Annex 21:

Operations and Maintenance Plan

07 September 2022

Contents

List of figures

1. Introduction

Regular and ongoing maintenance is essential for correct operation and to maximise systems' lifespans. It is important that the owners, operators and users of the systems understand the steps required to maintain a system.

This operation and maintenance manual is intentionally broad and not all elements will be applicable for every system, indeed diesel fuel systems remain for legacy purposes. Each system should have an operation and maintenance plan customized for their system. This is to be conducted as part of the DWSSP implementation. A trained facilitator should assist the Rural Water Committee to understand and develop the plan. The wider community should also be involved in this development as they will be the end users and operators.

The operation and maintenance plans should be reviewed and updated periodically, and upon faults which could prevented through correct operation and maintenance.

The following sections include a simple description of each recommended system and its components, with associated maintenance checklists presented in the Annexes. A component-wise maintenance schedule is presented in Annex A as systems can have the same components. Health and safety considerations are provided in Annex D. The content for these operation and maintenance manual and checklists are adopted from the current DoWR manuals with minor changes throughout.

1.1 Gravity Fed Systems

Gravity Fed Systems (GFS) deliver water from a source to a community or demand centre via a series of tanks, storages and pipes, under the power of gravity and/or pumps. Gravity Fed Systems allows water to be brought directly to the community, potentially over a very large distance.

Water is collected at the water source and sent to tapstands near the habitations using gravity or pumps. A system which uses gravity only is known as a Direct Gravity Fed System, and typically is used for springs, but river and lake sources are also possible. An Indirect Gravity Fed System requires the use of a pump to elevate the water over topographic constraint or extend the reach of the pipe network. Indirect Gravity Fed Systems can use any water source.

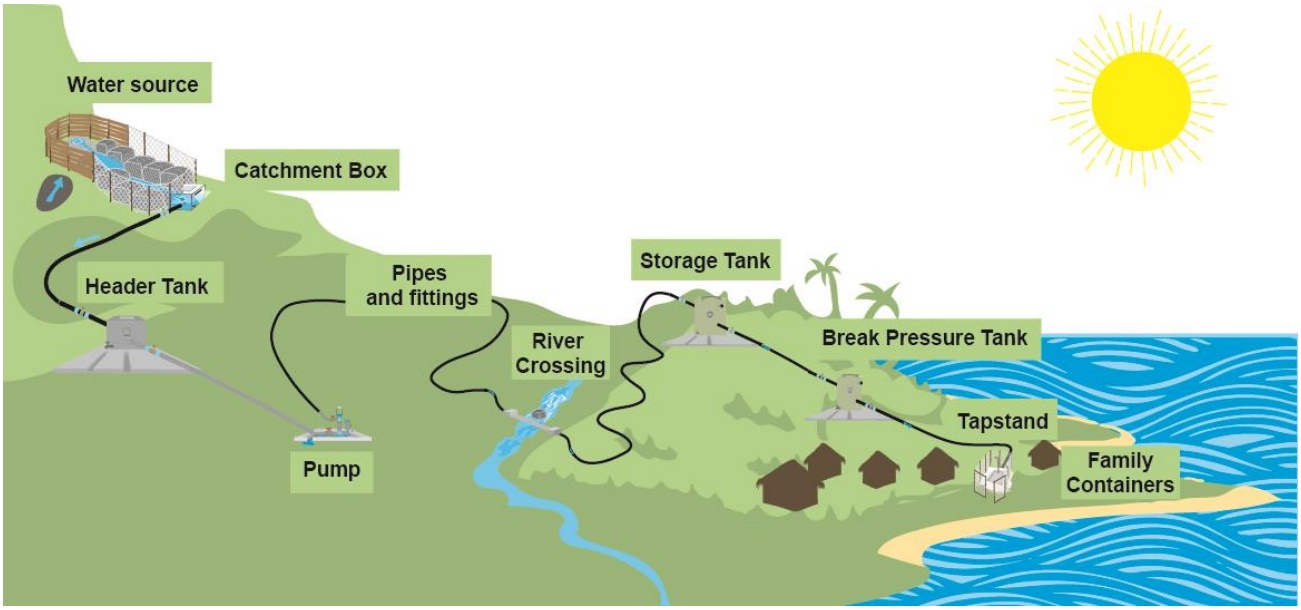

Figure 1. Gravity Fed System Components

Figure 1. Gravity Fed System Components illustrates the main components of a gravity fed systems:

- **Water source:** spring, river, lake, bore, well, etc. They are selected upon flow rate, quality, location and elevation.
- **Catchment box**: used to direct the water into the attaching pipe and protect the source. They are designed to protect the source, exclude pests and insects, and (in the case of springs) protect against back-pressure.
- **Header tank**: a large storage strategically located to store water from the source, provide pressure to drive the downstream taps, and can double as break pressure tank. The capacity of a header tank is determined as a balance between water source flow rate and daily demand patterns.
- **Pump**: if required, a pump may be used to impart pressure into the water thus elevate it to overcome a topographic obstacle. Pumps are designed according to the pressure required and flow rate.
- **Pipes and fittings**: fittings include valves, connectors, tap-off points, washout valves. Pipe are selected to minimise energy loss due to friction and maintain flow rate at taps. Pipes are either metal or plastic and rated according to the pressure are required to contain. HDPE pipes are most typical in Vanuatu, and the PE100 throughout is recommended to withstand pressures and physical damage.

- **River crossings:** pipes can be either buried or suspended to cross a river. Burying pipes safely in rivers can be difficult in meandering or rivers with large rock/sediment movement. Suspending them requires supports and can be prone to damage in high winds.
- **Storage tank:** to store water at an elevation to provide flow and pressure to taps.
- **Break Pressure Tanks:** these devices are used to reduce the pressure within pipes which drop significant elevation. Storage tanks can act as Break Pressure Tanks.
- **Air relief value:** placed at high points of the system and used to remove air from the pipe. Air will release from the water and cause air locks which can stop the flow of water or could damage pumps.
- **Scour out points:** placed at low points, these devices are used to remove sediment from the pipes.
- **Tapstand:** where consumers can collect water safely and reliably. They are designed to eliminate contamination, provide sufficient flow rate and pressure, and enough to serve the communities' population. Tapstands should be well drained and fenced to minimise animal access and improve safety of users.

These components can have a number of parts which can vary between models and makes, therefore they are not discussed.

Each of these components require some level of inspection and maintenance. The tables following are structured by frequency and timing of maintenance.

1.2 Rainwater Harvesting System

Rainwater collect rainwater runoff from hardtop rooves, via a network of gutters, droppers, downpipes, first-flush device and storage tank(s).

Rainwater harvesting systems are simple systems which can be attached to existing buildings, or projects may construct a new community shelter. Rainwater harvesting systems can range in size, can be private household or community systems.

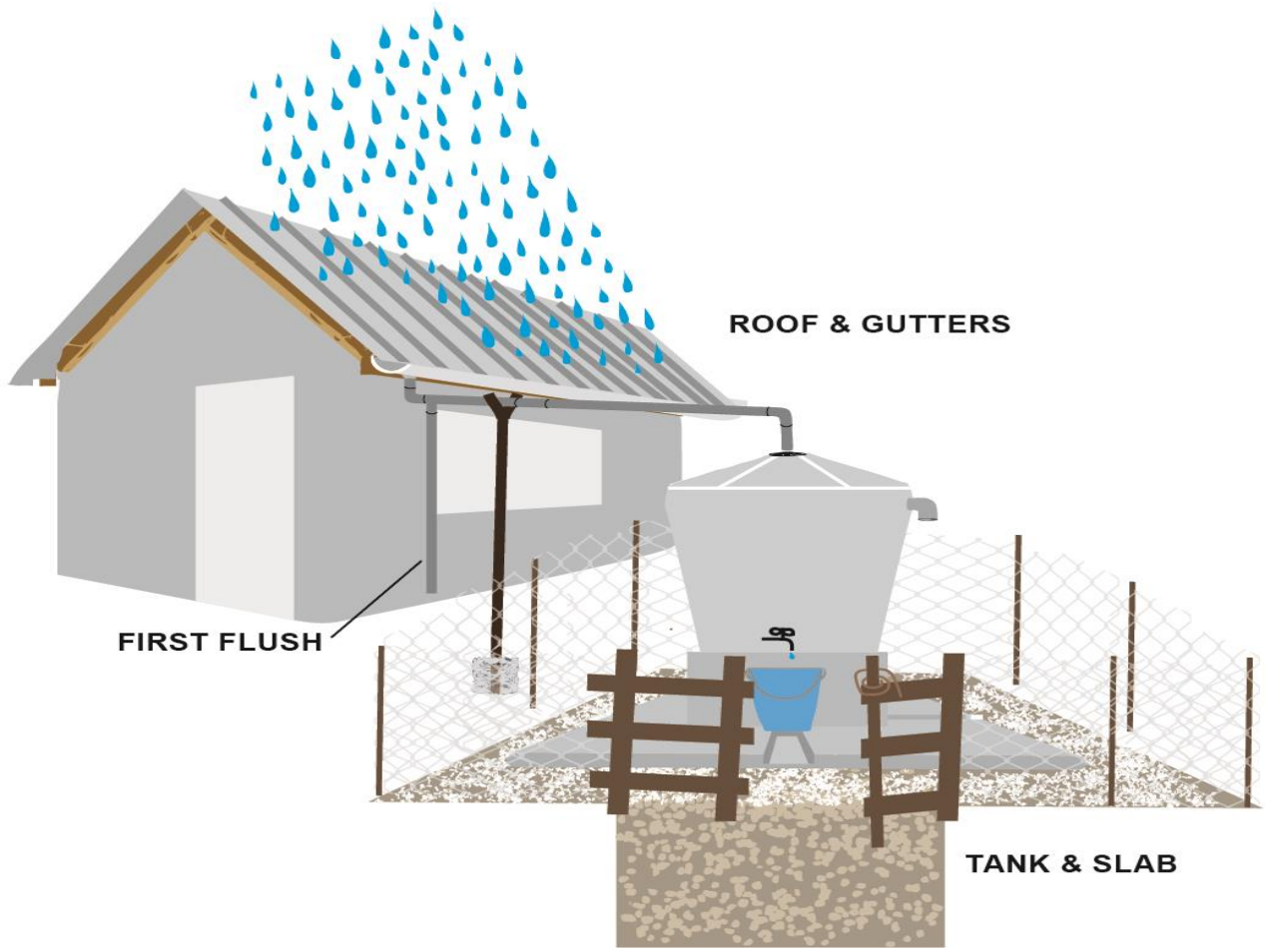

Figure 2. Rainwater Harvesting System

Roof: the roof catchment must be a hardtop material (kapa).

Gutters: collect the runoff from the hardtop, pitched roof. They should be sufficiently wide to ensure water is captured. They must slope towards the dropper.

Dropper: allows water to pass from the gutter to pipe. Droppers can include a screen/mesh to block large objects to enter, such as sticks and leaves.

Downpipe / pipes: carry the water from the gutter to the tank. The pipes should be located in a non-trafficable area. They should be sloped to minimize ponding. Pipe installation should allow for quick disconnection in the event of volcanic ash fall.

First Flush: divert an initial quantity of runoff away from storage, and any dirt or particle with it.

Tank: the tank(s) should be positioned in a protected and shaded area. The capacity will be determined by rainfall, catchment area, and demand. The inlets and any overflow must have mesh to prevent mosquito access.

Slab: the slab should be large enough and with correct reinforcement to ensure it can safely support a full, tied down tank. The tank should have tie down anchors.

Tap: can be installed directly on the tank but it is better to have a dedicated tapstand at a distance away. This will allow isolation between the tank and tap, and also prevent damage to the tank. Tapstands should be kept clean, be well-draining and fenced to protect animal access.

1.3 Desalination

Desalination is the process of removing minerals, pathogens and other unwanted components from water, for instance removing salt from sea water or brackish water. Desalination devices and plants range in scale from personal supply to city size demands. Desalination can be performed through distillation or filtration. Only filtration through reverse osmosis is covered in this manual.

Reverse osmosis uses high pressure to force water through a membrane / filter. The filter is fine enough that salt and pathogens cannot pass through. The fresh water which passes through and is collected has a very low level of salt and no pathogens in it and therefore it is very safe to consume without further treatment.

Reverse osmosis units should be powered by solar power or hydro power. The solar panels and associated electrical work will be placed in a safe location close to the desalination unit. They require periodic cleaning.

Refer to rainwater harvesting tank and tapstand maintenance plans for maintance of tanks and taps related to desalination units.

Further description of reverse osmosis components are not present as they will depend on the manufacturers build. Refer to the manufacturers training, and operation and maintenance materials.

Annex A. Component Maintenance

The DoWR developed a standard operating and maintenance manual in 2018 with support from French and Vanuatu Red Cross and UNICEF. A Bislama translation is available.

The manual has been written with communities as the audience, intended as an educational resource as well as a maintenance guidance. It presents the information in a well-structured and clear format, and has already had side adoption.

An updated version, with minor amendments, is given below.

Annex B: Gravity Fed System Maintenance Checklists

This checklist is based on the existing DoWR Operation and Maintenance manual, produced in 2018. Minor changes have been applied throughout, including safety and health messages.

All times

Timing	Part of the system	Maintenance to be done	Check
All times	Whole System	Report and fix leaking joints	☐
	Pipes & fittings	Be careful of farmer burning the land as it might melt the pipes	☐
		Make sure no one is gardening close to the pipe's position	☐
	Tapstands	Repair the fence if necessary, to prevent animal access	☐
		Check the tap is functioning well and that there is no leak on the valves or on the faucet	☐
	Family container	If any, use your home-disinfection device before consuming the water	☐
		The container should be closed with a lid during transport or storage in the home	☐
		The container can't be stored in the sun and should be protected from external contaminations	☐
			☐
			☐

Before use

Timing	Part of the system	Maintenance to be done	Check
Before use	Whole system	Flush and sterilize the system with clean water to remove sediments, dirt and other contaminants. **Ensure that water is not consumed by human or animal**	☐

	Tanks	Tanks	Sanitize and flush any capture tanks, capture tanks, break pressure tanks, etc. **Ensure that water is not consumed by human or animal**	☐
	Tap stands	Taps	Clean and sanitize each tank. Ensure all chemicals, paints, etc. have been removed.	☐
	Pump	Electric Safety	Check that the safety switch is functional	☐
	Pump	Fuel	Make sure that the fuel added in the pump is clean and of good quality (it might block the engine)	☐
			Make sure that the adduction pipe is not leaking and is full of water	☐
			If any, make sure that the anti-return valve is properly working	☐
			Follow the manufacturer's manual for more information	☐
	Pump	Mechanical	Turn the spindle of pump to ensure it is free to move	☐

On first use

Timing	Part of the system		Maintenance to be done	Check
On first use and periodically	Pump	Mechanical	Follow manufacturers guidance on initial start up.	☐
			Listen to the pump at high running rate. If it sounds like a rattle or like rocks in the pipe, immediately turn off the pump. This is cavitation and will damage the pump. To fix, increase the incoming pressure, reduce the working rate, or restrict the delivery valve	☐
				☐

Weekly

Timing	Part of the system	Maintenance to be done	Check
Weekly	Water source	Clean the protection zone around the spring	☐
		Make sure that there is no upstream source of contamination (animals grazing, defecation place, latrines, chemical/fertilizer use, etc.)	☐

		Repair, if necessary, the protection fence around the source	☐
	Tapstands	Clean the apron (make sure that the slippery layer is wiped off) and drainage channel, there should be no still water around or on the tapstand	☐
	Family container	The container needs to be cleaned and brushed	☐
			☐

Monthly

Timing	Part of the system		Maintenance to be done	Check
Monthly	Water source		Clean the protection zone around the spring	☐
			Make sure that there is no upstream source of contamination (animals grazing, defecation place, latrines, chemical/fertilizer use, etc.)	☐
			Repair, if necessary, the protection fence around the source	☐
	Catchment box		Make sure that the pipes and valves around the catchment box are not leaking and are in good shape	☐
	Catchment box		Ensure that the lid is in place and well fitting	
	Header tank	Polytank & Ferro-cement	Shut the inlet and outlet valve and clean the inside of the header tank with a brush	☐
			If any, make sure that the float valve is working properly	☐
			Make sure that the inlets or outlets of the header tank are not blocked, *cleaning with a brush should unclog them*	☐
			Open the wash-out valve to clean the dirty water and let the water flow to completely clean the tank	☐
			Check the mosquito net, it must be clean and in good condition	☐
		Wash-out	Make sure there is no accumulation of sediment in the low point	☐

High / low points of system		Make sure that there is no leaking on the pipes around the "wash-out"	☐
		Open the valve until clear water flushes out of the valve	☐
	Air-out	Make sure there is no accumulation of air in the high point	☐
		Make sure that there is no leaking on the pipes around the "air-out"	☐
		Open the valve until clear water flushes out of the valve	☐
Pump	Fuel	Make sure that the water being pumped is clean	☐
	Solar	Clean the solar panels with a clean cloth	☐
		Make sure the electric box is working properly	☐
		Lift the pump out of the tank and check if nothing has been damaged and if the pump is in good condition	☐
		Put the pump back in the tank and make sure it is safely and strongly attached to the hook	☐
		Wait for the tank to be full and for the overflow to be pouring water again before relaunching the pump	☐
	Ram	Make sure that the drive pipe from the header tank is in good condition and well supported	☐
		Check if there is any leakage on the pipes and valves around the ram pump	☐
		Press on the gasket until the water leaving the pump is clear. Do not use a finger, use a stick or screwdriver.	☐
		Make sure that the gasket is in good condition and properly functioning. Do not use a finger, use a stick or screwdriver.	☐
		If stopped, start the pump again by pressing on the gasket. Do not use a finger, use a stick or screwdriver	☐
Storage tank		If any, make sure that the float valve is working properly	☐

		Polytank & Ferro-cement	Check the mosquito net installed on the ventilation pipe, it must be clean and in good condition	☐
	Break-pressure tank	Polytank & Ferro-cement	Make sure that the float valve is working properly	☐
			Check the mosquito net installed on the ventilation pipe, it must be clean and in good condition	☐
	Pipes & fittings		Walk along the pipe line and make sure that there is no leakage (if the ground is moist, the pipe might be leaking)	☐
			Make sure that the pipes are well buried	☐
			Clean the ground around the pipeline	☐
			If any, make sure that the valve protective boxes are cleaned and that the valves or fittings inside are tight, not leaking and in good conditions	☐
			If a fitting is leaking, tighten its two sides. If the problem appears again, change the faulty part	☐
			Check that the pipe is not stressing / pulling on any valve, tap, fitting, etc.	☐
				☐
				☐
				☐
				☐
				☐

Quarterly

Timing	Part of the system	Maintenance to be done	Check
Quarterly	Catchment box	Shut the outlet valve and clean the inside of the catchment box and the strainer (if any) with a brush	☐
		Make sure that any outlets of the catchment box are not blocked, *cleaning with brush should unclog them*	☐

		If any, and after cleaning the catchment box, open the "wash-out" tap to flush out all the dirty water	☐
		Check the mosquito net installed on the ventilation pipe, it must be clean and in good condition	☐
Header tank	Polytank & Ferro-cement	Check if there is any leak on the valves and pipes around the header tank	☐
	Ferro-cement	Make sure that the valves outside of the tank are not corroded	☐
		If any, make sure that the drive pipe towards the ram pump is strongly embedded in the header tank and that the pipe is well supported and in good condition	☐
High / low points of system	Wash-out	If any, make sure that the valve protective box is in good condition	☐
	Air-out	If any, make sure that the valve protective box is in good condition	☐
Pump	Fuel	Check that the fittings and pipes are not leaking around the pump.	☐
		If any, make sure that the pump box is clean, that there is no fuel around it and that it is protecting the pump from rain and wind	☐
	Solar	Cut the trees that could fall on the panels	☐
Storage tank	Polytank & Ferro-cement	Clean the outside of the tank and its area (pay attention to the top of the tank that should be protected and clean)	☐
		Check if there is any leak on the valves and pipes around the storage tank	☐
		Shut the inlet and outlet valve and clean the inside of the storage tank with a brush	☐
		Make sure that the inlets or outlets of the storage tank are not blocked, *cleaning with a brush should unclog them*	☐
		Open the wash-out valve to clean the dirty water and let the water flow to completely clean the tank	☐

		Ferro-cement	Make sure that the valves outside of the tank are not corroded	☐
	Break-pressure tank	Polytank & Ferro-cement	Clean the outside of the break-pressure tank and its area (pay attention to the top of the tank that should be protected and clean)	☐
			Check if there is any leak on the valves and pipes around the break-pressure tank	☐
		Ferro-cement	Make sure that the valves outside of the tank are not corroded	☐
	River crossing	Under-river	Clean the area around the river crossing	☐
			If any, check the good condition of the gabion protecting the GI pipe	☐
			Make sure that the GI pipe is still buried under the bed of the river	☐
			Make sure that the fittings and HDPE pipes around the river crossing are buried and not leaking	☐
			Check the strength and position of the concrete blocks stabilizing the pipe on the side of the river	☐
		Suspended	Clean the area around the river crossing	☐
			Check that pipe and water weight are supported with cable	☐
	Tapstands		Check the platform for cracks and do the necessary repair	☐
			Instruct the tap users how to use the tap and how to keep the surroundings clean	☐
			Eliminate stagnant water by filling the dents and holes with earth	☐
				☐
				☐
				☐
				☐
				☐
				☐

Biannually

Timing	Part of the system		Maintenance to be done	Check
Biannually	Catchment box		Clean the outside of the catchment box and its area	☐
			If any, clean the rock inside the catchment box	☐
	Header tank	Poly tank & Ferro-cement	Clean the outside of the tank and its area (pay attention to the top of the tank that should be protected and clean)	☐
			Make sure that the overflow of the tank is safely evacuated and that there is not still water around the equipment	☐
			If any, check the platform for cracks and do necessary repair	☐
		Ferro-cement	Make sure that the tank is not leaking, if so, use dense concrete to plaster the leak	☐
			Make sure that the metal bars of the reinforced concrete inside the tank are not in contact with water	☐
	Pump / Solar	Safety electrics	Make sure the safety / isolator switch is functional	
	Pump	Solar	Disconnect the power and clean the electric box	☐
			Make sure that the electric cables are well protected	☐
		Ram	If any, clean the ram pump box and make sure that the waste water from the ram pump is well disposed	☐
			Make sure that there is no still water around the equipment	☐
	Storage tank	Polytank & Ferro-cement	Make sure that the overflow of the tank is safely evacuated and that there is not still water around the equipment	☐
		Ferro-cement	Make sure that the tank is not leaking, if so, use dense concrete to plaster the leak	☐
			Make sure that the metal bars of the reinforced concrete inside the tank are not in contact with water	☐

	Break-pressure tank	Polytank & Ferro-cement	Shut the inlet and outlet valve and clean the inside of the break-pressure tank with a brush	☐
			Make sure that the inlets or outlets of the storage tank are not blocked	☐
			Open the wash-out valve to clean the dirty water and let the water flow to completely clean the tank	☐
			Make sure that the overflow of the tank is safely evacuated and that there is not still water around the equipment	☐
		Ferro-cement	Make sure that the tank is not leaking, if so, use dense concrete to plaster the leak.	☐
			Make sure that the metal bars of the reinforced concrete inside the tank are not in contact with water	☐
	Pipes & fittings		If possible, check the inside of the pipes for potential deposits	☐
	River crossing	Suspended	Tighten the support cable	☐
			Check the foundation are stable and supported	☐
				☐
				☐
				☐
				☐

Reactionary

When the water looks dirty

Timing	Part of the system	Maintenance to be done	Check
When the water looks dirty	Water source	Clean the protection zone around the spring	☐
		Make sure that there is no upstream source of contamination (animals grazing, defecation place, chemicals, fertilizers, etc.)	☐
	Catchment box	Shut the outlet valve and clean the inside of the catchment box and the strainer (if any) with a brush	☐

			If any, clean the rock inside the catchment box	☐
	Header tank		Shut the inlet and outlet valve and clean the inside of the header tank with a brush	☐
			Open the wash-out valve to clean the dirty water and let the water flow to completely clean the tank	☐
	Pump	Ram	Press on the gasket until the water leaving the pump is clear	☐
	Storage tank	Polytank & Ferro-cement	Shut the inlet and outlet valve and clean the inside of the storage tank with a brush	☐
	Break-pressure tank	Polytank & Ferro-cement	Shut the inlet and outlet valve and clean the inside of the break-pressure tank with a brush	☐
			Open the wash-out valve to clean the dirty water and let the water flow to completely clean the tank	☐
				☐
				☐
				☐
				☐

When dirty

Timing	Part of the system		Maintenance to be done	Check
When dirty	Pump	Fuel	If any, make sure that the pump box is clean, that there is no fuel around it and that it is protecting the pump from rain and wind	☐
	Tapstands		Clean the apron (make sure that the slippery layer is wiped off) and drainage channel, there should be no still water around or on the tapstand	☐
	Family container		The container needs to be cleaned and brushed	☐
				☐

When broken / not working properly

Timing	Part of the system	Maintenance to be done	Check

When broken / not working properly	Water source		Repair, if necessary, the protection fence around the source	☐
	Catchment box		Make sure that any outlets of the catchment box are not blocked, *cleaning with brush should unclog them*	☐
	Header tank		If any, make sure that the float valve is working properly	☐
	Pump	Fuel	Follow the manufacturer's manual for more information	☐
		Solar	Disconnect the power and clean the electric box	☐
			Make sure the electric box is working properly	☐
			Lift the pump out of the tank and check if nothing has been damaged and if the pump is in good condition	☐
			Put the pump back in the tank and make sure it is safely and strongly attached to the hook	☐
		Ram	Make sure that the drive pipe from the header tank is in good condition and well supported	☐
			Make sure that the gasket is in good condition and properly functioning	☐
			If stopped, start the pump again by pressing on the gasket	☐
	Pipes & fittings		If a fitting is leaking, tighten its two sides. If the problem appears again, change the faulty part	☐
	River crossing	Suspended	Tighten the support cable	☐
	Tapstands		Check the platform for cracks and do the necessary repair	☐
			Repair the fence if necessary, to prevent animal to have access	☐
				☐
				☐
				☐
				☐

When cleaning

Timing	Part of the system		Maintenance to be done	Check
When cleaning	Catchment box		If any, and after cleaning the catchment box, open the "wash-out" tap to flush out all the dirty water	☐
	Pump	solar	Wait for the tank to be full and for the overflow to be pouring water again before relaunching the pump	☐
	Pump		Ensure pressure settings are correct. If an operating pump sounds like a rattle or rocks in it, turn it off immediately. This can be cavitation and will damage the pump. To fix, increase inflow pressure, decrease output pressure, turn down pump.	☐

If water flow decreases in system

Timing	Part of the system		Maintenance to be done	Check
If water flow decreases in system	Catchment box		Make sure that any outlets of the catchment box are not blocked, *cleaning with brush should unclog them*	☐
	Header tank		If any, make sure that the float valve is working properly	☐
			Make sure that the inlets or outlets of the header tank are not blocked, *cleaning with a brush should unclog them*	☐
	High / low points of system	Wash-out	Make sure there is no accumulation of sediment in the low point	☐
			Open the valve until clear water flushes out of the valve	☐
		Air-out	Make sure there is no accumulation of air in the high point	☐
			Open the valve until clear water flushes out of the valve	☐
	Pump	Solar	Reinstall and clean the solar panels with a clean cloth	☐
		Safety Electrics	Check that switch is still in the on position	
	Storage tank		If any, make sure that the float valve is working properly	☐

		Polytank & Ferro-cement	Make sure that the inlets or outlets of the storage tank are not blocked, *cleaning with a brush should unclog them*	☐
			Open the wash-out valve to clean the dirty water and let the water flow to completely clean the tank	☐
	Break-pressure tank	Polytank & Ferro-cement	Make sure that the inlets or outlets of the storage tank are not blocked	☐
			Make sure that the float valve is working properly	☐
	Pipes & fittings		Walk along the pipe line and make sure that there is no leakage (if the ground is moist, the pipe might be leaking)	☐
				☐
				☐
				☐

If water is not well-evacuated from equipment

Timing	Part of the system		Maintenance to be done	Check
If water is not evacuated from equipment	Header tank		Make sure that the overflow of the tank is safely evacuated and that there is not still water around the equipment	☐
	Storage tank	Polytank & Ferro-cement	Make sure that the overflow of the tank is safely evacuated and that there is not still water around the equipment	☐
	Break-pressure tank	Polytank & Ferro-cement	Make sure that the overflow of the tank is safely evacuated and that there is not still water around the equipment	☐

Before a heavy rain / wind event - Blue alert

Timing	Part of the system		Maintenance to be done	Check
Before a heavy rain / wind event -blue alert	Catchment box		Disconnect the catchment box from the system to avoid mud contamination. Reconnect when the source is clean	☐
	Pump	Solar	Cut the trees that could fall on the panels	☐

			Dismantle and secure the solar panels	☐
			Make sure that the electric cables are well protected	☐
	Storage tank	Polytank & Ferro-cement	Make sure that the overflow of the tank is safely evacuated and that there is not still water around the equipment	☐
	Break-pressure tank	Polytank & Ferro-cement	Make sure that the overflow of the tank is safely evacuated and that there is not still water around the equipment	☐
	River crossing	Under-river	If possible, take the HDPE and GI pipe out	☐
				☐
				☐

After a heavy rain / wind event - end of alert

Timing	Part of the system		Maintenance to be done	Check
After a heavy rain / wind event - end of alert	Catchment box		Clean and reconnect the catchment box to the system	☐
	Pump	Fuel	Make sure that the water being pumped is clean	☐
		Solar	Reinstall and clean the solar panels with a clean cloth	☐
	River crossing	Under-river	Clean the area around the river crossing	☐
			If any, check the good condition of the gabion protecting the GI pipe	☐
			Make sure that the GI pipe is still buried under the bed of the river	☐
			Make sure that the fittings and HDPE pipes around the river crossing are buried and not leaking	☐
			Check the strength and position of the concrete blocks stabilizing the pipe on the side of the river	☐
		Suspended	Clean the area around the river crossing	☐
			Check that pipe and water weight are supported with cable	☐
			Check the footings of supporting structure are still stable and well supported	☐

	Tapstands	Eliminate stagnant water by filling the dents and holes with earth	☐
			☐
			☐

Annex C: Rainwater Harvesting System Maintenance Checklists

This checklist is based on the existing DoWR Operation and Maintenance manual, produced in 2018. Minor changes have been applied throughout, including safety and health messages.

All times

Timing	Part of the system	Maintenance to be done	Check
All times	Roof & gutters	If the gutters are leaking, try to repair them by repositioning or adding PVC glue.	☐
	First flush	Empty and clean the first flush	☐
	Storage tank	Follow the schedule of storage tanks (GFS)	☐
	Underground RWH tank "well"	Make sure that there is a lid and that it is well adjusted to prevent sunlight to hit the water. This will help prevent bacterial development	☐
	Tank and / or Tapstand	Make sure that there is no still water around the equipment and that the drainage channels are not clogged	☐
		Check that the tank tap is functioning well and that there is no leak on the valves or on the faucet	☐
		Instruct the tap users how to use the RWH tank and how to keep the surroundings clean	☐
			☐
			☐

Weekly

Timing	Part of the system	Maintenance to be done	Check
Weekly	Slab	Clean the slab under the tank (make sure that the slippery layer is wiped off)	☐
	Tapstand	Clean the tapstand area (make sure that the slippery layer is wiped off)	☐

Monthly

Timing	Part of the system	Maintenance to be done	Check
Monthly	First flush	Make sure that the first flush is not leaking, if so, change the gasket	☐
	Slab	Repair the fence if necessary, to prevent animal to have access	☐
	Tapstand	Repair the fence if necessary, to prevent animal to have access	☐

Quarterly

Timing	Part of the system	Maintenance to be done	Check
Quarterly	Roof & gutters	Disconnect tank (to prevent dirty water from entering the reservoir) and clean the roof	☐
		Make sure that the roof sheeting is not rusted and well attached	☐
		Cut the trees that could fall on the roof	☐
		Disconnect tank (to prevent dirty water from entering the reservoir) and clean the gutters	☐
		Make sure that the gutters are fixed properly	☐
	First flush	Make sure that the pipe is well fixed	☐
	Slab	Check the platform for cracks and do the necessary repair	☐
	Tapstand	Check the drain is clear	☐
			☐

Biannually

Timing	Part of the system	Maintenance to be done	Check
Biannually	Storage tank	When empty, clean the tank with a brush * ensure there is plenty of ventilation * Use only water.	☐

		* DO NOT use chemicals, chlorine, soap	
	Slab	Make sure that the overflow of the tank is safely evacuated	☐
	Underground RWH tank "well"	Empty what is left of the tank with buckets and clean the tank with brushes. Expulse the dirty water again with buckets * ensure there is plenty of ventilation * Use only water. * DO NOT use chemicals, chlorine, soap	☐
			☐

Reactionary Maintenance

When broken / not working properly

Timing	Part of the system	Maintenance to be done	Check
When broken / not working properly	Slab and / or tapstand	Check the platform for cracks and do the necessary repair	☐
		Repair the fence if necessary, to prevent animal to have access	☐
			☐

When dirty

Timing	Part of the system	Maintenance to be done	Check
When dirty	Roof & gutters	Disconnect tank (to prevent dirty water from entering the reservoir) and clean the roof and gutters * Use only water. * DO NOT use chemicals, chlorine, soap * reconnect tank after rinsing roof and gutters	☐
			☐

When leaking

Timing	Part of the system	Maintenance to be done	Check
When leaking	First flush	Make sure that the pipe is well fixed	☐
		Make sure that the first flush is not leaking, if so, change the gasket	☐
	Tapstand	Isolate and repair leaking taps	☐
	Pipes	Isolate the section, and repair. Replace if necessary	☐
	Valves	Isolate the section, and repair. Replace if necessary	☐
	Connectors	Isolate the section, and repair. Replace if necessary	☐

Before rainy season

Timing	Part of the system	Maintenance to be done	Check
Before raining season	Roof & gutters	Disconnect tank (to prevent dirty water from entering the reservoir) and clean the roof * Use only water. * DO NOT use chemicals, chlorine, soap * reconnect tank after rinsing roof and gutters	☐
	Storage tank	Empty and clean the tank with a brush	☐
	Underground RWH tank "well"	Empty what is left of the tank with buckets and clean the tank with brushes. Remove the dirty water again with buckets	☐
			☐

Before a heavy rain / wind event - blue alert

Timing	Part of the system	Maintenance to be done	Check
Before a heavy rain / wind event - blue alert	Roof & gutters	Disconnect tank (to prevent dirty water from entering the reservoir) and clean the roof * Use only water. * DO NOT use chemicals, chlorine, soap	☐

		* reconnect tank after rinsing roof and gutters	
		Cut the trees that could fall on the roof	☐
	Tank	Before raining season - Empty and clean the tank with a brush	☐
	Underground RWH tank "well"	Empty what is left of the tank with buckets and clean the tank with brushes. Remove the dirty water again with buckets	☐
			☐
			☐

After a heavy rain / wind event - end of alert

Timing	Part of the system	Maintenance to be done	Check
After a heavy rain / wind event - end of alert	Roof & gutters	Make sure that the roof sheeting is not rusted and well attached	☐
		Disconnect tank (to prevent dirty water from entering the reservoir) and clean the gutters * Use only water. * DO NOT use chemicals, chlorine, soap * reconnect tank after rinsing roof and gutters	☐
		Make sure that the gutters are fixed properly	☐
	First flush	Empty and clean the first flush	☐
	Pipes	Check for damage or leaks, and repair	☐
			☐

After every rain event - end of alert

Timing	Part of the system	Maintenance to be done	Check
After every rain event - end of alert	First flush	Empty and clean the first flush	☐
			☐

At every volcanic ash fall event

Timing	Part of the system	Maintenance to be done	Check
As soon as eruption begins* **ONLY IF SAFE TO DO SO**	Downpipe	Disconnect from the guttering or tank to stop ash being washed into the tank	☐
	Tank inlet	Cover opening to stop ash falling/washing into the tank	☐
After ash stops falling	Downpipe and Tank Inlet	Disconnect the downpipe from the gutter or tank, cover the tank inlet. These is to stop ash being washed into the tank or falling in the tank	☐
	Roof & gutters	Clean the roof and gutters of any ash. Attempt to sweep the ash off the roof and gutters, then use water to further clean the roof and gutters.	☐
	First flush	Empty and clean the first flush device. Make sure the outlet is not blocked	☐
	Pipes	Empty and clean. Check that the pipes fit well	☐
	All	Check that the pipes fit well	☐
	Downpipe and Tank Inlet	Reconnect roof or tank	☐
If ash has got into the water tank	Storage tank	Open the outlet valve to completely empty the tank. Shut the inlet and outlet valve and clean the inside of the header tank with a brush Rinse the inside of the tank with only water. Remove all ash from the tank.	☐

* This may not be relevant for areas with consistently active volcanos, such as in Tanna.

Annex D: Desalination System Maintenance Checklist

Desalination operation and maintenance schedule will be provided by the supplier of the devices.

Operation and maintenance of the storage tanks, pipes, tapstands, pumps and solar panels should follow the schedule given in the Gravity Fed System Maintenance Checklist

Annex E: Health and Safety Guidelines

These health and Safety Guidelines are based on the existing DoWR Operation and Maintenance manual, produced in 2018. Additional items have been added.

Health and Safety are a very important part of any type of work. A few rules need to be followed in order to prevent injuries while working on the water system.

The Health and Safety Golden Rules:

1. Look after each other; health & safety is a team game;
2. Know the risks you face; think before you start work and maintenance;
3. Act safely; follow the safe working procedures;
4. Keep your workplace clear and tidy;
5. If any, wear the correct protective equipment; properly and at all times (shoes, hard-top hats, etc.);
6. Report to your community all accidents and near misses; and learn from them;
7. Only undertake work for which you are trained and competent to do;
8. Assess the weight of the load and act accordingly, always using the right posture to prevent injuries. Heavy loads should be carried with wheelbarrows as much as possible;
9. Use the correct equipment for the task; don't improvise. Try to assess the quality of the equipment before using and follow the manufacturer's guide closely;
10. Stop any work that becomes unsafe;
11. Laziness kills; do not cut corners.
12. DO NOT enter a tank, attempt to do all work from outside of the tank
13. DO NOT use chemical, glue, chlorine in confined spaces (i.e. a tank) unless very well ventilated
14. Always flush / rinse any surface, device or tank which has been sanitised or washed with soap
15. DO NOT breath in glue
16. Take care working at heights (i.e. on roofs or tanks)

Annex F: System Information

The following forms should be completed after construction and include all parts, make, model number, locations, etc. This information should reflect the as constructed system and provide a condensed reference form to make it easy to identify system information.

These are only suggested templates and should be tailored to a given system.

Water Sources

Number	Type	Location
1		
2		
3		

System Type

Source	Demand Centre	Collection Type
1		
2		
3		

The following tables are to be used for each system given above.

System no.: .

<insert picture of the system with components numbered>

Components

Component number:	**Component** (header tank, break pressure tank, tapstand, etc)	**Location** (lat/long, description)
A		
B		
C		
D		
E		
F		
G		
H		

Tanks

Component no:	**Type** (header, break pressure, storage)	**Capacity**

Pump

Part	**Location**

Pipes

Component to/from	**Length**	**Diameter**

Fittings

Part	**Location**

Annex G: Spare Parts Inventory

This list should be updated whenever a part is used. When a part has none remaining, new spare parts should be bought.

Spare Parts

Part	Quantity	Location

Annex H: Maintenance Log

Record the maintenance activity performed here.

Maintenance Activity Report

Activity Performed	Location	Initials / Date
Example: Quarterly Maintenance Performed	*Richmond*	*DK – 28/10/2021*

Annex I: Fault Log and Follow Up Action

Fault identification and follow-up Action Report

Use this form to document all problems, faults, failures and/or emergencies that occur to the system. These may be identified through routine maintenance checks, or during regular operation. Also provide follow-up actions taken to fix the fault/issue

Description	Corrective Action Taken	Initials	Date