk flow meter
- Electros and telemetry systems to connect pump and tanks
- Additional treated water storage of ~75,000 imp gallon, or ~341 m^3 (see Annex III)

Treated water storage – Trigo

[3] 1,269*1.013$^{(2033-2013)}$*90*3/4.55-50,000=47,583 imp gallon

[4] 1,269*1.013$^{(2033-2013)}$*90*3*100/(4.55*(100-20))-50,000=71,979 imp gallon

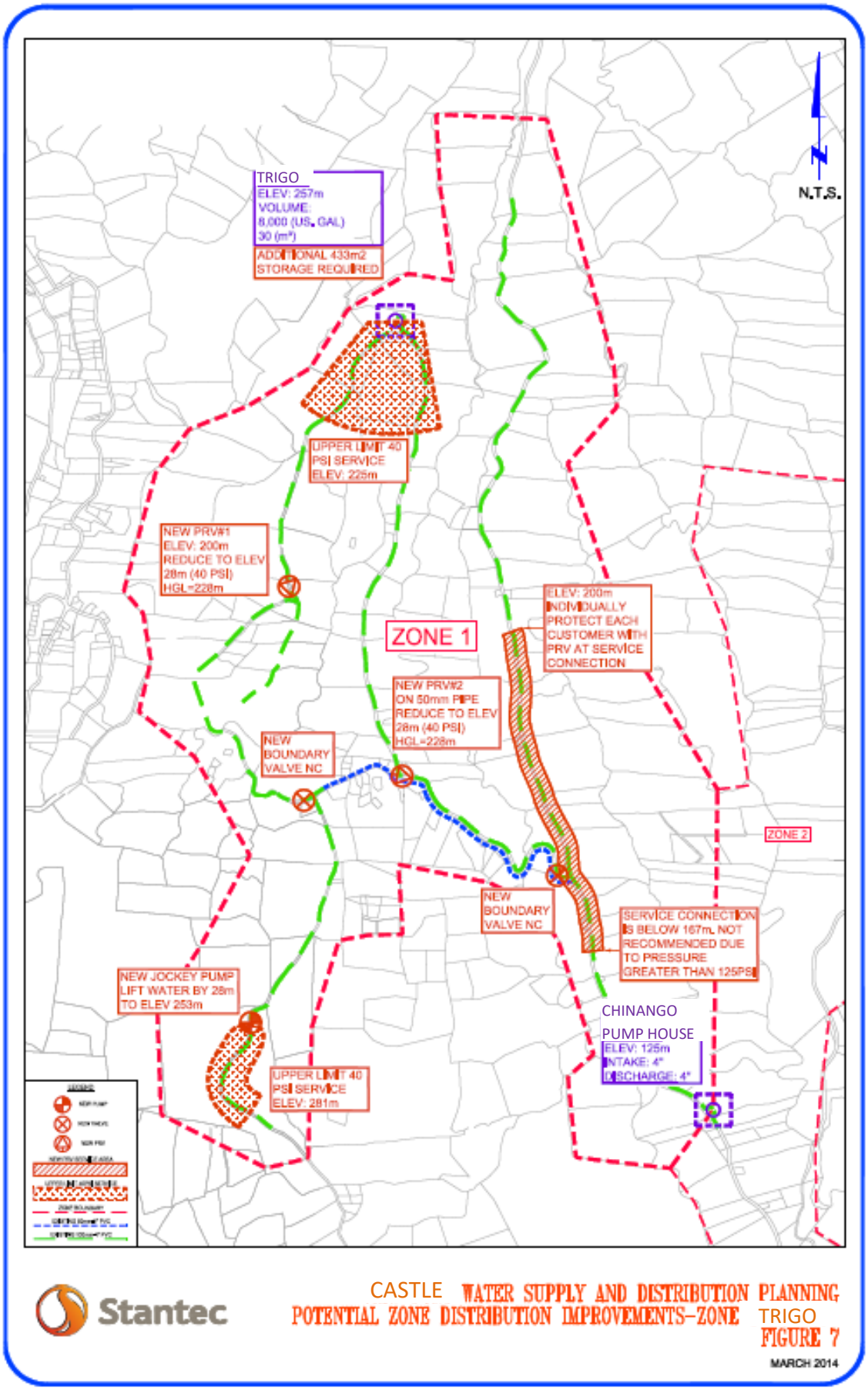


Figure 2.2: Layout of water supply distribution network Trigo

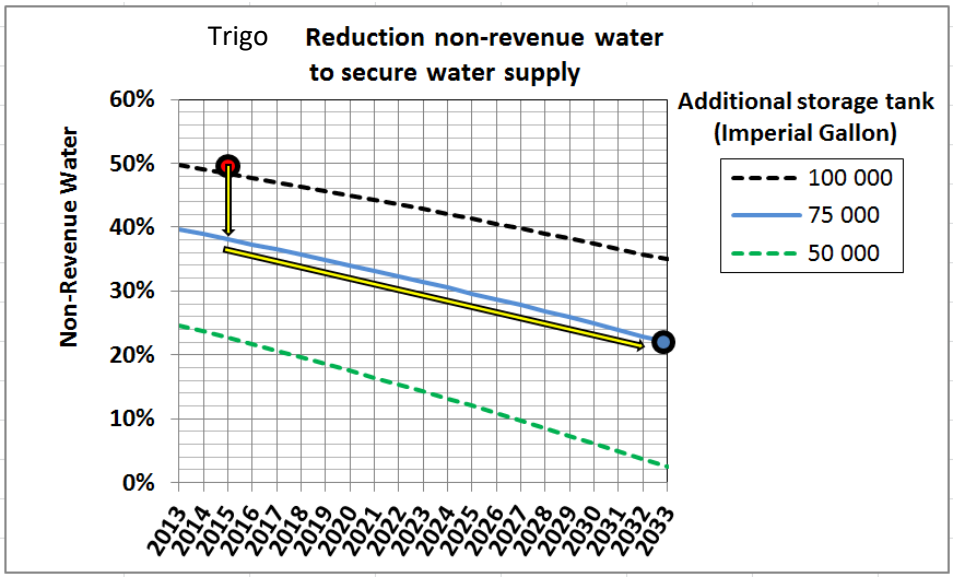


Figure 2.3: Non-Revenue Water threshold values for different additional storage for Trigo

Example
If the NRW is 50% in 2015, then for an additional 75,000 imp gallon tank to secure water supply to the present population, NRW has to be reduced by 30,000 imp gallon or from 50% to 38% (Figure 2.3; follow the arrow from the red dot). Thereafter, a yearly reduction of NRW of 1% would be sufficient to meet the target of 20% by 2033 (blue dot in Figure 2.3).

2.1.2 Option 2: Caté Riveaux

The Caté Riveaux service area provides domestic water to a population of 1,719 inhabitants (2013) over a total service area of 423 hectares (Figure 2.4). The distribution piping mainly consists of 100mm diameter PVC with a 150mm diameter travelling down the center of the pressure zone, which delivers water to customers down to and across a major river. The Caté Riveaux service area ranges in elevation from 209m amsl, at the Caté Riveaux storage tank, to 20m amsl at the Castle River crossing. The 150mm diameter supply main commences at elevation 162m amsl and transfers water to the elevation of 20m amsl at the river crossing and back up to elevation 50m west of the river crossing. The Donaire system which feeds the Caté Riveaux community, is interrupted several times a month for 24 to 48 hours as a result of clogged intake, turbid water, or low flow.

Given the existing storage of 227 m^3 (= 50,000 imp gallon)[5], the additional treated water storage - when there is no leakage from the distribution network - would be 82,188 imp gallon. However, the size of the additional treated water storage tank also depends on the amount of non-revenue water including leakage from the distribution network. Assuming that 20% is an acceptable figure for non-revenue water in the year 2033, additional storage of ~120,000 imp gallon would be adequate. Figure 2.5 shows the threshold value for non-revenue water, or maximum permissible non-revenue water, from the distribution network in the course of time below which the water supply to the community is secured for storage tanks ranging from 90,000 to 150,000 imp gallon.

Also for Caté Riveaux, a leak detection and leak reduction programme shall be put in place by MWASC to ensure that the threshold value for non-revenue water is not exceeded, and preferably such that it is reduced soonest to the acceptable figure of 20%.

To achieve the service standards in Caté Riveaux, the following infrastructure is recommended (MoFSE):

- Upgrade of 1050m of existing 100mm diameter distribution main to 200mm diameter
- Installation of 4 – 150mm diameter PRV's
- Installation of necessary PRV's at service connections
- One 4" bulk meter
- Electros and telemetry systems to connect pump and tanks
- Additional treated water storage of ~120,000 imp gallon, or ~545 m^3 (see Annex III)

Water storage – Caté Riveaux

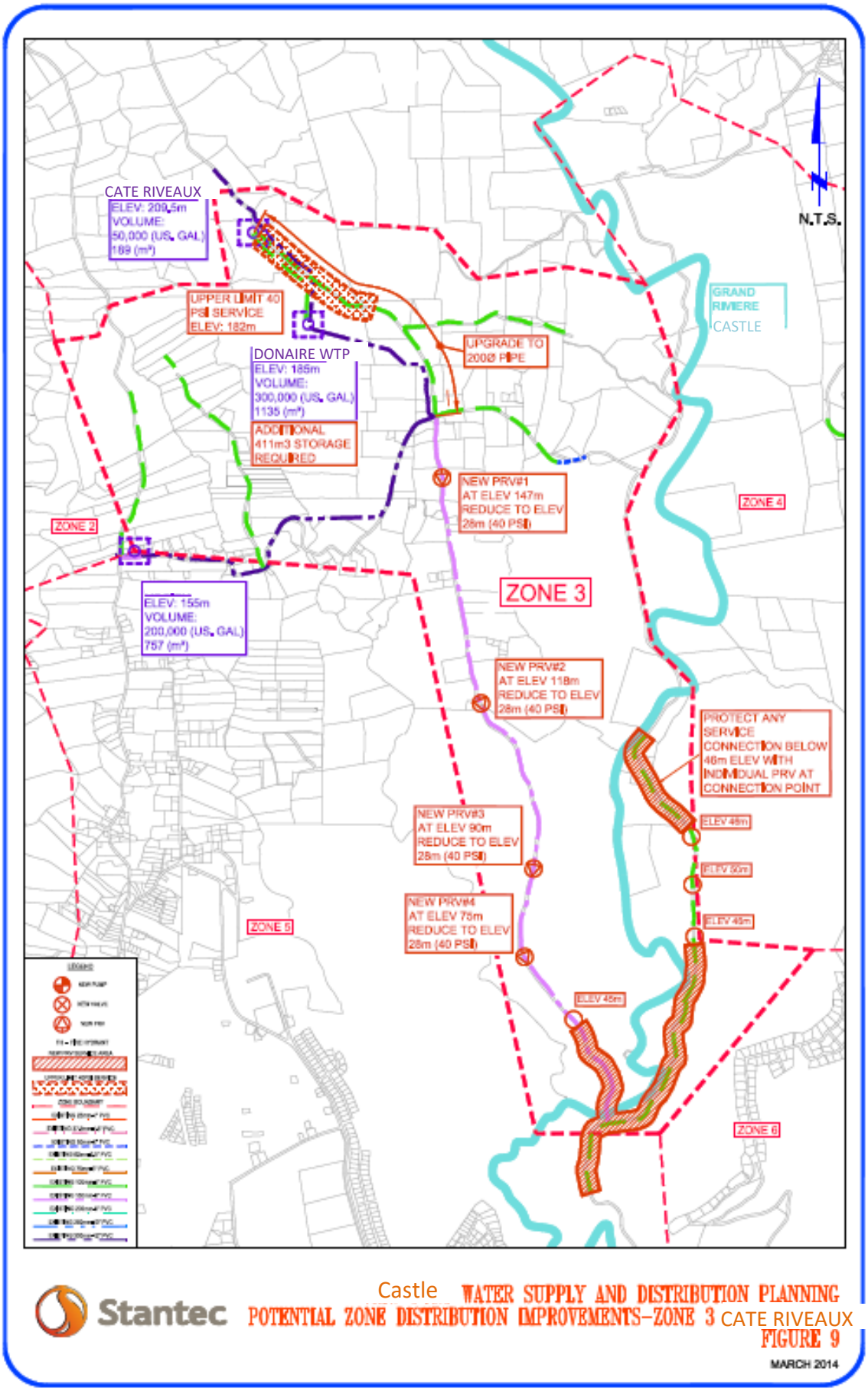


Figure 2.4: Layout of water supply distribution network Caté Riveaux

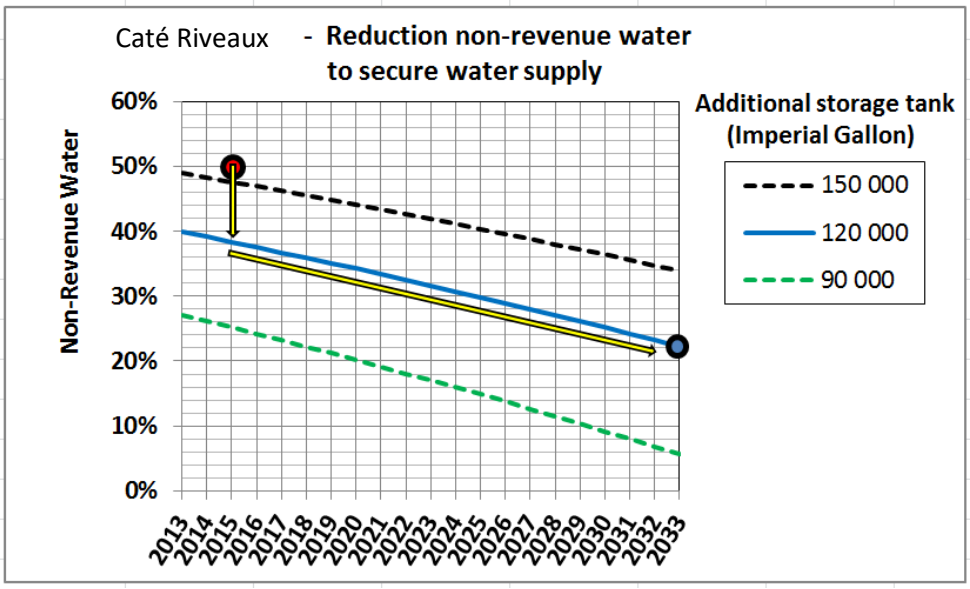


Figure 2.5: Non-Revenue Water threshold values for different additional storage for Caté Riveaux

2.1.3 Option 3: Apaya

The Apaya service area provides domestic water to a population of 1485 inhabitants (Figure 2.6). The existing storage tank is dysfunctional, so residents are instead supplied directly from the water main in Lana Roca. The lack of a buffer means that any interruption of service due to clogged intake, turbid water, or low flow leads to a water outage. The distribution piping mainly consists of 100mm diameter PVC with a small section of 37.5mm diameter located in the middle of the pressure zone. The Apaya service area ranges in elevation from 254m amsl, at the old Apaya storage tank, to 100m amsl in the lower areas.

The Apaya (~60 people) is about 300 yards (~275m) from the last water main. The residents have no direct (piped) water supply and strictly rely on a relatively small and unreliable spring water source. The community only received electricity one and a half years ago and many people still do not have access.

Treated water storage when connected to the main and when there is no leakage from the distribution network should be 123,344 imp gallons. However, the size of the treated water storage tank also depends on the amount of non-revenue water (including leakage) from the distribution network. Assuming that 20% is an acceptable figure for non-revenue water in the year 2033, additional storage of ~155,000 imp gallon would be adequate. Figure 2.7 shows the threshold value for non-revenue water, or maximum permissible non-revenue water, from the distribution network in the course of time below which the water supply to the community is secured for storage tanks ranging from 125,000 to 185,000 imp gallon.

For Apaya, additional infrastructure is needed to connect the main pipe to the treated water storage tank. As for the other communities, a leak detection and leak reduction programme shall be put in place by MWASC to ensure that the threshold value for non-revenue water from the distribution network is not exceeded, and preferably such that non-revenue water is reduced soonest to the acceptable figure of 20%.

To achieve the service standards in Apaya, the following is recommended (MoFSE):

- Design and implement a cost effective water supply system (incl. 3.3 km pipelines connecting the main water supply to the new storage tank and Apaya community and 2 pump stations)
- One 4” bulk meter
- Electros and telemetry systems to connect pumps and tank
- New treated water storage of ~155,000 imp gallon, or ~705 m^3 (see Annex III)



Dysfunctional water storage – Apaya / Washing and drinking water from unreliable spring water source

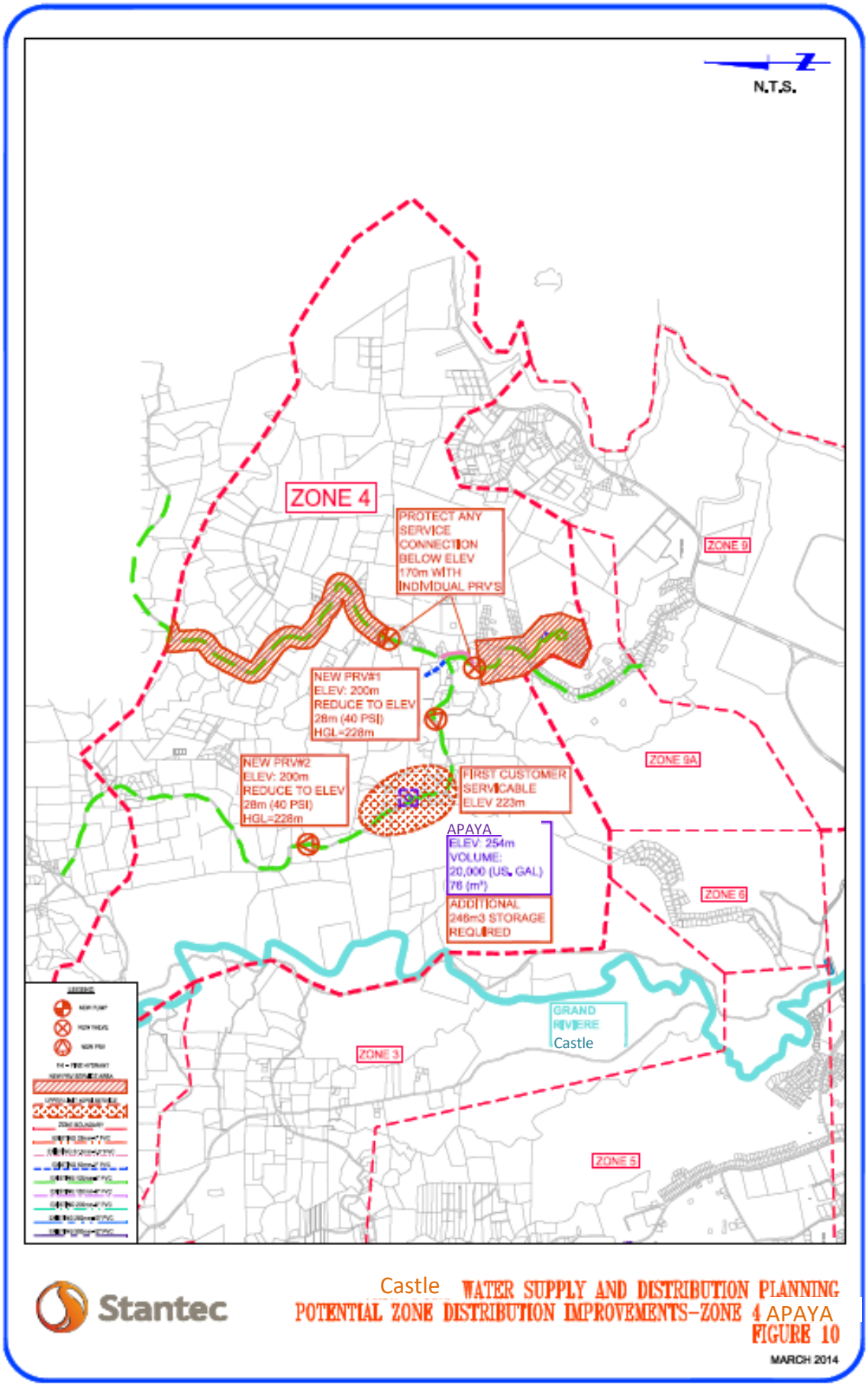


Figure 2.6: Layout of water supply distribution network Apaya

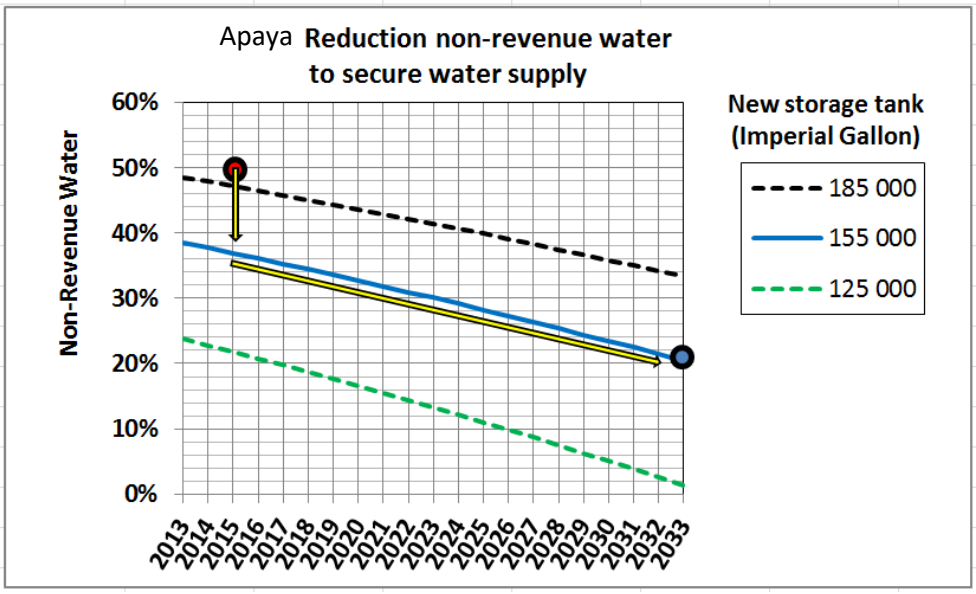


Figure 2.7: Non-Revenue Water threshold values for different storage for Apaya

2.2 Options analysis

At the multi-stakeholder water partnership meeting of 3 September 2015, the three options, i.e. investment in treated water storage facilities and other infrastructure, for the Trigo, Caté Riveaux and Apaya communities, were analysed in further detail using a multi-criteria decision support framework (DCLG, 2009).

2.2.1 Criteria for the analysis

In plenary, the following set of criteria for the options analysis was formulated:

- Need for increased access to potable drinking water (improved health conditions – especially women, children, and the most vulnerable);
- Reduced duration of water supply interruptions during extreme events in communities most at risk;
- Improved resilience during extreme conditions (natural or man-made);
- Minimum impact on ecological/environmentally sensitive areas;
- Building on existing initiatives / promotes further investment;
- Security in supply for productive use of water and increased economic opportunities; and
- Benefits to watershed and coastal management.

Highest importance was given to increased access to potable drinking water, shortening of water supply interruptions, improved resilience during extreme conditions and to minimum impact on ecological/environmentally sensitive areas.

2.2.2 Comparative analysis of the options and risks

The stakeholders were divided into two groups to analyse the three options against the criteria, and to undertake a comparative analysis. Table 2.1 summarizes the outcome of the group discussions.

Table 2.1: Comparative analysis of the options and risks

Criteria	Weight	Normalised	GROUP 1			GROUP 2		
			Trigo	Caté Riveaux	Apaya	Trigo	Caté Riveaux	Apaya
Increased access to potable drinking water (improved health conditions – especially women, children, and the most vulnerable)	100	15.7%	12%	12%	16%	16%	16%	16%
Shortening duration of water supply interruptions during extreme events in communities at most risk	100	15.7%	11%	11%	16%	8%	8%	16%
Improved resilience during extreme conditions (natural or man-made)	100	15.7%	11%	11%	16%	8%	8%	16%
Minimum impact on ecological / environmentally sensitive areas	100	15.7%	6%	6%	13%	16%	16%	16%
Building on existing initiatives / promotes further investment	90	14.2%	14%	14%	14%	9%	9%	9%
Security in supply for productive use of water and increased economic opportunities	80	12.6%	10%	10%	10%	4%	3%	9%
Benefits to watershed and coastal management	65	10.2%	5%	5%	5%	5%	5%	10%
Total	635	100%	**69%**	**69%**	**89%**	**65%**	**64%**	**91%**

The Apaya option scored highest (89 & 91%) followed by the Trigo(69 & 65%) and the Caté Riveaux (69 & 64%) options. The impact of the measures on the local communities is expected to be highest in Apaya, followed by Trigo and Caté Riveaux.

However, and as discussed previously, in the case of Apaya, additional infrastructure is needed next to the treated water storage tank to supply water to the tank as well as to distribute the water to the community. Although participants did not conclude on the additional infrastructure needed for Apaya, it was agreed that a longer timeframe and more money is needed for the Apaya option than for the Trigo and Caté Riveaux options.

2.3 Costs and benefits of the options

In 2014, the the MoFSE through a consultancy, assessed costs and benefits of the Castle potable water supply in terms of quantity and quality. Water supply to the Trigo, Caté Riveaux and Apaya communities is part of the Castle water supply system. Infrastructure development will alleviate the following problems (MoFSE):

- The intermittency of water supply, which forces many residents to rely on other sources for water such as bottled water
  - Not all people, however, can afford the added cost of bottled water and are forced to rely on unsafe alternatives such as untreated rainwater or stream flow
  - Recycling facilities are insufficient and bottles are often disposed of inappropriately resulting in blocked drains that cause flooding, thus creating further potable water issues
- Excessive time required to access water, thereby inhibiting community members, particularly women and children, from maintaining employment or school enrollment
- School may have to be cancelled due to inadequate water supply at the school itself

The MoFSE report includes a detailed account of the issues and challenges regarding the water availability and water supply to the Castle population including the respective communities (e.g. social impact study including household surveys; climate change assessment; emergency management plan and an environmental scoping study). The economic benefits to the communities of a secured water supply are through reduced bottled water purchases and an expected decrease in Acute Gastroenteritis episodes. It should be noted that MoFSE report does not use the revenue of extra income for MWASC from increased water sales in their cost-benefit analysis. In our opinion, however, this is the only direct benefit to get return on investment. In the subsequent cost-benefit calculations we have only used this revenue assuming that the customers will pay for the extra water consumed.

The cost for implementing the different options is directly related to the size of the treated water storage tanks and infrastructure. The investments for the treated water storage tank and infrastructure for Trigo is estimated at 150,000 USD, for Caté Riveaux 175,000 USD, whereas the investment for Apaya is estimated at 500,000 USD. By including a safety contingency of 20%, the investments amount to 180,000 USD for Trigo, 210,000 USD for Caté Riveaux and 600,000 USD for Apaya. If all three options were to be implemented in one phase, a reduction of the total price of 10% is assumed, considering that tendering a triple sized project will trigger companies to lower prices based on less overhead costs. Table 2.2 summarises the annual costs and benefits of the investments as follows:

- Annual costs:
  - Depreciation of the investment is taken over a time period of 15 years, which is common for infrastructure projects like this one;
  - Interest is considered 2% of the capital costs, based on the existing 2% loan from the water and sewerage company with the CDB;

- Maintenance of this kind of infrastructure (treated water storage tank) normally would amount to 3-4% of the capital costs. Moving parts, like pumps, in industrial environments have on average 4-5 % maintenance costs, while non-moving parts have 2-3 % maintenance costs. We have included extra maintenance costs in order to repair leakages from the distribution network making a total of 5%.

- Annual benefits:
  - Revenue from extra water sales based on (i) MWASC's statement of operations as at 31 Oct. 2013: one year 39,629,034 ECD (=14,677,420 USD) revenue from water sales – it is assumed that the revenue is proportional to the population size and increases with the same compounded growth rate of 1.3% per year and (ii) current number of days of water supply interruption per year, or water outage of 108 days for Trigo, 80 days for Caté Riveaux and 108 days for Apaya (MWASC).

Table 2.2: Costs and benefits of the investments

		Trigo[1] (180,00 USD)	Caté Riveaux[2] (210,000 USD)	Apaya[3] (600,000 USD)	3 options at once (928,125 USD)
Annual costs USD)	Depreciation	12,000 USD	14,000 USD	40,000 USD	59,400 USD
	Interest (2%*0.5)	1,800 USD	2,100 USD	6,000 USD	8,910 USD
	Maintenance (5%)	9.000 USD	10,500 USD	30,000 USD	44,550 USD
Annual benefits (USD)	Revenue from extra water sales	36,315 USD	36,439 USD	45,902 USD	118,657 USD

[1]Approximate cost of the tank for Trigo: 125,000 USD and up to 25,000 USD is available for site prep. & recommended additional infrastructure except for PRVs.

[2]Approximate cost of the tank for Caté Riveaux: 150,000 USD and up to 25,000 USD is available for site prep. & recommended additional infrastructure. Not included in this budget are the expenses for an upgrade of 1050m of existing 100mm diameter distribution main to 200mm diameter and installation of 4 – 150mm diameter PRV's and other PRVs at connection points.

[3]Approximate cost of the tank for Apaya: 180,000 USD; 60,000 USD for 2 pump stations and up to 260,000 USD for site prep., pipelines and recommended additional infrastructure except for PRVs.

Cost recovery of the investments, assuming that all the customers will pay for the extra water consumed, for all three options at once (annual benefits minus costs) would occur at a depreciation over 15 years; individually it would take 8 years for Trigo, 10 years for Caté Riveaux, and 35 years for Apaya. Obviously, if customers do not (need to) pay or contribute only a fraction of the assumed revenue from the extra water consumption, the investments cannot be recovered. It should be noted that further investigations will have to be carried out to determine the precise infrastructure needs for the Caté Riveaux and Apaya options.

3 Justification and Recommendation

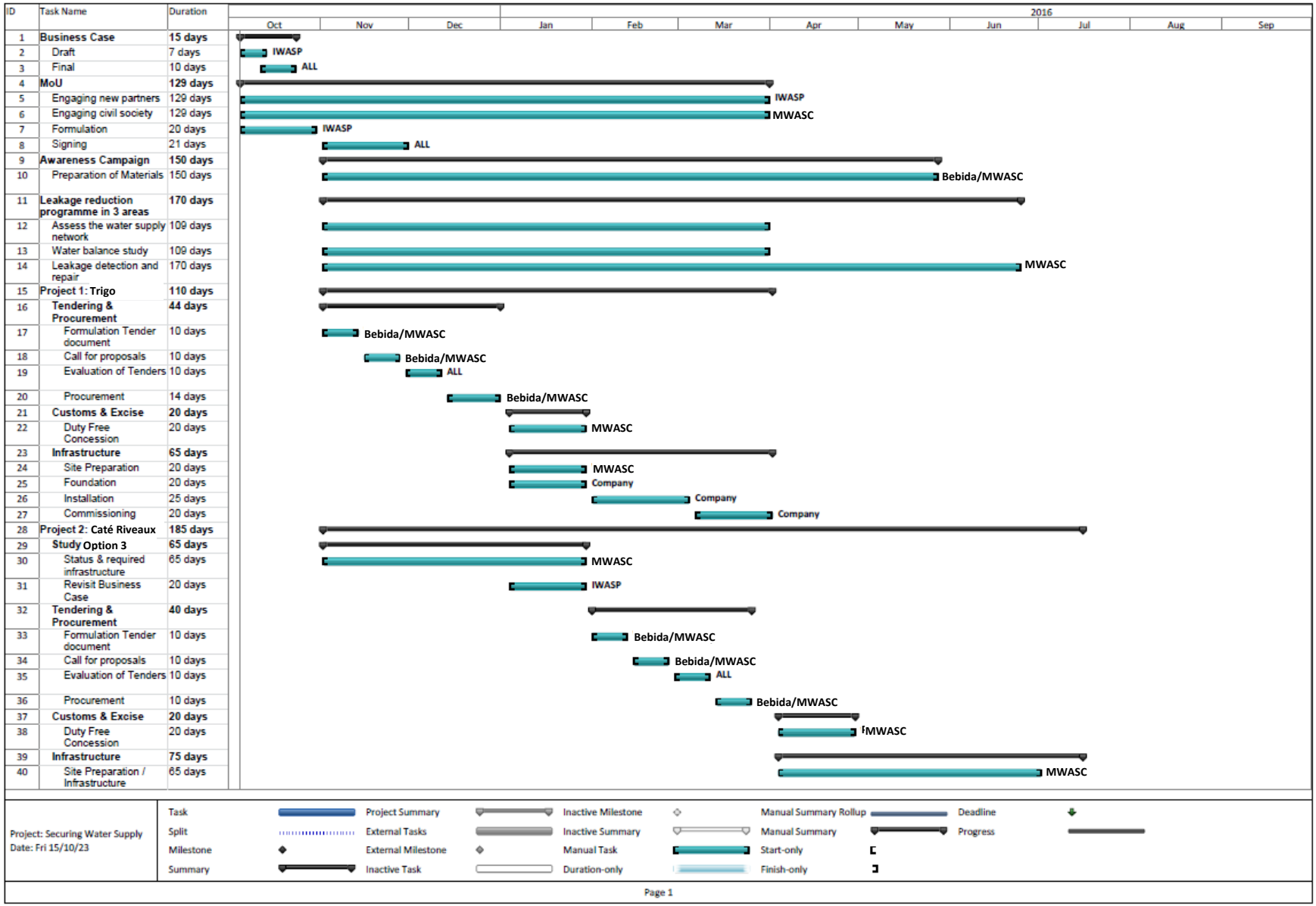
All parties involved in the partnership agree that action should be taken as soon as possible to increase the treated water storage in the Trigo, Caté Riveaux and Apaya communities for both operational needs and to build resilience (buffer) to the impacts of climate variability and climate change. Recent examples of the devastating impact of climate extremes on water supply oh islands in the Caribbean are testimony to the urgency for action.

Clearly, there are several, non-financial, reasons, mentioned in chapter 2, that justify improvement of a secure water supply and thereby raising the socio-economic conditions of the at present vulnerable rural communities in the Castle area. It should be noted that also the Bebida Ltd. is involved in this partnership with no immediate profit intentions other than safeguarding her long-term water supply chain and also to live up to her corporate social responsibility.

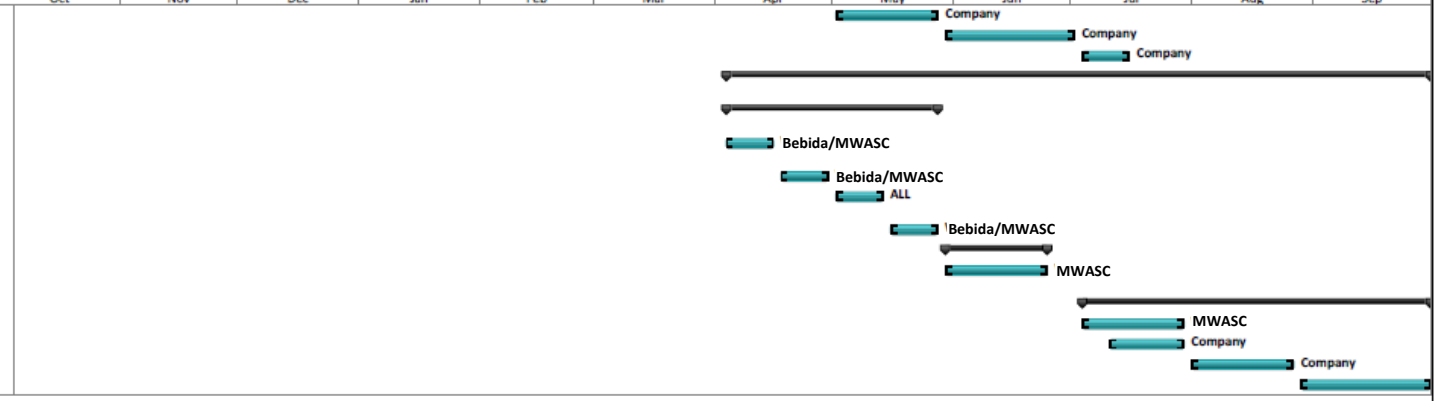
The expected average annual income by MWASC related to the increase of water supplied, assuming that all the customers will pay for the extra water consumed, can be estimated at 36,315 USD for Trigo, 36,439 USD for Caté Riveaux and 45,902 USD for Apaya over a depreciation time of the investments of 15 years (see Section 2.3). The positive effect of reducing non-revenue water is directly translated into a financial benefit of using fewer chemicals for the treatment of water. This effect, however, is expected to be relatively small and has not been accounted for in the calculation of benefits. The extra income from additional water supply and from reducing non-revenue water shall be administered and set aside for future investment of interventions through the partnership.

Based on the options analysis and costs and benefits of the interventions as discussed in chapter 2, the limited availability of funds, and the recognition that further investigations will have to be carried out to determine the precise infrastructure needs for the Caté Riveaux and Apaya options before they can be implemented, it is recommended to start with the Trigo option.

4 Implementation and Timing



ID	Task Name	Duration
41	Foundation	20 days
42	Installation	25 days
43	Commissioning	10 days
44	**Project 3: Upper Grace**	**130 days**
45	**Tendering & Procurement**	**40 days**
46	Formulation Tender document	10 days
47	Call for proposals	10 days
48	Evaluation of Tenders	10 days
49	Procurement	10 days
50	**Customs & Excise**	**20 days**
51	Duty Free Concession	20 days
52	**Infrastructure**	**65 days**
53	Site Preparation	20 days
54	Foundation	15 days
55	Installation	20 days
56	Commissioning	25 days



Project: Securing Water Supply
Date: Fri 15/10/23

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

ANNEX I: The Water Stewardship Partnership

1 Background

Freshwater is a fragile, finite and vulnerable resource vital to human, economic and environmental sustainability on Drop Island and determines national prosperity and quality of life. There is more than adequate rainfall on Drop Island for current consumption including that required for household, agricultural, commercial and other uses. However, the availability of water is not evenly distributed in space and time and there are also only limited water storage facilities available. Therefore, Drop Island suffers from periods of floods and drought, resulting in water shortages and poor water quality. In the future this situation is bound to worsen due to increasing demands and climate change. Action is needed to meet both short term demands and long term water security.

2 Drop Island Water Stewardship Partnership

In this context, the Government of Drop Island invited private businesses and International Development Partners (IDP) to assist in this vital endeavor. Miko Water and Sewerage Company Inc. (MWASC), the Bebida Ltd. and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) responded to this call to explore the possibility of developing novel types of development partnerships in the water sector in order to possibly mobilize additional human, technical and financial resources.

The *Miko Water and Sewerage Company Inc.* (MWASC) is the national utility in charge of water supply services. Lack of adequate storage capacity and declining water quality are negatively affecting the ability of the company to provide adequate potable water supplies. This leads to interruptions/disruptions in the public water supplies during extended dry periods and in times of extreme flooding. The resulting water outages, which are mainly due to damages to the pipe network, blockage of raw water intakes and incapacitated treatment facilities due to excessive sedimentation, impact negatively on the productivity of all customers (domestic users, business establishments). In the face of these annual/seasonal challenges, MWASC is committed to improve its services, continue to meet the daily water demands of customers and champion endeavors towards water security on Drop Island. The provision and access to safe, potable and adequate supplies of water is critical to achieving the sustainable development goals of the island and is the engine of growth and national development.

The *Bebida Ltd*. is an industrial enterprise that has been operational on Drop Island for many years. The enterprise continued to increase its production to meet the demands of local and export markets. However, operations are sometimes affected by supply interruptions and water quality issues associated with weather and climatic conditions. These challenges are expected to increase in frequency and intensify as a result of the climate predictions and projections for the island. The company is committed to build resilience to climate change in its operation on the island, demonstrate corporate responsibility by contributing to water security and by extending the well-being of the entire community in the southern parts of the island.

The *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) is a federal enterprise supporting the German government in achieving its objectives in the field of international cooperation for sustainable development. GIZ, through its International Water Stewardship Programme (IWaSP), aims towards:

- *Sustainable impacts*. They strive to work most strategically and effectively for the highest and most sustainable impacts on water security.
- *Shared benefits*. The outcomes of the partnerships benefit society, including its vulnerable members while enabling businesses to create value through sustainable operations.
- *High integrity*. They aspire to the highest integrity standards, ensuring transparency, accountability, inclusiveness.

- *Local capacity*. They always work to build the ownership and capacity of local actors to develop their own appropriate and lasting solutions.
- *Good governance*. They support the development and implementation of public policy with the mandated authorities and while encouraging multi-stakeholder engagement in water management.
- *Tailored innovation*. They encourage innovative partnership approaches and tools tailored to local needs, to help overcome traditional barriers to action in the water sector.
- *Open learning*. They openly share their lessons, practices and tools, to benefit and learn from others.

3 Financial contribution of the Partners

The total financial contribution of the partners for the first measure for Trigo to mitigate water risks amounts up to 180,000 USD and includes a contingency of 20%. Bebida Ltd. and GIZ-IWaSP each contribute up to 90,000 USD. In addition, all partners, MWASC Inc., Bebida Ltd. and GIZ-IWaSP provide in-kind contributions in terms of staff input, office and communication, equipment or services, and consultancies.

ANNEX II: Communication Strategy Drop Island Water Stewardship Partnership

1 Communication Strategy

The goal of this Communication Strategy is "Improved awareness and understanding of water issues and initiatives on Drop Island, which contribute to Water Security". This goal would be achieved through a number of strategic interventions related to an Integrated Water Resources Management (IWRM) framework, which addresses, among others, Governance of Water Resources (regulatory and institutional environment), Water Wisdom (public awareness and knowledge gaps), Urgent Water Needs (access to water and sanitation, water conservation, etc.), and Strengthening the Financial Base for the Desired Future (cost recovery approaches, PPPs, etc.). In particular the interventions will address issues related to Climate Variability and Climate Change (e.g. disaster preparedness and management), Water Supply, Sanitation and Hygiene, Water Demand Management and Water Resources Development. For the first year of the Partnership the following general areas of intervention are planned:

- Awareness raising activities on water related issues;
- Development of communication materials including brochures, factsheets, video documentaries, press releases, and radio broadcast; and
- Formulation of a long term Communication Strategy.

2 Communication Materials

These comprise an electronic platform, press releases, printed materials, radio broadcast, and a video documentary.

2.1 Electronic platform

In an ever-expanding digital landscape, an electronic platform (e.g. website, social media), is an economic and effective means of directly engaging stakeholders. A portal/website will act as a repository of materials and information regarding the partnership. It is proposed to host the same Water Partnership information under each of the partners' website.

2.2 Press releases

Critical in the process of development of the partnership is the communication with the general public through press releases and radio broadcast.

2.3 Printed flyer and brochure

Printed materials are an integral part of engaging external stakeholders in person (e.g. students at a school) and emphasize key points during a presentation. Additionally, they're a great resource for newly-created ambassadors to spread awareness throughout their own communities.

A significant percentage of the targeted population is illiterate and in such a case infographics would be an alternative means of communication. Furthermore, encapsulating all necessary information regarding water consumption and management in an easily digestible form is impossible to achieve through text alone.

2.4 Radio broadcast

Radio is another means of mass communication on the island and needs to be exploited to the fullest.

Regular radio programs by GIZ & partners on water-related issues commenced in Febuary 2015 in collaboration with 'Radio Drop Island'. This is anticipated to broaden further by bringing in other stakeholders such as MWASC but also the two alliances that the GIZ program kick-started.

2.5 Video documentary

A video documentary is planned for to enhance awareness among the general public and policy and decision-makers on key issues related to water security in Castle and the role of a PPP. The envisaged duration of a video documentary is 2 - 6 minutes maximum with dissemination by DVD, through a national/regional broadcaster and web-based media.

First a concept note should be developed by the partnership in close liaison with stakeholders. The concept note provides the most important entry point for making the video documentary and provides guidance for the video documentary producer.

There are three phases anticipated in the making of the video documentary: (i) pre-production or planning of the documentary, (ii) production or shooting of the film and (iii) post-production or putting the film together. The making of the documentary should follow a step by step approach and requires review and approval of specific deliverables at certain stages of the process.

The overall coordination and management of the contract with the Video Production Company (VPC) should be carried out by a Coordination Team comprising the Bebida Ltd., MWASC and GIZ-IWaSP communication officers and representatives.

The production of the video documentary should not take more than 5 months.

2.6 Budget

The budget needed to accomplish the electronic platform, press releases, printed flyer and brochure and radio broadcast would be less than 5,000 USD and the production of a video for broadcasting should not cost more than 5,000 USD.

3 Timeline of Activities

ACTIVITY	DATE
• Media release coinciding with signing of MoU • Concept note for video production	**October 2015**
• Sign contract with local video production company	**November 2015**

• Begin video production
• Media release on project progress
• Materials for awareness campaign
  ○ Brochure and infographics
  ▪ Water use
  ▪ Water Management
	December 2016

• World Water Day [22 March] materials complete
  ○ Media Release
  ○ Brochure / Infographics
  ○ "Trailer video"
  ○ Electronic platform
	Early Febuary 2016

• Tank unveiling – media day • Launch of awareness campaign	**Febuary 22nd 2016**
• Completion of video production • Formulation of a long term communication strategy	**April 2016**

ANNEX III: Specifications for potable water storage tanks in Trigo, Caté Riveaux and Apaya

The tanks are of a glass fused to steel type with a capacity of 75,000 imp gallons for Trigo, 120,000 imp gallons for Caté Riveaux and 155,000 imp gallons for Apaya. A minimum soil bearing capacity of 3000 PSF is required for the foundation construction with adequate drainage potential.

1 Site access and clearance

Item	Description
1	Supply plant and labour for the clearing and approve disposal of all vegetative matter from the proposed site
2	Earth works and filling

2 Base preparation and slab construction

Item	Description
1	Supply, plant, labour, and material for the preparation of a base using approved stabilised granular material compacted to withstand 3000 PSF. Dimensions - diameter of 12 m and 0.3 m thick.
2	Supply, plant, labour and material for the construction of reinforced concrete slab as directed by engineer

3 Tank specifications

Water Storage Tank	Trigo	Caté Riveaux	Apaya
Diameter	~11 m		
Capacity	75,000 imp gal	120,000 imp gal	155,000 imp gal
Material used	Glass Fused to Steel		
Freeboard	300mm		
Roof	Aluminium Dome or Tapered beam		
Seismic	Zone 3; Seismic Use Factor 1.25		
Wind	150 MPH; Importance Factor 1.15; Exposure Category C		
Live Load	$0.75kN/m^2$		
Specific Gravity	1		
Base	Embedded concrete ring		

4 Pricing schedule for tender

Items	Description	By whom
1	Supply plant and labour for the clearing and approve disposal of all vegetative matter from the proposed site	**MWASC**
2	Removal and disposal of top soil from site	
3	Construction of base with a minimum soil bearing capacity of 3000 PSF using approved stabilized / compacted granular material. Dimensions : diameter of 12 m and 0.3 m thick.	
4	Supply, plant, labour and material for the construction of reinforced concrete slab as directed by engineer	**Company***
5	Price of a Glass Fused to Steel Water Tank (1*75.000 imp gal, 1*120.000 imp gal and 1*155,000 imp gal)	
6	Installation of Glass Fused to Steel Water Tank (1*75.000 imp gal, 1*120.000 imp gal and 1*155,000 imp gal)	
7	Connection to inlet, outlet, drain and overflow connectors and hydraulic testing	**MWASC**
8	Recommended additional infrastructure (Section 2.1-2.3)	

*Selective tendering will be carried out for items 4, 5 and 6 for the Trigo option