THE SOLOMON ISLANDS
RURAL WATER SUPPLY, SANITATION & HYGIENE
DESIGN AND CONSTRUCTION STANDARDS

Technical requirements for rural WASH Projects

Version 4, October 2017

The Rural Water Supply, Sanitation, and Hygiene Program

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INTRODUCTION

Since 2010, the Ministry of Health and Medical Services (MHMS), through the Environmental Health Division's (EHD) *Rural WASH Program* has developed a set of regulations for the rural WASH sector, resulting in the RWASH Policy, the RWASH Strategic Plan, Community Engagement Guidelines, Community-Led Total Sanitation Toolkit (CLTS), and these *Design and Construction Standards* (Engineering Standards for short). The first version of the Engineering Standards was made available in November 2014, followed by 2 minor updates. This update is prompted by 2 changes:

1. The Sustainable Development Goals (SDG). The SDG clearly identify the various monitoring service levels and what RWASH interventions must comply with to reach the required minimum acceptable levels. The MHMS adopted the SDG indicators for RWASH as its Core Indicators for the sector and the RIS has been adapted accordingly.
2. The development of the M&E framework for the RWASH sector (RIS): the RIS identified the monitoring challenges that come with a highly prescriptive set of standards. While SDG monitoring focusses on access to WASH *regardless* of what the engineering details, Engineering Standards are required to ensure both functionality and durability. A balance must be struck between functionality and quality of design & construction.

It is expected that all RWASH implementers in Solomon Islands follow these technical standards. It is recognized that innovation in the sector is desirable, so exceptions will be considered for any element where strong justification exists and endorsement is obtained from the RWASH Program's Chief Engineer or Program Manager.

This document is technical in nature and therefore written for practitioners with sufficient technical background.

The document is set up as follows:

- *Chapter 1* provides GENERAL INFORMATION on topics such as topography, climate and socio-economic aspects. This is the only chapter which contents *do not constitute requirements*, but provides information that impacts project design. It aims to provide newcomers to the sector with some general but relevant information.
- *Chapter 2* provides an overview of the RWASH FRAMEWORK – where does the RWASH sector fit in the Solomon Islands regulations and strategic objectives.
- *Chapter 3* discusses the RWASH STANDARDS. These standards were scattered over the various chapters in the previous versions but are now grouped together for easy of use.
- *Chapter 4* describe the SURVEY & DESIGN requirements. In the previous versions, design and construction parameters were combined making it less user friendly.
- *Chapter 5* all CONSTRUCTION REQUIREMENTS are detailed in this chapter.
- Appendices: rainfall data, design report format and tool list.

This is not the first such document produced for Solomon Islands: "A manual of Technical Procedures for Rural Water Supply & Sanitation" (WHO/SIG) was written in1982. Then in the mid-1990s "Solomon Islands Rural Water Supply & Technical Manual" was produced during the RWWS Project. This manual is more up-to-date and takes into consideration new paradigms such as climate change and resilience to disaster. Periodic Updating will still be required and as such this is a living document. The Rural WASH program welcomes comments and suggestions from stakeholders.

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ACKNOWLEDGEMENTS

The Ministry of Health and Medical Services wish to acknowledge the assistance received from many of the WASH stakeholders in the Solomon Islands in the development of this manual. The manual was developed following a long consultation with technical members of the WASH Stakeholders Group and workshops during 2012 and 2013.

VERSION HISTORY

Ve	Date	Changes
1	October	First edition
2.1 2.2	November 2015 February 2017	Promoted references to Climate Change and adaptation, corrected references to water demand calculation from 1982 manual, introduced dual septic as acceptable emptying solution corrected various grammatical errors. Fixed formatting errors. Redone Sanitation Selection chart
3	October 2017	Alignment with Sustainable Development Goals; Less prescriptive than previous versions, with more focus on functionality and introduction of ‘required’ and ‘recommended’ aspects of structures.

ABBREVIATIONS & DEFINITIONS

ADD	Average Daily Demand
CBR	Community Based Rehabilitation Department
C.O.M	Community Owned and Managed
CLTS	Community-Led Total Sanitation
CRPD	Convention on Rights for Persons with Disabilities
DGF	Direct Gravity Fed
EA	Environment Act
EHA	Environmental Health Act
EHD	Environmental Health Division
EIA	Environmental Impact Assessment
GI	Galvanized Iron (pipe)
GPS	Global Positioning System
HDPE	High Density Polyethylene (pipe)
HH	Household
HP	Hand Pump
IGF	Indirect Gravity Fed (pumped system)
MHD	Maximum Hourly Demand
MHMS	Ministry of Health and Medical Services
Nuisance	Anything that injures or is likely to injure health.
O&M	Operation & Maintenance
PLWD	Person Living With Disability
PVC	Polyvinyl Chloride
RIS	RWASH Information System (the sector's M&E framework)
RWC	Rainwater Catchment
RWP	Rural WASH Program (of the Environmental Health Division of the MHMS)
SBD	Solomon Dollar
SDG	Sustainable Development Goals
VLOM	Village Level Operation and Maintenance
WASH	Water Supply, Sanitation, and Hygiene
WHO	World Health Organisation
CLTS	Community Led Total Sanitation

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1 GENERAL INFORMATION

1.1 LOCATION AND POPULATION

The Solomon Islands lies between latitudes 5°S and 13°S and longitudes 155°E and 169°E. The country's 992 islands are scattered in a double chain stretching over approximately 1500km from East to West. The total land surface area is 28,896 km^2.

Source: http://www.vidiani.com

The rural population of the Solomon Islands, 80% of the total population, lead a largely subsistence lifestyle with very little cash income. Most live in coastal communities though some of the more populated islands have significant numbers of communities inland. The Solomon Islands rank at position 156 of the Human Development Index (2016), a drop from position 123 in 2010. The adult literacy rate (>15 yrs) is 78%.

Table 1: 2009 Population data:

Area	Total	# Households (HH)	Average HH size	Average population growth (%)
CHOISEUL	26,379	4,741	5.5	2.8
WESTERN	76,649	13,998	5.3	2.0
ISABEL	26,158	5,212	4.9	2.5
CENTRAL	26,051	4,924	5.3	1.9
RENBELL	3,041	709	4.4	2.5
GUADALCANAL	93,613	17,379	5.4	4.4
MALAITA	137,596	24,556	5.6	1.2
MAKIRA	40,419	7,311	5.5	2.7
TEMOTU	21,362	4,298	4.9	1.2
HONIARA	64,602	8,980	7.0	2.7
Rural total	414,072		5.5	1.8
Urban total	101,798		6.5	4.7
TOTAL	**515,870**	**92,241**	**5.5**	**2.3**

1.2 GEOGRAPHY

The Solomon Islands are very young in geological terms. The main island building force is plate tectonics. The geology is still very active with numerous earthquakes and tremors and volcanic activity. The second origin of island building is coral formation. Large limestone formations can be found in the Solomon Islands, which often provide good water bearing layers. Thick capping of soil and loosely consolidated (volcanic) deposits may result in surface waters significantly reducing in flow or even disappear during dry periods. The Solomon Islands are mostly mountainous with natural forests covering its surface.

1.3 CLIMATE

The Solomon Islands have a very uniform temperature, both throughout the year as well as along the latitudes. Diurnal variation averages about 7°C. Average daytime temperature is around 30 °C. Average Annual rainfall is between 3000 – 5000mm, though there is considerable difference between the windward and leeward sides of islands. Highest average rainfall is from January to February, with west to north-western monsoon winds prevailing. From May to October south- eastern trade winds prevail. Several cyclones may come about during the wet season, bringing strong wind and torrential rains, with mostly the south of the Solomon Islands being affected.

The effects of *climate change* are likely to be significant and considerable work is being carried out for Pacific islands states. Changing rainfall patterns, increased temperatures, rising sea level, as well as more frequent and/or intense extreme weather events and increased rainfall variation (Droughts and Floods) are considered likely to occur. Subsequent effects such as landslides and salt water intrusion may occur more frequently or more pronounced.

1.4 COMMUNITY ASPECTS

Solomon Islands communities are nucleated rather than dispersed, with gardens generally located in the hinterland. Most communities practice open defecation, using selected beach areas, the mangroves or the bush. Men and women use separate areas.

The Solomon Islands is a predominantly Christian country. An estimated 34% belong to the Church of Melanesia, 20% Catholic, 18% South Sea Evangelical Church, 11% United Church and 10% Seventh-Day Adventists. The remainder is a mix of Christian churches including Jehovah's Witnesses, Church of Christ, Baha'i, Church of the Later-Day Saints and others. The plethora of churches may affect water supply projects, as communal facilities must be accessible to all religious groups within a community. For example: a rainwater tank installed on a church building may not be used by those of a different denomination.

Land is the principal economic resource to indigenous Pacific Islanders, which has the highest rate of customary land ownership in the world. Approximately 85% of land in the Solomon Islands is claimed by custom owners. Written records are sparse and many disputes arise over who is the owner of a certain piece of land. This can certainly affect infrastructure projects which cross several land boundaries, such as for example piped water supplies. Clear agreement and consensus is required prior to commencing a project, though this is not a guarantee that a project will avoid any land issues in the future. Any negotiations with a community must take into account the social structures within a Solomon Island community. Communities are headed by a chief or 'big man', whom with fellow 'big men' and village elders decides on issues affecting the community. Women generally play a subservient role to men and are often not involved in decision-making. As women are responsible for the collection of water and many household tasks, it is recommended to involve them in at all stages of the project process.

2 THE RWASH FRAMEWORK

2.1 INTRODUCTION:

On April 27 2017, the Rural WASH Oversight Committee - a high-level committee concerning itself with policy, strategy, sector performance and funding – agreed to adopt (with a minor variation) the Sustainable Development Goals (SDG) indicators for its (rural) WASH Program, thereby setting the program in the international framework for development. The SDGs follow the Millennium Development Goals that ended in 2015 and represent ambitious targets for global development. For WASH, the SDG is defined as follows:

> *"Goal 6: Ensure availability and sustainable management of water and sanitation for all"*
>
> *6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all;*
>
> *6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations;*

Universal access is central in the Solomon Islands National strategies which further define the RWASH framework:

2 National Development Strategy (2016 – 2035);
3 National Health Strategic Plan (2016 – 2020);
4 National Rural WASH Strategic Plan (2016 – 2020).

An overview of the above strategies and their relevance to the RWASH sector is presented below. Access to essential services, inclusive access/equity (disabled, disadvantaged) and disaster/climate change resilience are themes that feature prominently in all three strategic plans, as well as the RWASH Policy.

2.2 RWASH POLICY

The RWASH Policy was endorsed by Cabinet in February 2014 and is the first of its kind for the sub-sector.

Although there is no dedicated Water Act or Water Resources Act, the following Acts have relevance to the RWASH sector:

- The Environmental Act (1998) and Environment regulations (2008);
- The Environmental Health Act (1996);
- The River Waters Act (1996);

Under the above Acts and regulations, the Ministry of Mines, Energy and Rural Electrification (MMERE) is responsible for the overall management and regulation of the water resources of the Solomon Islands. The Ministry of Health and Medical Services (MHMS), Environmental Health Division (EHD), Rural Water Supply, Sanitation and Hygiene Program is responsible for rural WASH activities which, although not specifically referred to, are managed under the Environmental Health Act, 1996 and its subsidiary legislation (Section 5(1)), Order Delegating Functions, 1987. The National Rural WASH Policy is the policy for the RWASH sub-sector, overseen by the RWASH Program of the Environmental Health Division.

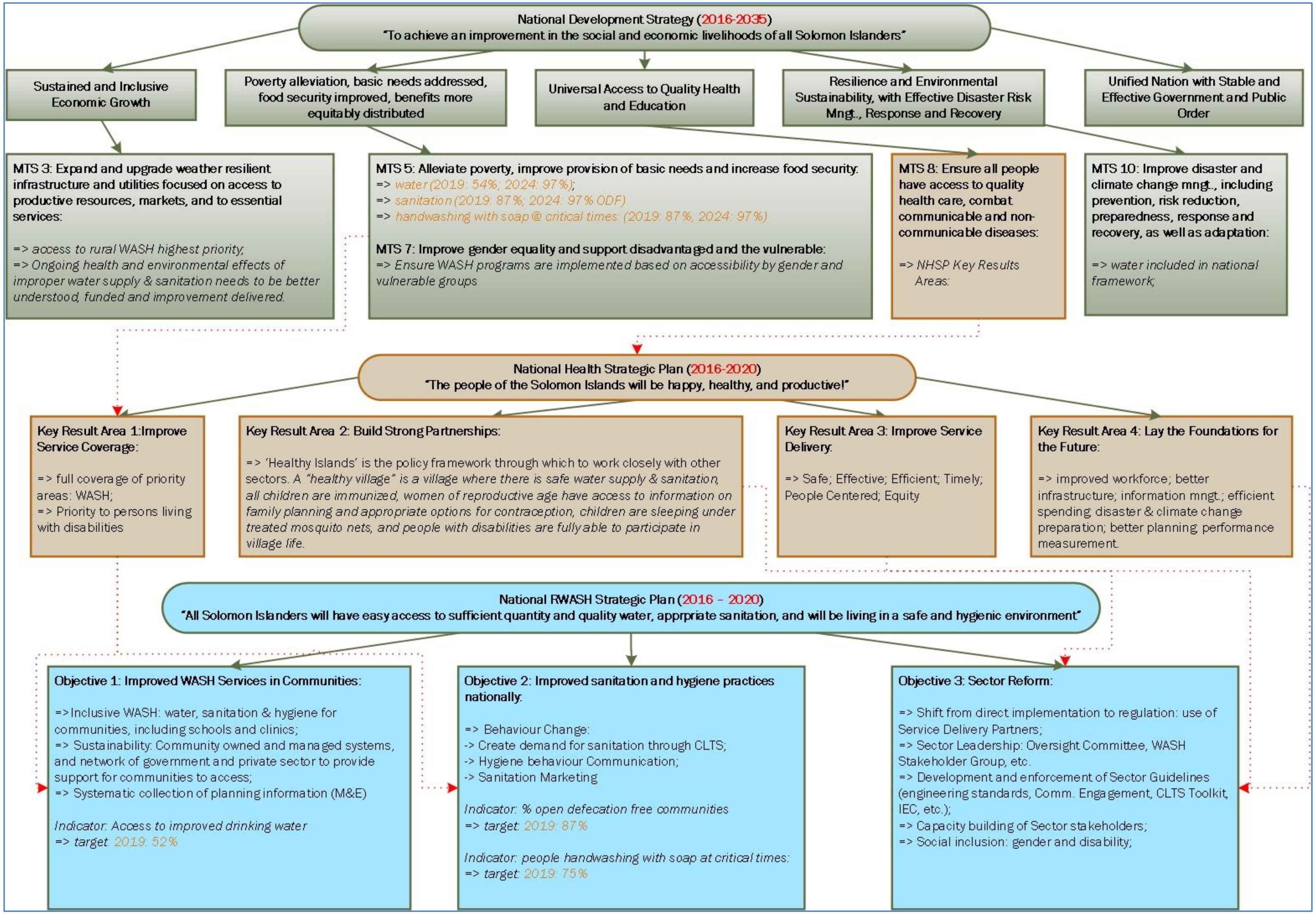

Figure 1: Key strategic plans relevant to RWASH sector

Broadly, the RWASH Policy (and the subsequent RWASH Strategic Plan) can be divided in 3 main parts:

1. Water Supply:

Key focus of the RWASH Program is on *Community Owned and Managed* (COM) schemes. With (government) resources being too limited to operate and manage (O&M) individual water supply schemes throughout the country, responsibility of O&M largely falls on the community. A distinction is made between major maintenance (e.g: storage tank collapse, intake or pipeline destroyed by landslide, etc) and minor maintenance (repair small leaks, tap repair or replacement, small concrete repair work etc.) with the communities responsible for minor O&M. Major is described as beyond the technical and financial means of a community. In order to achieve C.O.M., the RWP has developed the *Solomon Islands RWASH Community Engagement Guidelines* which details the processes to prepare, organize and mobilize recipient communities for their new WASH scheme. These guidelines can be downloaded from www.sirwash.weebly.com.

Linked with C.O.M is the emphasis on *appropriate WASH schemes*: systems that can be managed and maintained by communities because they are not hi-tech, too large, or costly to operate (such as some pumped systems). These *Solomon Islands RWASH Design & Construction Standards* are written to assist in developing appropriate designs. WASH schemes should also be holistic: for example, schools that are in a village should be included in the village WASH scheme (or at least developed at the same time) or vice versa to avoid conflicts between them with the schools using the village supplies or villagers using the school's system. The same applies to health facilities.

2. Sanitation & Hygiene:

Decades of fully subsidized sanitation projects have brought little progress in rural sanitation coverage (in fact sanitation coverage has reduced over the years). The RWASH Policy now focuses on sanitation triggering and a no-subsidy approach to community sanitation. There are a few exceptions to the no-subsidy rule: it does not apply to persons living with disability (PLWD), schools and clinics, and communities where the only viable technical option is beyond the means of the average household (for example, compost toilets on an atoll island with fragile fresh water lens).

Hygiene (with focus on handwashing with water and soap at critical times) now must be included in any WASH project and at several times during the project.

The policy also looks at sanitation (or WASH) marketing to meet the demand created by the new sanitation approach.

3. Sector Reform & Management:

The RWP is the sector lead, responsible for monitoring and evaluating activities by the various stakeholders in the sector. The responsibilities of the stakeholders are outlined in the policy, as well as the need for information management, including the RWASH database and use of SIG developed templates.

Climate change is expected to have significant impact on the water sector and therefore the RWASH sector needs to adapt its processes, approaches and regulations accordingly. *Gender* aspects are a key issue in WASH with women and girls predominantly responsible for collection of water, yet they are often not involved in the decision-making process. The policy requires that sector regulations and processes aims to maximize the involvement of women in the full project process to maximize the success of WASH schemes. Inclusive WASH is highlighted in the Policy to ensure that PLWD are involved in all aspects of the WASH schemes. *Persons living with disability* (PLWD) must be identified at the initial stages of the project process. Only registered PLWD can be provided with specialized/dedicated facilities.

As the sector lead, the RWP is responsible for the regulation of the sector. *Monitoring and evaluation* will therefore become a key activity of the RWP. With resources limited to do so effectively, the program will gradually shift from direct implementation towards sector regulation. This implies that the RWP is looking towards outsourcing the direct implementation to the civil and private sector.

2.3 PERSONS LIVING WITH DISABILITY

A survey conducted in 2005 recorded 14,400 PLWD of which approximately 85% (12,240 people) live in the rural areas. Thirty percent of PLWD are physically impaired (3,672 persons), 80% of which (2,938 persons) have a wheel chair. CBR maintains and aims to regularly update a registry of all PLWD in the country. This is a considerable task, made more difficult by many PLWD not being reported/coming forward for various reasons (taboo, shame, lack of awareness etc.).

While internationally elderly are not classified as PLWD, in the Solomon Islands they are increasingly regarded as persons with an impairment. As many households include elderly we need to avoid this is used as an excuse for subsidizing sanitation. Therefore, for the elderly the approach is one of family support, with only in extreme cases the elderly person being eligible for outside support.

Clear identification of who is eligible for subsidised support is not always a simple matter, as is determining what facilities are appropriate to the PLWD's needs. The variety of impairments make it necessary for individual solutions to be found. To ensure that appropriate measures are taken to provide WASH infrastructure to a PLWD, close cooperation with CBR staff will be required.

For rural WASH implementers the following approach/procedure applies:

1. Check project locations with the CBR registry for known PLWD and if so, include CBR staff in the design of the project;
2. **ONLY** CBR-registered PLWD are eligible for subsidised support;
3. CBR must approve and endorse all technical designs for PLWD. The engineer may propose a design solution but must obtain final approval from CBR – this will often require that a CBR field worker to visit the project site;

It may be that the registration process of new PLWD is not completed before the project ends. In this case the project assisted in identifying PLWD but WASH infrastructure is not constructed as part of the project.

2.4 RELEVANT ACTS TO THE RWASH SECTOR

Stakeholders are encouraged to read the relevant Solomon Island Acts to the RWASH sector, which can be found here: http://www.paclii.org/sb/indices/legis/Acts_Alpha_June2010.html. A brief summary is presented here:

Table 2: Overview Acts relevant to RWASH:

Act	Key sections	Summary
The Environmental Act (1998) and Environmental Regulations (2008): The Environment Act (EA) came into force in 2003 and aims to provide for and establish integrated systems of development control, environmental impact assessments and pollution control, as well as reduce risks to human health and prevent the degradation of the environment. In the event of conflicts	15, 16, 34, 35	Water supply schemes are only referred to in the context of agricultural development, though the distinction between providing livestock or humans with water is small in terms of required infrastructure. Sanitation facilities must clearly take the potential to pollute into account.

between this and other Acts, the Environment Act will prevail.		
Environmental Health Act (1996) The Environmental Health Act (EHA) makes provision for securing and maintaining environmental health and for matters connected therewith or incidental thereto.	22, 24, 25, 34, 35, 36, 37, 47, 48, 49, 91, 95	Areas must be kept clean with short grass and animals kept in a healthy manner. Sanitation options may not become a nuisance or become detrimental to health and may certainly not pollute any open water source. The latter effectively rules out most sanitation options near water sources. Polluting a water source or willful damaging of government or local authority owned water supply infrastructure may be fined (though SBD40 will not be much of a deterrent). Communal facilities (such as school toilets) may not be fouled by any user.
River waters Act (1996) The River Waters Act provides for the control of river waters and the equitable and beneficial use thereof and for matter incidental thereto and connected therewith. It applies to such part or parts of the Solomon Islands, including any rover or parts thereof.	4, 5	Any works impeding, obstructing, or otherwise affecting the flow of a river (river means any watercourse whether natural or artificial and any dam, lake, pond, swamp, marsh or any other body of water forming part of that watercourse) may be prohibited by the Minister, except where the water is used for domestic purposes. In other words, it does not apply to most WASH schemes.

2.5 PROVINCIAL ORDINANCES

No single list exists of the ordinances (local acts) regulating activity in provincial areas. However various provinces do have local ordinances either specifically covering Water and Sanitation or related areas such as solid waste management and nuisance as well as building regulations. Implementation authority and efficacy of implementation vary significantly across the country. The best source of information regarding these ordinances comes from the local EHD office and the provincial secretary.

2.6 RWASH SYSTEMS AND CLIMATE CHANGE

2.6.1 Water Supplies

Water supply is defined here as any facility that provides a source of water. The selection of the type of system depends on numerous factors, including user preference, suitability of existing water sources, land ownership issues, geology and topography.

The various types of water supply in rural the Solomon Islands are:

Direct Gravity Fed (DGF):
A facility where an uphill source is dammed or tapped into and the water is transported using gravity to the users. This type may include a storage tank. Most water supplies are gravity fed systems. These systems use public tap stands - household connections are seldom found. DGF systems can provide a large quantity of water, are easy to construct, operate & maintain, and are cheap relative to the service provided (in terms of water quantity/user/day). Land ownership issues can play a role however

Indirect Gravity Fed (IGF):

A facility where a pump is used to pump water to an overhead storage tank from which the water gravity feeds to the users. IGF systems are not very common in the Solomon Islands, as the funds and skills required for operation and maintenance (O&M) are often beyond the capacity of a community. High initial investment costs are a further barrier. Pumped water supplies are recommended only for public institutions (schools, hospitals etc.), which usually have personnel and funds available for maintenance.

Significant interest has been shown in recent years on solar pumped systems which are stated to be low or zero maintenance. These require specific design to ensure that the yield and head meet the needs for the system and it is important that the project leaves behind the capacity to carry out or procure problem solving and repairs and address how replacement costs will be met.

Hand pumps (HP):

A facility where water is manually pumped up from a borehole, a hand- dug well, an underground storage tank or other. RWASH recommends a version of the Blair hand pump called the Solomon Hand pump (Sol Mark), the India mark II or Rope & washer pump. Hand pumps the least common type of system. Spare parts are difficult to get and systems break down fairly quickly. Hand pump systems can provide a good level of service however. Any hand pump project needs to be accompanied with solid technical training and the necessary tools.

Hand-dug wells:

A facility where the groundwater is reached by digging a well. Water in most cases in the Solomon Islands is extracted using a bucket, though fitting a lid and hand pump will reduce the potential for pollution and may improves access. Wells are often lined with drums, rocks, timber or concrete;

Climate Change:

Piped water supplies, are inherently highly vulnerable to climate change effects due to its size and complexity. Piped supplies are exposed to multiple threats, starting at the source, through treatment systems (if applied) and the distribution network. The network may cross many different environments with significant hazards and may have numerous joints that are vulnerable to leakage. Proper design, construction, leakage detection and choice of materials contribute to the reduction of the vulnerability.

Protected springs (with the exception of artesian springs) have low-medium resilience to climate change effects, as they cannot be relocated and have limited adaptability in design. Water quality may be adversely affected by increased rainfall, or flow may be reduced in drying environments.

Boreholes are highly resilient to most climate change impacts but are less resilient to saline intrusion from rising sea levels. Drying environment may make boreholes less viable (deepening is not always possible or economically viable), especially where motorized pumping is used.

Hand-dug wells are highly vulnerable to reducing quantity of water and contamination following rainfall (ingress of water along the upper parts of the lining). Securing year-round supply is in many cases already problematic.

Rainwater harvesting rarely provides enough water throughout the year already and increased but less frequent rain or reduced rainfall makes the technology very vulnerable. Often systems are difficult to relocate and have limited adaptability in design.

Rainwater harvesting (RWC):

A facility where rainwater is collected and stored in a tank. In the Solomon Islands, only roofs are used as catchment areas. Rainwater harvesting is the second most common type of water supply. RWC systems are easy to construct and maintain but are relatively expensive, as water quantity per person per day is limited.

Boreholes:
Boreholes then are the only technology with high resilience to climate change effects. However, they are not universally applicable in the Solomon Islands and are relatively expensive to construct. Motorised pumping is usually outside the management capacity of the recipient community, leaving hand pumps as the more appropriate solution. Hand pump programs in the Solomon Islands have seen only limited success.

To mitigate the effects of climate change, it is recommended to provide a backup water supply in addition to the primary one. For example, another spring may be protected for use when the primary system fails. F or example, communal rainwater harvesting may be added to a piped water supply or hand-dug well project. As the Solomon Islands continue to prepare for climate change, the above approach should be applied in those areas identified as highly prone to climate related hazards. **All projects should include in their design report consideration of vulnerability to climate change and options for adaptation.**

2.6.2 Sanitation

Sanitation is defined here as the means of promoting health through the prevention of human contact with wastes. Waste in this manual refers to human excreta (faeces and urine) only. Common sanitation facilities[1] are:

Simple pit latrine:
The most basic and cheapest sanitation option, consisting of a pit with a slab on top. The slab may be made of concrete but timber or other materials are suitable as well. To make the facility 'improved' care must be taken to prevent any flies, rodents and others to gain access to the waste: the sides of the pit just below the slab must be sealed properly and the squat hole (or seat) must have a lid. This type does not require water to flush and does not limit wiping material to toilet paper only (leaves/husks/newspaper). Once the pit is full, it is covered and the slab and superstructure may be reused on a new pit.

Ventilated Improved Pit latrine:
As the simple pit latrine but with an added vent pipe to draw out odours from the pit. Traditional design requires the inside of the superstructure to be dark (so flies are not encouraged to enter) and the squat hole not covered to allow airflow to enter the pit through the squat hole and out the vent pipe. However, this requires careful construction of the superstructure and fly netting to be in place to keep flies from invading the pit. In practice this does not often happen with toilets made in the villages by users themselves, so the use of a lid on the squat hole is still more than highly recommended.

Pour-flush:
Sometimes called *bucket-flush*, as a bucket is usually used to flush the waste away. Often constructed in combination with a pit, though offset pits or septic tanks are common as well. The use of water means applicability is more limited, **as a reliable source of water must be available throughout the year**. Common types of water seals use a relatively large amount of water (4-5 liters/flush) but technologies exist that require much less (e.g: SaTo Pan), though they are not widely available in the Solomon Islands just yet

[1] NOTE: A latrine is a temporary facility, i.e. it gets replaced every now and then. When the pit is full, a new one is dug and a new latrine is constructed. Toilets are permanent facilities: the waste is disposed off-site or is removed from the holding receptacle when required and the structure is continued to be used. At times permanent superstructures are built on top of pits that cannot be emptied – the facility will be of no use once the pits are full.

Septic tank systems:

In septic systems the effluent is partially treated in the septic process. Septic tanks require de-sludging, which in rural areas usually means manual dislodging, which is unhygienic. Where pump-out services or portable de-sludging pumps are available, septic systems can be a viable option. All water-based sanitation requires constant water availability and proper cleansing materials (toilet paper) should be used.

Compost toilets:

Compost toilets consist of (usually) a dual chamber structure, with one chamber used at the time. Compost toilets are environmentally friendly and do not require water. Being permanent concrete structures, they are expensive however. In some environments however they may present the only viable technical solution. Atoll islands for example have small freshwater lenses too precious to pollute with other sanitation options. Subsidy for sanitation in these cases may be provided. The use of compost toilets will require considerable adjustment however. Though water is not needed to flush (in fact should not be used at all), adding ashes/sawdust/dry leaves after using the toilet will greatly aid the composting process. Once one chamber is full it is left to compost for 6-12 months during which the other chamber is used. Once the composting process is finished, the compost (now harmless) can be used as fertilizer or simply discarded.

Climate Change:

Effects of climate change will be particularly noticed in changes in the water cycle. Increasingly unpredictable rainfall will lead to less predictable water flows and recharge, and more droughts and floods.

The potential resilience of sanitation technologies can be classified as high, medium or low. Highly resilient technologies should function under most expected climate change conditions, medium resilient under a significant number of climate conditions, and low under a restricted number of conditions.

Pit latrines are highly resilient mainly because adaptation can easily be made. Flooding of pits is the main threat, potentially causing significant environmental contamination.

Pour-flush latrines have a slightly lower resilience than dry-pit latrines, as a wetter environment increases the risk of groundwater contamination. A drying environment reduces the resilience as well, as the technology requires water to operate.

Septic tanks are vulnerable to flooding or flotation in the case of groundwater level rise. Sealed covers and measures to prevent back-flow will reduce the risks though a drying environment may make the volumes of water necessary to keep the septic tank functioning difficult to sustain. Septic tanks are therefore less resilient than pit latrines.

Compost toilets generally are permanent, above- ground structures and don’t require water for operation, but drainage measures may be vulnerable to back flow.

Generally dry sanitation technologies are more resilient to changing climate conditions than water-based technologies.

3 RWASH STANDARDS OVERVIEW

3.1 INTRODUCTION

Technical design and construction standards are written to ensure that:

- Protection of public health. Though WASH infrastructure nearby the users is convenient, saves time and contributes to improved livelihood, WASH essentially is about preventative health. Good design encourages good construction and maximizes health benefits.
- Systems are designed and constructed in such a way as to achieve 'basic' or safely managed' level;
- Ensure sustainable and durable facilities are constructed.

It is important to keep a balance between functionality and durability. For example, a public tapstand has 2 functions: provide sufficient quantity of water for users and ensure no adverse (health) affects are created by for example poor drainage. A ½" PVC tapstand and a ¾" GI tap stand have the same functionality, but the ¾" GI standpipe is far more durable.

Sustainability of systems is largely about the operation and maintenance. The government nor the sector in general has the resources to maintain all the systems built in the country. As per the RWASH Policy this means that maintenance of schemes is shared between the users and the wider sector: minor maintenance (repair taps, leaking pipes, and small concrete work etc.) is the responsibility of the recipient community. Major maintenance really involves repair of significant damage to a system or components of a system that fall outside the capacity (both technical and financial) of the community to deal with. For example, a failed (ferro-cement) tank, an intake structure washed away by a landslide and similar. Most maintenance and operation is therefore done by the communities themselves. To ease the demand on technical skills and financial resources, systems should be designed to be within the capacity of the users to manage, i.e. appropriate to the local settings.

All designs must be endorsed by a qualified engineer:

1. Professional engineer with a qualification in civil engineering, or other relevant engineering degree;
2. Professional civil engineering consultant registered and approved to practice in The Solomon Islands.
3. Any individual trained to perform the duties of a water engineer, as recognised by the Government of the Solomon Islands.

3.2 SUSTAINABLE DEVELOPMENT GOALS

In March 2017 the MHMS RWASH Oversight Committee adopted the following *core indicators* for the RWASH sector:

'% of population using basic or safely managed drinking water services'
'% of population using basic or safely managed sanitation services'
'% of population with basic handwashing facilities (soap and water in the household)'

It differs from the SDG indicators in that they also include 'basic' access as an acceptable level of service. While aspiring to 'safely managed' systems is good, the reality in the Solomon Islands is that most households/communities currently have access to basic facilities only. The level of management and systems required to achieve safely managed is at this point in time beyond the reach of the sector in general.

For the households WASH, the SDG defines the access levels as follows:

Table 3: SDG monitoring ladders:

Drinking water ladder:	Sanitation ladder:	Handwashing ladder:
Safely managed: Drinking water[2] from an improved source, which is located on premises, available when needed and free of faecal and priority chemical contamination.	**Safely managed:** Private improved facility where faecal wastes are safely disposed on site or transported and treated off-site; plus a handwashing facility with soap and water	
Basic: Drinking water from an improved source provided collection time is no more than 30 minutes for a roundtrip including queuing.	**Basic:** Private improved facility which separates excreta from human contact	**Basic:** Handwashing facility with soap and water in the household.
Limited: Drinking water from an improved source where collection time exceeds 30 minutes for a roundtrip to collect water, including queuing.	**Limited:** Improved facility shared with other households.	
Unimproved: Drinking water from unprotected dug wells or unprotected springs.	**Unimproved:** Facility which does not separate excreta from human contact.	**Unimproved:** Handwashing facility without soap or water.
Surface water: Drinking water collected directly from a river, dam, lake, pond, stream, canal, or irrigation channel.	**No service:** Open defecation	**No facility:** No handwashing facility.

The RWASH sector therefore must strive to achieve at the minimum 'basic' services. An improved source is one which by its construction minimizes the risk of pollution at the point of intake. For example: a spring box will minimize pollution at the source but cannot control pollution in the springs catchment area. A piped system drawing water from a river or stream is considered to be an improved water supply, as the location and construction of the intake can be placed away from immediate sources of pollution or the system can have measures to improve water quality.

For WASH in health facilities, the SDG defines the access levels as follows:

Table 4:JMP/SDG Monitoring ladder for ***WASH in Health Facilities***

Water in Health Facilities:	Sanitation in Health Facilities:	Hand hygiene in Health Facilities:	Waste disposal in Health Facilities:
ADVANCED: TO BE DEFINED AT NATIONAL LEVEL, IF APPROPRIATE			
Basic: Water from an improved source is available on premises.	**Basic:** Improved toilets are usable, separate for staff & patients, allow menstrual hygiene management and meet the needs of people with limited mobility	**Basic:** Hand hygiene materials (either basin with water & soap or alcohol rub) are available at points of care and toilets.	**Basic:** Waste is safely segregated into at least 3 bins in the consultation area, and sharp and infectious wastes are treated and disposed of safely
Limited: Water from an improved source is available off premises, OR an improved water source is on premises but water is not available.	**Limited:** Improved toilets (flush/pour flush, pit latrine with slab, composting toilet) are present but not usable, or do not meet the needs of specific groups (staff/women/people with limited mobility.	**Limited:** Hand hygiene materials are available at some, *but not all*, points of care and toilets.	**Limited:** Waste is segregated but not disposed of safely, or bins are in place but not used effectively.
No service: Unprotected dug well or spring, bottled water, or no water source available.	**No service:** Pit latrines without slab or platform, hanging latrines and bucket latrines, or there are no toilets at the facility.	**No service:** Hand hygiene stations are absent, OR they are present but without water or soap.	**No service:** Waste is not segregated or safely treated and disposed.

[2] Drinking water = water used for drinking, cooking, food preparation and personal hygiene.

3.2 ENGINEERING STANDARDS OVERVIEW

The overall standards are summarized as follows:

Table 5: Standards Overview

TOPIC	STANDARD	NOTES
Survey & Design	*Projects are properly surveyed and are designed to provide basic access to WASH, while keeping maintenance and operation requirements to a minimum.*	Surveys must, with sufficient accuracy, record key information to enable good design. Minimal *O&M requirements* should not be at the expense of service level: e.g., choosing rainwater harvesting instead of gravity-fed water supply because the maintenance is easier – service level will be much lower. Simple/basic systems should be chosen over hi-tech complicated solution (like automatic systems). The size of the system heavily influences the O&M requirements, especially when the number of villages, beneficiaries and landowners is high. Organizing O&M is more challenging and the chance of resource disputes increases.
Water Supply	*Basic access to sufficient quantity of water is available at all times for drinking, food preparation, personal hygiene, cleaning and laundry and is safe for the purpose intended.*	Access to an improved water source within 30 minutes round trip including queuing time. Key here is *sufficient quantity*: year-round basic access must be achieved. Too many projects provide water for limited time only (especially with rainwater harvesting) or too little is provided to save cost or because of a too limited budget. Neither contributes to meeting the strategic target of universal access: villages cannot be considered as done unless water supply demand requirements are met for the design period (15 years).
Sanitation	*Users have access to improved and usable sanitation facilities, appropriate to their access to resources and the environment.*	*Improved* means hygienically separating human waste from human contact. *Usable* means private, functional and private. The engineering requirements in this document are mainly for institutional facilities: The Community-Led Total Sanitation approach leaves latrine construction details to the user, as long as it is improved and usable. NOTE: sanitation requirements for schools are detailed in a separate document.
WASH for Persons Living with Disability (PLWD)	*PLWD are provided with appropriate access to water supply and sanitation facilities on the household compound*	*Appropriate* means fit for the type of disability. All designs must be endorsed by the Community-Based Rehabilitation Division of the MHMS. The no-subsidy policy for household sanitation does not apply to PLWD.
WASH in Health Facilities	*Health facilities are provided with basic access to water supply, sanitation, hand hygiene and waste disposal facilities.*	Water supply is often not available, unreliable or in insufficient quantities, but sanitation is worse. Waste disposal facilities are largely absent, particular in small clinics where open pits are commonly used for waste disposal. Table 4 above describes the requirements for WASH in clinics.

4 SURVEY & DESIGN

4.1 SURVEY REQUIREMENTS

Good design is only possible if based on a good survey. The following elements are discussed:

1. Community information and current situation;
2. Source inspections and flow measurements
3. Detailed survey of pipe alignments and structure locations;
4. Sanitation survey requirements;

4.1.1 Community information and current situation

In order to determine the best solution to the WASH needs of a community, the existing situation needs to be examined carefully. This includes but is not limited to the following:

- ✓ *Population data*: current population figures (including # of households), design population; persons living with disability;
- ✓ *Location and logistics*: map and GPS coordinates of the project location, information regarding access by land/sea/air; village layout for location of water points; school layout (including roof sizes and condition if rainwater harvesting is an option); clinic setting (for location of water disposal facilities);
- ✓ *Schools (if applicable)*: number and type of schools, sex-segregated, current and future student/staff numbers student/staff numbers;
- ✓ *Clinics (if applicable)*: # of outpatients and inpatients (if applicable) using normal figures (not emergency spikes);
- ✓ *Current water sources*: types, distance/accessibility, quality (state) of existing sources including private facilities; identification and survey of an alternative backup source[3]; The STATUS form of the RWASH M&E system could be used to provide a baseline for any project; Resource ownership and availability to the community (landowners agreements);
- ✓ *Past water supply systems*: status, reasons for disuse (including possible disputes), salvable components, size/length/condition of pipes and structures.;
- ✓ *Sanitation*: current sanitation facilities and use in the village;

4.1.2 Source inspection

Water source inspections should include (but are not limited to) the following:

- ✓ Photo/sketch and GPS location of water source(s);
- ✓ Flow measurements at least at the end of the dry season, but ideally at several times through the year; Inquire community members about changes in flow throughout the seasons;
- ✓ SDG indicators for safely managed systems require testing for at least bacteriologic contamination and 2 key chemical contaminants (Sulphur and arsenic). The latter 2 are more relevant to groundwater use though springs/surface waters near volcanoes will require testing as well. For e-coli testing the multi-compartment testing (e.g. Aquagenx) is recommended; Though not mandatory at this stage, it is highly recommended to carry out a sanitary survey of the source(s) as per WHO guidelines (http://www.who.int/water_sanitation_health/publications/dwq-guidelines-4/en/;)
- ✓ Land use at and nearby the source needs to be recorded. In particular mining/logging will affect the (future) flow of the water source, and agriculture may affect the water quality if fertilizers and/or pesticides are used.;
- ✓ Flow measurements should be done at the source even if (part of) an existing system is used, as leakage or blockage in the pipeline will affect measurements;

[3] Being discussed is the strategy to provide a backup source or partially develop an alternate (f.e. spring box on backup source but no pipe system) to mitigate the effect of disasters where the main water source is not accessible anymore;

- ✓ For systems using groundwater, sources of pollution must be identified and mapped (sanitation, waste disposal, cemeteries). For pumped systems, a pumping test must be conducted to establish the safe yield of the groundwater source.
- ✓ For rainwater harvesting projects, existing roofs should be measured and the status recorded (including fascia boards, guttering etc.) but careful consideration should be given to the use of private roofs used for communal rainwater tanks.

4.1.3 Detailed survey of pipe alignments and structures

Where a pipe reticulation system is required, surveys should include (but are not limited to):

- ✓ Distance and elevation measures of the planned route of the pipe lines. Distances can be measured using a tape measure or GPS. Elevations should be measured with a barometric altimeter (not just GPS unless the GPS has a built-in barometric altimeter) – preferably using the two-altimeter method to account for changes in atmospheric pressure that affect the accuracy of the measurements. Specialized survey equipment such as theodolites or dumpy level can be used but is not recommended or needed for most situations and is very time consuming.
- ✓ Distance and elevations should be recorded at regular intervals (not merely major points such as junctions, tank site, village site etc.) and spaced closely enough to allow good design and identification of potential issues (eg. potential air traps) and location of structures;
- ✓ Soil conditions should be recorded along the route of the pipeline, as pipes must be buried where possible;
- ✓ Potential locations for structures such as storage tanks, break pressure tanks, sedimentation tanks, pipe junctions, creek crossings and others must be identified. Drainage options for tanks should be considered;
- ✓ Village layout and locations for water points and drainage;
- ✓ Reports must include (cleaned up) survey data and topographic profiles and friction loss curves;

4.1.4 Survey requirements for sanitation projects

For subsidized sanitation projects (institutions and the few exceptions for communities as per RWASH Policy), surveys should (but are not limited to):

- ✓ Record the availability and reliability of any water sources to determine if water-based sanitation is feasible;
- ✓ Take note/record the management implications of certain technology options (e.g: septic tanks require safe desludging facilities and perhaps road access by septic trucks; flush toilets require toilet paper that may not be affordable).
- ✓ Record location, type and use of water points to avoid undue pollution of the water source;
- ✓ Record groundwater table levels to ensure bottom of the pits are sufficiently above the water level;
- ✓ Discussion (and consensus) with the users on the location of the facilities to enhance/ensue use. This includes privacy/visibility concerns of the facilities;
- ✓ Record flood prone areas if any;

4.2 DESIGN REQUIREMENTS

(This section provides an overview of the design parameters for WASH projects)

4.2.1 Key water supply design parameters

- The design period for all RWASH systems is 20 years;
- All designs shall incorporate an annual population increase of 2.3% (national average2009 census).
- Minimum flow per tap: 0.125 l/s;
- Minimum residual head at water points:5m (to avoid too low a flow. Where not possible due to topography, tapstands are not recommended but water should flow to small storage tanks fitted with taps instead);
- Maximum residual head at tapstands: 50m (to avoid excessive flow rate);
- Maximum strongly recommended residual head at any point in system: 90m (to avoid excessive wear, overly costly pipes and to aid maintenance);
- Recommended velocity rate between 0.7m/s – 3.0m/s;

- Incorporate break-pressure tanks as the primary means to control excessive pressure in the system (over pipe diameter variations);
- Designs should account for peak hour demand. Storage tanks should be included in the system if the peak hour flow is bigger than the safe yield or when it is more economical to include a storage tank (thus allowing for a smaller feeding line to the tank).
- Usable storage volume may be calculated as follows:

Table 6: Storage tank volume estimation

Period	% total daily demand used
2	30%
8	40%
2	30%

4.2.2 Water demand:

The following figures will apply:

Table 7: Community Water Demand figures:

Category	Quantity	Description
Community	5 l/p/d	Minimum for rainwater harvesting projects when other water sources are available. Due to the very high (relative) costs for RWC projects, minimum water demand is set at 5 l/p/d in line with WHO standard for minimum drinking quantity
	20 l/p/d	Absolute minimum for any water supply system. If rainwater is the only viable source, this minimum amount must be met with rainwater storage. If a source cannot provide this minimum, it should be supplemented with rainwater storage
	50 l/p/d	WHO minimum for rural communities. Can still be used f 100l/p/d cannot be supplied by the source but will require extra community expectation setting
	100 l/p/d	The standard for rural communities
Inpatients	50 l/bed/day	When rainwater is the only water source available;
	100 l/bed/day	For combined rainwater and other water sources (where the other source is not able to provide 200 l/bed/day)
	200 l/bed/day	For large enough piped water supplies
Outpatients	5 l/outpatient	
Special: Maternity Other	100l/intervention 250l/d	Dentist, laboratory etc.
Special needs	50l/p/d	This is for PLWD with uncontrollable bowel movements (cerebral palsy) for whom medication is not effective. 50l/p/d regardless of the water source

NOTE: more than one water source may be used to meet the water demands.

- One tapstand for maximum of 5 households, unless in conflict with:
- Access to water no more than 30 minutes round-trip including queueing (this may mean that 3 households located relatively far away would get their own tapstand);
- One well (with or without hand pump) for maximum of 20 households, unless in conflict with point above (30 minutes' total collection time);

Software may be used for design purposes but reporting must include the calculations in such manner that manual verification is possible.

4.2.3 *Key sanitation design parameters:*

- Toilets with pits may not be used within 30m radius of any water extraction point (surface or ground) where water is used for domestic use. Where the ground is very permeable[4], a radius of 100m must be adhered to;

- On-site septic tanks may only be used where supporting infrastructure (septic trucks, waste dump sites etc.) is available to ensure the safe and sanitary disposal of accumulated solids; manual emptying of septic tank must be avoided; As infrastructure expands and alternate technology is developed for emptying and treating septage this technology may become more viable. Note that as an alternative to vacuum trucks to empty tanks especially where retrofitting existing remote locations, where it is not possible to use other technologies a duplicate tank installed with a Y-junction can be used so a full tank can be left for at least 12 months to stabilize before manual emptying.

- For public facilities, local context is taken into account: privacy concerns, segregation (male/female, staff/non-staff); This may affect the number of facilities, but also design features (privacy walls for example) and location;

4.2.4 *Key health facility design parameters:*

- Maximum distance to water points and toilets facilities shall be: 30m over an easily accessible path;

Table 8: Toilet ratios for clinics:

Category	**Required**	**Notes**
Inpatients	2 toilets for every 20 beds	Segregated by sex
Outpatients	2 toilets for every 40 outpatients[5]	If toilets inside the building are not available, the number of toilets is calculated on aggregate basis, with one inpatient counting as 2 outpatients.
Backup	2 VIP latrines	Backup toilet, 1 Male, 1 Female

- Water-based toilets should use off-set pits or septic tanks if sludge removal services are available;
- As per Sustainable Development Goals: one toilet must have menstrual hygiene management facilities and one must be disabled accessible (note one toilet may have both);
- Outpatients may not go through inpatient areas to reach toilets: dedicated outpatient toilets/latrines must in that case be constructed;

Table 9: Water points for clinics:

Category	**Required**	**Notes**
Hand Washing facility	• At every toilet block; • At each treatment area;	Water + soap or alcohol hand rub is available at all toilet (blocks) and patient treatment areas. For alcohol rub, the dispenser may be transported from one treatment area to the next (not recommended for large centers);
Showers	1/40 user	Segregated by sex, users include staff, inpatients and caretakers
Laundry	1/40 inpatients	Laundry soap to be provided by the health facility

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[4] *A basic percolation test can be done to estimate seepage*

[5] Average daily number of outpatients.

5 CONSTRUCTION REQUIREMENTS

5.1 SANITATION CONSTRUCTION REQUIREMENTS

(The following applies to subsidised sanitation facilities, i.e. for schools, health facilities, PLWD and some particularly vulnerable environments (like atolls). With the new RWASH Policy dictating no-subsidy and sanitation triggering as key elements of the sanitation approach in the Solomon Islands, households will construct their own toilets as they see fit. The main objective of the RWASH Policy's sanitation approach is behavior change, a process which would be stifled by dictating technical standards.)

Table 10: Sanitation Construction Requirements

STRUCTURE	REQUIRED	RECOMMENDED/NOTES
Common (applicable to all facilities)	• Prevent flies, rodents and others having access to the waste (sealed floor, lid/cover of squat hole/raiser, no holes on outside; • Prevent surface water from entering the pit; • Minimum internal dimensions: L x W x H = 1.0m x 0.8m x sufficient to stand; • Squat hole (if applicable) max.: 360mm x 180mm	• • • L x W = 1.2m x 1.0m or more • Key hole shape recommended;
Basic pit latrine	• Bottom of the pit at least 0.5m above highest groundwater level; • Line the pit wall where necessary to prevent collapse;	• Easily removable slab and superstructure for re-use once pit is full;
VIP Latrines	As basic pit latrine, PLUS: • Straight vent pipe sealed into slab/base (no bend entering pit from the side: reduces flies getting attracted by the light at top of vent pipe; • Minimum diameter vent pipe: 150mm (smooth pipe), 200mm (rough pipe); • Top vent pipe covered with fly netting; • Top vent pipe min. 500mm above roof top;	• Easily removable slab and superstructure for re-use once pit is full;
Water-sealed above pit	• Include vent pipe min. 40mm diameter; • Line the pit wall where necessary to prevent collapse	• Easily removable slab and superstructure for re-use once pit is full;
Water-sealed with off-set pits or septic tank	• Include vent pipe min. 40mm diameter; • Drain pipes as short as possible to minimize water required for flushing; • Drain pipes laid in straight line or with less than 45^O bend; • Drain pipe slope 1:50; • Drain fitted with air vent(s) to prevent air locks; • Include inspection ports at pipe junctions;	• Steep slope will risk water to run too fast not carrying the waste with it; shallow slope will prevent proper drainage
Septic tanks	• As per Solomon Islands building code	• Prefabricated septic tanks are allowed for households up to 10 people provided the capacity is at least 2,500 liters for black water only, or 4,500 liters for both black and grey water. These tanks may be single chamber only.
Compost toilets	• Dual chamber (or 2 single) to allow one chamber to compost with the other in use; • Constructed using reinforced concrete, or other durable water tight material (e.g: wheelie bins); • Include easily accessible chambers for emptying; • Size of chambers to allow 6 months minimum composting time; • Each chamber fitted with vent pipe (min. diameter 10mm); • Drainage pipe min. diameter 50mm with min. 2mm sized slots (cut with handsaw); • Liquid containment box: water tight, min. $0.15m^3$;	• Squat slab highly recommended to be made of reinforced concrete as well (some designs use timber but that rots quickly)

5.2 WATER SUPPLY CONSTRUCTION REQUIREMENTS

STRUCTURE	REQUIRED	RECOMMENDED/NOTES
Intake	• intake pipe secured in reinforced concrete (blocks), stones, or masonry; • Cover the intake where applicable(springs), ensuring access and ventilation; • Use GI pipes & fittings for main outlet; • Outlet fitted with control/gate valve and screened inlet; • Animal access prevention measures; • Washout at floor level, min 50mm GI, long enough to prevent erosion near the intake; • Crest of dam or overflow below the natural water level to avoid backflow; • Filtration facility required for sources with high sediment load;	• Fence 5m around the source;
Pipes & fittings	• All pipes must be buried where possible: min. 300mm in trenches without sharp objects/rocks or large quantities of organic material; • Use high-density poly-ethylene (HDPE) pipes & fittings where pipes can be buried: **AS/NZS 4130-1997, SDR 17 or equivalent ISO standard**; • Use GI pipes & fittings were burying is not possible and along creeks: **AS 1074-1989, AS/NZS 4792-2006 or equivalent ISO standard;** • Include washout valves and air release valves at critical points in the pipeline; • All major branch lines to be fitted with gate valves/isolation valves (**AS 2638.1-2002 or Equivalent ISO standard);** •	• uPVC pipes are not allowed for reticulation systems, including tap lines. • Limit pipe diameter to 90mm to ease repair and maintenance (over-sized tools not needed, easier to tighten smaller fittings, availability of spare parts, cheaper parts); • Automated air release valves not recommended due to maintenance and supply chain issues;
Tanks	• Fitted with strong and secure cover, with manhole access; • Use GI fittings for inlet and outlet(s), fitted with gate valves; Inlets and outlets may NOT go through the base of the tank (to prevent snapping during earthquake); • Prevent access by rodent and insects to the water; • Include float valves for all tanks in a gravity fed system; • Include prevention measures for earthquakes/cyclones (sufficient reinforcement/bracing/strapping); • Overflow drained away from tank preventing erosion and mosquito breeding;	• Plastic and fiber-glass tanks in particular are vulnerable to strong winds. Lids often fly off. Earthquakes may cause tanks to slide of the platform; Tank stands need sufficient anchoring and bracing;
Tapstands and Showers	• Include good drainage facilities; • Slab thickness min. 75mm reinforced concrete;	• Are constructed to promote use and health – under no circumstance should it become a health hazard due to stagnant water and poor drainage;

	• Gravel pack around edge of slab to prevent scouring;	
Suspended crossing	• Crossing less than 10m can be done using GI pipes; • Crossing more than 10m requires pipe suspended under steel cable; • Cable sufficiently anchored by dedicated structure (no trees); • Sufficiently high above max water level to stay clear of any debris;	• Trees should not be used, as the steel cable may kill the tree causing the anchor to fail;
Road crossing	• GI pipe with sockets is used as a sleeve for the water pipe; • Otherwise buried at min. 1m depth and extending beyond the trafficable areas on both sides of the road;	• Right angles to cross the road;
Pump house	• Min. 100mm slab, reinforced concrete; • Smooth floor surface to avoid accumulation of spilled fuels but including measures to prevent spilling into the environment (raised edge); • Ample ventilation to prevent gas built-up; • Located in easily accessible place to allow safe transport of fuels etc.; • Pump shed is constructed so that floor level is above the maximum known flood level;	• Large enough to allow both pump and fuel/oil to be placed inside (with room for O&M), the fuel separated from the pump by a concrete or masonry wall;
Sedimentation tank	• Width : Length = 4:1; • Min. depth 750mm; • Min. retention time: 20 minutes (for system with storage tank), 60minutes (for system without storage tank); • Max. velocity: 0.5cm/s; • Inlet fitted halfway depth of the water, with valve and even flow distribution; • Outlet designed to collect surface water only (e.g: collection gutter); • Fitted with a washout (min. 50mm);	• Perforated pipe or baffle to stop turbulence;
Hand-dug wells	• >30m from human waste disposal site (toilet), confined animal housing, and up-gradient from sources of pollution; • Drainage facility that drains spillage at least 6m away from well/borehole; Minimum slope drain: 5%; • For conventional wells raised at least 600mm above ground level (to avoid small kids falling in); • Lid on wells; Buried wells with 80mm PVC pressure pipe casing extending from the apron is also acceptable; • Be fitted with adequate measures to prevent pollution of the aquifer through surface infiltration along the side of the casing (using a clay/concrete plug or seal);	• Concrete apron size 2.0m x 2.0m to prevent spilt water landing on surrounding ground and provide wash area for more than one user; • Well construction is work for skilled persons and many requirements must be met, too many to include here. It is highly recommended to refer to the following publication: *Water Supply Well Guidelines for use in Developing Countries - 3rd edition (Schneider 2014)* http://www.rural-water-supply.net/_ressources/documents/default/1-411-2-1436178959.pdf
Boreholes	• As with wells, except:	• Borehole construction is work for skilled persons and many requirements must be met,

	• Raised at least 300mm above the ground to avoid floodwater from entering the bore; • Lids may not be possible at all time, though unused boreholes should be covered;	too many to include here. It is highly recommended to refer to the following publications: *Supervising Water Well Drilling – a Guide for Supervisors (RWSN 2014)* http://www.rural-water-supply.net/_ressources/documents/default/1-392-34-1418981410.pdf & *Code of Practice for cost effective Boreholes (RWSN 2010)* http://www.rural-water-supply.net/_ressources/documents/default/1-128-2-1344514867.pdf
Pumps	• If fitted on hand-dug well or bore, above requirements apply;	• Wind-powered pumps are **not allowed**. Half of the Solomon Islands lies within the zone around the equator (±8^{O}) in which wind powered systems are known not to be effective. The system is susceptible to damage by strong winds which regularly occur in the southern part of the Solomon Islands. Also, compared to solar systems, wind powered systems hold little advantage. • The use of mechanically driven pumps shall be limited where possible due to the increased demands pumped supplies place on operation, maintenance and spare parts; • The following hand pumps are recommended: SolMark 4 (PVC version) and 5 (GI version), and the Rope & Washer hand pump. SolMark and Rope & Washer pumps can easily be made using locally available materials; • Commercially available, imported pumps such as the Nira, Tara, Indian Mk and other may be used but availability of spare parts, dedicated tools and the training required to operate and maintain them significantly affects the sustainability of them in a market as small as the Solomon Islands.
Rainwater	• Includes a soak-away or other drainage facility; • Screened inlets and outlets; • Includes first-flush system; • Maximum gutter bracket spacing: 300mm • Have sufficient spacing under the tap for water containers/buckets; • Tank stand designed to withstand the weight of a full tank; • Tanks are secured to the tank stand/slab to withstand cyclones and earthquakes;	• Recommended: extended downpipe with end cap; • The 'standard' 500mm bracket spacing is not enough in cyclone areas; • Semi-circular gutters are recommended (better drainage);
Concrete & Timber structures	• Use steel reinforcement; • Min. 25mm thick concrete cover over reinforcement; • Durable (hardwood) or treated timber; • Strong anchoring: min. 600mm in ground encased in concrete; • Bracing to prevent collapse during earthquake/strong winds;	• Only steel reinforcement is allowed: no fiber/rope, nylon etc.); • Rainwater catchments, pump houses, tank stands, etc. • Use of cyclone strapping, cleats or bolts recommended for key joints;

5.3 WATER & SANITATION FOR PERSONS LIVING WITH DISABILITY

(NOTE: the below requirements are in addition to the technical requirements in the previous chapters.)

ITEM	REQUIREMENT	RECOMMENDATION/NOTES
SANITATION:		
Access	• Independent access over a non-slippery route; • Delineation markers for visually impaired	• Visible or tangible
Ramp	• Up to 10m length: gradient 1:20; • Up to 5m length: gradient 1:15; • Min. width: 1m, non-slippery material; • Curb on outside edge;	
Stairs	• Max height: 160mm; • Min width: 280-420mm; • Min length: 1m • Hand rails one at least one side: 800-1000mm height;	• All steps must be of equal dimensions (no irregular steps)
Doors	• Min. width 1m • Wheels able to be stationary on flat area not directly in front of door; • Door handles and locks to allow full hand operation (not just fingers);	• Door opens to **outside**; Door swinging to inside will increase toilet size, as the quarter turn by the door adds to internal space needed if wheel chair is used. • No sliding door – do not last and get stuck too quickly;
Internal:	• Large enough to turn wheelchair: min. 1.5m diameter; • Handrails: min. 500mm length, middle point between 500-700mm from floor, at 500mm from center of toilet bowl;	• Applies to all facilities, whether disabled has a wheel chair already or not yet; • Thick rope may be used but is not recommended;
Toilet seat:	• Max 400mm from floor (so commode can be used);	•
Water in toilet	• Water accessible from the inside; • Hand was basin usable while sitting; • Shower: only if piped supply is available. Location to minimize spilled water	• Not just a tap above the floor, as splashed water will make it slippery and dangerous for the user; • In corner, away from door;
WATER SUPPLY:		
Water points	• Inside house boundary or inside house where appropriate; • Usable and accessible from wheel chair; • Taps that allow water hose connection; • Full hand operation taps (no delicate finger action)	• No raised edge on tap stand base; • Required to allow easy bathing; • Quarter turn large handle, high-pressure ball valve taps recommended;

5.4 WASH IN CLINICS

5.4.1 Introduction

All existing health facilities must at minimum comply to the Sustainable Development Goals indicators and to meet these requirement table 5.4.2 below outlines the WASH requirements for Health Facilities.

The MHMS Role Delineation Policy (RDP) stipulates the minimum infrastructure requirements including WASH requirements for various health facility levels. The RDP infrastructure requirements applies to the construction of new health facilities and major renovation of existing health facilities. At this stage, many existing, non-conforming health facilities do not meet the requirements of RDP, however they still should at minimum comply to the Sustainable Development Goals indicators.

Specific policies and laws exist in relation to the control of certain pharmaceuticals. The National Medical Stores provides specific advice for control and disposal of these substances (the 'Infection Prevention Policy Guidelines for Health Facilities').

Radiological waste is not covered by this standard and for disposal of radiological waste one is referred to the National Environmental Health Program and the Ministry of Environment, Climate Change, Disaster Management and Meteorology for advice.

5.4.2 Construction requirements for WASH in Health Facilities

Table 11: Health Facility WASH Construction requirements

ITEM	REQUIREMENT	RECOMMENDATION/NOTES
WATER SUPPLY:		
Tanks, taps, wells etc.	• As per requirements in paragraph 5.2 above for individual structures	•
SANITATION:		
Toilets & latrines	• As per requirements in paragraph 5.1 above for individual structures; • Seat risers used for all toilet/latrine types (wet or dry) to provide support for weak/unstable patients;	•
HAND HYGIENE:		
Handwashing station at toilets and treatment areas.	• Robust, permanent structures should be constructed (tap, tank, or other). Temporary facilities such as tippy taps will require too frequent replacement/repair to be practical.	• Highly recommended to install a hand wash basin/sink with adequate drainage and connected to a water source in the patient treatment areas; SDGs states hand hygiene facilities (basin with water & soap or alcohol rub) to be available at all points of care and toilets. As most of the WASH implementers do not provide (and cannot provide on sustainable basis) consumables such as alcohol rub or plastic basins, permanent facilities are promoted here. • Changes to internal facilities should be done in consultation with the staff.
WASTE DISPOSAL:		
General	• All waste disposal facilities are fenced off into a *waste disposal* zone and the gate fitted with lock; • Waste disposal zone is at least 30m from any water extraction point and not be prone to flooding;	
Burn pit (general waste)	• Concrete base and walling (or brick walling);	• Small size health facility minimum: 1.5 x 1.5 x 1m (L x W x H); • Larger size health facility minimum: 2 x 2 x 1m (L x W x H);
Organics pit	• Option 1: burying: the sides and/or top of pit lined and fitted with metal cover (which can be reused); when adding organic material, soil must be added to cover the waste; • Option 2: burning: concrete lined base and walls where organic material is burned; Metal cover; • Ventilation pipe 50mm with prevention for rain;	• Pits dug to similar dimension as burn pit • Option 2 is recommended for larger health centers which generate considerable amounts of organic waste;
Sharps pit	• Enclosed container with a narrow opening (pipe) sized to only allow the sharps to go through;	• Small health centers: at least 0.5m^3 effective volume (i.e. not including 50cm freeboard),

	• The opening must be covered; • If (partially) buried: at least 50cm above the highest groundwater level;	• Larger health centers: 1m^3 effective volume; • Sharps, like all waste may be temporarily stored and collected and disposed of later. • Note that sharps include needles and scalpels and the opening should be big enough to accommodate; • Sharps should be disinfected in the incinerator before disposal in the sharps pit;
Incinerator	• Permanent structures. Temporary structures (such as oil drums) will not be acceptable; • Location to allow effective operation with minimal local air pollution to health center or nearby housing;	• Temporary structures are unlikely to comply with the high-temperature requirement; • Incinerators are required for ALL levels of health facility;

APPENDIX 1: RAINFALL DATA

Table 9: Long-term average rainfall data:

Province	Location	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	Annual
Choiseul	Taro	1976-1995	254	313	301	319	290	273	351	321	286	273	236	192	**284**	**3409**
New Georgia	Munda	1962-1996	399	371	365	290	270	245	333	269	250	229	233	287	**295**	**3541**
Santa Isabel	Bula	1989-1990	417	288	337	351	295	256	290	423	426	490	533	368	**373**	**4474**
Guadalcanal	Henderson	1975-2000	238	281	255	155	129	69	83	101	103	89	150	200	**154**	**1853**
Malaita	Auki	1962-1996	361	372	400	248	216	182	231	221	206	210	213	287	**262**	**3147**
Makira	Kirakira	1965-1996	319	320	350	312	311	234	312	321	269	244	225	295	**293**	**3512**
Santa	Lata	1971-1996	399	400	421	332	382	292	357	363	342	357	324	331	**358**	**4300**
			341	**335**	**347**	**287**	**270**	**222**	**280**	**288**	**269**	**270**	**273**	**280**		

More recent data or specific data closer to the design site may exist where available this should be used. The SIG agency responsible for keeping rainfall data is the SI Met Service.

APPENDIX 2: DESIGN REPORT FORMAT

PART 1: BACKGROUND INFORMATION

1.1 SURVEY DETAILS (surveyor, date, season):

1.2 COMMUNITY & LOCATION:

1.2.1 Population:

1.2.2 Location, travel and materials delivery:

1.2.3 Economy, social & village structure:

1.2.4 Schools, clinics & denominations:

1.2.5 Skilled labor:

2.1 CURRENT SITUATION - WATER SUPPLY:

2.1.1 Current water sources:

2.1.2 Details existing water supply systems (type, state, possible improvement, etc.):

2.1.3 History of previous water supply systems:

2.1.4 Details existing water committee:

2.1.5 Surveyed water sources, flow rates and justification of choice:

2.2 CURRENT SITUATION - HYGIENE & SANITATION:

2.2.1 Current (observed) hygiene practices:

2.2.2 Existing sanitation facilities and/or defecation areas:

PART 2: PROPOSAL

3 WATER SUPPLY PROPOSAL:

3.1 SUMMARY OF PROPOSED WATER SUPPLY DEVELOPMENT:

3.2 BACKUP OPTION IN CASE OF SYSTEM FAILURE:

3.3 COMMUNITY CONTRIBUTION (raw materials, skilled/unskilled labor):

3.4 ESTIMATED DURATION OF THE CONSTRUCTION:

4 SANITATION:

4.1 POTENTIAL/PROPOSED SANITATION DEVELOPMENT

4.2 COMMUNITY CONTRIBUTION (raw materials, skilled/unskilled labor):

5 COSTS *(implementation, value community contribution and total)*:

PART 3: DESIGN INFORMATION

6 WATER SUPPLY:

6.1 DESIGN LIFE:

6.2 CURRENT AND DESIGN POPULATION:

6.3 FLOW MEASUREMENTS, SAFE YIELD AND DESIGN FLOW:

6.4 GROUNDWATER LEVELS:

6.5 WATER QUALITY:

6.6 STORAGE TANK VOLUME:

6.7 BREAK PRESSURE TANKS:

6.8 DESCRIPTION OF MAJOR COMPONENTS FROM SOURCE TO END SYSTEM:

6.9 RESIDUAL HEAD FIGURES:

6.10 WATER POINTS (taps, showers):

6.11 SUPERVISOR SKILLS REQUIRED

6.12 ADDITIONAL NOTES:

7 SANITATION:

7.1 CURRENT NUMBER OF HOUSEHOLDS:

7.2 GROUNDWATER LEVELS:

7.3 PERCOLATION TEST RESULTS:

7.4 NUMBER OF PROPOSED/POTENTIAL TOILETS AND TYPE:

APPENDIX 1: LOCATION MAP(S) & GPS DETAILS APPENDIX 2: SURVEY FORM

APPENDIX 3: MATERIALS BREAKDOWN PER SECTION APPENDIX 4: SUMMARY BoQ:

APPENDIX 5: LOCATION DRAWINGS & DETAILED PIPE LAY-OUT

APPENDIX 6: HYDRAULIC GRADE LINE PROFILES APPENDIX 7: DESIGN DRAWINGS

APPENDIX 3: TOOL LIST

#	Tool	Supervisor /contractor	Piped supply	Hand Pump	Rainwater harvesting
1	Hand saw, 22”	1	1		1
2	Hack saw, 12” + set blades	1	1	1	
3	Claw hammer, 16 Oz	1	1	1	1
4	Shifting spanner (300mm)	1	1	1	1
5	Level (600mm)	1			1
6	Tape measure (5m)	1	1	1	1
7	Pipe wrench, 10 (1/2”)	1			
8	Pipe wrench, 12 (1”)	1			
9	Pipe wrench, 18 (1 ½”)	1	1	1	
10	Pipe wrench, 24 (2”)	1			
11	Pipe wrench, 36 (3”)	1	1	1	
12	Pipe wrench, 48 (4”)	1			
13	Open spanner set	1		1	
14	Screw driver, Flat head, set	1	1		
15	Screw driver, star, set	1	1		
16	Trowel	2	2	1	1
17	Wooden floater	1	1	1	1
18	Steel floater	1	1	1	1
19	Pliers, side cutter, 180mm	1	1		1
20	Pliers, end cutter, 300mm	1	1		1
21	Bolt cutter, 900mm	1	1		
22	Brush (for white wash)	1	1		1
23	Line level	1			1
24	Profile string (20m)	1			1
25	Carpenters pencil	1			1
26	Cold chisel	1	1		1
27	Combination square	1			1
28	Hex key set	1			
29	Mattock	1	1	1	
30	Spade	1			1
31	Tin snip 10” (254mm)	1			1
32	Reseating tool (3/4” taps)	1	1		1
33	Tool box (lockable) w/lock	1	1	1	1

This represents a minimum standard set of tools for most installations seen in SI. Where specific new technologies are used (e.g. imported hand pumps such as Indian Mk) these may require different tools. The community should always be left with the capacity to undertake basic maintenance of whatever is installed and an understanding of where to go to get major repairs done if they are beyond the capacity of the community to complete.