WaterAid/Drik/Parvez Ahmad

Technical Guide for handwashing facilities in public places and buildings

August 2020
Version 1

WaterAid/Mani Karmacharya

WaterAid

Table of contents

Introduction

Purpose

In response to the COVID-19 pandemic, the World Health Organization (WHO) has recommended that all member states provide universal access to public handwashing facilities.[1] Consequently, WaterAid and other organisations have been working with governments to install handwashing facilities in a wide range of public places and buildings, to support improved handwashing practices and reduce transmission of the virus. Locations include markets, public transport hubs, public/communal toilets and buildings such as healthcare facilities, schools, restaurants, places of worship, commercial and public offices.

The crisis has triggered renewed interest and a rapid scale-up of handwashing facilities, and at the same time a wide range of new designs. The purpose of this document is to provide guidance on existing best practice for handwashing facilities, and to share innovation and learning from WaterAid's hygiene response to COVID-19[i] to date.

WaterAid/Ernest Randriarimalala

Scope

A comprehensive hygiene behaviour change programme needs to: motivate people to practice good behaviours; put in place inclusive facilities in specific settings where behaviours need to happen (with visual cues and nudges as reminders); and good behaviours need to be ingrained as part of social norms for habit formation.

During implementation, these three elements have to be put in place together. However, this Technical Guide focuses mainly on the 'hardware', i.e the design, construction and functionality of the facility, as one element of a hygiene behaviour change programme – since hygiene behaviour change interventions are described in detail elsewhere.

This Technical Guide covers permanent or semi-permanent handwashing facilities[ii] for public places and buildings (rather than humanitarian settings). Access to handwashing facilities in the home is equally important, but this has not been included in this document, since the types of design tend to be different (locally appropriate, context-specific, low-cost, and/or available consumer products) and the responsibility for installing and maintaining these types of facilities belongs to household members.

◀ Rojotiana, 10 years old and her best friends and classmates, Fochine and Rosa at the newly built handwashing facility for their school in Tsarafaninjo village Madagascar.

i. Please see our blog post: *How can we ensure everyone can wash their hands with soap and water, to protect lives from COVID-19?* for more information. Available at: washmatters.wateraid.org/blog/how-to-ensure-everyone-can-wash-hands-to-protect-lives-from-covid19 (accessed 30 Jul 2020).
ii. Sometimes referred to as handwashing or hand-hygiene stations, devices or units. The focus of this document is on designing facilities using soap and water for handwashing, as opposed to those using alcohol-based hand rubs, though the latter may be preferred in certain settings such as healthcare facilities.

Sustainability

In the current pandemic, even handwashing facilities in permanent buildings, such as a school or healthcare facility, may be installed rapidly, without consideration of long-term sustainability. Hence there is a high risk that in six months (or less) many handwashing facilities will no longer be functional.

Although the risk of further waves of the current pandemic remains, donors may lose interest in replacing broken facilities after the initial funding surge. Furthermore, it is critical that we don't return to the status quo and that the current response builds a legacy of long-term sustained advancements in hand hygiene to improve public health.

Therefore, while a quick response is critical, plans should also be made for the long-term. If facilities are designed as semi-permanent structures or for a specific timeframe, there should be plans to disassemble, remove and replace with permanent facilities as soon as possible. Ideally, design for the long-term from the beginning.

Handwashing with soap and water is one of the most critical behaviours to reduce transmission of COVID-19.It has also been linked to:[2,3]

- 16–23% reduction in acute respiratory infection
- 50% reduction in pneumonia
- Substantial reductions in neonatal infections
- Up to 48% reduction in endemic diarrhoea

WaterAid/Anindito Mukherjee

Structure of the Technical Guide

This Technical Guide is structured in three sections. Part A provides best practice guidelines covering the design, installation, operation and maintenance (O&M) of handwashing facilities, with a separate section highlighting adaptations made during the COVID-19 response.

Part B provides a sample of different designs from WaterAid country programmes, and Part C contains further technical details and protocols for cleaning and monitoring.

A final note

This Technical Guide has been put together rapidly to guide WaterAid's COVID-19 response, and will be available for external use by other organisations. It is anticipated that this document will be revised as more learning becomes available on issues relating to sustainability, and to reflect updated COVID-19 guidance from WHO.

Attention is also drawn to other excellent resources that have been developed, such as the *Handwashing compendium for low resource settings*[4] developed by the Sanitation Learning Hub, which contains a wide range of designs from different agencies and further resources on the **Hygiene Hub**.

PART A: Guidelines

1. Initial considerations

Before rushing into design, some preliminary work needs to be done to understand the context and requirements for handwashing in that public place or building.

This should include:

- **Visiting the proposed location**.
- **Consulting with a diversity of users** (including women, children, older people, people with disabilities, community leaders/user committee coordinator) on both the design and location of the handwashing facility. It may be helpful to present a range of ideas for discussion, based on existing designs or those already available in the market or produced by other agencies. This community engagement should also reinforce the need for correct handwashing practices.
- **Co-ordinating with other stakeholders** to align efforts. Functional coordination with government and relevant stakeholders is necessary at the initial stage to avoid any duplicated efforts, as well as to identify the right institution/group/community to own the process.
- **Discussing with the future owner** roles and responsibilities for O&M. These must be clear and agreed before handwashing facilities are installed. An indication of the likely requirements and budget for this should be provided so the owner has realistic expectations and can plan accordingly.

A sample checklist is provided below:

Pre-design questions	
1	What are the particular design requirements for that location? (Designs for a health facility, school and market are likely to be different. One size does not fit all).
2	Where can/should handwashing facilities be placed to encourage use?
3	How many users are expected? (Plan accordingly to make sure that handwashing facilities don't become crowded and act as 'COVID-19 hotspots').
4	Is space limited? (This may require a quick assessment of each building/location).
5	Can existing handwashing facilities be repaired or modified?
6	Do suitable handwashing units already exist that can be procured locally?
7	Is a piped water supply available? Or what alternative sources can be used?
8	Is an alcohol-based hand rub preferred and available (or able to be easily produced)?
9	Is it clear who will be responsible for O&M?

2. Design

2.1 Design principles

The design of the handwashing facility will depend on the context and needs of the area so it is not possible to present a single solution – however the table below sets out key issues for the designer to consider. In the initial response it may be very difficult, if not impossible, to meet the full list of requirements and it should be noted that having any handwashing facility with soap and water is better than not having one at all; nevertheless, these recommendations will help build sustainable facilities that will help change behaviour.

Design principles for the handwashing facility		
	Key features	**Factors to consider**
Attractive, convenient and easy-to-use		
1	**Attractive and pleasurable to use**[iii]	For example, by painting in bright colours; use of high quality materials and fittings; use of decent quality soap; and adding accessories such as a mirror (a mirror above the handwashing place may encourage people to spend longer washing their hands).
2	**Easy-to-use**	The tap, soap and hand-drying should all be easy and intuitive to use.
3	**Accessible to all users (Accessible locations are covered in Section 3: Installation)**	The height and design of the basin and tap need to be adjusted for children and people with disabilities.[iv] For children the height should be between 500–700mm and for wheelchair users <850mm.[5] In practice, this will require either two handwashing facilities set at different heights, or a single unit with two taps and basins. For wheelchair users, older people who might be unsteady on their feet and users with other mobility devices (e.g. crutches), check that they don't need to lean too far forward to reach the tap/soap/basin or push too hard to access the soap or turn the tap on. The area around the basin should be flat with a non-slip surface.
4	**Sufficient taps**	The maximum number of users during peak demand should be considered. One handwashing facility with many taps or multiple separate units may be required to prevent queues (people's willingness to queue for handwashing will be much less than for a waterpoint or communal toilet for example).

iii. For more information on user-centred design and behavioural nudges – see references 6, 7 and 8.
iv. Considering the needs of wheelchair users is not the same as considering the needs of all people with disabilities. While it is outside the scope of this document to design a facility which is universally accessible for all needs, WASH accessibility audits[9] can be used to guide this process.

5	**Appropriate size/shape**	Where space is limited (typically inside buildings) the handwashing facility design may need to be adapted accordingly.
Facilitates effective hand hygiene		
6	**Reliable water supply**	Unless there is a reliable 24/7 piped water connection available, a local water storage container will be required. This could be part of the handwashing facility, or in the case of a building a central storage tank may be sited (e.g. on a roof or an elevated stand) to supply multiple handwashing facilities. The water storage container should be: • Large enough to avoid regular refilling (assume average of 1 litre/person).[v] • Easy to refill – the larger and higher-up a container is, the harder it will be to refill. • Covered to avoid contamination. • Secured, so it cannot be easily knocked over when empty or stolen. • Transparent, if possible, so water levels are easy to check (or install a low-cost water gauge). If directly connected to the water supply, a float valve is recommended for the tank.
7	**Allowing both hands to be washed at the same time and rubbed together, but avoiding unnecessary wastage of water**	A high flow rate is not required for effective handwashing,[10] so selection of taps with a low flow rate can reduce water consumption (though the flow rate will vary with water pressure). Some taps are also self-closing to avoid wastage.
8	**Soap available at all times**	There are various options with advantages and disadvantages and this should be considered in the initial consultation: • Liquid soap is generally preferred and can be adapted to hands-free operation (see Section 2.2). However, it is expensive so may be a desirable item likely to be stolen, and may require frequent refilling (to avoid this recommend selecting larger containers than normal household dispensers). To reduce the risk of being taken, the liquid soap can be installed in a lockable container. • Soapy water can be made-up as a low cost alternative, and is equally effective for good hand hygiene,[11] but may be seen as less attractive by users. • Bar soap may be the easiest option, but is highly likely to go missing in a public facility. This risk can be reduced by fitting the soap on a string.

v. WHO (2020) COVID-19 WASH Guidance cites a figure of 0.5–2 l/person. This is based on research by Hoque, B.A.[12] which found that 'an increased volume of water showed a lower faecal coliform count and the difference was found to be statistically significant when rinsing was performed using between 0.5 and 2 litres of water'. UNICEF[5] note that water conscious usage or water-saving taps can bring consumption down to 0.3–0.6 l/person. In this document, 1.0 l/person is assumed as an average to allow sufficient but not excessive use of water, while noting there will be variation according to the type of tap installed, water pressure and user behaviour. The best guide is to monitor consumption in a particular setting.

9	**Avoid splashing and provide good drainage**	The basin should be large enough to avoid splashing. The waste pipe should be large enough to avoid getting blocked with dirt and scum (32mm or 40mm pipe should be sufficient) and with quality fittings to prevent leaks. Connection to a soak-pit or drain will depend on the location (see Section 3).
10	**Hand drying**	In most cases, air-drying is likely to be the most practical option. However, shaking wet hands does pose a major issue for re-contamination and in some settings, such as healthcare facilities, a means of drying will be required – such as disposable paper towels.[vi]
Sustainable		
11	**Selection of materials**	For handwashing facilities installed in an outside area, appropriate materials should be selected that do not corrode quickly (e.g. stainless steel) or degrade in sunlight (plastics must be UV-resistant). Ceramic basins may be seen as desirable by users, but are brittle and easily damaged, so less suitable in some areas such as a market-place. The components most likely to fail are the tap, the fitting between the tap and tank, or (for hands-free designs) the mechanism for operating the tap. In order to reduce future maintenance, it is worth doing some research on taps to search for high quality brands. However, this must be balanced by assessing the risk of the tap later being stolen.
12	**Durable and reliable**	Designs must be robust to provide a long-term facility for hand hygiene with minimal maintenance required. Given that public facilities are likely to be used intensely, appropriate materials should be selected (see point 11) and a high quality of craftmanship ensured. The stand for the water tank must be strong enough for the maximum weight of water, and stable to prevent it being easily knocked over (or blown over for facilities outside). For large water tanks, a separate valve (stopcock) is recommended to avoid wastage of water when a tap breaks or is being changed.
13	**Easy to repair**	Simple to repair with materials, spare parts and relevant technical skills available locally. Sometimes capacity and supply chains may need to be actively built.
14	**Affordable and provides value-for-money**	A long-lasting facility will cost more but will be better value in the long run. So, when evaluating different design options consider both the capital cost (including transport and onsite assembly work) and the ongoing O&M over the design life ('lifecycle costs'). Affordability will also be influenced by who is funding the facility – something that is affordable for a non-governmental organisation (NGO) or private company to buy, may not be affordable for the local government or a community-based organisation and thus limiting future replication and scale-up.

vi. The WHO Guidelines[13] recommend for drying hands that 'paper towels and a bin are provided; if not encourage air drying for several seconds'. A paper reviewing the hygienic efficacy of different hand-drying methods found that 'most studies suggest that paper towels can dry hands efficiently, remove bacteria effectively, and cause less contamination of the washroom environment. From a hygiene viewpoint, paper towels are superior to electric air dryers. Paper towels should be recommended in locations where hygiene is paramount, such as hospitals and clinics.'[14]

2.2 COVID-19 adaptations

During the COVID-19 pandemic, the design of handwashing facilities (especially in public places) has been revisited to ensure that the facilities do not pose a risk for transmission of the virus between users. Adaptation has thus focused on the following areas:

COVID-19 adaptations for handwashing facilities		
1	**Hands-free tap**	Hands-free mechanisms are desirable in general to prevent cross-contamination, but this has been strongly prioritised in the COVID-19 response. There are three main design options: (a) **Contactless**, i.e. an automatic sensor. Expensive, not easily available in many countries, and also relies on a power supply. It may require less frequent maintenance, but is more likely to be difficult to fix locally. (b) **Taps which can be operated using the forearm**, e.g. taps with a long-lever arm. This is a good option for quickly and cheaply adapting existing handwashing facilities; though it may not be intuitive and some users may continue to use their hands. Long-lever taps are also useful for people in wheelchairs, using crutches or who have impaired mobility or strength. (c) **Foot-operated**, either using a pedal with a mechanical lever arrangement or a foot-pump. Designs adopted by WaterAid are provided in Part B, and more details on the lever mechanisms in Part C. Further experience needs to be gathered on the maintenance requirements for these designs. Also note that foot-operated designs may be harder to use for those reliant on crutches, wheelchairs or unsteady on their feet due to age or impairment. Note, that where liquid soap is being used this can also be converted to hands-free operation, though this is less critical than the tap since hands are washed after touching the soap dispenser. Where bar soap is used this is not possible; however, studies have shown that even when bar soap contaminated with micro-organisms is used for handwashing there are no traces of these pathogens on the hands afterwards and that hands are equally as clean as compared to using a brand new bar soap.[15]

WaterAid/Bangladesh

WaterAid/Pakistan

2	**Physical distancing**	Current guides on minimum physical distancing to be observed vary from 1m to 2m; with 1m as the global WHO minimum recommendation. Physical distancing needs to be maintained both when queuing and when using the facility. (a) **Queuing** – guidelines painted or otherwise marked on the ground. (b) **In use** – where there are multiple units or taps these need to be spaced apart in line with physical distancing guidelines. If this is difficult to achieve partition walls could be installed (these only need to cover the top body part, hip to head but a width of at least 0.8m must be allowed for wheelchair users).[5]
3	**Greywater management**	The water draining from handwashing stations (known as greywater or sullage) is usually not very polluted and current evidence is that the risk of COVID-19 transmission associated with this greywater is low. Existing best practice for drainage should be followed – see Section 3.
4	**More regular cleaning and disinfection of the facility**	Handwashing facilities should be cleaned regularly and thoroughly in order to reduce risk of cross-contamination, as well as ensuring that facilities are appealing to users (blocked sinks, wet or unclean floors etc are likely to discourage users or even make them impossible to use). This involves cleaning with soap and water and then disinfecting with chlorine solution. A procedure for this is provided in Part C. The frequency will vary according to location and use. Note, that if the water supply is lightly chlorinated (i.e. in line with normal requirements for potable water with a free residual chlorine of 0.2–0.5mg/l), this can help reduce the risk of contamination of the basin/sink. Highly chlorinated water (for example 0.05% used for hand hygiene in a cholera treatment centre) is not recommended for long-term hand hygiene use because it can have a detrimental effect on the skin.

3. Installation

This section addresses site-specific issues depending on where the handwashing facility is to be installed. Note that the appropriate authorities, facility management, business owners and local community members must be consulted in deciding where handwashing facilities are placed, whilst bearing in mind the requirements below and the need to maintain physical distancing of users. General requirements are presented first, followed by a dedicated section (3.2) on healthcare facilities where handwashing facilities need to be of a higher standard – because the risks associated with contamination and pathogen breeding sites are higher and protocols need to align with IPC (infection, prevention and control) procedures.

3.1 Installation – general requirements

Design principles for the handwashing facility		
	Key features	**Factors to consider**
Location and access		
1	**Visible and convenient**	Located in a place which is close to where it is needed and easily visible. WHO recommends 'that hand hygiene facilities should be provided in front of all public buildings and transport hubs – such as markets, shops, places of worship, schools and train or bus stations. In addition, functioning handwashing facilities with water and soap should be available within 5m of all toilets, both public and private'.[1] Specific guidance for healthcare facilities is set out below (Section 3.2). For handwashing facilities installed outside a roof cover/awning is preferable, where possible, as people are unlikely to remain outside for 20 seconds to wash their hands when it is raining. It may also prevent accidental damage to the facility.
2	**Safely accessible**	Located in a place which is: • Safe for all users, including children and women to use (consider lighting for places open at night-time).[16] • Accessible to users with disabilities (check path leading to facility is flat and clear from obstructions and any ramps have appropriate gradient with sturdy handrails). • Avoid flood-prone areas (if installed outside).
3	**Minimise risk of theft/vandalism**	For external handwashing facilities, consider whether to bring them inside for safe storage at night-time. Otherwise for permanent installations ensure the handwashing facility is securely fixed.

Connections to water supply and drainage		
4	**Water availability**	A location with a reliable piped water supply is preferred. In some cases, the existing plumbing may need extending to the handwashing facility (for long extensions, check that the pressure is sufficient) or improving to prevent wastage of water through leaks. Where a piped water supply is not available management arrangements must be in place to ensure water is regularly refilled. Rainwater harvesting can also be used to provide water for part of the year (see Part C for further details). The quantity of water should be sufficient (approximately 1 litre/person) to enable rigorous handwashing for 20 seconds, yet avoiding unnecessary wastage of water. A float valve is necessary for big tanks connected to piped water supply to avoid water wastage.
5	**Water quality**	The quality of water for handwashing does not need to be of drinking water standard but should be from an improved source[13] with turbidity less than 20 NTU[5] and without any undesirable smell or colour.
6	**Greywater management**	Greywater should be directed to a nearby drainage system or a covered soak-pit, provided the groundwater table is not shallow (see Part C for further details).
Messages and behavioural nudges		
7	**Signposting and cuing behaviour**	Behavioural nudges to remind people to wash their hands, e.g. footsteps or arrows painted on the path, visual cues to attract attention etc.[17]
8	**Visual illustrations to promote key messages (at handwashing facilities and other key locations) and hygiene behaviour change intervention**	Visual stickers or painted illustrations on the tank or above the sink, to promote key messages, for example: • Motivation – why 20 seconds washing both hands is important. • Instructions about use (especially if an unfamiliar design). • Correct hand-washing procedure. • Physical distancing while queuing. • Water is for handwashing only, not for drinking. Note, if there are too many simultaneous messages users are likely to ignore them, so you will need to be selective. It can be useful to rotate messages to keep it interesting.[18]

9	**Branding and labelling**	It is common for NGOs to display their logo on facilities installed or constructed; however, this can have a negative effect because it creates the impression that the facility then belongs to the NGO and they will be responsible for ongoing O&M. It is recommended that any branding should primarily reflect the local government or branded campaign logo with its own identity or institution that it is being handed over to. If the NGO's logo is required for donor accountability this should be relatively small and clearly state 'supported or funded by...'. Instead, a clear label should be included on who can be contacted if the facility needs repairs or refilled with soap and/or water. If a large number of handwashing stations are to be maintained by a single authority/organisation, consider numbering them to facilitate easy referencing for monitoring and providing location maps to be made available to the public, to government and shared between actors.

In addition, a hygiene behaviour change intervention needs to be conducted to motivate people to thoroughly wash both hands at various critical moments in multiple settings. Behaviour change campaigns should be surprising, attractive and rewarding, and it should be emotional and motivating for people to practice the behaviours. Any promotional activities should be done using the 'do no harm' principles, such as maintaining physical distancing, using non-contact methods for promotion (mass, social and digital media) and adhering to other behavioural requirements to avoid any chance of cross-contamination – this should lead to change in social norms and habit formation. Campaigns should expose people multiple times to reinforce the behaviours.

3.2 Specific considerations for healthcare facilities

In most cases, installation of hand hygiene facilities in healthcare facilities will be part of a much larger project to assess and improve all WASH facilities and IPC procedures in the health institution/clinic/hospital. This is the ideal. Where WaterAid and partners are only focusing on hand hygiene improvements, attention must still be paid to the following aspects:

Additional hand hygiene requirements for healthcare facilities		
1	**Location of hand hygiene stations**	Hand hygiene stations are required at all of the following:[19] 1. Entrance and exit. 2. Toilets (within 5m). 3. Each point of care (as per IPC protocols in-country). 4. Where PPE is being put on and taken off. 5. Waiting rooms, public areas and dining/food preparation (and other service areas). 6. Where healthcare waste is handled. Assess the individual facility and the workflow of staff, clients/patients and family members/visitors to improve hand hygiene at all of these locations.

2	**Design**	Consider appropriate designs: • Sinks may exist in the clinic but could be modified, e.g. installing lever-arm taps to facilitate hands-free use. • Consider how patients who are sick or immobile can access handwashing facilities. • If alcohol-based hand rubs are available,[vii] they may be preferred by clinic staff who need to wash their hands very frequently and dispenser units can be installed accordingly. Handwashing facilities will still be needed with soap and water for when hands are visibly dirty. • When installing multiple hand hygiene units it may be more effective to have a central water storage tank with internal plumbing to supply water to all the required locations.
3	**Training**	Provide regular training for healthcare and maintenance staff on how and when to wash hands. This should include the WHO's 'five moments for hand hygiene',[21] and additional critical moments for health workers due to the COVID-19 situation, such as before putting on PPE and after removing it; when changing gloves; after any contact with a patient with suspected or confirmed COVID-19 infection, their waste or the immediate environment and after contact with any respiratory secretions.[13] The training should also include motivational and promotional activities with visual cues/nudges to remind and reinforce handwashing behaviour; as well as cleaning and disinfection of the hand hygiene facilities.
4	**O&M**	Discuss and plan with health facility staff for a refill (water, soap), O&M plan. Healthcare facility policies and Standard Operating Procedures (SOPs) will also need to outline activities required to ensure hand hygiene and support of WASH and IPC in the facility.
5	**Monitoring and feedback**	Ensure there are the right processes and procedures to monitor hand hygiene, understand hand hygiene perceptions, knowledge and practice and feedback mechanisms to support improvements. Monitoring of resources and supplies is also important. **Tools** are available for this through **WASH FIT** and the **Hand Hygiene Self-Assessment Framework**.[22]
6	**Collaboration**	Seek to collaborate with respective health institutions and ministries. Also collaborate with other organisations or local government departments that have the capacity and resources to conduct a full assessment. As part of the COVID-19 response WaterAid has developed a WASH in **HCF rapid assessment tool** in mWater (based on WASH-FIT) for this purpose.[23]

vii. Alcohol-based hand-rubs (containing at least 60% alcohol) are also effective in removing the virus that causes COVID-19.[13] Such products should be certified and where supplies are limited or prohibitively expensive, can be produced locally according to WHO-recommended formulations.[20]

4. Management, operation and maintenance

It is critical that all handwashing facilities are kept fully operational and clean to reduce transmission of the virus (and other pathogens). Poorly maintained or unclean facilities will deter people from washing their hands, and can become an epi-centre in transmitting various diseases.

O&M may be carried out by the owner (i.e. the community, institution, organisation or government authority that the handwashing facility is handed over to) or contracted to a private company or CBO through a service-level agreement.

As part of the handover of the facility, ensure there are clear, agreed management arrangements, support them in planning for costs and O&M, and provide them with a monitoring checklist (see Part C).


WaterAid/Malawi

Management arrangements for the handwashing facility must be clear and agreed before the unit is installed.


WaterAid/Eliza Powell

▲ A healthcare worker washes her hands in Benga Health Centre in Nkhotakota, Malawi, where a newly-installed hands-free facility and hygiene supplies helps to promote handwashing.

◀ Midwife Fostina Sedjoah washes her hands at a health centre in Ghana.

O&M guide		
	Key features	**Factors to consider**
Management arrangements		
1	**Organisational responsibilities**	The handover document should clearly identify which organisation is responsible for providing water and soap, and the cleaning and maintenance of the facility to keep it in good condition.
2	**Individual responsibilities**	More detailed operating procedures may be needed (particularly in a large institution such as a hospital and schools): ● Who will provide/refill the soap and water? ● Who will clean and disinfect the facility? ● How often will this person check? ● What happens if this person is on leave/sick etc? ● Who are they accountable to? ● Do they know who to contact if something is broken?
3	**Budget**	The monthly or annual operating cost must be estimated so the owner can budget accordingly. Costs may include the water supply, consumables (soap, cleaning products, PPE for cleaners etc), staff costs, monitoring, repairs and eventually replacement of the handwashing unit.
Cleaning and disinfection procedures		
4	**Cleaning and disinfection**	Guidance/training should cover: ● Timing and frequency of cleaning required. ● Correct use of and provision of PPE for cleaners. ● Correct use of cleaning products. See Part C for further details.
Monitoring		
5	**Post-installation survey**	A survey of a sample of handwashing facilities post-installation (e.g. three months after) is recommended to collect information on functionality, cleanliness and (if possible) hand hygiene practice. This may be a donor requirement and should be done in conjunction with the owner, who will be responsible for future monitoring. A sample template for monitoring is included in Part C.
6	**Learning**	User feedback should be collected to help inform future improvements to the design, its accessibility and usability. Document key learning – successes as well as challenges/failures.

PART B: Examples from WaterAid programmes

1. Handwashing facility – foot-operated for 1–2 users

Summary

This section includes examples from Bangladesh, Madagascar, Nepal, Burkina Faso, Nigeria, Pakistan, Malawi and Sierra Leone.

The handwashing facility is designed with (normally) a single water tank of capacity 50–500 litres with 1–2 taps connected directly to the tank and operated with a pedal, so is therefore hands-free, limiting cross-contamination.

These handwashing facilities also support physical distancing and can be easily installed in various public locations. Facilities are accessible for all ages, genders and people with disabilities. Facilities are branded with visual cues/reminders with context-specific messages to encourage handwashing with soap.

General description

A container filled with water, fitted with a push tap. The tap connects to a foot pedal so that when the pedal is pressed, the tap opens and water flows out.

Bar soap or liquid soap is stored next to the container. Liquid soap bottles can be attached to one of the foot pedals which releases soap.

Target locations

Community centres, bus and railway stations, markets, healthcare facilities, motor parks, quarantine centres, schools, government offices, religious centres and public places.

▲ A man washes his hands in Hyderabad, Sindh (Pakistan), after the installation of new hands-free handwashing facilities.

WaterAid Bangladesh

Description

Two steel sinks attached with a mild steel frame, a 100–300 litre water storage tank set on top of the frame, a soapy water bottle holder and four pedals to operate the bibcock and soap dispenser. Total frame height is 1.5 metres and sinks are attached at 910mm and 610mm height. A wastewater disposal pipe connects from sinks to soak-pit/drainage.

Handwashing water supply connection is made from a rainwater harvesting system. Once the frame is built, the sink, tank, pedals and plumbing accessories are added. It can then be branded as required and allows for two people to use at one time.

▲ Community members washing their hands at a dual-user inclusive small pedal operated station.

Advantages	Disadvantages
● Accessible to people with disabilities and children. ● Connects to rainwater harvesting system to ensure continuous supply. ● Safe disposal of wastewater.	● Ensuring continuous water availability by refilling the tanks where running water is not available. ● Risk of theft.

Figure 1: Mild steel (MS) angle frame and other components.

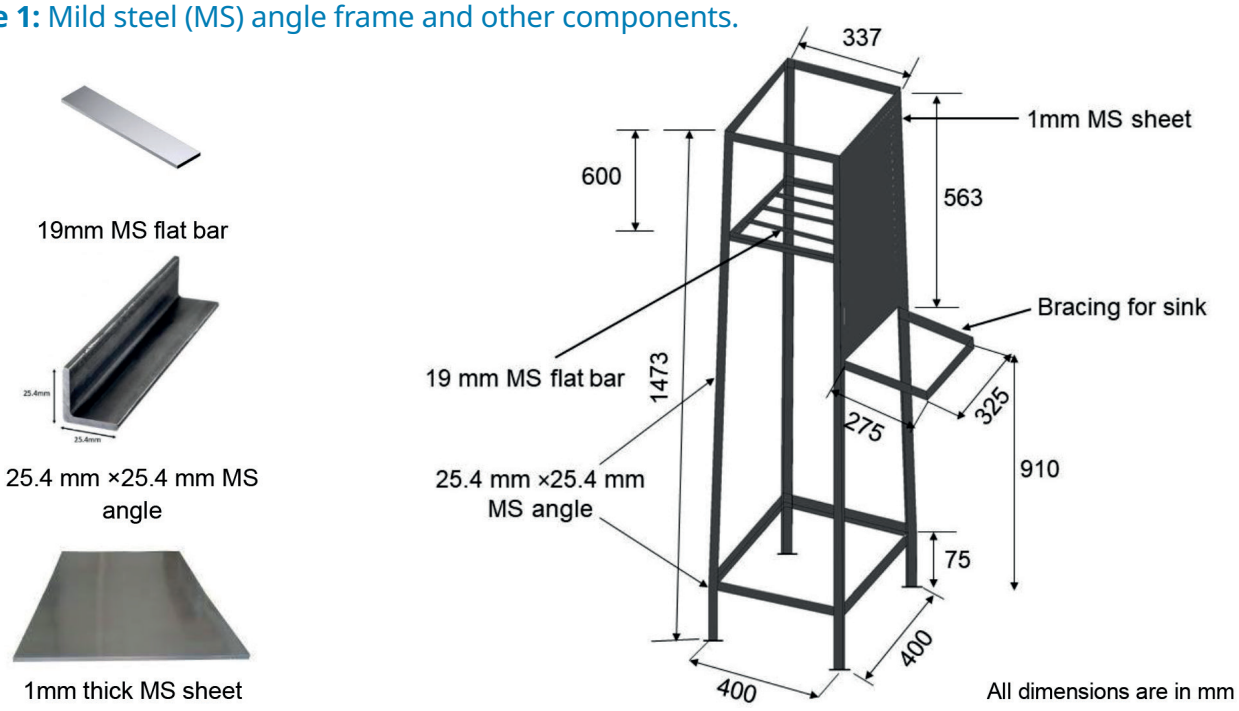
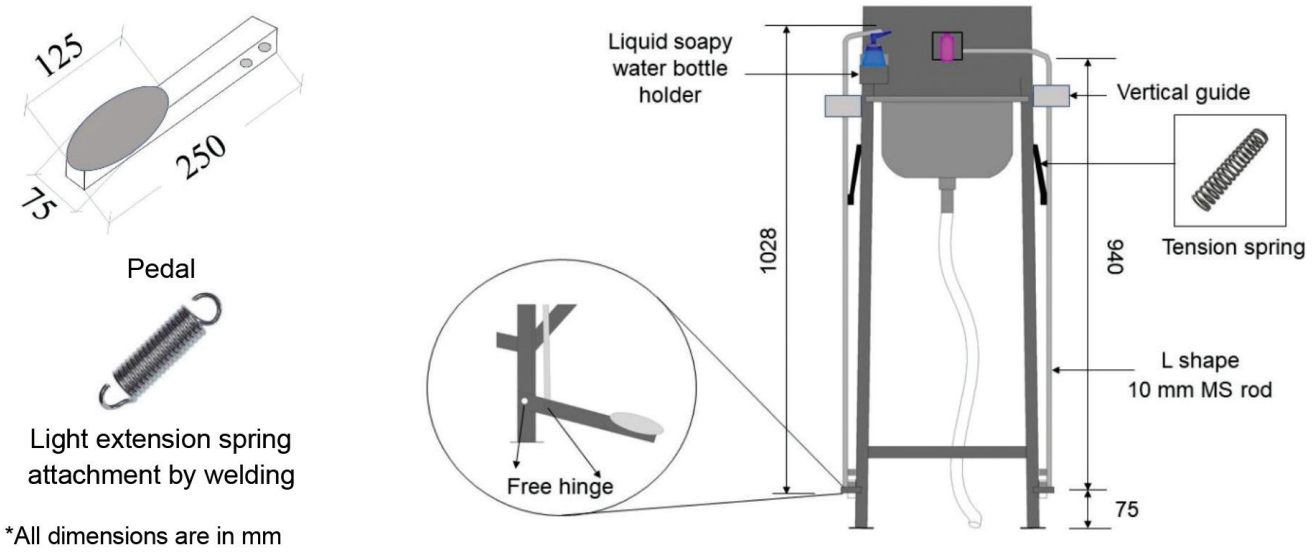


Figure 2: Pedal operational arrangement.



How to build

Making the MS angle frame

- Make a frame with 25.4mm x 25.4mm MS angle.
- Add 19mm MS flat bar to support water tank as shown in Figure 1.
- Attach 1mm MS sheet at one side of the frame which can be used for attaching a mirror or hygiene messages.
- Add two bracing structures at height of 910mm and 610mm in two opposite sides of the frame using 25.4mm x 25.4mm MS angle to support sink as shown in Figure 1.

Making soapy water bottle holder

- Use a 3mm MS sheet and fix the liquid soap holder at the right side of the frame so people can have the soap holder at their left as shown in Figure 2.

Arrangement of pedal-operated system

- Take a 250mm long MS box section and attach an oval-shaped footrest made of MS sheet at one end. Attach the other end of the pedal to the frame using a hinge.
- Fix one vertical guide with the frame to keep the MS rod in vertical position as shown in Figure 2.
- Make an L-shape 10mm MS rod with a vertical dimension of 1028mm for soap dispenser and 940mm for water tap. The length of the horizontal part of the L-shape rod needs to be cut at the actual dimension required for the soap dispenser or tap.
- Place the bar through the vertical guide and attach the lower end to the pedal with the free hinge.
- Connect a light extension spring with the rod and frame so that it carries the self-weight of the rod and the spring can bring back the pedal system to operational mode after every use.
- Make two pedal sets, one for soapy water and another for water dispensing. Horizontal part of the bar is to be placed just above the soap dispenser and push shower.
- The user will use the left pedal for soapy water and the right one for the water dispenser. The total pedal system will push downward to activate the soapy water and water supply.

Fixing tank, sink and plumbing accessories

- After painting the frame and pedal set, a 305mm x 355mm steel sink is fixed at a height of 910mm and 610mm of the frame.
- Two fixed push showers are attached with the necessary plumbing accessories for water dispensing.
- Place a tank of 100 to 300 litres and connect with water storage tank of rainwater harvesting system.
- A hose pipe and clamps will be needed for drainage connection to soak-pit/drains.
- Finally, after fixing all the plumbing accessories for water supply connection and drainage, the handwashing facility is ready for use.

Installation/repair

Various materials can be selected (mild steel/ stainless steel, plastic/steel/ceramic basins, plastic/steel bibcock valve, etc). An approximate total cost for the facility is 104GBP. Once the pedal-operated system is fabricated it can be easily replicated.

Handwashing facilities are fixed to the ground and managed by the community, volunteers with minimum mechanical experience are appointed as caretakers. Initial maintenance and reparation are provided by manufacturers for a certain period (six months to one year) and then regular maintenance and minor repairs can be done by the volunteers.

O&M

The caretaker cleans and disinfects the station twice a day and ensures the water and soap supply. A lump sum budget for maintenance of the facility is secured to continue operation from the organisation.

▲ People washing their hands with the new hands-free facilities in Madagascar.

WaterAid Madagascar

Description

This handwashing facility has two taps activated by a pedal and is equipped with two 60 litre containers which rest on a welded metal stand. Unit cost 57GBP.

O&M

The facilities easily accommodate soap and the design allows for easy regular cleaning/ disinfecting of taps, basins, soap dispensers and frequently touched surfaces. Refilling of consumables, such as soap and water storage, is easy and safe.

The use and maintenance of the hands-free handwashing station will be managed by the local technician at either the municipality, school or healthcare facility level.

Wastewater is discharged into the public sewer and is managed by the WASH committee.

WaterAid Nepal

Description

This type of handwashing facility can use a storage container of 200 or 500 litres. The water tank connected to this facility needs to be refilled regularly from other available sources. The refilling of the water and liquid soap depends on the numbers of users and the capacity of the water tank and soap dispenser. A metal lift cock type water tap (brass made) is more suitable for use, which will reduce frequent maintenance issues.

This simple mechanised unit can be easily fabricated at the local engineering workshop with readily available materials such as steel for the frame, a PVC tank, brass taps, and plastic or metal basin and pipes. A durable soap container needs to be provisioned in a 150mm metal tube with a length of 300mm so that it can hold 4 to 5 litres of liquid soap, which serves 800 to 1,000 hand washes.

General design features

For comfortable handwashing and to collect greywater safely, a 300mm depth and 500mm diameter basin is fixed on one side of the facility at appropriate height, with a drainage pipe connected to the proper drainage system.

The pipe diameter can be the same as is generally used for a bathroom washbasin or sink (40mm). A separate container or pipe connection up to the existing drainage will be provisioned for greywater management. If a drainage facility is not available, a container has to be placed at the lowest level to collect greywater from the basin, which can then be disposed of safely. If possible, it is advisable to connect the basin drainage pipe directly to the city drainage or sewer system, otherwise a soakpit will need to be dug.

Installation/repair

The steel parts are either welded in the metal workshop and installed or can be provisioned with nut bolt type parts for easy assembly at the installation site. It weighs around 70–80 kilograms.

A metal type soap dispenser and brass tap with heavy duty materials should be used. After installation, the unit should be handed over to a management committee, local community or youth group for O&M to be regularly carried out.

The facility itself should last for at least two years due to the steel and heavy-duty fabrication. Local caretakers trained from management committees for general repair is reliable and cost effective. The water tank will need to be washed and taps changed, which are replaceable by materials easily available in local markets.

Advantages	Disadvantages
• Accessible to some people with disabilities and children when height of basin is adjusted. • Hands-free – reduces chances of spreading virus and other diseases.	• If a water source is not available nearby, lifting of water will be required and can be tedious for the management committee. • Risk of theft. • Basin with wastewater needs to be regularly emptied.

WaterAid Burkina Faso

Description

The two pedal handwashing facility is composed of a metal structure with two tanks/containers. This facility allows for handwashing water to be collected through a container/receptacle, which is regularly emptied into a drain. Additionally, there is a metal holder for single-use paper towels and a waste bin to collect solid waste.

Design features

Storage tank is made of plastic with a lid and has a capacity of 50 to 100 litres. This is supplied with water collected in jerrycans from the local handpump, as most health centres are not connected to a drinking water supply network.

The tank is equipped with a metal tap. Another plastic container with a volume of 15 litres and metal tap contains the soap. An additional 15 to 20 litre container collects the water from handwashing, which is then regularly poured into a drain. A final plastic basket is used to collect solid waste (such as used paper towels). All of these contents are placed on a 1.2 metre painted metal frame support.

▲ Hands-free handwashing facility in Burkina Faso.

Advantages	Disadvantages
● Accessibility of materials and tools. ● Maintenance by local craft workers. ● Option for tissues to dry hands and bin.	● Regular refilling of water tank and wastewater collection required. ● Basin with wastewater needs to be regularly emptied.

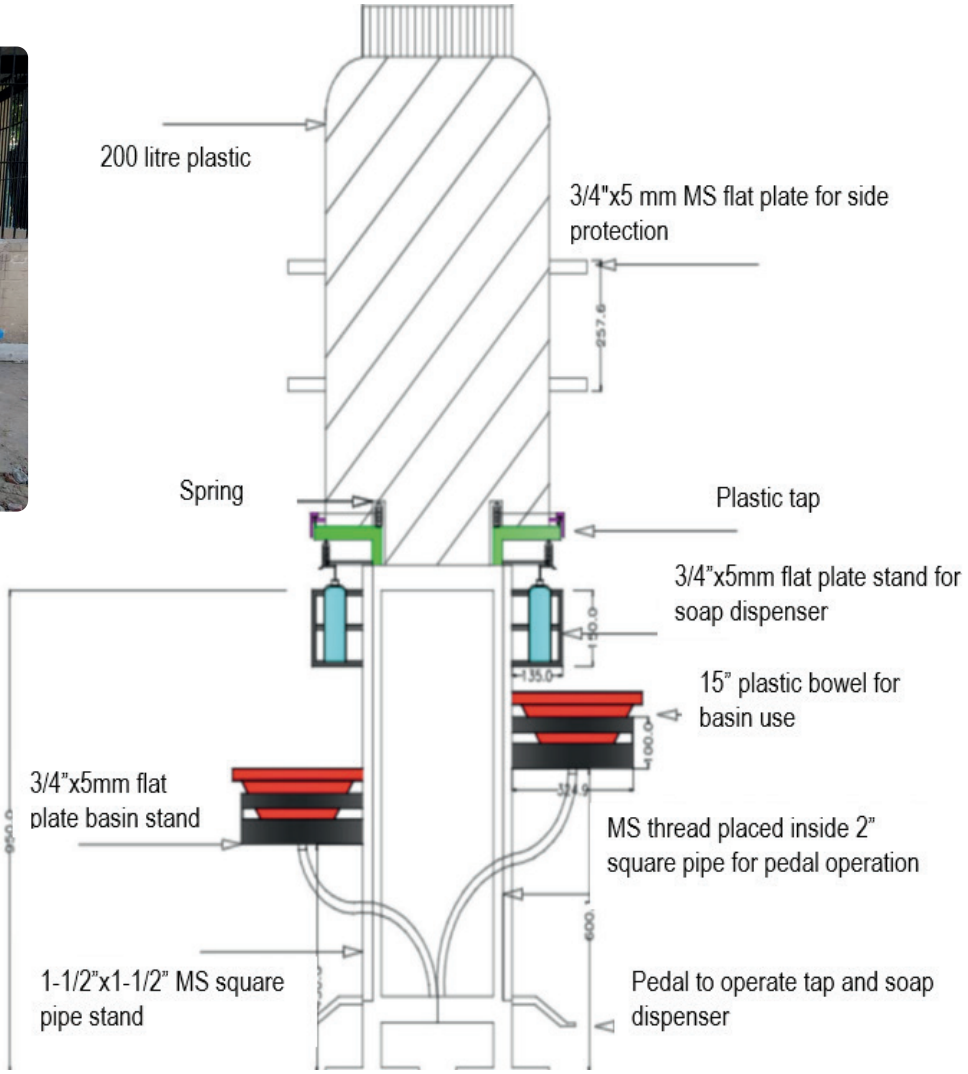
WaterAid Sierra Leone

WaterAid/Sierra Leone

▶ Hands-free design with 500 litre plastic tank with regulating tap.

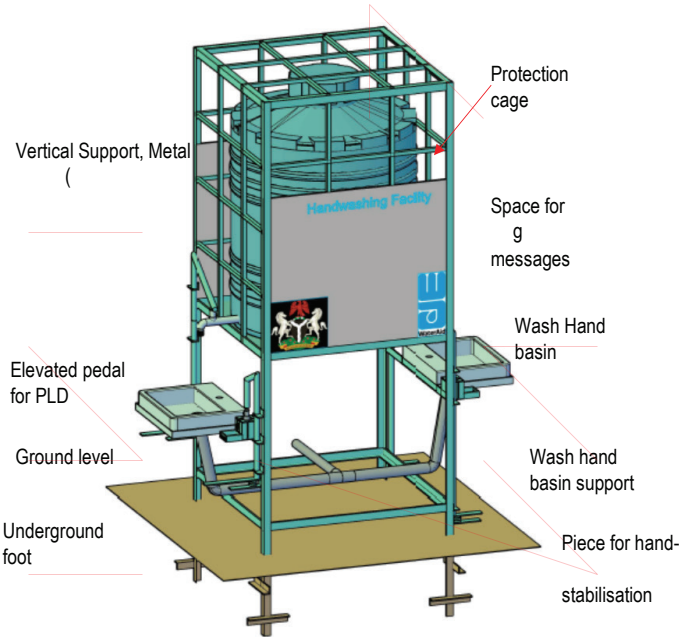
WaterAid Pakistan

WaterAid/Pakistan



WaterAid Nigeria

WaterAid/Nigeria



WaterAid Malawi

▼ A nursing and midwife officer washes her hands at a healthcare facility in Malawi.


WaterAid/Malawi

▼ Handwashing facility in Malawi.


WaterAid/Malawi

2. Handwashing facility – foot-operated for 2 or more users

Summary

This section includes examples from Pakistan, Liberia and Bangladesh.

General description

A water tank with pipe connects to multiple basins/sinks.

Target locations

Community centres, healthcare facilities, quarantine centres, schools, government offices, religious centres and public places.

WaterAid/Pakistan

◀ Group of men washing their hands in Pakistan at the Mardan medical complex.


WaterAid/Pakistan

WaterAid Pakistan

Description

This facility includes two main steel frames, one is the stand for the water tank and the other consists of stainless steel sinks for multiple users, which rests on a metal sheet with soap arrangements. These frames are welded together. Pipes are then installed from the water tank to the taps and the 200 litre water tank can then be filled either manually or connected to the main water supply.

A drainage pipe is connected to all sinks to properly drain out the greywater to a nearby drain. If no drain is available, then a soak-pit is recommended. As these handwashing facilities were installed very early in the response to COVID-19, normal taps were used, therefore this is not a hands-free facility.

General design feature

The metal frames for sinks and the water tank are fabricated from square pipe (25 x 25mm). The sink stand is 4.9 metres long and 609mm wide, which allows for a one metre physical distance.

The metal sheet of thickness 16 standard wire gauge (SWG) is installed and cut to adjust to the sinks on top of the metal frame and the sink sizes (500 x 430mm) are fitted in the metal sheet. The frame is then welded and supported with six legs bringing it to 914–1,219mm in height.

◀ Handwashing facility being fabricated.

Advantages	Disadvantages
● Can be easily disassembled and moved to another place. ● Simple design and can be easily fabricated.	● Needs periodic O&M. ● Not hands-free. ● This was installed as an emergency solution.

WaterAid Liberia

Description

This is a metal frame foot paddle handwashing facility produced by WaterAid Liberia and our partner Community Development Services. The single tap and double tap costs around 320GBP and 400GBP to produce locally. To wash your hands, you step on a foot paddle and the pedal faucet opens to allow water to flow.

▲ Double basin handwashing facility with foot paddle.

O&M

The water supply part of the facility is made of a pick-feet barrel and unplasticised polyvinyl chloride (uPVC) pipes and has a joint couple to allow for easy assembly and dismantling of the facility.

The wastewater pipe is connected to a soak-away to drain wastewater directly to the ground to prevent any human contact. Where wastewater pipes cannot be connected to a soak-away due to a concrete floor, it is connected to another 75 litre container to be carried when it is full. This is the same size as the water supply tank, which means when the water supply runs out the wastewater container is full.

Maintenance is minimal and consists of cleaning the water supply and wastewater containers daily with soap/detergents. The water supply is then filled with water or chlorinated water. If handled well, the pick-feet barrel, uPVC pipes and springs can last up to two years before replacement, while the metal frame foot paddle handwashing facility has an estimated five to ten year life span.

Advantages	Disadvantages
• Easy maintenance. • Easy assembly and dismantling. • Long life span.	• Where a 90 litre wastewater container must be used due to concrete ground, can be heavy to be carried away.

3. Handwashing facility with large overhead tank feeding multiple taps

Summary

This section includes examples from eSwatini and Rwanda.

General description

A large overhead tank (1,000 litres plus) which then feeds into multiple taps. This is a higher-cost, permanent installation.

Target locations

Community centres, healthcare facilities, quarantine centres, schools, government offices, religious centres, public places.

WaterAid eSwatini

Description

This hands-free facility allows for up to four people to wash their hands, with a reasonable distance between users. The water flows from the 5,000 litre tank into the small concrete storage tank that then feeds four taps.

The storage tank is closed to avoid the intrusion of dust and debris. The design can control the pressure no matter how you open the tap, and it is also designed to save water by reducing the pressure for all taps. This is especially important in the rural growth areas where the stations are being used. Since there is no local water source the stations use tanks, mounted on three-metre metal stands. These are refilled by the project owner for a period of three months.

Installation/repairs

All materials used to construct the group low pressure handwashing facility are procured locally, therefore spare parts are readily available in local hardware stores. The stand is a steel tank and the taps are standard household taps, often made of brass. There is a drainage ditch/soak-pit to manage drainage, and a concrete storage tank where soap is mixed with water. Theft is prevented because the handwashing facilities are permanent concrete installations.

This concrete facility is incredibly durable and also eliminates the risk of theft of the plumbing materials as these are located inside the concrete tank (such as the pressure valve, sensor to open and close the water when the concrete tank is empty). Additionally, soap is placed into the top of the container where it is then mixed with the water. This results in soapy water being dispensed and reduces the risk of users using the water for personal use. Cost of installation of the unit is 2,796GBP including storage. Cost to refill the 5,000 litre water tanks is 18GBP per month.

▶ A group of people washing their hands at a newly installed handwashing facility in eSwatini.

Advantages	Disadvantages
● Can be used in rural areas where there is no water source. ● Cost effective, low pressure option for handwashing under running water. ● Durable and affordable.	● Chance of cross-contamination through touching the tap since it is hand-operated (the team is currently working to design a hands-free option).

WaterAid Rwanda

Description

This handwashing facility is constructed with durable materials to ensure sustainability. Each facility has six water taps allowing six people to wash their hands at the same time.

These are inclusive and can easily be used by children as taps are fixed at different levels and an additional tap design has been developed for people with disabilities.

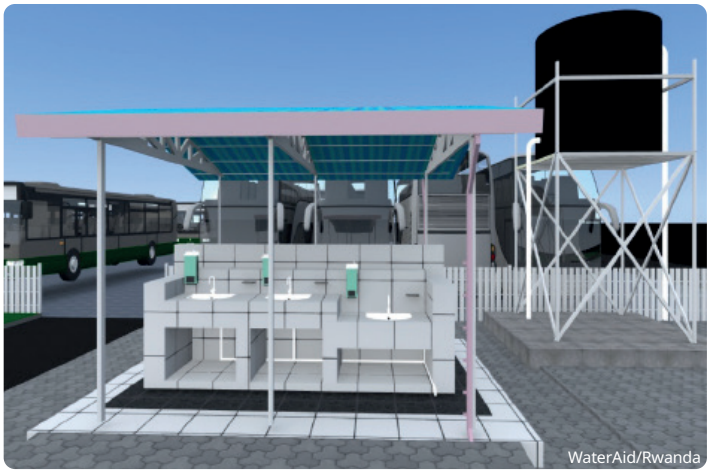
General design features

Handwashing facilities are connected to a water scheme, which can be a piped water supply system with water storage tanks or a rainwater harvesting tank, to ensure reliable water supply for the facility.

The stand design has a floor plan with taps one metre apart to allow for physical distancing.

The facilities are fitted with liquid soap dispensers and a sensor tap, using electricity to ensure a hands-free mechanism and lever-arm taps for those facilities where users do not have electric power. Basins are paved with tiles for easy cleaning, and greywater is drained to well-protected soak-pits.

▲ Rainwater harvesting is being used for a handwashing facility for a school in Rusekera.



▲ Design of a handwashing facility to be installed at bus stops.

Advantages	Disadvantages
● Facilities are permanent and sustainable. ● Six people can wash their hands at once, which saves time queueing. ● Facilities are connected to a water scheme, which ensures reliable water supply. ● Made of locally available and affordable materials. ● Design for bus station includes a roof, which will encourage people to wash hands even when raining.	● Design with sensor (electric) taps are not feasible in areas without electricity. ● Need to be properly managed to prevent damage to facilities.

4. Handwashing facility connected to piped water supply

Summary

This section includes examples from Pakistan and Bangladesh.

General description

These handwashing facilities include multiple basins or sinks that are connected to an existing (or extended) piped water supply.

Target locations

Community centres, healthcare facilities, quarantine centres, schools, government offices, religious centres and public places.


WaterAid/Mani Karmacharya

WaterAid Pakistan


WaterAid/Pakistan

▲ Ceramic basin handwashing facility in Pakistan.

WaterAid Bangladesh


WaterAid/Bangladesh

▲ Wall mounted pipe system – unit cost: 77GBP.

Advantages	Disadvantages
● Facilities are permanent and sustainable. ● Facilities are connected to a water scheme, which ensures reliable water supply. ● Made of locally available and affordable materials. ● Safe disposal of wastewater.	● Materials might not be suitable for outside conditions. ● Not accessible to people with disabilities and small children. ● Hand-operated.

5. Adaptation for users with disabilities

Summary

This section includes an example from Zambia.

General description

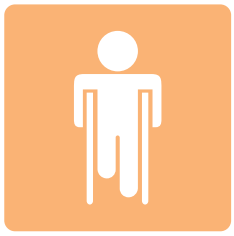
A hands-free device which is adjustable in height can include a ramp, which allows for easy access by those in wheelchairs or on crutches. These adaptations generally focus on people with physical impairments.

Target locations

Community centres, care homes, healthcare facilities, quarantine centres, schools, government offices, religious centres and public places.

Considerations for inclusivity

The path to the handwashing facility should be accessible, obstacle free, non-slip and include markings (see **WaterAid's Compendium of accessible technologies**, page 3).



WaterAid Zambia

Description

This hands-free facility is pedal-operated by either plates for the knees or pedals for the foot, which dispense water, soap and sanitiser. Tissues are then dispensed for drying hands. The facility comes with two 20 litre waste buckets for used tissues and greywater.

The facility is equipped with an 80 litre supply tank and water supply is manually loaded, although it can have a permanent connection. The stand is designed using 20mm square tubes welded together and can accommodate most 500ml bottles of handwashing soap.

WaterAid/Zambia

▶ Handwashing facilities being launched at Home of Happiness – a children's care home for children with disabilities.

Installation/repair

This facility is easily maintained, although it is recommended to be moved into a lockable room at the end of the day to prevent theft.

The material is very durable and the bolts and nuts for connection are available in most hardware stores, even in rural districts, while buckets are easily accessible in most communities.

It is quite simple to repair, those who repair bicycles and oxcarts will be able to repair the equipment easily and additional training will also be provided to locals on how to repair the facilities. The cost of this facility is around 110GBP.

Accessibility

The design can be partially or fully inclusive and can be used by those using wheelchairs or crutches. It comes with support for people with disabilities and signage/instructions on how to use the facility for people who are paralysed, in wheelchairs or on crutches.

The model for children is adjustable to allow for different heights. Another model includes a ramp to assist those who need it.

▲ Accessible handwashing facilities at Home of Happiness.

▶ President of Zambia, His Excellency Dr. Kenneth Kaunda washing his hands.

Advantages	Disadvantages
• Inclusive and universal. • Can be used for both handwashing with soap and sanitising. • Easy to maintain. • Can be installed in various areas because it is mobile. • Easy to refill water.	• Not suitable for mass handwashing. • Since manual refilling of the water tank is needed, this can result in the facility not having water.

PART C: Technical details and protocols

1. Details of hands-free mechanisms

The COVID-19 response has triggered renewed interest and innovation in designing handwashing facilities that can be operated without using hands in order to prevent cross-contamination.

Part B shows photos of some of the pedal-operated designs that have been installed by WaterAid. The purpose of this section is to provide further technical details for designers detailing how the mechanisms work.

A brief description is also provided of two alternatives: taps with a long-lever arm (which can be opened/closed using the forearm) and contactless taps using an automatic sensor.

1.1 Foot-operated pedals

The pedal-operating mechanism will depend on which type of taps are installed. Taps may be opened and closed using a pull, push or rotational motion as shown in these images.

Four examples are presented on the following pages. Figure 3 is for push taps; Figures 4 and 5 for pull-up taps and Figure 6 for rotating taps. In each case the designer should consider:

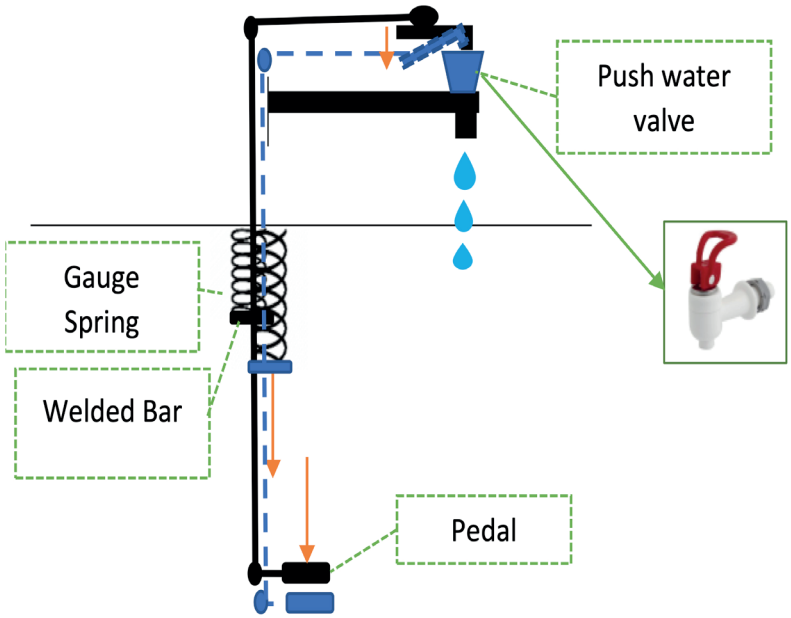
- Ensuring the tap closes when the pedal is released (this is more difficult to achieve for rotational taps).
- Minimising maintenance requirements. The spring is likely to be the weakest component, so high-quality springs should be used. An alternative is to use a steel cable rather than a rigid lever mechanism (Figure 7).
- Ensuring the appropriate range of movement because a large force may be accidentally exerted with the foot, so a limiting bar, rubber pad or spot weld should be used to restrict the motion of the tap.

Pull-up taps

Rotational lever/handle

Push taps

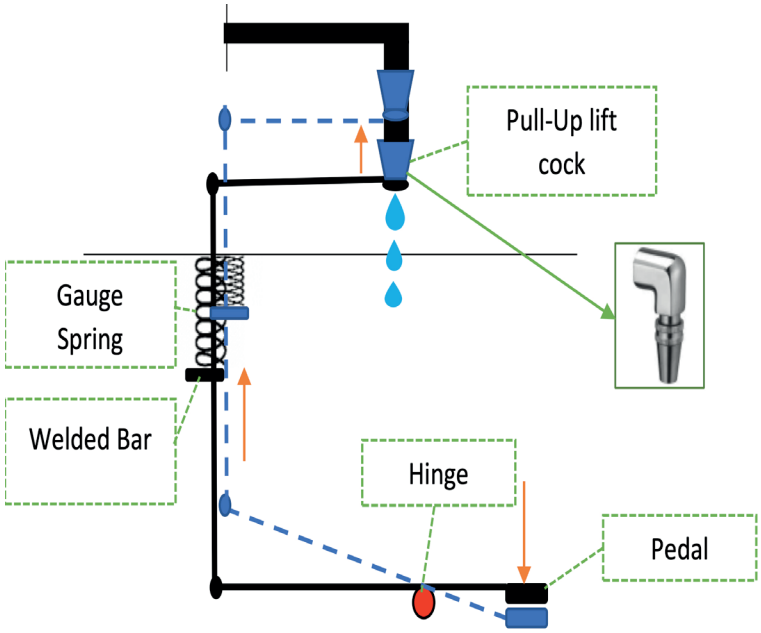
Figure 3: Pedal arrangement to operate push taps and soap dispenser.



▲ Direct action arrangement schematic diagram.

▲ Direct action pedal arrangement for soap and water dispenser.

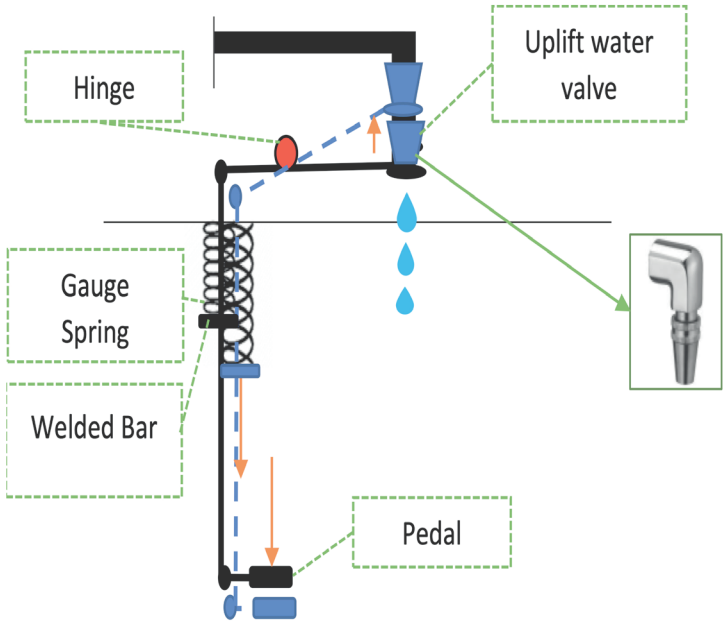
Figure 4: Pedal arrangement for pull-up taps.



▲ Mechanism 2: Pedal arrangement for pull-up lift cock.

▲ A pedal arrangement working in an upward direction. Note the lift cock is getting direct upward push for water distancing.

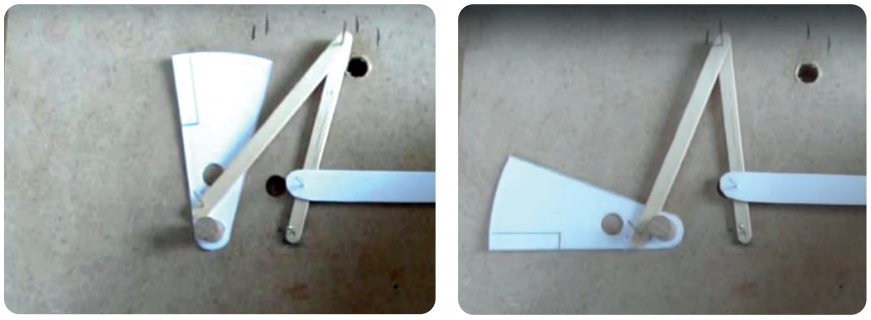
Figure 5: Pedal arrangement for pull-up taps to operate lift cock by lever action at the horizontal.



▲ Mechanism 3: Pedal arrangement for pull-up lift cock.

▲ A pedal working in a downward direction, but the lift cock is receiving the upward push by the lever action.

Figure 6: Pedal arrangement for rotation to operate lever type bib cock.

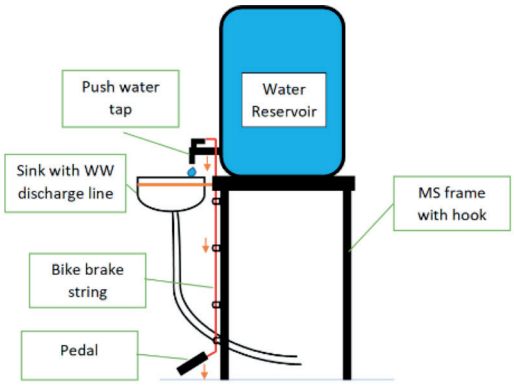


▲ Transition mechanism to translate linear movement to rotation (see this video for more details: youtube.com/watch?v=09jZsBDHalE).

▶ A pedal working in a downward direction, but the lever type tap is getting rotation from a transition mechanism.

Another option for a foot-operated pedal, rather than using a rigid lever mechanism, is to operate the tap or soap dispenser using a small steel cable (e.g. bike brake cable), which may require less maintenance if the cable is of good quality and protected against corrosion. This is illustrated in Figure 7.

Figure 7: Pedal arrangement using bike brake cable to dispense water and soap (WaterAid Malawi).



▲ Pedals which operate soap and water dispensers.

1.2 Lever-arm taps

One of the popular hands-free mechanisms that already exists, particularly in healthcare facilities, is the long-lever arm taps. These can be operated by the elbow or forearm without using fingers. In this way, existing handwashing facilities can easily be upgraded to hands-free by changing the tap rather than installing a completely new (and more complex) device. (Figure 8).

Figure 8: Different types of lever arm sink taps.

1.3 Sensor-based technology

Sensor-based taps contain an LED (light-emitting diode) which continuously emits an infrared signal. When a solid object, such as a hand enters the LED's range, it reflects the infrared signal back to a receiving diode which then opens a solenoid valve and allows water to flow through the tap. As soon as the object (hand) is removed, the solenoid valve closes and the tap is turned off (or alternatively it can be set to open for a set period of time). Similarly, such a sensor can also be used to operate a soap dispenser.

While sensor-based taps are normally associated with high-income settings because of the cost, they could be appropriate in some high-use handwashing facilities, such as public toilets in cities. They provide true contactless operation, reduce wastage of water and require less maintenance than mechanically-operated taps. One disadvantage is that they require a continual power supply, so it is recommended that they are installed with rechargeable batteries to ensure they continue to function during any power failures. Another disadvantage is that they can occasionally be triggered by false signals, and will be much harder to repair locally.

2. Handwashing facilities linked to rainwater harvesting

Rainwater harvesting can be used in some locations to provide a water supply for the handwashing facility for part of the year.

Advantages	Disadvantages
• Reduces cost and effort of regularly refilling the container. • Reduces water consumption in water-scarce areas. • A larger system can provide water for other uses.	• Increases cost of the handwashing facility. • Not suitable where a handwashing facility is installed a long distance from a building. • Not suitable in locations with a very short rainy season.

The design of a rainwater harvesting system for handwashing is shown in the figure below. Galvanised iron sheets (G.I.), aluminium, clay tiles or concrete can be used for roofing. Waterproof plastic sheeting may be added for thatch-roofs.

A gutter is provided along the edge of the roof for collection of water. It should be fixed with a gentle slope towards the down pipe, which helps a free flow of water to the storage tank. This may be made up of PVC pipe, G.I. sheet, wood, bamboo or any other locally available material.

The down pipe should be at least 100mm diameter and be provided with wire screen at the inlet to prevent large particles, dry leaves and other debris from entering. Add a lock valve to control water collection. Connect a 300–500 litre or higher (demand specific) water storage tank with the system to collect rainwater. Make a frame using an MS/SS angle and set the tank on top of it. Finally, connect the device with this tank for water supply.

▼ An example of a rainwater harvesting system for handwashing from Bangladesh.

3. Soak-pit design

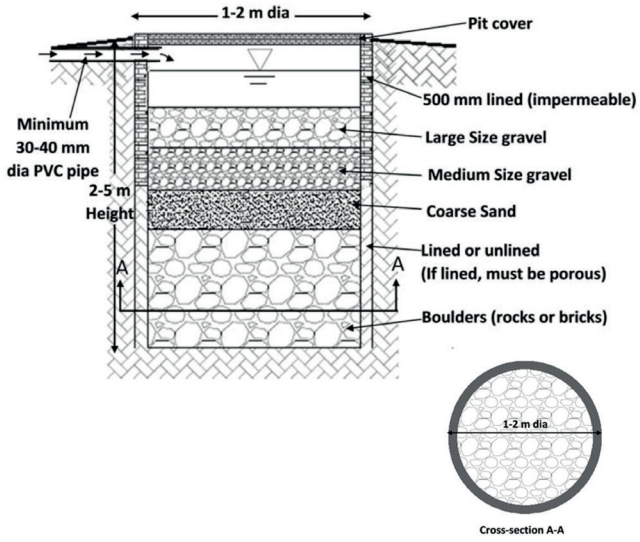
Greywater from a handwashing facility should be safely disposed of by connecting the facility to a nearby drainage system or a covered soak-pit in order to prevent direct human contact (though it is considered low risk) and avoid stagnant water around the facility – which would make it unpleasant for users and could act as a breeding ground for mosquitos and other vectors.

A soak-pit is an excavation in the ground that is back-filled with porous materials that allows the greywater to infiltrate into the ground. It is a relatively quick and cheap solution, but is not suitable in all conditions.

Design considerations

- Availability of space: usually the size of the soak-pit varies from 2m to 5m in depth and 1m to 2m in diameter.
- Distance from the handwashing facility: required to have drainage connection with appropriate slope to the handwashing facility.
- Amount of greywater: amount of greywater for handwashing stations depends on the number of users – assume 1 litre per person per use.
- Soil type, infiltration and absorption capacity: functionality of a soak-pit depends primarily on the permeability of the soil. Course and medium sand soil have the highest permeability for wastewater (50mm/day) and clay soil is not suitable for a soak-pit. The wastewater permeability is reduced to 33mm/day, 24mm/day, 18mm/day and 8mm/day for fine and loamy sand; sandy loam and loam; loam, porous silt loam; silty clay loam and clay loam respectively.[24]
- Moreover, the soil pores may become clogged with time and this can reduce the infiltration capacity of a particular soak-pit. Seasonal variations in the water table can also affect the performance greatly, and a soak-pit which works perfectly in the dry season may overflow at other times of year.

Figure 9



Advantages	Disadvantages
• Low cost. • Easy and relatively quick to construction. • Uses local materials.	• Not suitable in the following situations: - Surfaced urban areas. - Areas prone to flooding or with a high-water table. The base of the soak-pit should be at least 1.5m above the water table. - Close to waterpoints, with a minimum distance required of 30m. - Clay soils. • May become clogged and eventually saturated, depending on greywater quality.

Construction procedure

The size of a soak-pit depends on the volume of liquid to be disposed of and the type of soil in which the pit is excavated. The size and depth of the soak-pit can be fixed depending on the available space.

It may be calculated using the following process:

1. Required pit area = daily wastewater flow/soil infiltration rate.
2. Choose a diameter of the soak-pit.
3. Calculate depth of pit required to dispose of all greywater = all pit surface area(m2)/(π x diameter).
4. Add 0.5m for lined depth.

Once the depth is fixed, choose a clear space as near and low to the ground as possible from the handwashing facility and dig a pit. Fill a layer of large-sized gravel or brick at the bottom of the pit. Fill other layers with the large-sized gravel and sand up to the brim of the pit so that water can easily flow. Set the tank/pitcher/bowl as shown in the diagram below.

Connect the PVC pipe from the handwashing facility outlet. The pipe should be on a slope so that the wastewater flows easily. Finally, cover the pit and pipe with sand or soil. The top 0.5m of any pit must have a sealed lining in order to prevent the infiltration of rainwater.

Maintenance

The soak-pit should be checked periodically to ensure there is no overflow or damage. Soil pores may become clogged with time leading to reduced infiltration capacity.

Eventually it will be necessary to dig out the soak-pit, remove materials, wash and refill them. This problem can be avoided, or reduced, by fitting a filter or a simple grease trap at the inlet to the soak-pit, which is much easier to clean and change rather than needing to dig out the pit itself (see the WEDC sanitation report[24] for further details).

▲ Margaret, 40, a resident of Kandeke Community shows a soak away pit for on-site sanitation at her house since the arrival of piped water. Ndola City, Zambia.

▲ Examples of a soak-pit.

4. Cleaning and disinfection protocol

Public handwashing facilities should be cleaned and disinfected regularly to reduce the risk of cross-contamination and ensure that facilities remain accessible and pleasurable to use. In the case of the COVID-19 pandemic this is even more critical, and WHO has issued specific guidance for cleaning and disinfecting surfaces.[25] In healthcare facilities, additional IPC procedures will apply and should be followed as per national protocols.

Frequency of cleaning

The basin and tap should be cleaned and disinfected at least once a day and for handwashing facilities in high-use, this should be increased to two or more times per day. The surrounding environment should be checked each time and cleaned as needed. The water tank will also need periodically emptying and cleaning depending on the sediment load in the water.

Procedure for cleaning and disinfection

Both cleaning and disinfection are required. Cleaning involves using water, soap/soapy water/detergent and some form of mechanical action (e.g. brushing or scrubbing) to remove and reduce dirt. This helps to significantly reduce pathogen load on contaminated and highly touched surfaces and is an essential first step in any disinfection process.


WaterAid/Guilhem Alandry

Disinfection involves applying chemical disinfectants such as chlorine or ethanol to kill any remaining pathogens. The disinfectant concentration and contact time are both critical for effective surface disinfection. WHO recommends[25] using ethanol (at least 70% concentration) or a 0.1% (1,000ppm) chlorine solution and a minimum contact time of one minute.

Note that 0.1% in the context of COVID-19 is a conservative concentration that will inactivate the vast majority of other pathogens. While higher concentrations can be used (and may be required in healthcare settings), care should be taken, as high concentrations of chlorine can lead to corrosion of metal and skin irritation.

Safety precautions

Cleaners should wear appropriate Personal Protective Equipment (PPE) and be trained to use it safely.

- Chlorine is very corrosive, so contact with the skin and eyes must be prevented. In non-healthcare settings where disinfectants are being prepared and used, the minimum recommended PPE is rubber gloves, impermeable aprons and closed shoes. Eye protection may also be needed to protect against chemicals or if there is a risk of splashing.
- Chlorine is also a strong oxidising agent, so avoid inhaling the vapour and dust when opening a container, and never use a damp spoon to take chlorine powder from a container.
- Chlorine is unstable when exposed to air, heat, light or metal and should be stored in sealed containers in well-ventilated areas out of direct sunlight. Non-metal containers must be used for both storage and dilution.
- Chlorine products must be stored in locations out of the reach of children.
- Spraying disinfectants in any circumstances is not recommended by WHO.

Additional PPE will need to be issued to cleaners working in areas where suspected or confirmed COVID-19 patients are present.

Preparing chlorine solutions

Apart from health and safety precautions, additional considerations when preparing chlorine solutions are:

- A chlorine solution should be well-mixed using a non-metallic stirrer.
- A fresh chlorine solution should be prepared each day, since the concentration of chlorine will degrade with time.
- Adjustments should be made where locally available chlorine products have been stored in the shop for a long time and may have a lower concentration than stated by the manufacturer at time of purchase

Guidelines for preparation of 0.1% (1,000ppm) of disinfectant using commonly found chlorine products are shown in the table below.

Product	Available chlorine	0.1% solution
High-test calcium hypochlorite (HTH)	70%	1.4g (1/3tsp) to 1 litre water
NaDCC (sodium dichloroisocyanurate) powder	60%	1.7 g (1 tablet = 1.5g) to 1 litre water
Calcium hypochlorite ('bleaching powder')	35%	2.8g (2/3tsp) to 1 litre water
Sodium hypochlorite – liquid bleach	5%	1-part bleach to 49 parts water (e.g. mix 10ml of bleach to 490ml of water and stir for 10 seconds and cover the lid)

5. Monitoring checklist

This is not an assessment of the design, safety and accessibility of the handwashing facility but is intended for routine monitoring of the status of the facility. Consider what level of detail is necessary and adapt to the context.

1. Handwashing facility details		
1.1	Location – district/municipality	
1.2	Location – institution or place name	
1.3	Location – description or serial number	
1.4	Organisation – owner	
1.5	Organisation – responsible for O&M	
1.6	Date of installation	
1.7	Date of assessment	
1.8	Name of assessor	
1.9	Photographs taken?	Yes / No

2. Functionality? (as observed at time of assessment)		
2.1	Is the handwashing facility functional? Fully functional = working as intended Yes, needs repair = handwashing is possible but some faults or leaks (do not count minor issues like repainting)	Yes – fully functional / Yes – but needs repair / No
2.2	Is water available?	Yes / No
2.3	Is soap available?	Yes / No
2.4	Is path to the facility clear and accessible?	Yes / No

3. Maintenance required?		
3.1	Is any maintenance required? If NO, move to Section 4	Yes / No
	What maintenance is required? Mark all that apply	
3.2	Water storage tank	Replace / Repair / No maintenance required
3.3	Stand	Replace / Repair / No maintenance required
3.4	Plumbing – clean water	Replace / Repair / No maintenance required
3.5	Tap	Replace / Repair / No maintenance required
3.6	Soap dispenser	Replace / Repair / No maintenance required
3.7	Basin/sink	Replace / Repair / No maintenance required
3.8	Pedal-mechanism	Replace / Repair / No maintenance required
3.9	Plumbing – greywater	Replace / Repair / No maintenance required
3.10	Waste bucket/drain/soak-pit	Replace / Repair / No maintenance required
3.11	Pathway to facility	Repair / No maintenance required

4. Hygienic condition?		
4.1	Is water quality acceptable? Check for obvious smell or high turbidity	Yes / No
4.2	Is basin or tap obviously dirty?	Yes / No
4.3	Is there any stagnant water around the base?	Yes / No
4.4	When was it last cleaned?	Today / Yesterday / Within last week / More than 1 week / Don't know
4.5	Is handwashing facility visibly clean?	Yes / No

5. Other observations

References

1. WHO (2020). *Recommendations to Member States to improve hand hygiene practices to help prevent the transmission of the COVID-19 virus*. Available at: who.int/publications/i/item/recommendations-to-member-states-to-improve-hand-hygiene-practices-to-help-prevent-the-transmission-of-the-covid-19-virus (accessed 23 Jul 2020).
2. Curtis V, Cairncross S (2003). Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. *Lancet Infectious Diseases*. vol 3, no 5, pp 275-81. Available at: pubmed.ncbi.nlm.nih.gov/12726975/ (accessed 23 Jul 2020).
3. Aiello A E, Coulborn R M, Perez V, Larson E L (2008). Effect of hand hygiene on infectious disease risk in the community setting: a meta-analysis. *American Journal of Public Health*. vol 98, no 8, pp 1372–1381. Available at: ncbi.nlm.nih.gov/pmc/articles/PMC2446461/ (accessed 23 Jul 2020).
4. Institute of Development Studies, Coultas M, Iyer R, with Myers J (2020). *Handwashing compendium for low resource settings: a living document, Edition 2*. Available at: opendocs.ids.ac.uk/opendocs/handle/20.500.12413/15376 (accessed 23 Jul 2020).
5. UNICEF (2020). *Handwashing Stations and Supplies for the COVID-19 Response*. Available at: unicef.org/documents/handwashing-stations-and-supplies-covid-19-response (accessed 23 Jul 2020).
6. Hulland K R, Leontsini E, Dreibelbis R, et al. (2013). Designing a handwashing station for infrastructure-restricted communities in Bangladesh using the integrated behavioural model for water, sanitation and hygiene interventions (IBM-WASH). *BMC Public Health*. vol 13, no 877. Available at: doi.org/10.1186/1471-2458-13-877 (accessed 23 Jul 2020).
7. Global Handwashing Partnership (2017). *FAQ: Using Nudges to Encourage Handwashing with Soap*. Available at: globalhandwashing.org/wp-content/uploads/2017/11/Using-Nudges-to-Encourage-Handwashing-with-Soap.pdf (accessed 23 Jul 2020).
8. WashEm (2019). *How to design handwashing facilities that change behaviour*. Available at: files.globalwaters.org/water-links-files/washem_quicktip_handwashingdesign.pdf (accessed 23 Jul 2020).
9. WEDC/WaterAid (2013). *Accessibility and safety audits*. Available at: washmatters.wateraid.org/sites/g/files/jkxoof256/files/Accessibility%20and%20safety%20audit%20-%20facilitators%27%20guide.pdf (accessed 23 Jul 2020).
10. CSA Group (2020). *Testing the Effect of Faucet Flowrate on Handwashing Efficacy*. Available at: csagroup.org/wp-content/uploads/CSA-Group-Research-Faucet-Flowrate-Handwashing-Efficacy.pdf (accessed 23 Jul 2020).
11. White S (2020) *Can soapy water be used for handwashing?* Available at: resources.hygienehub.info/en/articles/3915816-can-soapy-water-be-used-for-handwashing (accessed 23 July 2020).
12. Hoque B A (2003). Handwashing practices and challenges in Bangladesh. *International Journal of Environmental Health Research*. vol 13, S81–S87. Available at: ircwash.org/sites/default/files/Hoque-2003-Handwashing.pdf (accessed 23 Jul 2020).
13. WHO/UNICEF (2020). *Water, sanitation, hygiene, and waste management for the COVID-19 virus. Interim guidance*. Available at: apps.who.int/iris/bitstream/handle/10665/331846/WHO-2019-nCoV-IPC_WASH-2020.3-eng.pdf (accessed 23 Jul 2020).
14. Huang C, Ma W, Stack S (2012). The hygienic efficacy of different hand-drying methods: a review of the evidence. *Mayo Clinic Proceedings*. vol 87, no 8, pp 791–798. Available at: ncbi.nlm.nih.gov/pmc/articles/PMC3538484/ (accessed 23 Jul 2020).
15. White S (2020). *Can bar soap spread COVID-19?* Available at: resources.hygienehub.info/en/articles/3915932-can-bar-soap-spread-covid-19 (accessed 23 Jul 2020).
16. Oxfam/WEDC (2018). *Shining a Light. How lighting in or around sanitation facilities affects the risk of gender-based violence in camps*. Available at: oxfamilibrary.openrepository.com/bitstream/handle/10546/620605/gd-shining-light-sanitation-gender-211218-en.pdf (accessed 23 Jul 2020).
17. Dreibelbis R, Kroeger A, Hossain K, et al. (2016). Behaviour Change without Behaviour Change Communication: Nudging Handwashing among Primary School Students in Bangladesh. *International Journal of Environmental Research and Public Health*. vol 13, no 1, pp 129. Available at: ncbi.nlm.nih.gov/pmc/articles/PMC4730520/ (accessed 23 Jul 2020).
18. WashEm (2020). *Changing messages*. Available at: washem-guides.s3.eu-west-2.amazonaws.com/activities/ACT47_en.pdf (accessed 23 Jul 2020).
19. WHO (2009). *Guidelines on Hand Hygiene in Health Care: a Summary*. Available at: apps.who.int/iris/bitstream/handle/10665/70126/1/WHO_IER_PSP_2009.07_eng.pdf?ua=1 (accessed 23 Jul 2020).
20. *WHO (2010). Guide to local production: WHO recommended hand-rub formulations.* Available at: who.int/gpsc/5may/Guide_to_Local_Production.pdf (accessed 23 Jul 2020).
21. WHO (2009). *Tools for training and education of health care workers*. Available at: who.int/infection-prevention/tools/hand-hygiene/training_education/en/ (accessed 23 Jul 2020).
22. WHO (2010). *Hand hygiene monitoring feedback*. Available at: who.int/gpsc/5may/monitoring_feedback/en/ (accessed 23 Jul 2020).
23. WaterAid (2020). WASH in HCF rapid assessment tool in mWater.
24. WEDC (2002). *Emergency sanitation: assessment and programme design*. Available at: repository.lboro.ac.uk/articles/Emergency_sanitation_assessment_and_programme_design/9585065 (accessed 23 Jul 2020).
25. WHO (2020). *Cleaning and disinfection of environmental surfaces in the context of COVID-19*. Available at: who.int/publications/i/item/cleaning-and-disinfection-of-environmental-surfaces-inthe-context-of-covid-19 (accessed 23 Jul 2020).

Acknowledgements

We acknowledge the contribution made by different WaterAid staff and external reviewers to produce this document. A special thanks the core team who have led this work from concept to draft to finalisation – John Knight, Lara Kontos, Joana Da Cunha Forte, Golam Muktadir and Om Prasad Gautam.

Thanks to all the WaterAid staff from Bangladesh, Burkina Faso, eSwatini, Ethiopia, Ghana, Liberia, Madagascar, Mali, Malawi, Nepal, Nigeria, Pakistan, Rwanda, Sierra Leone, South Africa and Zambia who contributed photographs, drawings and details of the handwashing facilities which have been designed and installed during the first few months of the COVID-response programme.

Your innovation and work under such challenging circumstances has been the inspiration for this Technical Guide and apologies that there is only space to include a selection of the designs.

Great appreciation to Sian White from the London School of Hygiene and Tropical Medicine, the Hygiene Hub and WaterAid colleagues – Tommy Ka Kit Ngai, Kyla Smith, Priya Nath, Tidiane Diallo and David Watako – who all provided detailed comments and feedback on the first draft, which has significantly improved the quality of the Guide. Our appreciation to the editorial team and the designer for their work on this Guide.

Erik Harvey
Programme Support Unit Director
International Programme Department
WaterAid UK

▶ Workers at a ready-made garment factory in Narayangani, Bangladesh wash their hands after learning about the importance of handwashing through hygiene behaviour change training.

Authors

John Knight, Lara Kontos,
Joana Da Cunha Forte, Golam Muktadir
and Om Prasad Gautam

@WaterAid

WaterAid is an international not-for-profit, determined to make clean water, decent toilets and good hygiene normal for everyone, everywhere within a generation. Only by tackling these three essentials in ways that last can people change their lives for good.

WaterAid