Cleancommunities

A practical guide to building and maintaining toilets in the Pacific

LIVE&LEARN
Environmental Education

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A practical guide to building
and maintaining toilets in the Pacific

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Live & Learn Environmental Education WASH materials

Live & Learn Environmental Education believes that Pacific communities have the right, knowledge and skills to choose and implement appropriate sanitation solutions to suit their needs. Demand-driven approaches to sanitation in Pacific communities ensure that toilets and hygiene facilities (such as handwashing points) are sustained when they have been developed and maintained by the users. With these resources, Live & Learn aims to present a range of approaches to support community-based solutions to sanitation needs in the Pacific islands.

Development of educational and community sanitation and hygiene resources

As part of this innovative process, a suite of educational and community sanitation and hygiene resources have been developed to support Live & Learn's work.

These include:

- *Discovering healthy living: Participatory Hygiene and Sanitation Transformation (PHAST) in Pacific communities*
- *Putting your waste in the right place: A Community-Led Total Sanitation (CLTS) approach for the Pacific islands*
- *Building strong and healthy communities: Setting up a sanitation enterprise in your community*
- *Setting up and managing a small enterprise: A guide for the Pacific*
- *Clean communities: A practical guide to building and maintaining toilets in the Pacific islands*
- *Hands up for hygiene! – teaching hygiene behaviour in Pacific schools: Teacher's guide*
- *Germ-buster: Student workbook*
- *Posters/board game/stickers*

Who can use these resources?

These resources can be used by communities, NGOs and governments to improve sanitation and promote hygiene behaviour in the Pacific islands.

How to use these resources

These resources have been designed to complement each other and support the facilitation of a broader participatory approach to improve sanitation in Pacific schools and communities. However, Live & Learn acknowledges and understands the diverse educational needs in the Pacific region and has ensured that each resource has been designed with the view that it might be used separately and not as part of the whole set. The resources are designed to support facilitated community and school activities, and some require previous knowledge and experience. Where this is the case, this is clearly outlined in the introductory pages of each resource.

Contents

Introduction

Sanitation refers to the disposal of human waste. Whilst a basic need, less than half of Pacific islanders have access to clean and safe sanitation services such as toilets (WHO 2008).

The lack of toilets can result in conditions such as diarrhoea, which claims the lives of close to 3,000 Pacific islanders each year–most of whom are under the age of five (WHO 2008).

Live & Learn Environmental Education is working with local communities in the Pacific to establish 'sanitation enterprises': demand-driven businesses that provide sanitation services (such as toilets) to improve sanitation in the Pacific islands. Based on the notion of 'sanitation marketing', the strength and success of these businesses pivots on the value the community places on toilets and improved sanitation.

This manual is a simple, easy-to-use guide that can assist in the construction and maintenance of toilets in Pacific communities.

The information in this manual can help build demand for improved sanitation in communities, while also raising awareness of other key hygiene behaviours such as handwashing with soap.

As with any other critical community resource, this manual is a 'work in progress' and will continue to evolve with increased use and reference. Live & Learn welcomes and encourages additional contributions to this manual to ensure that the needs and aspirations of Pacific island communities are met.

How to use this handbook

Who is this book for?

This resource aims to support the construction of toilets in Pacific communities to improve sanitation. It can be used by community groups, Non-Government Organisations (NGOs), government, private enterprises or donor bodies. Given the technical level of this resource, readers do require a basic skill set and previous construction experience.

The handbook contains information on:

- the importance of toilets
- the variety of available toilet designs, including: advantages and disadvantages of each design; how to construct each toilet; the materials and tools needed; suggested location; and maintenance
- promotional posters that can be put inside toilets.

How to use this resource

This resource is designed to be a guide. The construction of each toilet will depend on a number of factors including resources available, location and skill set. The materials recommended for each toilet are based on previous toilets constructed in Pacific communities and are examples only. The materials used can be substituted by locally-available resources. For example, you could use bamboo instead of PVC pipes, or the toilet wall structure could be made out of woven matting instead of bricks.

Language–toilet talk

When this manual is used within a community, choose words that are acceptable to participants and reflect local language. You should discuss the words first to ensure everyone is comfortable with the terminology.

Glossary

A glossary of terms is on page 89. The glossary explains the key terms in this resource.

Additional resources

There are a number of resources available that may support your work in the community. A list of these resources can be found on page 2 of this handbook. They are also available from the Live & Learn Environmental Education website, www.livelearn.org.

Toilets and sanitation

The links between hygiene and health

Hygiene, sanitation and water storage habits affect people's health. Waste water can contain pathogens or disease-causing organisms, which can make people sick.

We can reduce the spread of these invisible pathogens by doing a few simple things:

- using toilets
- washing ourselves, (personal hygiene)
- ensuring access to clean water
- effective waste water drainage.

Common health problems that can result from not using toilets and not washing hands include:

- diarrhoea
- skin diseases
- parasitic infections (e.g. hookworm).

Diarrhoea: the invisible killer

It is estimated that there are 6.7 million cases of acute diarrhoea each year in the Pacific (WHO 2008). This results in close to 3,000 deaths–mostly of children under five. Diarrhoea is the second largest killer of children under five in the world. Handwashing with soap is estimated to reduce the incidence of diarrhoea by nearly half (Fewtrell et al 2009). Building toilets and handwashing facilities will result in a healthier community.

A healthier community will:

- reduce the number of children missing school and adults missing work due to illness
- stop diseases spreading to other people and their families
- save money on medicine.

When considering the costs of improving the hygiene of your community, it is important to consider the costs of the continued spread of hygiene-related diseases.

Why do we get these diseases?

Reason 1: Not washing hands

If everyone washed their hands with soap after going to the toilet and before eating, almost 50% of health issues would be solved.

Reason 2: Not using toilets

Around the world, not using toilets has been shown to be the number one cause of diarrhoea in children under five.

Not using toilets (open defecation) and not burying faeces, can lead to the spread of parasites, bacteria and viruses. These germs are spread to human food or water supplies by insects, wind, animals or people.

Reason 3: Contaminated water

Water is important for daily life, as we use it for most activities. It is also vital in the environment as it supports our animal and plant life, which in turn supports our livelihood.

Keeping our waterways clean and safe is dependent on how we manage our waste. If people defecate in the open, or toilets are poorly constructed, human waste can seep into groundwater, wells, rivers and the sea. This can spread invisible pathogens.

The Six Fs: how disease spreads and sanitation hygiene solutions

	F	Description	Example	Solutions
	Fluids	Dirty drinking water	Our drinking water can be contaminated if open defecation occurs too close to the water source.	Water sources should be least 30 metres from toilets or defecation sites. Bring water to a rolling boil before drinking.
	Fields	Soil and crops that have been contaminated with human waste.	Open defecation takes place where crops or food are grown.	Always wash your hands with soap after working in the field.
	Fingers	Unwashed hands preparing food or going into the mouth.	Hands are not washed with soap prior to food preparation.	Always wash your hands with soap after going to the toilet or before eating food.
	Feet	Walking barefoot through contaminated fields can spread faecal matter.	Walking barefoot through fields and then into our homes, schools and other buildings.	Wear shoes when outside. If this is not possible, ensure your feet are clean before walking inside buildings.
	Food	Eating contaminated food.	Food that is contaminated by unwashed fingers, or food is not washed properly prior to preparation, or washed in water that is contaminated.	Always wash fruit and vegetables with clean water before preparation.
	Flies	Spreading disease from faeces to food and water or directly to people – particularly problematic where open-air defecation occurs.	Flies carry poo particles into homes and schools and can affect food and water.	Keep flies off food or places that you eat. Cover food and cups to stop flies spreading disease.

(WHO 2005)

Reasons why toilets are important:

Safety: Toilet facilities in a safe, easily accessed location reduces the risk of being harassed or attacked, particularly for girls and women.

Health: Faeces should be contained in a toilet. This will reduce the risk of it being spread and ending up in our food or water.

During the rainy season, faeces can also wash into local rivers and local groundwater and contaminate drinking supplies.

Faeces can also be spread by animals.

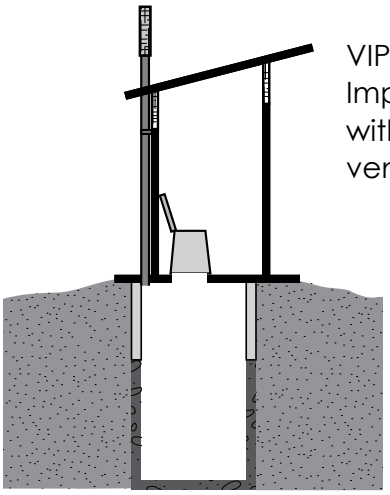
Status: In many places, toilets are a valued status symbol in a community, showing that the house and its occupants are 'modern'.

Education: There is a direct link between the provision of toilets and the standard of education (particularly of girls). Once girls start menstruating, their attendance at schools might be affected by the lack of toilets at school.

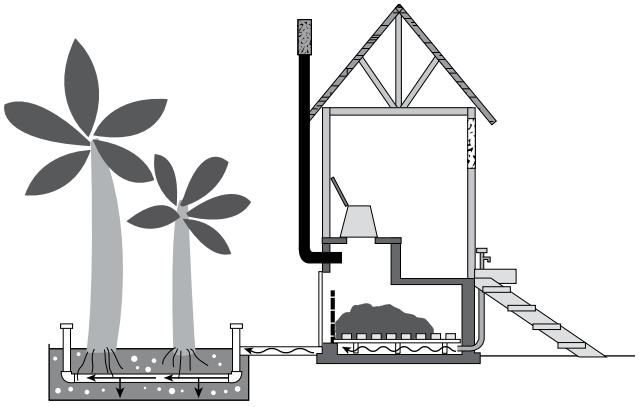
Sanitation options

The sanitation options below show the range of toilet options available to households and communities. It is important to choose the right toilet technology to suit people's needs and the conditions of each location. On the left are dry toilets which use no water for removing waste or cleaning. On the right are toilets that use water.

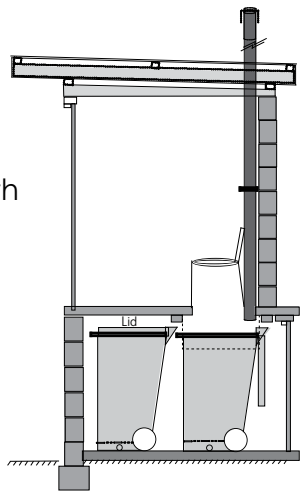
Dry toilet options



VIP: Ventilated Improved Pit toilet with seat riser and vent



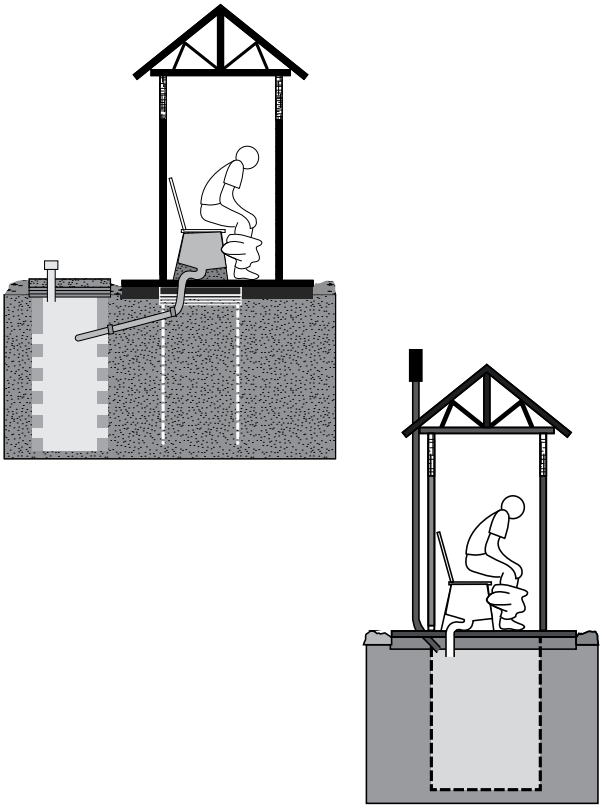
Compost toilet: Double chamber

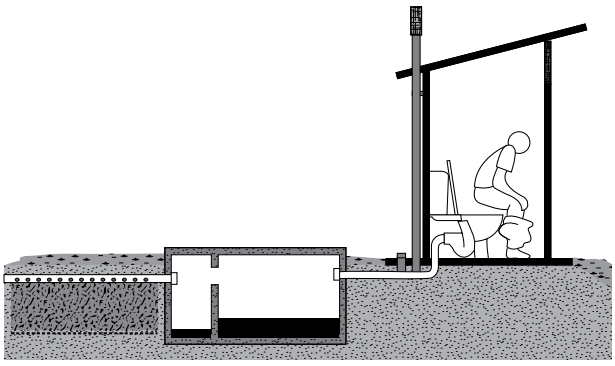


Compost toilet: Single chamber with two wheelie bins

Wet toilet options

Pour flush toilets





Septic tank toilet

Choosing the 'right' toilet

Some things to consider

This section will help people decide which toilet best suits their needs.

Communities across the Pacific have very different sanitation needs. This handbook provides a range of options to suit the income levels and needs of most families.

Encourage your community to begin by burying their waste while they build or begin to save money for a basic toilet. This will be a step towards a healthier community.

Choosing a toilet

Choosing the 'right' toilet means selecting the one that best fits the needs of the household.

It is important to find out the needs of ALL the people in the family who will be using the planned toilet facilities.

Make sure you include women, men and children in your discussions. You may need to speak to each group separately about this.

Access

Ensure that the toilet is accessible and that all users, including children, can sit on the toilet easily and comfortably. Also consider any special needs that exist in each house (elderly, pregnant or those with disabilities). Toilet structures can be fitted with design modifications for those with special needs. Some examples are: handrails on steps for support; handhold bars to provide stability and support when getting on and off the toilet seat, or a ramp to allow wheelchair access.

Privacy

Ensure that the toilets are private so people feel comfortable using them. In some cultures it may be very important that people cannot be seen entering or leaving an outdoor toilet. It is important to consult with both men and women when choosing a site.

Women's menstruation

During monthly menstruation, women need safe, clean areas, and access to sanitation services such as a separate washing area or adjoining room. Blood and cotton cloths can be disposed of in pit toilets and compost toilets along with other matter. However, sanitary pads and other sanitation protection items which contain plastic cannot be put into the toilet. These objects will need to be buried (away from water sources) or burnt. In schools, an absence of toilets for girls who are menstruating can result in health problems and could mean that girls are reluctant to go to school.

Safety and security

Ensure the toilets are in a safe and secure location, close to home. This is particularly important for girls and women.

Cleanliness

People are more likely to use a toilet if it is a pleasant experience. Ensure the toilet seat, pan and surrounds can be easily cleaned.

Location

When choosing the location to build toilets, there are some issues to consider. Firstly, does the toilet use water?

Make sure the location is safe for women and children to use at night. It should also be located in a place that is easy for all people to reach, including those less mobile and elderly.

The table below shows suggested distances that toilets should be built from a house or water source.

Wet toilets should not be built closer than 30 metres to a water source such as a well, river, sea or groundwater, as the waste may leak into the water, causing contamination. Dry toilets, such as the compost toilet, can be closer to rivers and wells because they do not affect the groundwater supplies.

Access to water and soap

The community's access to water will also guide their choices in toilets. Compost toilets require no water, while pour flush toilets will require many litres per use. Some water will be required for cleaning the toilet and toilet room. Water and soap are recommended for handwashing, but if water supply is limited, look at increasing your water supply through water harvesting and rainwater tanks. If soap is not readily available, see the soap making section on page 80.

Toilet type	Suggested distance from house	Suggested distance from water source, e.g. well or river
VIP toilet	10–15 metres	30 metres
Compost toilet	can be inside house	does not affect water source
Pour flush	can be inside house	30 metres

Working out the household's needs

The questionnaire below can be used as a guide for discussions with the people who want a toilet. This can be used to work out what kind of toilet best suits their needs.

Family

☐ Family size–how many people will use the toilet? Can it cope with this level of use?

☐ Can all the family use the same toilet? Do you need separate male/female toilets?

☐ Do any family members have special needs? e.g. elderly/ill or unable to climb steps, or need a handrail, or require wheelchair access.

The environment

☐ Land–is there enough land to install the toilet and its soakage pits, soakage trenches or septic tank?

☐ Location–is there somewhere safe to put the toilet so that women/children can safely use the toilet at night? Is the location at least 30 metres from wells or places where water is gathered for drinking or cooking?

☐ Flooding–is this area prone to flooding? If so, a raised toilet and raised chamber/pit might be needed.

☐ Soil type–it is rocky, sandy, clay? Will waste water soak away quickly enough? If not, a dry toilet might be needed. Is the soil stable when a hole is dug? If not, the pits will need to be lined.

Water

☐ If a wet toilet is used, is there enough water for flushing, including during the dry season?

☐ Is there access to water for handwashing, cleaning and toilet maintenance?

☐ What style of handwashing facilities suit your conditions? See examples on page 77.

☐ Is soap available?

Costs

☐ Money: what is affordable–including ongoing costs such as water bills and repairs. What are people willing and able to pay?

☐ Is it possible for a few families to pool funds to build a joint toilet block?

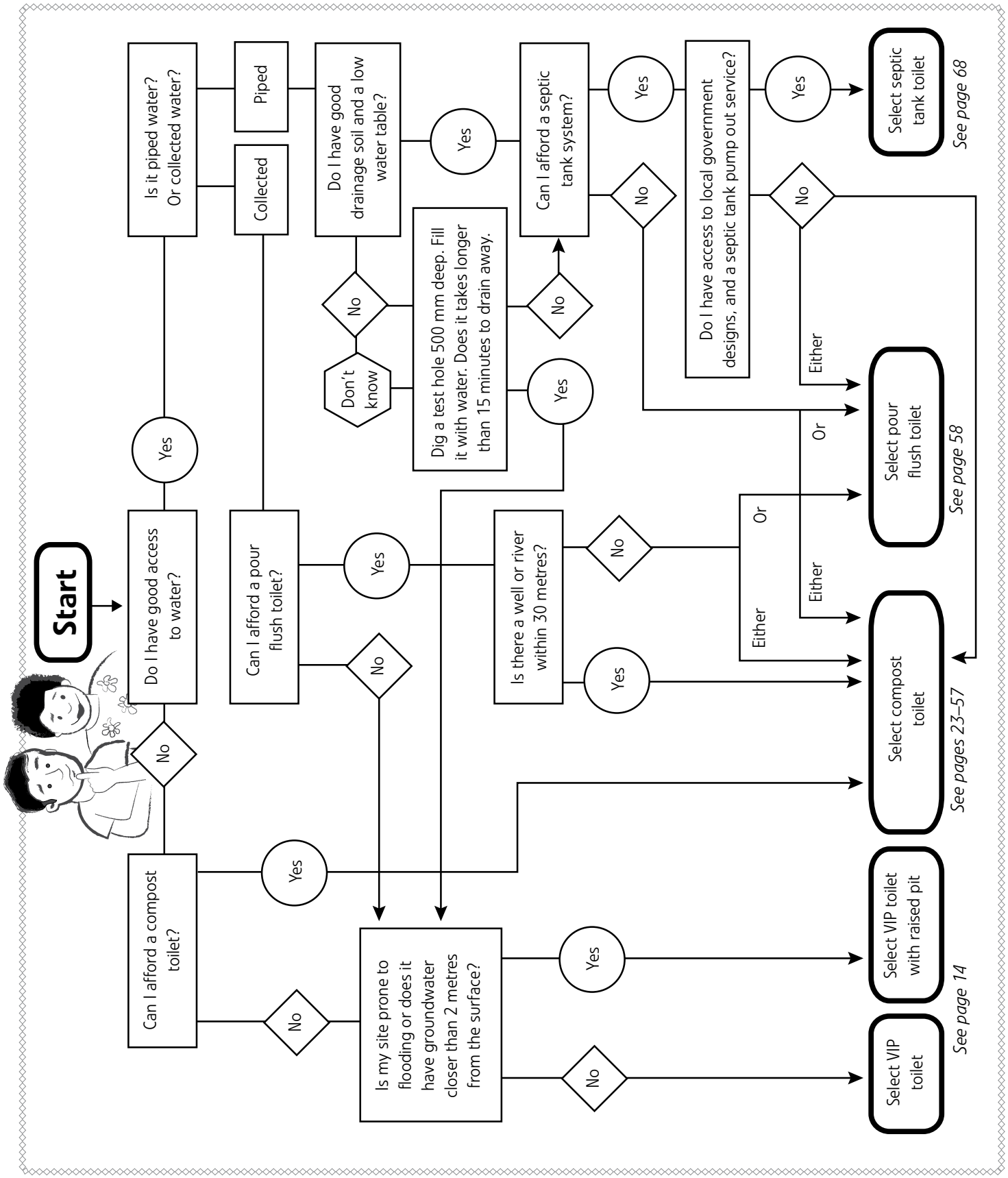
☐ Savings plan–could a community savings plan be possible?

☐ Is micro-financing available in your area?

This is a good way to learn about the wants and needs of families looking at constructing a toilet. Once this information has been gathered, discuss the findings with the family. For example, a community with little or no water might not be able to build a pour flush or flush toilet.

Which toilet option is best for my household?

Use this chart to help your customers work out which toilet best suits their household. Find the 'START' and discuss the pathways to lead you to the most suitable toilet model for them.



Toilet options and construction

This section presents several options for toilets, detailing advantages and disadvantages of each design as well as instructions on how to construct each model. These toilet designs are a guide only. Before you construct each toilet, we suggest you check with your local authorities to have plans approved.

1. Ventilated Improved Pit (VIP) toilet

What is a VIP toilet?

The Ventilated Improved Pit (VIP) toilet is a standard pit toilet with an added vent pipe that reduces smells and flies.

How it works

The vent pipe rises from inside the pit to above the toilet roof. Wind passing across the top of the vent pipe sucks air up the vent pipe, from inside the pit. This removes smells from the pit and stops them rising back up through the toilet seat or hole. A gap should be left, usually above the toilet door, to allow air to enter the toilet room. The flow of air is increased if the doorway of the toilet faces into the normal wind direction.

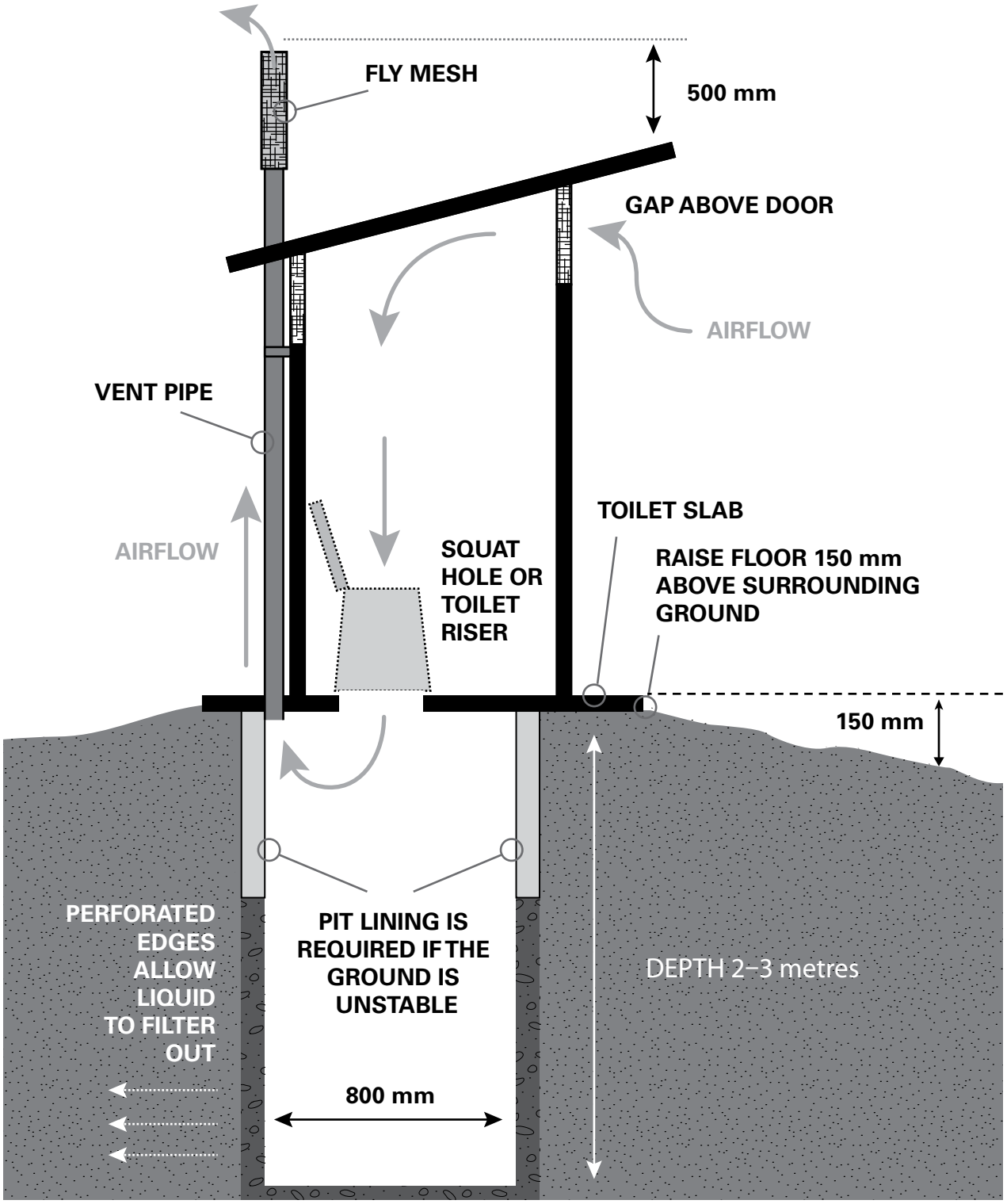
The vent pipe is covered by fly mesh to stop flies entering or leaving the pipe. If the toilet room is kept sufficiently dark, any flies that enter the dark pit through the squat hole or seat, will be attracted to the daylight at the top of the vent pipe. It is important not to cover the toilet seat/hole during the day as this will restrict the air-flow.

If a door is fitted to the toilet it should be kept shut at all times to keep the inside of the toilet room reasonably dark.

The toilet will need to be moved when the pit is almost full (500 mm from the top). This is usually after two or three years.

Advantages and disadvantages of a VIP toilet

Advantages	Disadvantages
Low cost	Does not control mosquitoes in the pit
Can be built by householder (minimal skills required)	Extra cost of providing vent pipe
Needs no water for operation	Need to keep inside of the toilet room relatively dark
Easily understood	Odours from the pit can rise up into the toilet room if there is no wind blowing outside
Control of flies and reduced smell inside toilet room, compared to a pit toilet with no vent	May not meet the social aspirations of users when other more 'advanced' toilets are installed in the area (e.g. water seal or flush toilets)
Any cleaning material (such as toilet paper, leaves) can be used without blocking the toilet	
Can choose whether to install a squat hole or seat riser	
Slab can be round so is easy to lift and roll to new pit when toilet is full	


FLY MESH
500 mm
GAP ABOVE DOOR
AIRFLOW
VENT PIPE
AIRFLOW
SQUAT HOLE OR TOILET RISER
TOILET SLAB
RAISE FLOOR 150 mm ABOVE SURROUNDING GROUND
150 mm
PERFORATED EDGES ALLOW LIQUID TO FILTER OUT
PIT LINING IS REQUIRED IF THE GROUND IS UNSTABLE
DEPTH 2–3 metres
800 mm

How to build a VIP toilet

Materials required

- 1 x 40 kg bag of cement
- 3 m of 100 mm diameter PVC pipe or similar size bamboo opened through centre
- 2 kg of 1.6 mm tie wire or 1200 mm x 1200 mm F72 steel mesh or 1.6 mm tie wire and nails
- clean sand and stones for concrete mix
- black paint
- fly mesh 400 mm x 400 mm; optional plastic vent cowl
- four 50 mm x 50 mm x 1.4 m timbers
- suitable local materials for house and door.

Tools required

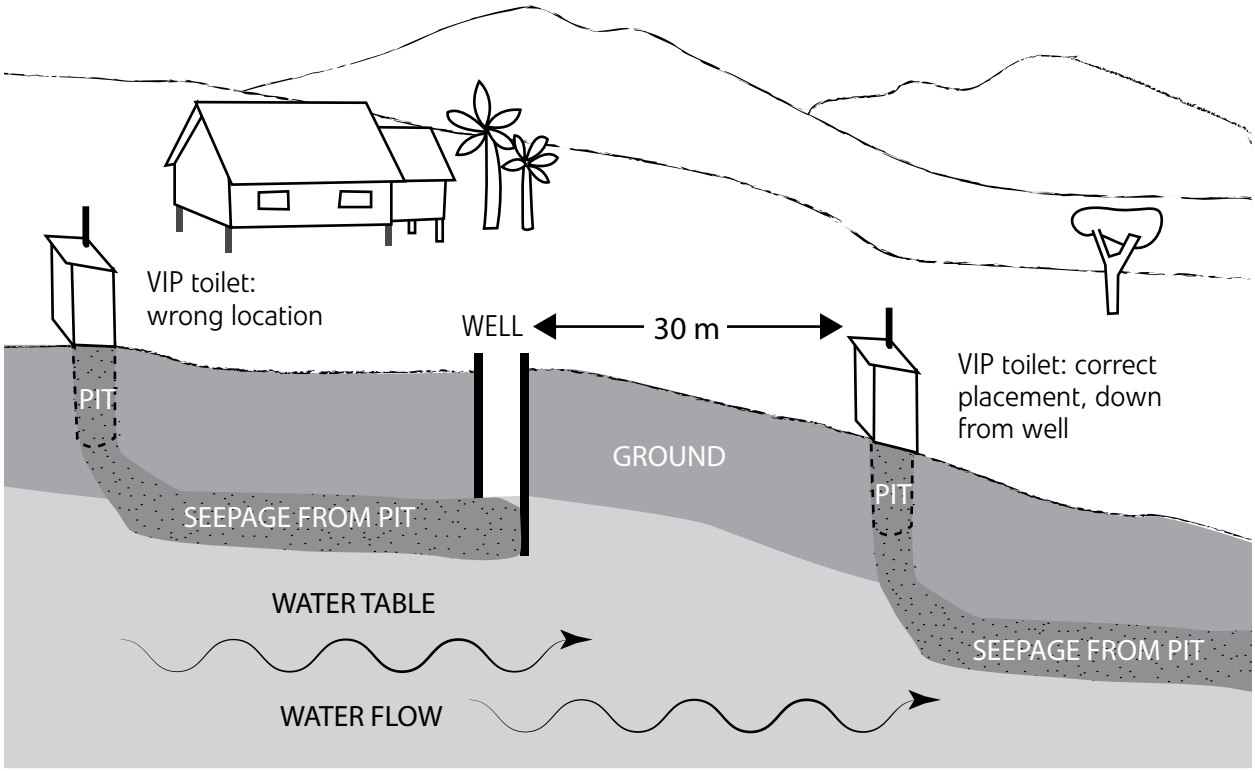
- bucket
- hammer
- trowel
- spade
- pliers
- builder's spirit level
- paintbrush.

There are four key stages to building a VIP toilet:

1. Selecting the best location
2. Digging the pit
3. Building the toilet slab
4. Building the toilet house

1. Selecting the best location

- Convenient location (accessible to users).
- Well drained land where the groundwater level is more than 2 metres deep (otherwise a raised pit may be needed).
- At least 30 metres from any existing water source e.g. a well or stream used for drinking or cooking.
- If possible, the door should face the wind direction and the vent pipe should face the sun.



2. Digging the pit

The pit needs to be at least 2–3 metres deep, more than the head height of a man standing at the bottom. The pit can be a round or square hole and should be about 800 mm wide. Cut a stick to 800 mm long and use it as a guide to ensure the width of the hole is even. For the bottom 800 mm of the hole it can be a bit wider, to increase the pit capacity. Using some of the soil, mound up the top of the pit to around 150 mm above the surrounding ground level. This stops storm water flowing into the pit and eroding the edges. If the soil is unstable, line the pit with timber, stone, bricks or some old 200-litre drums (with the tops and bottoms removed) to support the walls. A small concrete foundation can be added to the top edge of the pit to support the toilet slab.

3. Building the toilet slab

The toilet slabs must be made of reinforced concrete so they are long-lasting and safe. A simple slab of 1.2 m x 1.2 m with reinforcement is adequate.

Make sure the slab is at least 400 mm wider than the pit, so there is no danger of collapse. The slab is built with two holes for the vent pipe and the squat hole (or seat riser). Make sure the squat hole is too small for a young child to fall through. A brick is a useful guide for size. If you are adding a seat riser make a piece of formwork that is the same size as the bottom of the seat riser.

Build the formwork for the slab on a smooth, flat level surface. The slab needs to be 1200 mm x 1200 mm and 50 mm thick at the edges. It can be thicker towards the centre. Old oil can be painted on the inside of the formwork to help it separate from the concrete once set.

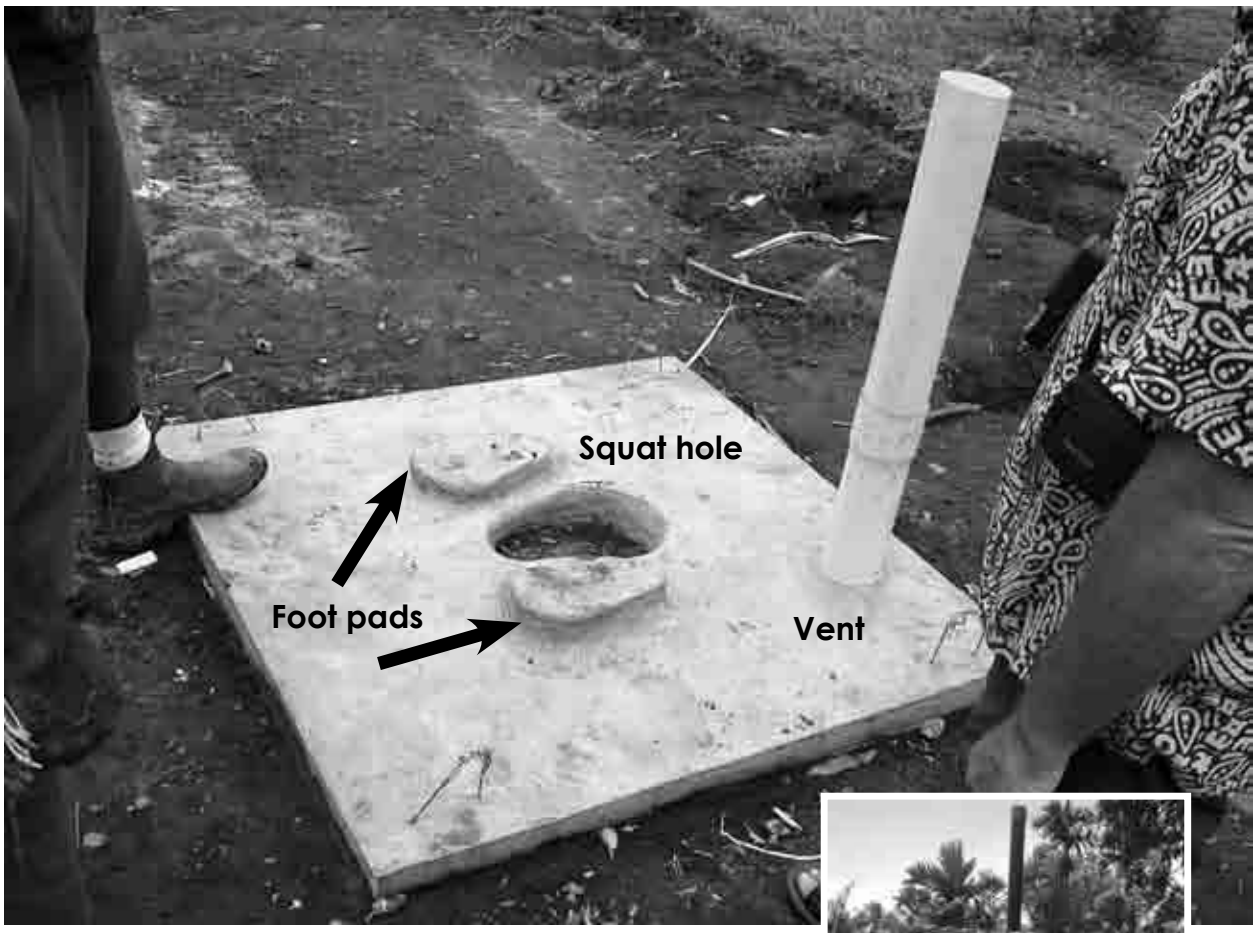
Use F72 steel mesh or make mesh using tie wire. Twist 22 sets of three strands of tie wire tightly together about 1600 mm long (they shrink during twisting). Put nails along the edge of the formwork at 100 mm spacing. Stretch the twisted wire across the nails and weave them into a mesh. Tie the wires together where they cross. Cut the twisted wire off the nails just inside the formwork to complete the mesh. This forms a strong wire mesh that locks into the concrete and makes it stronger. Cut out the sections where the vent pipe and holes will be. Place a short length of 100 mm PVC pipe in one corner for the vent pipe and 250 mm diameter formwork for the squat hole or toilet riser (or this can be cut out with a trowel later).

Building the formwork for the toilet slab.

Cement

Collect, sieve and wash sand and stones if you have any doubts about their purity (particularly if they contain salt from seawater). Let it dry before mixing with the cement. Dust and impurities may weaken the concrete.

Mix cement with sand and stones in the proportions: 1 part cement, 2 parts sand, 2 parts stones. Add very little water and mix well. Divide into two parts and add a little extra water and cement to the softer one of the heaps to make



it liquid. Stir well in a bucket. Pour the liquid concrete in the formwork to a depth of 20 mm and tap/hammer gently on the formwork with a piece of wood to release air bubbles. (If you do not do this you may get small holes in the surface of the slab.) Put in the reinforcement mesh before adding the very stiff concrete to cover the reinforcement well. Compact the concrete with a piece of wood until the cement water comes to the surface. The concrete can be about 12 mm thicker in the centre to increase slab strength and aid drainage when cleaning. Use a trowel to form foot pads if using a squat hole. Cover the slab with banana leaves or plastic for 3–4 days. Sprinkle with water each day to slow the hardening process–this increases the finished strength. Smooth the top of the slab as it dries, so it is easier to clean. When it is dry, gently lift the slab into its final position over the pit.

Remember, don't use too much water to make a 'sloppy mix' when mixing the concrete as this reduces the finished strength. The drier the mix, the stronger the finished concrete.

4. Building the toilet house

The house can be any design that meets local needs and can use local bush materials or timber and roof iron. Air flow up the vent pipe will work a bit better if the whole pipe is exposed to the sun. Air inside the pipe will heat up and rise. To do this, build the toilet walls so the pipe is outside the toilet. Paint the pipe black to help it absorb more heat. The top of the vent should extend 500 mm above the roof and should be covered with fly mesh. With a vent pipe installed it is not essential to cover the slab hole or seat but doing this will help reduce smells, especially in cooler times like early morning, or when the wind is not blowing.

How to build a seat riser

The VIP with seat riser has the same design and maintenance aspects as a VIP toilet, but has a raised seat (or seat riser) to provide a western-style sitting position.

Advantages and disadvantages of a VIP toilet with seat riser

Advantages	Disadvantages
Low cost	Does not control mosquitoes in the pit
Can be built by householder (minimal skills required)	Extra cost of providing seat riser
Needs no water for operation	Need to keep interior relatively dark
Easily understood	Needs more cleaning inside seat riser
Control of flies and reduced smell inside toilet room	Odours from the pit can rise up into the toilet room if there is no wind blowing outside
Meets some social aspirations of users wanting upmarket design	May not meet the social aspirations of users when other more 'advanced' toilets are installed in the area (e.g. water seal or flush toilets)
Any cleaning material (such as toilet paper) can be used without blocking the toilet	

VIP toilet with seat riser in Minda village, PNG. The vent behind the back wall attracts more sun and heat to assist ventilation.

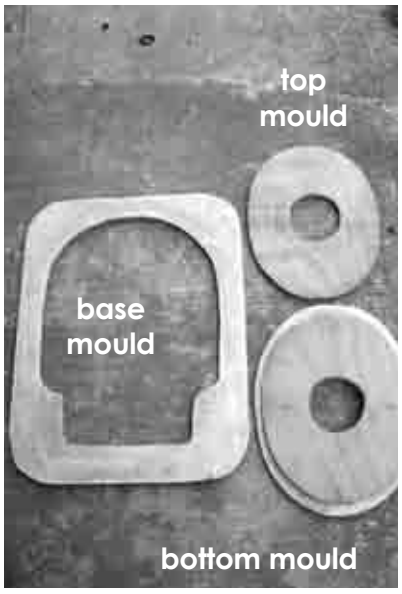
Building a seat riser

Materials required:

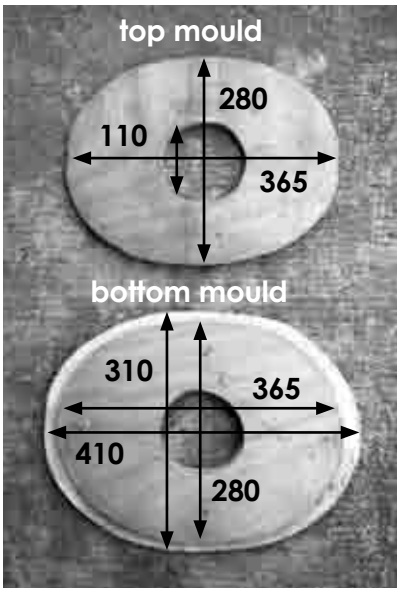
- plywood moulds (12 mm) x 3
- flat iron–1120 mm x 450 mm
- chicken wire (10 mm) –1120 mm x 475 mm
- tie wire (1 mm)–8 metres
- cement–1/3 of 40 kg bag
- sticks (10 mm diameter) x 2
- sand–very fine, sifted
- toilet seat and lid.

Tools required:

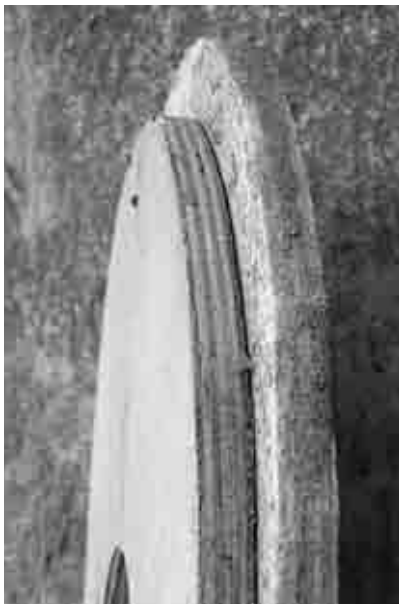
- pliers
- trowel–floating
- wire cutters.



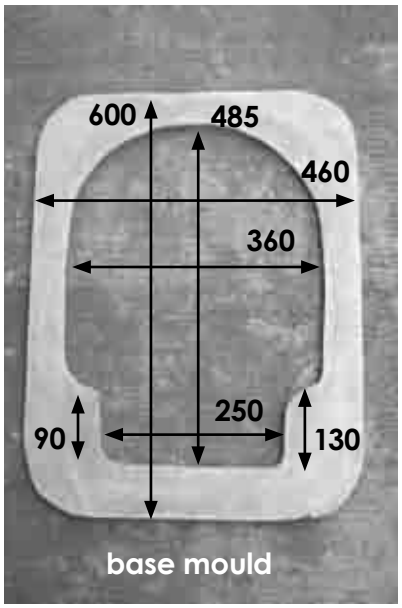
Make 3 plywood moulds.



Join 2 layers of 12 mm plywood to make the bottom and top moulds. (measurements in mm)



Close-up, showing the 2 layers of plywood, joined together.



Plywood mould for base of toilet. (measurements in mm)

Cut chicken wire to same length as flat iron, but 25 mm wider.

Bend flat iron around inner lip of bottom mould.

Insert top mould in top, wrap flat iron tightly around it, secure with tie wire.

Wrap & tie chicken wire tightly. It should extend 25 mm above flat iron.

Turn riser over, place in base mould, on smooth surface. Bend chicken wire out around the base.

Mix 1 part cement, 3 parts sand & water to make stiff mix.

Trowel 10 mm layer of cement firmly onto wire. Dry 1 hour, add another 5 mm layer.

Press sticks through base where toilet seat attaches. Leave 1 day to dry.

Remove moulds & flat iron. **If building a dry toilet:** Apply 5 mm cement layer inside riser. Smooth.

Fit toilet seat & lid. Use cement to render to toilet floor. Riser is ready to use.

Using and maintaining a VIP toilet

How to use the toilet:

- Keep the room dark to discourage flies from entering.
- Don't cover the seat or squat hole during the day (a cover reduces air flow down into the pit and up the vent pipe).
- Use a temporary cover if smells are coming from the toilet hole due to no wind or cool weather.
- Keep the area around the toilet clean so it is a safe and pleasant area to be.
- Encourage the community to use the toilet and share usage tips.
- Consider and implement toilet cleaning and maintenance plans.

Maintaining the toilet

When the pit is ¾ full (around 500 mm from the top), remove the slab and fill the hole with soil. Dig a new pit, check the slab for cracks or damage and re-use it if ok. Rebuild the house around it.

Common problems and solutions

Problem	Solution
Water has washed away soil around the edge of the slab to expose an opening to the pit.	Repair with soil or concrete to prevent flies or rats entering.
Bamboo used for the vent is broken or rotten.	Replace
Fly mesh is blocked with mould.	The fly mesh must be clear at all times. Make side openings at the top of the vent to prevent mould growth.

Don't forget ...

Every toilet needs to include handwashing facilities with water and soap.
There are simple examples you can easily make on page 77.

2. Compost toilets

What is a compost toilet?

A compost toilet is a dry toilet that uses no water for flushing. All waste is captured within a closed chamber that sits above ground level. Compost toilets are the best option where there is a risk of polluting groundwater or the environment.

How it works

Composting human waste has been done in many countries for hundreds of years. Waste is mixed with organic matter to create fertile soil. Compost toilets do the same thing. A properly maintained compost toilet is very clean and hygienic and does not smell. In a composting toilet, the toilet seat sits immediately above a fully-enclosed dry chamber. After each use, a handful of organic matter is added, and the mixture produces a composted soil conditioner in about 12 months (refer to section on appropriate use on food crops). No water is used, except a minor amount for regular cleaning of the toilet riser. Harmful germs (or pathogens) are killed by the heat of the compost pile and by the length of time the compost is left before removal from the chamber. The finished compost is eventually removed and can be used as a soil conditioner (fertiliser).

The most common design of compost toilet in the Pacific is the 'batch system'. This system uses two or more chambers to capture the waste. Batch-system toilets include two-chamber compost toilets and wheelie-bin compost toilets. One chamber is used until full, then sealed and left to compost down while a second chamber is used. When the second chamber is full, it is sealed and the first chamber is emptied of finished compost so it can be used again. Any excess liquid drains from the base of the chamber to a small, shallow soakage pit.

Typically, chambers are sized to fill over a minimum 12 month period, with a further 12 months allowed for undisturbed composting before emptying. In two-chamber systems, the toilet seat is moved from one chamber to the other. In the wheelie bin system, the toilet seat remains in the same location and the full wheelie bin is removed and stored elsewhere for composting. An empty bin is wheeled in to replace the full bin.

The chambers sit above the ground and are sealed from their surrounds. This prevents groundwater contamination, soil pollution and health problems common with other wet and dry toilet systems. Users, however, must become comfortable with occasional handling of composted waste (every 9 to 18 months).

Appropriate use

The compost toilet is an effective solution where groundwater levels are high or can be easily polluted. However, it can be used as a reliable waterless toilet in many other areas as well. It can be built close to houses, or directly on the side of a raised house.

The compost toilet is mostly suited to the needs of a single family. They can be built in clusters for institutions like schools but they must be carefully managed to keep them clean and to avoid overuse, which can mean they get full too quickly, leaving insufficient time for adequate composting.

Appropriate use on food crops

The World Health Organisation (WHO) recognises waste from composting toilets as a suitable fertiliser for food crops. It contains important minerals and nutrients, like all other fertilisers communities currently use. WHO recommends, provided the excreta is dry and odourless, and left in a dark, covered place for two years or more it can safely be used as a fertiliser on food crops. For more information, please refer to WHO *Composting latrines*.

Selection of best location

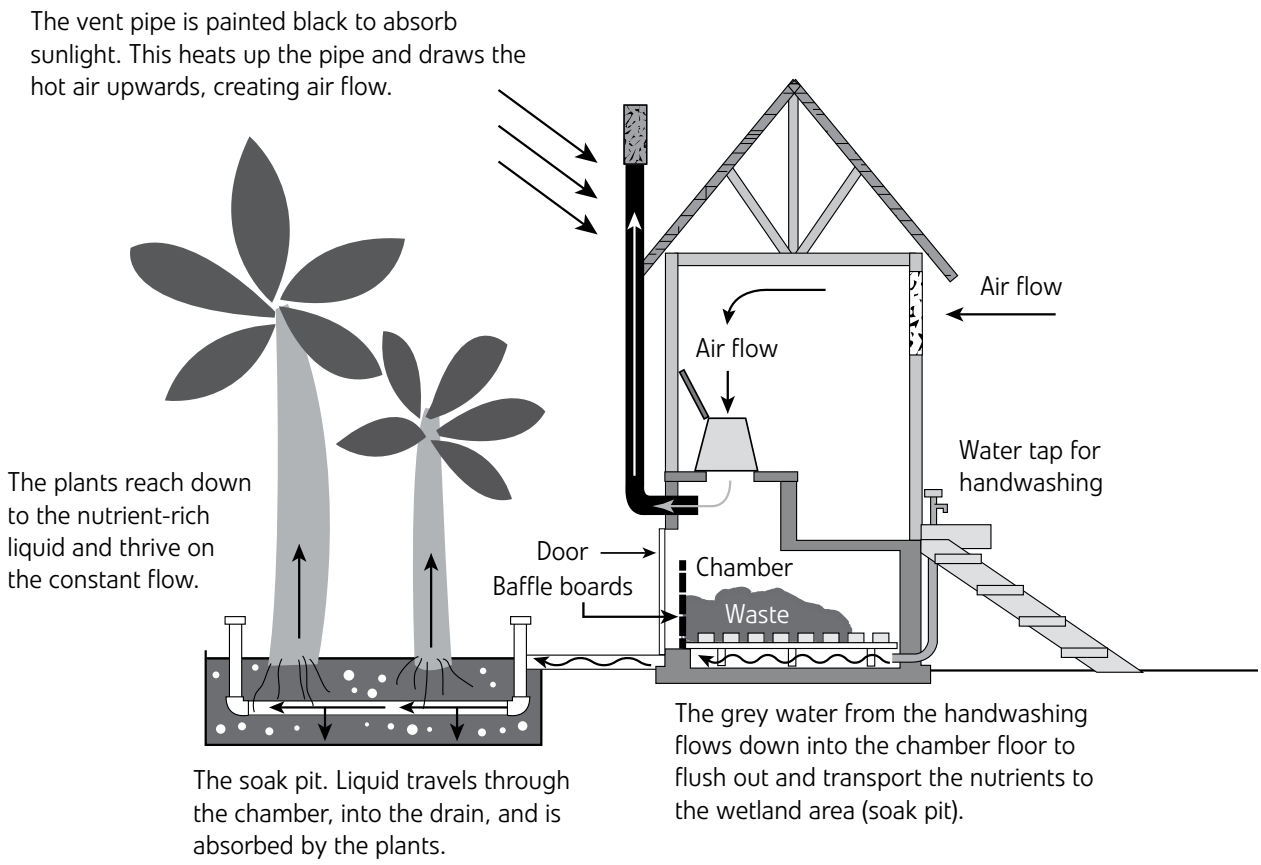
When built and maintained well, the compost toilet does not give off any bad odours and can be placed almost anywhere. Vent pipes function best when there is a passage of air over the top of them (see VIP toilet section) so site selection should allow for this. The access door for compost removal should be easy to get to.
A significant advantage of compost toilets is that their location is not dependent on the location of an existing water source, and they do not require level land or land with good drainage. They can be established in a confined space close to a house.

Advantages and disadvantages of a compost toilet

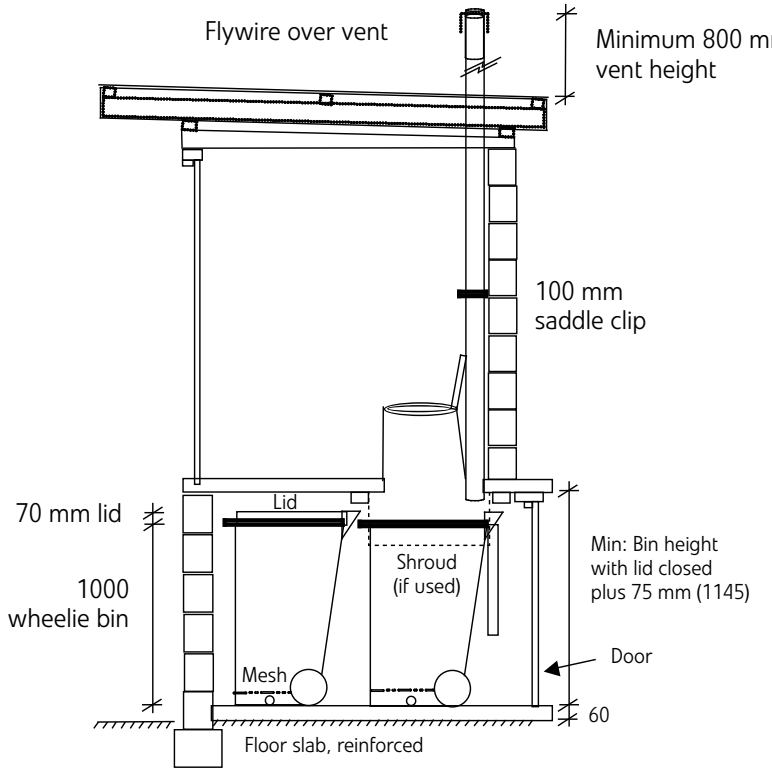
Advantages	Disadvantages
Almost no water is needed (just a small amount 1–3 L per day – for cleaning purposes)	Organic matter (or ash) must be regularly collected and stored in the toilet for use
No smell in the toilet room when properly maintained	Users must understand and control the addition of organic matter to ensure proper composting
Suitable for families. (2 chambers: 10 people) (Wheelie bin: 6 people)	For a two–chamber compost toilet, same construction cost as a septic tank system
Does not pollute the environment or groundwater	Users have to overcome discomfort about emptying composted toilet wastes from the chambers, every 9–18 months
Can be located anywhere, as the chambers sit above ground. Requires no digging of pits.	The toilet room is elevated above the ground, so access may be difficult for elderly or disabled
The compost produced can be used for soil conditioning	
Permanent structure with no need to rebuild/ move when full	
Biodegradable cleaning material (such as toilet paper and leaves etc) can be used.	
Clean and hygienic	

This section provides information on two compost toilet designs:

1. Compost toilet - 2 chambers



2. Compost toilet - 1 chamber, two wheelie bins



How to build a compost toilet with 2 chambers

It is important to note that while the toilets are relatively easy to construct, you will need access to specialist skills and work tools to support the construction process.

There are ten key stages to building a compost toilet with 2 chambers:

1. Select and prepare the site
2. Construct footings and base slab
3. Construct chamber walls
4. Prepare the chamber inside
5. Cast the chamber roof (which is the toilet room floor)
6. Prepare the false chamber floor
7. Prepare the rear door and baffle boards
8. Construct the soak pits – evapotranspiration (ET) beds
9. Construct the seat riser
10. Construct the toilet house walls and roof

MATERIALS LIST – 2 CHAMBER COMPOSTING TOILET

Qty	Material description Base structure (house bush materials)	Use
60	8" full standard concrete block	Chamber walls
9	8" half standard concrete block	Chamber walls
8	10 mm rebar x 1 m	Chamber
2	F71 Arc Mesh 2.5 m x 1.5 m	Foundation and floor
1	Tie wire 1 kg x 1.5 mm	Steel work
6	Cement 40 kg bag	Concrete work
3 pkt	50 mm galvanised flat head nails	False floor
1 pkt	75 mm masonry nails	Chamber frame
2 pkt	65 mm bright nails	Formwork
18	Carriage bolts 140 mm x m10+nut+flat washer	Rear door cover
8	Bolt 80 mm x m10+nut+flat washer	Toilet pan
1	'Tuffa' poly toilet pan and seat	Toilet seat
1	12 mm (or 18) marine ply 2.4 x 1.2 sheet	Floor formwork & rear doors
2	150 x 25 mm rough sawn 3.9 m	Formwork
3	35 x 25 mm rough sawn 3.9 m	Formwork & pegs
15	150 x 25 mm sized hardwood 3.9 m	False floor slats & rear baffle
3	100 x 50 mm sized hardwood 3.9 m	Chamber door frames
1	Super flex plank smooth 3660 x 230 x 7.5 mm	Rear baffle
2	100 mm DWV pipe PVC x 6 m	Vent and drains
4	100 mm PVC 45 degree	Drains
2	100 mm PVC 90 degree	Drains
2	100 mm PVC end cap	Drains
1	Stones 50 mm–200 mm 1 m cube	Soak pit
3	Sand and stones for concrete 1 m cube	Concrete
	PVC glue	
	black paint	
	Optional house structure materials	
5	Galvanised roof iron 6 ft	Roof
2	Roof nails pkt	Roof
38	50 x 50 rough sawn 3.9 m	Framing
3	50 x 25 sized 3.9 m	Door
2	75 x 25 sized 3.9 m	Door
2	100 x 50 sized 3.9 m	Door frame
2	150 x 50 sized 3.9 m	Steps
4	100 mm nails pkt	Framing
1	Bracing strap (roll)	Frame bracing
2 pkt	50 mm galv clouts	Cladding
6	Primaflex 2.4 x 1.2 x 6 mm (or 'whipped cream' wall iron)	Cladding
2	Ezybond construction adhesive	Framing
2	Tee hinge light duty 100 mm	Door
1	Pad bolt slug eye 100 mm x 38	Door
1	Hasp & Staple Ridgid ZP 100 mm	Door
1	12 mm marine ply 2.4 x 1.2 m sheet	Door

Selecting a suitable site for the toilet.

Construction steps

Note: The steps and materials are a guide only and can be altered to suit local materials and construction techniques. Dimensions are based on using concrete blocks 400 mm x 200 mm x 200 mm. Alter dimensions to suit your chosen/available materials. The chambers need to be close to 1 cubic metre (1 m x 1 m x 1 m) to provide a suitable volume for a family of up to 10 people.

1. Select and prepare the site

Select a suitable location where the family will be comfortable using the toilet. It needs about 1 metre of space at the back or sides to construct the soak pit evapotranspiration (ET) beds for treating the urine/liquid. Level ground is OK, but sloping ground is better as it allows the chamber to be recessed into the hill with level access to the top floor, avoiding the need for steps. The compost toilet can be built connected to a house, provided that the vent pipes extend 500 mm above the roof of the dwelling and toilet house.

Remove grass and topsoil. If the ground slopes, dig a level space for the chamber construction.

2. Construct footings and base slab

Lay out and level the base site using pegs and string line.

Use the 150 x 25 rough sawn timber to build formwork for the concrete base slab. The formwork should be sized to match the size of the chamber. In this case, concrete blocks are used for the walls, so the concrete base needs to be 2560 mm x 1540 mm x 150 mm thick. Dig a 200 mm deep footing under the position of each block wall. Square and level the formwork. Position 100 mm PVC elbows into the floor to line up with drains to the soak pit. The drain can be located at the side or back of the toilet, depending on the space and conditions at the site. Use F71 mesh reinforcing steel in the floor and set vertical 10 mm reinforcing bars at correct spacing for concrete block walls. Prepare concrete, pour and then trowel the base slab and footings smooth.

Preparing the base site using pegs and string line.

Making a wooden frame to hold the cement for the base slab.

Constructing the chamber.

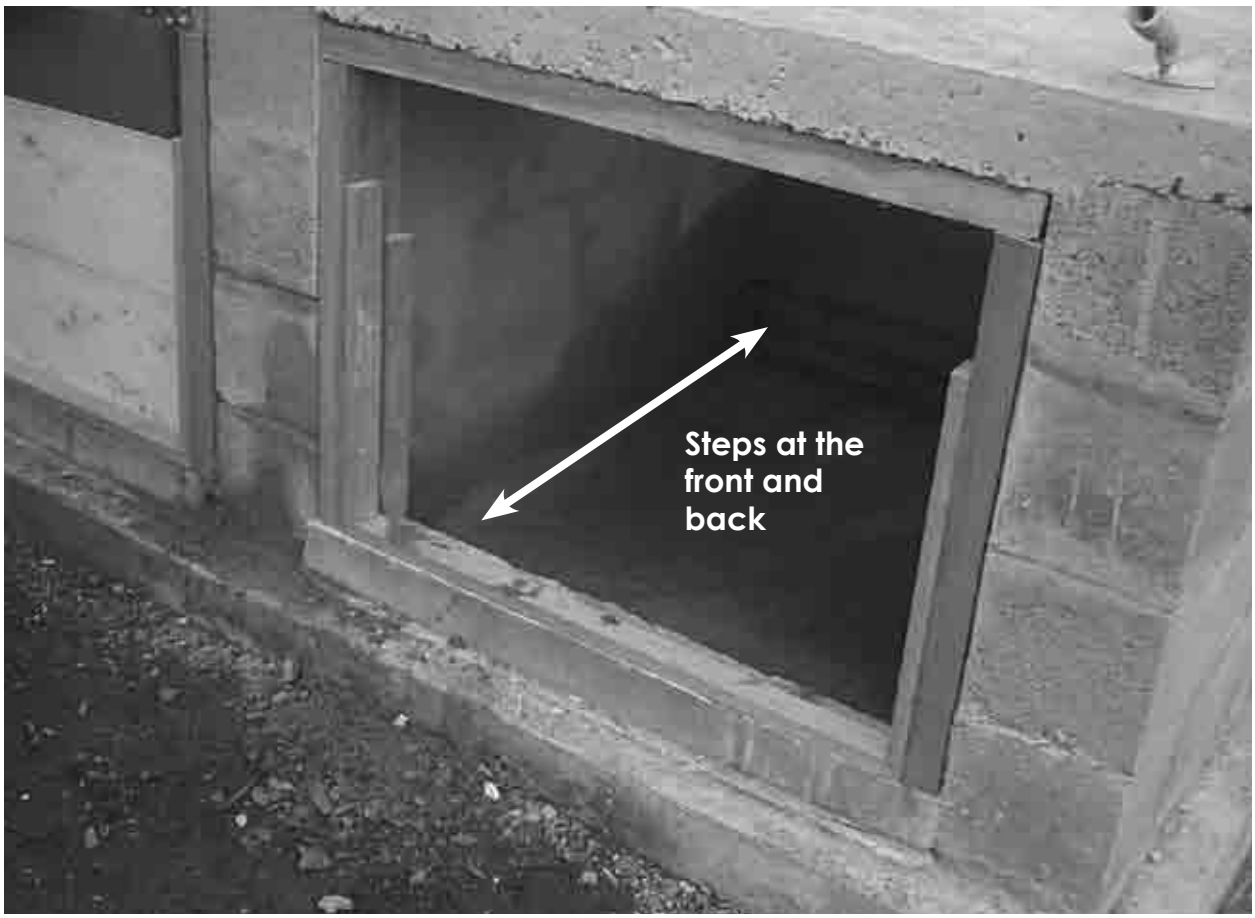
3. Construct chamber walls

Lay four courses of concrete blocks (or five for larger chamber) on the base slab to form the 2 compost chambers. Fill the hollow cores in the blocks with concrete. (An alternative to concrete blocks is ferro-cement construction e.g. similar to building a cement water tank. Pig fence and chicken wire can be used for reinforcing.)

4. Prepare the chamber inside

Cast a 100 mm high x 100 mm wide concrete step along the floor against the back wall and cast a 50 mm high x 150 mm wide step across the front of the floor. Use mortar to plaster and seal the inside of the walls and floor. Form a gradient about 10 degrees towards the drain to ensure good floor drainage.

This example from Solomon Islands shows the ferro cement chamber.



The inside of the chamber.

Plastering the inside walls of the chamber.

Preparing formwork for cast concrete floor. The concrete floor has been cast in place, but it can be cast separately and lifted into position.

5. Cast the chamber roof (which is the toilet room floor)

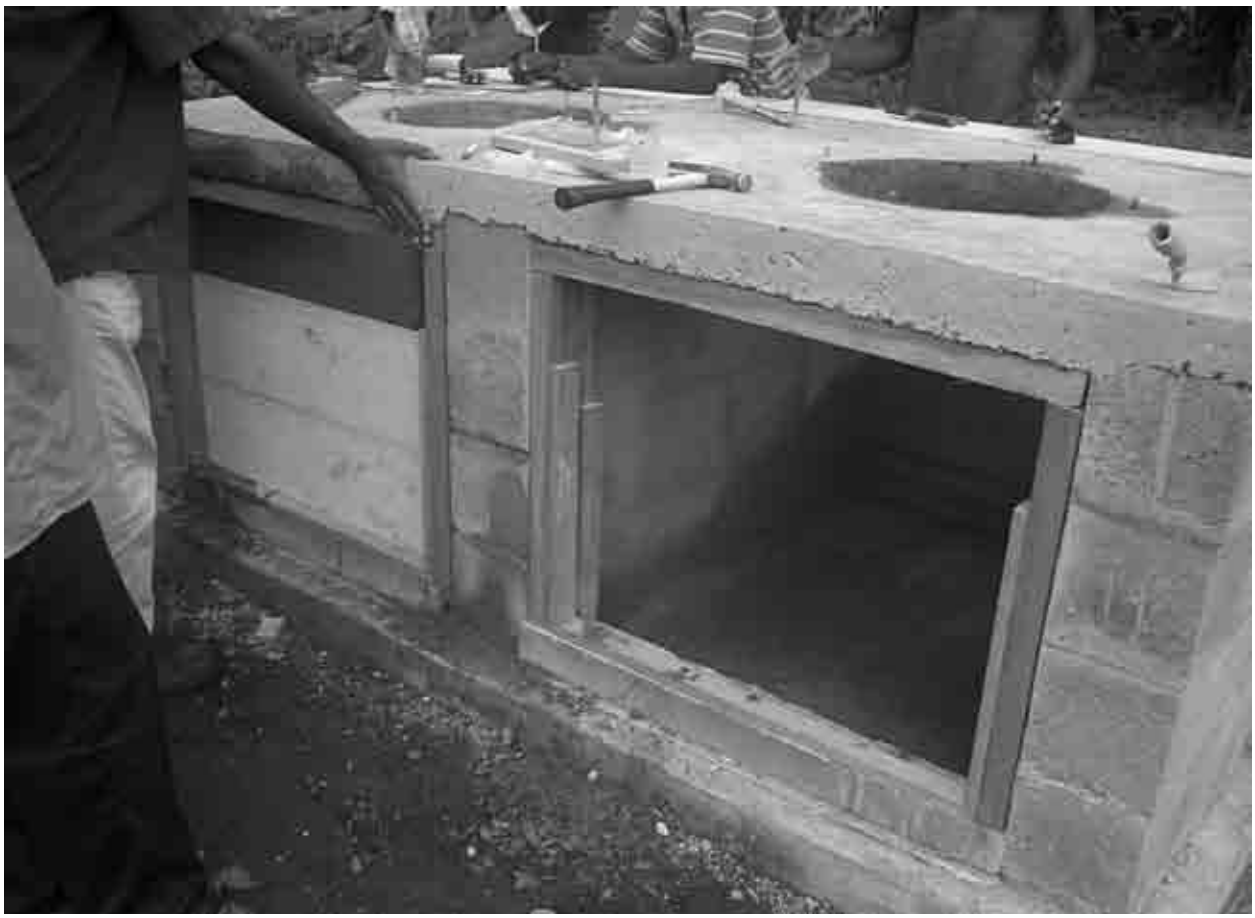
Using plywood or local materials, prepare formwork to cast the top floor 75 mm thick. Use plastic or leaves to prevent concrete sticking to formwork. Make round formwork for an opening to match the toilet pedestal. Place 100 mm PVC inserts for vents at the back edge of the floor over each chamber. (One central vent is an option if there is a gap in the central wall at the top edge.) Use F71 reinforcement steel in the floor and bend in 10 mm rebar from the walls.

If adding a seat, insert bolts into the floor before the cement sets to attach the seat riser and wall base plates.

Finished cast concrete floor.

6. Prepare the false chamber floor

Make a 50 mm x 50 mm hardwood slat floor using galvanised nails. The floor will sit inside the chamber to support solid waste and allow urine to drain. An alternative to hardwood is using bamboo. This will reduce the cost but the bamboo will need replacing each time a chamber is emptied. Make this floor in two pieces for ease of installation.



Rear baffle boards in place and baffle board guides shown.

7. Prepare the rear door and baffle boards

Fix 100 mm x 50 mm hardwood or treated pine around the door opening with masonry nails to support a rear door cover and baffle boards (the baffle boards stop the compost building up against the outside door). Fit 50 mm x 25 mm hard wood to make a guide for the super flex plank baffle boards. Cut marine ply to match the door opening, place against the frame and drill four holes for the rear door bolts. Install the bolts from the inside so the marine ply door can be fixed from the outside.

Left rear door is removed and one baffle board removed.

8. Construct the soak pits – evapotranspiration (ET) beds

Prepare soak pits about 1 metre long, 400 mm wide and 600 mm deep for the drainage from each chamber. If the ground has a very high water table unsuitable for soak pits, build sealed evaporation pits which can be planted to extract moisture. Both chamber drainage pipes can 100 mm or 50 mm PVC and connected together into one pit. Drill holes or saw cut slots in the underside of the pipe to allow drainage into the soak pit. Fill the pit with 20 mm stones up to the drainage pipe, cover the pipe with sand and then cover the sand with soil. This draws the moisture up and it then evaporates away (evapotranspiration). Use inspection caps on the corners and end so the pipe can be cleared if necessary at a later date.

Inside the toilet room: PVC seat riser and organic material bin and ash bucket.

9. Construct the seat riser

You can either use a fibreglass or PVC seat riser as shown in this example, or you can construct your own cement seat riser as described in the VIP toilet on page 20. Inside the toilet house you need to provide a place to store the biodegradable material (dry leaf or sawdust and ash etc) that is added each time the toilet is used.

Making a cement seat riser.

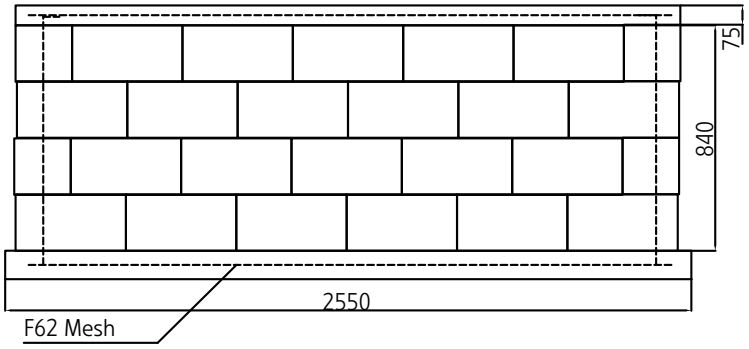
10. Construct the toilet house walls and roof

Concrete blocks, sawn timber framing, iron wall cladding or other local materials can be used for the house. Gutters can be made from PVC pipe or locally available bamboo. Detailed construction guidelines for building walls are included in the wheelie bin compost toilet section, on page 45. You may also choose to install a small rain water catchment tank if no other water supply is available for handwashing.

Don't forget ...

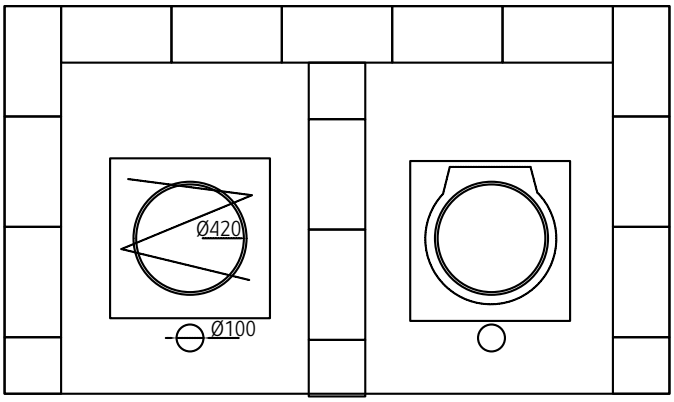
Every toilet needs to include handwashing facilities with water and soap.
There are simple examples you can easily make on page 77.

Technical drawing - compost toilet with 2 chambers

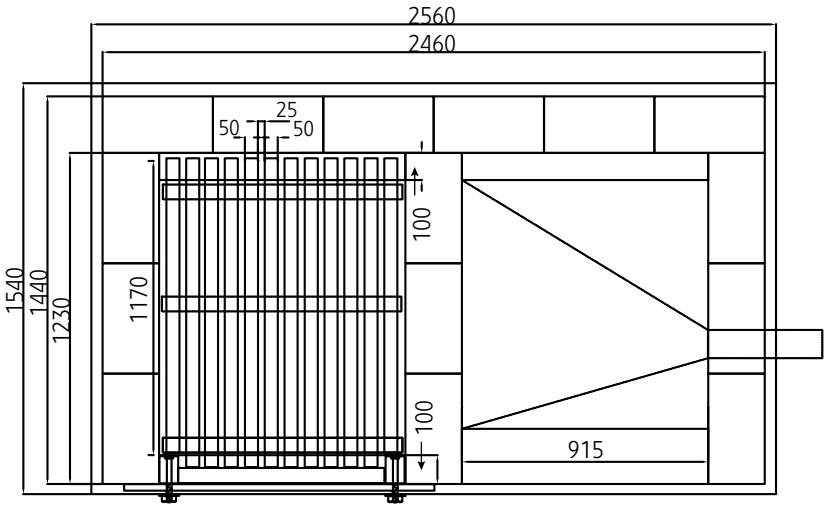


FRONT

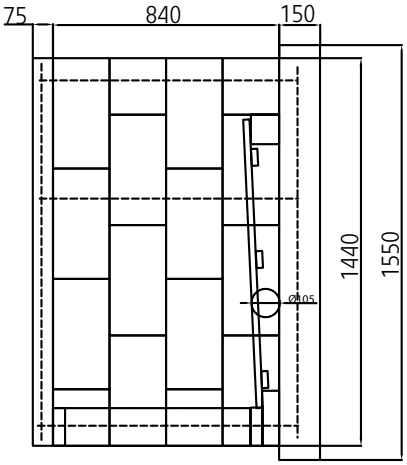
Note: You can add an extra row of blocks to increase capacity for a larger family.



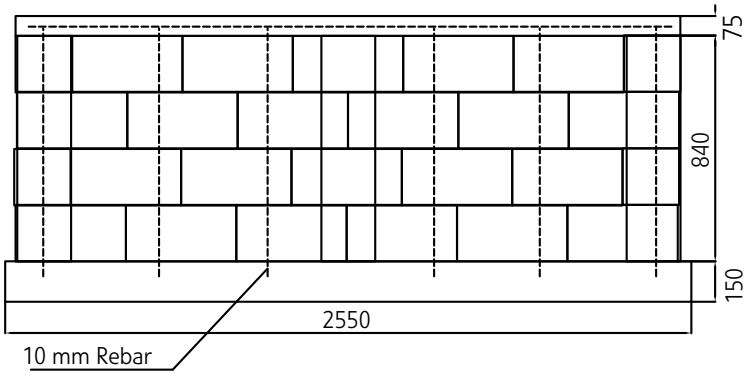
SECOND BLOCK LAYER & SLAB LAYOUT



PLAN



END



BACK

How to build a compost toilet with 1 chamber and 2 wheelie bins

Materials:

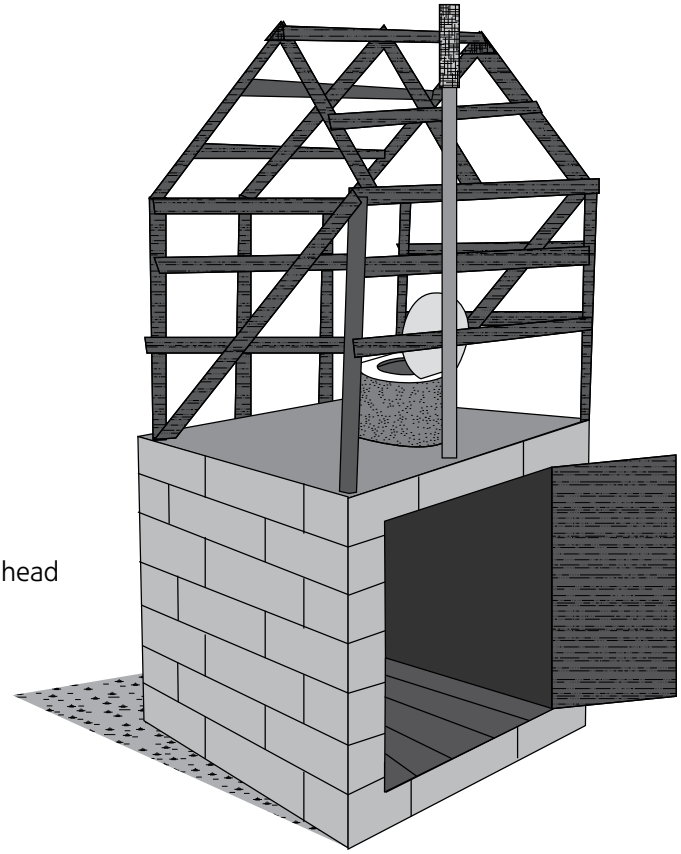
- See list on pages 40-41

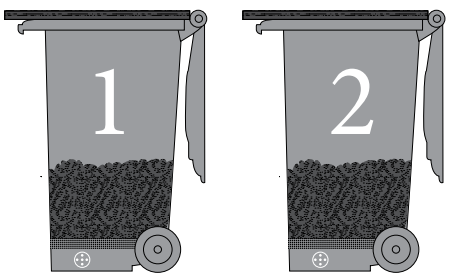
Tools required

- shovel x 2
- crowbar
- hammer
- handsaw
- hacksaw & blades
- pliers
- trowel - pointed
- trowel - floating
- spirit level
- string line
- measuring tape
- cold chisel
- wood chisel
- bolt cutters
- tin snips
- water buckets
- carpenter's square
- screwdrivers - flatblade & phillips head
- wheelbarrow
- knife
- drill & drill bits (optional)
- silicon gun & cartridge
- cement mixer (if available)

Mixes for concrete, mortar and block-fill

- Concrete: Mix 4 shovels aggregate, 3 shovels sand, 1 shovel cement. Add water until wet, not sloppy.
- Mortar: Mix 3 shovels sand, 1 shovel cement. Add water until 'stiff'.
- Block-fill: Mix 3 shovels sand, 1 shovel cement. Add water until 'sloppy', to pour easily down block holes.





Materials list is a guide only and needs to be modified to suit locally available materials.

Materials list Wheelie bin CT			
CHAMBER & STEPS		**QTY**	**USE**
Concrete block - 6" standard whole 395 x 190 x 145		57	Chamber walls
Concrete block - 6" standard half 195 x 190 x 145		6	Chamber walls
Concrete block - 6" standard corner block		12	Chamber walls
Cement - 50 kg bag		9	Foundation/walls/top
Sand - '1/2 bag'		4	Mortar - walls
Sand/Gravel premix - '1/2 load'		40	Foundation/walls/top
Reinforcing (deformed) bar - 12 mm x 6 m rod	54 m	9	Chamber walls
Reinforcing (black welded) mesh - 6 m x 2.4 m x 668	0.5 sheet	1	Floor/slab
Builders plastic 20 micron - 1840 mm x 60 m roll	10 m	1	Foundation/chamber floor/ ET bed
Tape for builders plastic - 50 mm x 20 m	1 roll	1	Foundation/chamber floor/ ET bed
Mesh tie wire - 1.5mm (1.6mm) 1kg roll		1	Floor/walls/slab
Timber 4" x 2" pine rough sawn treated	3.5 m	1	Chamber door frame
Timber 2" x 1" pine rough sawn treated	3.5 m	1	Chamber door frame
Melthoid - 100 mm x 20m roll	1 roll	1	Chamber door frame
Nails - concrete 100 mm 10 pack	15 nails	2	Chamber door frame
Nails - timber galvanised 75 mm 1 kg pack		2	Chamber door frame
Timber 4" x 1" pine lining tongue & groove 10 @ 1.2 m	12	1	Chamber door
Timber 6" x 1" pine rough sawn treated	4.0 m	1	Chamber door brace
Hinge tee light duty zinc plated 200 mm twin pack		1	Chamber door
Padbolt 3/8" zinc plated 100 mm		2	Chamber door
Concrete block - 6" standard whole 395 x 190 x 145		16	Steps
Concrete block - 6" standard half 195 x 190 x 145		8	Steps
Step - cement 50 kg bag		2	Steps
Step - sand/gravel premix - '1/2 bag'		8	Steps
Step - formwork - obtained free locally		1	Steps
Timber 4" x 2" pine rough sawn treated	4.5 m	1	Steps rail
Angle bracket - 125 mm x 100 mm		1	Steps rail
Toilet pan (get mould from Ministry of Health)		1	Toilet
Toilet seat & lid		1	Toilet
PVC stormwater pipe - 100 mm dia x 6 m length	3 m	1	Vent
PVC stormwater pipe saddle clip - 100 mm dia		1	Vent
PVC stormwater pipe vent cowl - 100 mm dia		1	Vent
Fly mesh-STAINLESS STEEL OR ALUMINIUM 1 m x 1 m		1	Vent
Black paint - 400 mL can		1	Vent
Silicon tube		1	Vent
Wheelie bin - 240 L		2	Wheelie bin
Mesh - galvanised gothic 2.4 m x 1.2 m x 2.7 mm	500 x 500 mm	1	Wheelie bin false floor
Truck tyre inner tube - used		1	Wheelie bin collar
PVC 50 mm stormwater pipe - 6m length	6 m	2	Excess liquid/ET
PVC 50 mm stormwater pipe - valve socket		4	Excess liquid/ET
PVC 50 mm stormwater pipe - faucet socket		4	Excess liquid/ET
PVC 50 mm stormwater pipe - 90 degree elbow		7	Excess liquid/ET
PVC 50 mm stormwater pipe - tee		2	Excess liquid/ET
PVC glue 500 grm		1	Excess liquid/ET
50mm push on cap		1	Excess liquid/ET
$2m^2$ of shade cloth			Excess liquid/ET

SHELTER OVER CHAMBER - OPTION 1 - CONCRETE BLOCK WALLS			
Concrete block - 6" standard whole 395 x 190 x 145		86	Walls
Concrete block - 6" standard half 195 x 190 x 145		10	Walls
Concrete block - 6" standard corner block		22	Chamber walls
Cement - 50 kg bag		7	Wall blockfill & mortar
Sand - '1/2 bag'		8	Wall mortar
Sand/Gravel premix - '1/2 bag'		24	Wall blockfill
Reinforcing bar - 12 mm x 6 m rod	Incl above		Wall blockfill
Timber 4" x 2" pine rough sawn treated. 3 x 2.4 m	7.2 m	1	Roof plate
Timber 3" x 2" pine rough sawn treated. 3 x 1525mm	4.58 m	1	Roof noggin
Timber 6" x 1" pine rough sawn treated	8.0 m	1	Roof fascia
Roofing iron - zincalume - 2.44 m x 0.8m x 26 g		2	Roof cladding
Timber 4" x 1" pine lining tongue & groove @ 2.0 m	18.0 m	1	Toilet door
Timber 4" x 2" pine rough sawn treated	5.0 m	1	Toilet door frame
Timber 2" x 1" pine rough sawn treated	5.0 m	1	Toilet door frame
Timber 6" x 1" pine rough sawn treated	4.0 m	1	Toilet door brace
Hinge tee zinc plated 200 mm	1 pair	1	Toilet door
Padbolt - 200 mm twin set		1	Toilet door
Roofing nails - 65 x 3.75 mm galvanised plain r/p		1	Roof & walls
Neoprene rubber washer for roof nails 100/packet		1	Roofing nails
Nails, concrete. 100 mm 1 kg pack		2	Toilet door frame
Nails, bullet head. 50 mm galvanised 1 kg pack		2	Toilet door
Paint - Exterior timber brown 4 L		1	Toilet door & fascia
Paint - Exterior timber primer 4 L		1	Toilet door & fascia
Paint brush - 4"		2	Toilet door & fascia

SHELTER OVER CHAMBER - OPTION 2 - CORRUGATED IRON			
Timber 4" x 2" pine rough sawn treated.	6.1 m	6.1	Floor plate
Timber 4" x 2" pine rough sawn treated 7 @ 2.4 m	16.8 m	16.8	Wall frame
Timber 3" x 2" pine rough sawn treated	10.6 m	10.6	Wall frame
Bracing strap - roll		1	Wall frame
Roofing iron - zincalume - 2.4 m x 0.8 m x 26 g		7	Wall cladding
Timber 4" x 2" pine rough sawn treated.	6.1 m	6.1	Roof plate
Timber 4" x 2" pine rough sawn treated. 3 x 2.4 m	7.2 m	7.2	Roof frame
Timber 3" x 2" pine rough sawn treated. 3 x 1525 mm	4.6	4.6	Roof noggin
Timber 6" x 1" pine rough sawn treated	8.0 m	8	Roof fascia
Roofing iron - zincalume - 2.44 m x 0.8 m x 26 g		2	Roof cladding
Timber 4" x 1" pine lining tongue & groove @ 2.0 m	18.0 m	18	Toilet door
Timber 4" x 2" pine rough sawn treated	5.0 m	5	Toilet door frame
Timber 2" x 1" pine rough sawn treated	5.0 m	5	Toilet door frame
Timber 6" x 1" pine rough sawn treated	4.0 m	4	Toilet door brace
Hinge tee zinc plated 200 mm	1 pair	1	Toilet door
Padbolt - 200 mm		2	Toilet door
Roofing nails - 65 x 3.75 mm galvanised plain r/p		1	Roof & walls
Neoprene rubber washer for roof nails 100/packet		1	Roofing nails
Nails, bullet head. 100 mm galvanised		1	Wall frame
Nails, bullet head. 75 mm galvanised		1	Wall frame
Nails, bullet head. 50 mm galvanised		2	Toilet door
Paint - Exterior metal off white 4 L		1	Roof & walls
Paint - Exterior timber brown 4 L		1	Toilet door & fascia
Paint - Exterior timber primer 4 L		1	Toilet door & fascia
Paint brush - 4"		2	Toilet door & fascia

Fiji Concrete Blocks

In Fiji, concrete blocks are 400 mm long x 200 mm high x 150 mm wide. 'Corner blocks' are available, with one end being 200 mm wide, for corners. Blocks are typically laid with 10 mm mortar between layers, and no gap between blocks next to each other.

Standard Fiji corner block.

Steps to building a compost toilet

There are 18 key stages to building a compost toilet with two wheelie bins:

1. Select and prepare site
2. Construct footings
3. Construct chamber walls
4. Construct chamber roof (which is the toilet room floor)
5. Construct toilet seat riser
6. Prepare timber for roof and door
7. Construct chamber floor
8. Construct toilet room walls
9. Construct toilet roof
10. Install toilet riser and vent pipe
11. Construct toilet room door
12. Prepare wheelie bins
13. Construct shroud between toilet hole and wheelie bin
14. Install soakage trench for excess liquid
15. Install excess liquid pipe
16. Construct chamber door
17. Construct stairs
18. Fit wheelie bins, provide organic matter, erect posters

Preparing the footings.

1. Select and prepare site

Select a site at least 3 metres from house walls and 5 metres from wells. Leave enough room for a 1 metre soakage trench on one side of the chamber. Make sure householders are comfortable with the location and privacy of the site.

In this example, the site is 5 metres from the house, on a slope, next to an existing pit toilet.

Clear and level the ground where the toilet will be built. If the ground slopes, dig into the slope to reduce the number of steps up to the toilet room.

2. Construct footings

Mark location of U-shaped footings 2070 mm x 1315 mm. Loosely place 5 blocks along long walls and 3 along short wall to check that you have the right length. The footing should be 50 mm wider than the bricks on all sides. Leave correct gaps between blocks if mortar will be used between them. Make sure the footings are at right angles to each other, or the walls will not be square.

Footings prepared.

Mix and place concrete First row of blocks in place.

Dig the footings 250 mm wide x 200 mm deep. Cut and lay reinforcing mesh into the footings, resting on stones 30 mm above the base. Cut 10 lengths of reinforcing bar 1600 mm long and bend each into 'L' shape with a 100 mm end.

DO NOT install L-bars yet.

Pour concrete into trenches, to ground level.

While concrete is wet, lay the first row of concrete blocks. Insert L-bars down the 1st, 4th, 7th and 10th block holes on both long walls, and down the middle hole of the short wall. Push each L-bar 100 mm into the wet footing. Fill all block holes with concrete, except one. Insert crumpled paper (or used cement bag) into the 3rd or 5th block hole of the wall where the excess liquid pipe will go through to the soakage trench. Allow concrete to set overnight.

First row of blocks in place.

3. Construct chamber walls

The wheelie bin chamber is 6 blocks high, to match the height of a 'standard' 240 L wheelie bin. As the layers are completed, fill the block holes with sloppy mortar every one or two layers. Tamp mortar down using a spare reinforcing bar.

4. Construct chamber roof (which is the toilet room floor)

In this example, the chamber roof is made from concrete. An alternative is 20 mm marine ply. Using available materials, construct a strong formwork base, level with the top of the blocks. Nail boards to the outer walls (using concrete nails) to make a 60 mm high formwork for the chamber roof. The top of the roof must slope 1:200 towards the door of the toilet room, for drainage when cleaning. Cut and lay reinforcing mesh inside the formwork, resting it on stones 20 mm above the base. At the chamber door end, tie reinforcing bar between existing L-bars, 20 mm above the formwork base. This gives strength to the floating beam of concrete. For optional extra strength, add a reinforcing bar across the middle of the slab as well.

The roof is usually poured in place but could be made separately and lifted into place.

Mesh in place ready to pour concrete.

Cut 1 x 1200 mm reinforcing bar and bend a 100 mm L at one end. Use this to reinforce the back wall of the toilet room. Note, the back wall is half a block in from the edge of chamber roof (as shown in the technical drawing). Position the reinforcing bar where the middle block hole will go. Tie the reinforcing bar upright to the chamber roof mesh.

Construct a (wooden) blank for the toilet riser hole, 70 mm high. Alternatively, use a flexible strip of bamboo/metal, bent to the same shape as the hole of the toilet riser. Cut the reinforcing mesh where the hole will be located.

Place a 300 mm length of 100 mm PVC pipe at the location of the vent pipe. (See notes below.) Pour and smooth concrete.

Note, the toilet riser hole is slightly offset to one side of the toilet room floor. This is so the wheelie bin can be offset below, to allow room to remove excess liquid pipe when swapping bins. The hole is offset to the OPPOSITE side from the soakage trench.

To position the vent pipe, mark the location of the inner back wall of the toilet room (350 mm in from the slab edge). The vent pipe is 25 mm in from this wall. The vent pipe should be 330 mm from the nearest side of the slab. If the wheelie bin is 580 mm at its widest point, then the toilet hole edge needs to be 415 mm from the nearest side of slab, and 480 mm from the back of slab. To double-check the location, place both wheelie bins into the part-finished chamber, 50 mm from the chamber side wall on the OPPOSITE side from the soakage trench. The front edge of the floor hole should be 50 mm inside the front edge of the active wheelie bin. The side edge of the hole should be 50 mm inside the side edge of the bin on the soakage trench side. The non-active bin should have enough room to sit without obstruction.

It is important that the vent pipe is located directly over the wheelie bin opening, so that any flies entering the wheelie bin are attracted to the daylight at the top of the screened pipe and die there. The vent pipe must be offset diagonally from the riser hole, so that the toilet seat lid does not hit the vent pipe when lifted up.



Constructing a toilet seat riser, using a metal mould and pouring the concrete mixture.

5. Construct toilet seat riser

The Fiji Ministry of Health loans toilet riser moulds made of metal. Pour a half-wet, half-sloppy concrete mix into the mould, gently tap the sides to settle the concrete, then leave it overnight. When set, carefully remove the mould and ensure the inside of the riser is smooth, for ease of cleaning when in use.

Alternatively, risers can be made from rendered chicken wire, see pages 20–21.

6. Prepare timber for roof and door

Paint all timber lengths with timber primer. Allow to dry.

7. Construct chamber floor

After the chamber roof has set, remove formwork. Determine at what height you need to install the chamber floor. Measure the total height of the wheelie bin with the lid closed (handles may be highest part, measure to these if so). Add 75 mm to this height. Mark this distance downwards from the underside of the chamber roof. This marks the top of the chamber floor. Fill or remove enough soil to enable a 60 mm floor slab to be poured below the mark. Fit formwork to the front of the chamber, where no wall exists. Cut and lay reinforcing mesh inside the chamber walls, resting on stones 20 mm above the base of the floor. Pour and smooth the concrete, ensuring that the floor slopes 1:200 towards the chamber door for drainage when cleaning.


8. Construct toilet room walls

The toilet room walls are 9 blocks high. A reminder – the back wall is built half a block in from the edge of the toilet room floor. The front wall is only ¾ of a block wide, to create a suitable gap for the door frame. Cut and render the ends of each ¾ length block.

Cut 8 x 1200 mm reinforcing bar and attach this to the existing reinforcing bars jutting from the floor, using tie wire. Add a second 1200 mm reinforcing bar when the wall is 4 blocks high, so the reinforcing bar projects 200 mm above the top blocks when completed. Fill the block holes with sloppy mortar every one or two layers and tamp down with a spare bar. If desired, whitewash or render and paint the block walls inside the toilet room and outside. This is not required inside the wheelie bin chamber.

Construct a concrete collar around the top of the walls, including a reinforced beam across the door gap. The top of the collar should slope 50 mm from the door end to the back wall end, for roof drainage.

For the beam over the door, install formwork across the gap using available local materials. For the collar, nail boards on outer and inner wall edges to create a 100 mm high formwork on the toilet door end, sloping to 50 mm high on the back wall end. Check that the fall is enough using a spirit level.

Timber frame for toilet roof construction.

Bend all reinforcing bars projecting up from the walls, then cut and tie the reinforcing mesh to these inside the formwork. Add an additional reinforcing bar for the beam over the toilet room door gap. Pour concrete and allow to set.

9. Construct toilet roof

Measure the distance between the outside of the toilet walls. Cut 2 x 100 mm x 50 mm pieces of timber to this length. Nail them to the top of the wall beam using 100 mm concrete nails at each end. Cut 2 x 150 mm x 50 mm pieces of timber. The length should be 100 mm less than the roof sheets. Nail these to the outer edge of the first pieces of timber, standing upright, overhanging 450 mm at the door end and 200 mm at the back wall end. Cut 3 x 75 mm x 50 mm pieces of timber, 1475 mm long (50 mm less than the width of two overlapping roof sheets). Nail these to the 150 mm timber below, flush with each end and in the middle.

Nail 2 x roof sheets to the timber frame. Complete the roof by installing a 150 mm timber skirt around underside of roof sheets. Cut 4 x 150 mm x 25 mm pieces of timber to size and nail them to the edges of the timber frame, butting up against the roof sheets above. Paint all timber with final colour when ready.

10. Install toilet riser and vent pipe

Place the toilet riser over the hole of the toilet room floor. If the hole in the floor is less than the inner diameter of the riser, carefully chip away the floor-concrete until both are the same diameter. Clean dust and debris from the floor and the riser, then use mortar to secure the riser to the floor. Ensure that the join is smooth inside for ease of cleaning when in use. Do not disturb until the mortar is set. If a plastic toilet seat and lid are to be fitted later, secure these to the riser. Fit a toilet roll holder to the wall if desired.

For vent pipe, cut a 2700 mm length of 100 mm PVC pipe (so that 3 metres remains of the original 6 metre length, to use on the next toilet). Paint the top of the pipe, above the roof line, with dark paint. Mark the roof sheet where the vent pipe will penetrate, and cut a 100 mm hole.

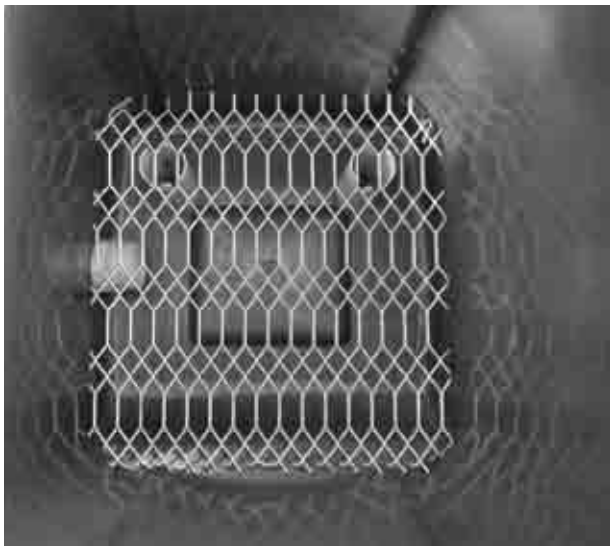
Join the 2700 mm length of pipe to the existing 300 mm length protruding from the floor (if there is no flange at the end of the pipe, carefully heat the long pipe until flexible and slip it over the short length). Cut 300 mm x 300 mm fly mesh, fold this over the top of the vent pipe and secure with several wraps of tie wire. Use silicon to seal the roof sheet hole around the vent pipe.

11. Construct toilet room door

Measure the width of the toilet door opening at its narrowest point (if the walls are not square). In this example, the width is 740 mm. Construct a door frame to suit, using 100 mm x 50 mm timber on top and two sides, and nothing on the base. Secure the frame to the walls using the concrete nails, ensuring the frame is straight and square. If the walls are not square, fill the gap between the wall and the door frame using the mortar.

To construct the door (in this example, 640 mm wide), cut 7 x 100 mm x 25 mm pieces of tongue and groove (T&G) timber to length, allowing for a 2 mm gap at the top and bottom. For the backing door brace, cut 5 x 150 mm x 25 mm pieces of timber - 3 braces horizontal, 2 diagonal to form two Z shapes underneath each other. Nail the T&G to the brace, then cut the last piece of T&G timber to the right width.

Fit the door to the frame with 2 x door hinges using timber nails. Close the door so it is flush with the ouside walls and mark the place where the 35 mm x 20 mm timber rests (slamer rail) needs to be positioned. Nail the rests to frame. Fit padbolts to the inside and outside of the door and frame. Paint the door and frame with the final colour when ready.



This picture shows the false floor inside the wheelie bin. On the left is the pipe to the soakage trench. The false floor is raised using 2 pieces of PVC pipe.

12. Prepare wheelie bins

Use a 50 mm faucet and valve socket to mark a hole in middle of the base of the wheelie bin wall that will face the soakage trench. Cut (or burn) the marked hole and fit the screwed socket, using silicon to properly seal the socket to bin, then leave to set. Do this for both bins. For the second bin, cut a 100 mm length of 50 mm PVC pipe, glue push-on cap to end, and insert this into the socket as a plug (do not glue into socket).

For the false floor of the bin, measure the inner dimensions of the base of the bin, and cut galvanised mesh to suit. Suspend the mesh 75 mm above the bin floor by cutting 2 x 100 mm lengths of 50 mm PVC pipe. Cut 25 mm high x 10 mm wide slots in the top of the upright pipe, so the mesh rests in these, and 2 x 15 mm x 10 mm slots in the base of the pipe for liquid flow. Rest the mesh on these and on the ledge of the bin base. Do this for both bins.

Place shade cloth or shredded coconut husks in the base of the active wheelie bin, on top of the false floor, to stop the first faeces dropping through the false floor mesh.

13. Construct shroud between toilet hole and wheelie bin

Obtain used truck tyre inner tube/s and cut to 2520 mm long x 350 mm high. Cut 4 x 75 mm x 5 mm timber pieces to the same length as the outer lip of the wheelie bin top (2 x 660 mm and 2 x 585 mm in this example). Nail these to the underside of the chamber roof with concrete nails, directly above where the active wheelie bin will sit (surrounding the toilet hole and vent pipe hole). Before nailing, place the top of the 100 mm of tube between the timber and the roof, so that when complete, the tube shroud hangs from the roof in the shape of the wheelie bin top. Sew the ends of the tube together with fishing line to form a continuous shroud. When the wheelie bin is put in place, use tie wire to secure the tube shroud to the underside of the wheelie bin lip, effectively sealing the bin. Ensure the wire twist join is easily accessed for bin change-over.

This shroud has been made using a piece of plastic to connect the top of the bin to the underside of the chamber roof.

14. Install soakage trench for excess liquid

Ensure the trench is at least 1 m from the toilet walls. Ensure the ground level is the same or lower than the chamber floor. Dig a soakage trench 1200 mm long x 400 mm wide x 500 mm deep. Dig a pipe trench 200 mm deep from the trench to the chamber, with bends at appropriate places.

Fill the bottom 250 mm of the soakage trench with stones of the same size**. Measure the distance from the far end of the trench to the point where the 50 mm PVC pipe first bends on its way to the wheelie bin (the layout of the pipe and number of bends will differ at each toilet depending on trench and chamber location). Cut pipe to this length and drill (or burn) 10 mm holes into the bottom half of first 100 mm of pipe. Remove all stones at the far end of the trench. Glue a 50 mm tee-socket to the holed end, with the socket facing up and down, and the pipe holes facing downwards. Glue a 250 mm length of pipe to the bottom socket and leave this open-ended at the bottom of the pipe. Then glue a 250 mm length of pipe to the top socket, and fit the push-on cap to the top.

Soakage trench for excess liquid.

Place the pipe on top of the stones in the trench, temporarily removing rocks from the end of the trench to fit the t-section. The vertical push-on cap should be 50 mm above ground level, to enable removal of the cap for later inspection of liquid depth in trench. Fill the trench with extra stones until the pipe is just covered. Place the shade cloth (or other non-rotting material that will stop soil moving down between the stones) over all the stones## and around the pipe where it enters the trench, then backfill soil above this. Mound the soil 100 mm above ground level to allow for settling and to prevent stormwater pooling.

** The job of the stones (or broken bricks) is to create spaces between the stones in the trench so liquid can fill the spaces before soaking into the surrounding soil. Do not mix stones of different sizes, as smaller stones will fill gaps between larger stones, reducing space for liquid. The actual size of the stones is not critical, they can be anywhere between 10 mm and 100 mm.

If the soil is sandy, then place shade cloth down both sides and ends of the trench as well as over the top, to stop the soil washing into the trench over time. Do not put shade cloth on the base of the trench.

Drainage pipe in place.

Shade cloth covering pipe and stones ready to back fill.

15. Install excess liquid pipe

To run the 50 mm drain pipe through the chamber wall, break a 50 mm hole through the 3rd or 5th block hole that was earlier stuffed with paper, at the same level as the chamber floor. Do not install the pipe yet.

Cut and lay the remainder of the 50 mm pipe and joints to connect the trench to the wheelie bin socket. Do not glue the joins yet. Ensure a minimum 1:60 fall along all pipes and bends.

To enable easy removal of the wheelie bins, fit 2 x 90 degree bends inside the chamber, so the pipe can be rotated upwards when removed from the wheelie bin socket. Once all the pipes are cut to the proper length, glue all the joins with pipe glue, except 1 x 90 degree bend in the chamber (to allow the pipe to be rotated upwards for bin changes) and where the pipe fits into the wheelie bin socket. Fill the wall penetration gap with mortar. Backfill the soil over the 50 mm pipes.

Construct chamber door

Construct 1 x chamber door and frame, as per the toilet room door. Ensure the door is a tight fit, to minimise light inside the chamber, and stop pests from entering the chamber.

16. Construct stairs

In this example, concrete steps are used. Wooden steps could also be built. Only 3 steps are required here due to the toilet being built on a slope. Dig two 150 mm deep footing trenches, 2 blocks long (800 mm) and 1 block wide, on each side of step location. Lay reinforcing mesh in the trenches and fill with concrete. While the concrete is still wet, install 2 x blocks on each footing as the outer edge of the steps, then one block on each side for the second step. Place and compact fill between blocks, up to 70 mm from the top of the blocks. Fit formwork to the front of each step, and pour concrete into form, including into the blocks.

17. Fit wheelie bins, provide organic matter, erect posters

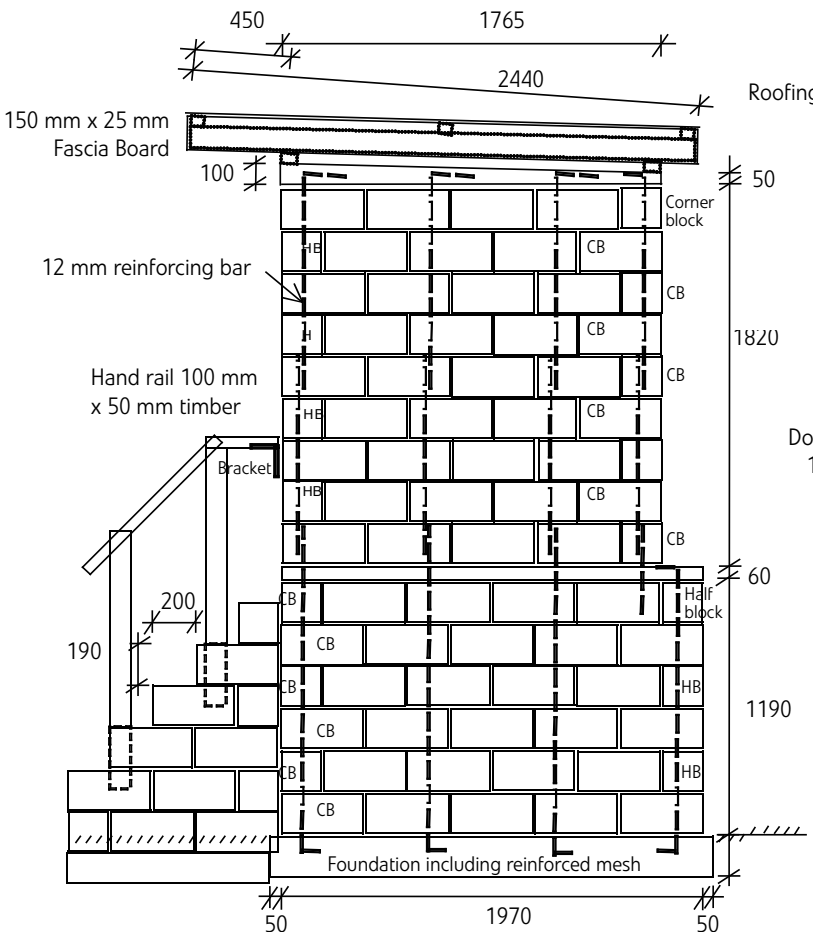
Place both wheelie bins in the chamber. Connect the drain pipe to the active bin. Secure the tube shroud to the underside of the wheelie bin lip. Place a bucket of organic matter (e.g. leaves) inside the toilet room. Place posters in the toilet room on 'How to use your wheelie bin toilet' and 'How the wheelie bin toilet works'. Place posters on the inside door of the bin chamber on 'Fixing smells in the wheelie bin toilet' and 'Changing full wheelie bins'.

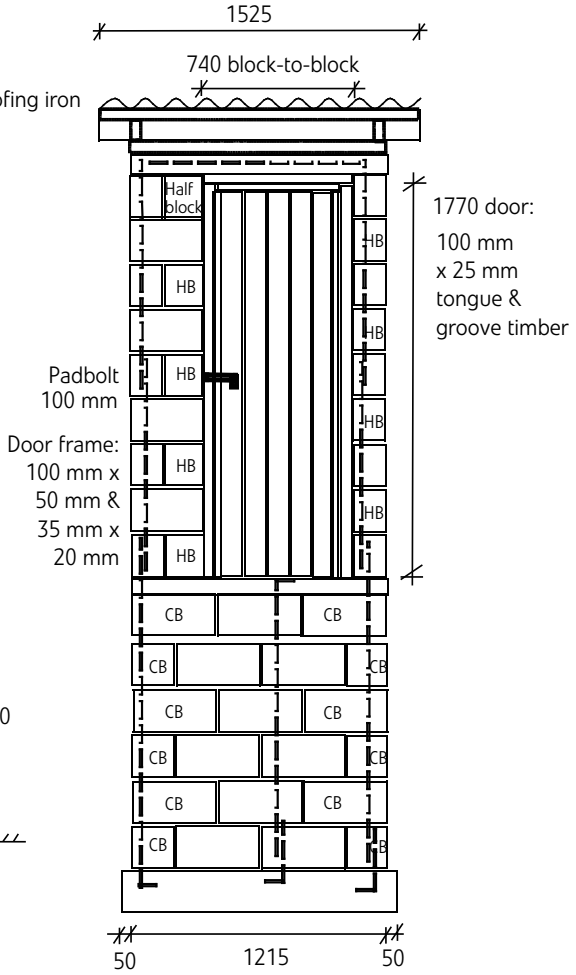
Commence use.

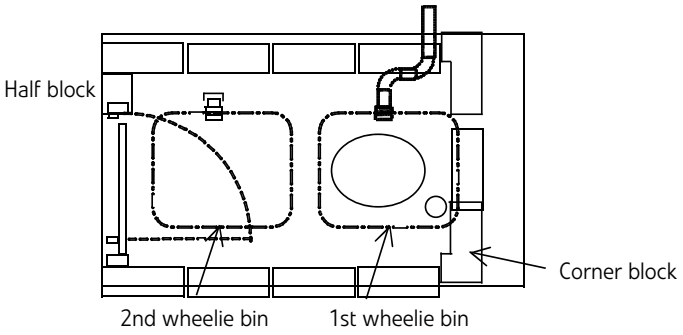
Don't forget ...

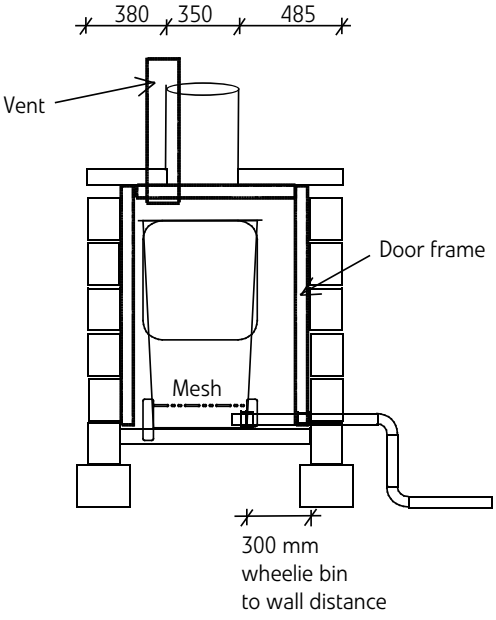
Every toilet needs to include handwashing facilities with water and soap.
There are simple examples you can easily make
on page 77.

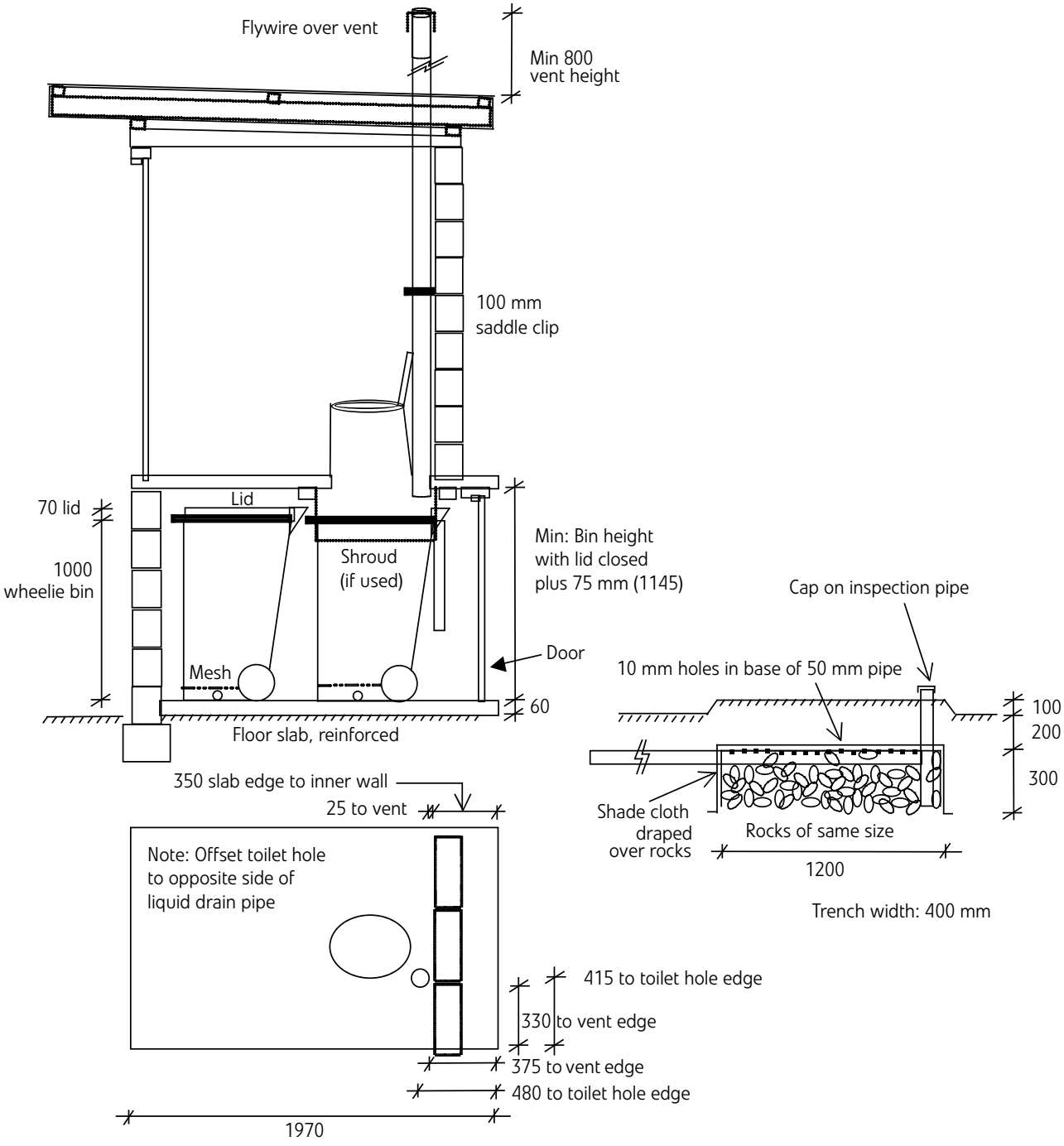
Technical drawings – compost toilet with one chamber and 2 wheelie bins










Flywire over vent
Min 800
vent height
100 mm
saddle clip
70 lid
Lid
1000
wheelie bin
Shroud
(if used)
Min: Bin height
with lid closed
plus 75 mm (1145)
Door
Mesh
60
Floor slab, reinforced
350 slab edge to inner wall
25 to vent
Note: Offset toilet hole
to opposite side of
liquid drain pipe
415 to toilet hole edge
330 to vent edge
375 to vent edge
480 to toilet hole edge
1970
Cap on inspection pipe
10 mm holes in base of 50 mm pipe
100
200
300
Shade cloth
draped
over rocks
Rocks of same size
1200
Trench width: 400 mm

3. Pour flush toilet

What is a pour flush toilet?

A pour flush toilet is like a regular flush toilet except that instead of the water coming from a cistern above, it is poured in by the user, using a bucket.

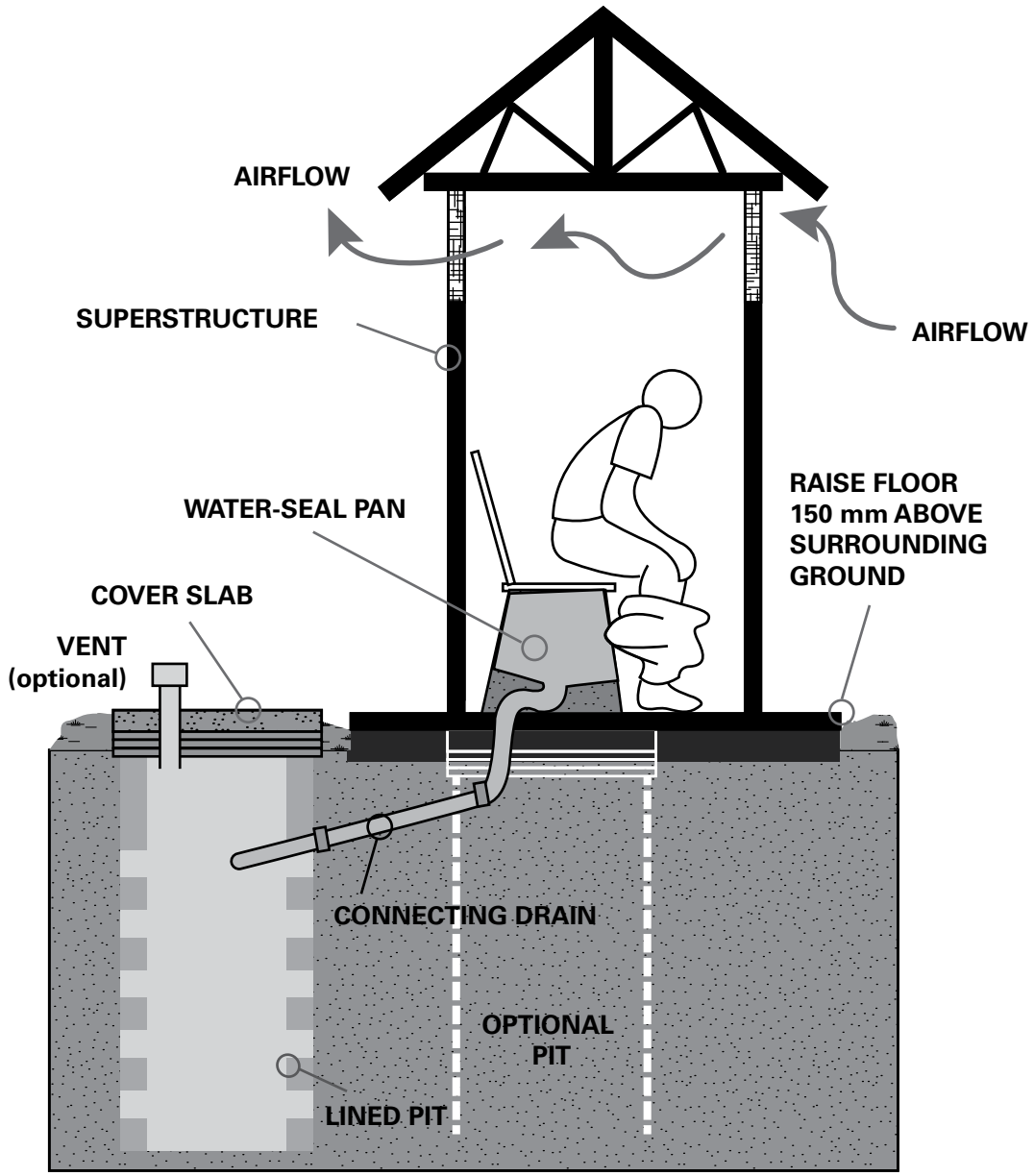
How does it work?

The toilet pan is 'flushed' by pouring (or, better, throwing) a few litres of water into the pan after use. The amount of water used varies between one and four litres depending mainly on the pan and design of the toilet. Pans requiring a small amount of water for flushing have the added advantage of reducing the risk of groundwater pollution. The flushing water does not have to be clean and could include laundry, bathing or other water pre-used from around the house.

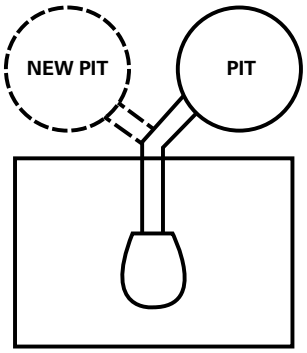
Water and faeces enter a 2 to 3 metre deep soakage pit in the ground, either directly below the toilet or offset to the side and connected by a pipe. The liquid soaks away into the surrounding soil, whilst the faeces slowly fills the hole over 2 years or so. When almost full, a new pit is dug and the old pit filled with soil.

Advantages and disadvantages of a pour flush toilet

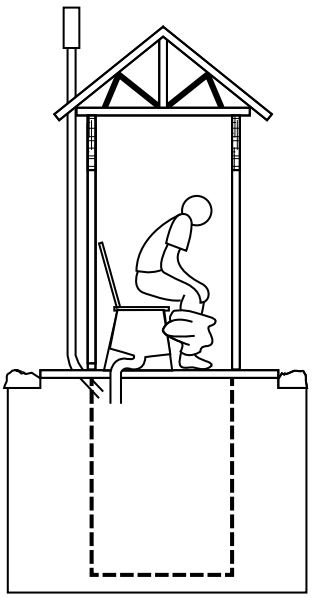
Advantages	Disadvantages
Low cost	A reliable (even if limited or pre-used) water supply must be available
Control of flies and mosquitoes	Unsuitable where solid cleaning material is used (such as stones or leaves)
Absence of smell in toilet room	Potential groundwater pollution if seasonal watertables are close to the surface
Contents of pit not visible	Seat over pit: Must move toilet room each time a new pit is dug
Offset type: Gives users the convenience of a flush toilet	
Offset type: Toilet room can be inside the house and the pit/s outside. There is no need to move the toilet room each time the pit fills	
Offset type: Toilet seat/riser is supported by the ground	
Can be upgraded by connection to sewer if sewerage becomes available	
Can include a washing area inside the toilet room	



OFFSET OPTION ALLOWS FOR A SECOND PIT WITHOUT MOVING TOILET HOUSE



PIT BELOW TOILET TYPE



How to build a pour flush toilet

Tools required:

- spade
- crowbar
- hammer
- hacksaw
- bolt cutters
- handsaw
- pliers
- tin snips
- tape measure
- level
- cold chisel
- paint brush
- wheelbarrow
- bucket
- trowel - pointed
- trowel - floating.

Materials required:

Floor slab:

- plywood base (12 mm) - 1 m x 1 m
- base frame timber - 40 mm x 40 mm x 6 m
- formwork timber - 40 mm x 40 mm x 1240 mm x 4 or flat iron - 1120 mm x 40 mm and tie wire
- nails 75 mm
- rebar/steel mesh
- plywood blanks
- banana leaves, plastic or oil.

Toilet riser:

- flat iron - 1120 mm x 450 mm
- chicken wire (10 mm) - 1120 mm x 475 mm
- tie wire (1 m) - 10 metres
- plywood blanks (12 mm) x 3
- sticks (10 mm diameter) x 2
- sand – very fine, sifted
- plastic seal (for pour flush)
- toilet seat and lid.

Pit:

- 44–gallon drums x 2
- PVC pipe 50 mm x 3 m
- PVC 50 mm 90° elbow x 1
- fly mesh - 200 mm x 200 mm
- formwork timber - 150 mm x 25 cm x 1700 mm x 4
- rocks – even size rocks about 100–200 mm across
- PVC vent pipe 50 mm x 3 m

Concrete:

- cement - 2 x 40 kg bags
- sand - very fine sifted x 2 bags
- gravel and sand - mixed 4 bags.

Example of completed pour flush toilet.

1. Dig a square pit 1.5 m x 1.5 m wide x 1.6 m deep.

2. Remove top and bottom from two 44-gallon drums.

3. Make multiple holes in all sides of the bottom drum.

4. Hammer the two drums together.

5. Place the drums in the middle of the hole. The top should be 100 mm above the surrounding ground.

6. Fill the hole with rocks to the top of the bottom drum.

7. Put plastic over the rocks.

8. Fill the hole with dirt and stamp it down.

9. Floor slab: Construct a plywood base and frame for the floor slab.

10. Cover the base with banana leaves (or plastic or oil).

11. Fit the formwork on top (dovetail timbers into each other).

12. Make plywood blanks for toilet hole: 2 large & 2 small. Nail the small ones together. Place rebar steel mesh reinforcing or use tie wire twisted to 4.5 mm (3x1.5 mm) and tied at 100 mm spacing.

13. Alternative: Use the flat iron and tie wire hoop for toilet hole.

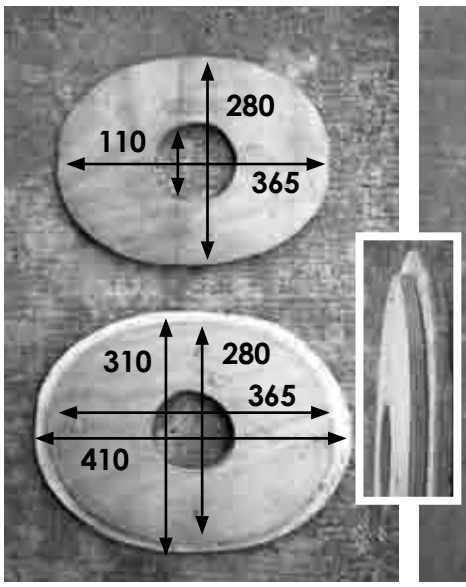
14. Install blanks and mesh. Cut mesh around blanks.

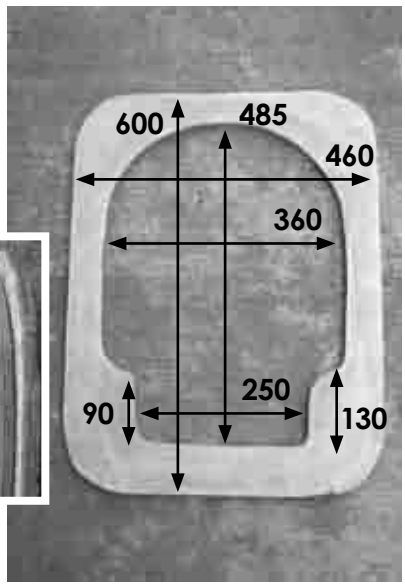
15. Fill with concrete. Ratio: 1 part cement, 3 parts sand, 4 parts gravel, or 1 part cement and 5 parts sand.

16. Smooth the top. Tap the sides with a hammer.

17. After 1 hour, remove the small blanks. Leave for one day.

18. **Toilet riser:** Make 3 plywood moulds.*





19. Join 2 layers of 12 mm plywood for bottom mould. (measurements in mm)

20. Cut chicken wire to same length as flat iron, but 25 cm higher.

21. Bend flat iron around inner tip of 2-layer mould.

22. Insert 1-layer mould in top, wrap flat iron slightly, secure with tie wire.

** The Fiji Ministry of Health loans toilet riser moulds made of metal. Check with your local Government Health provider.*

23. Wrap and tie chicken wire tightly, extend 25 cm above flat iron.

24. Turn riser over, place in mould on smooth surface. Bend chicken wire out.

25. Sift fine sand. Mix 1 cement, 3 sand and water to make stiff mix.

26. Trowel cement firmly onto wire. 10 mm thick. Dry 1 hour.

27. Ensure 2 sticks are inserted where toilet seat screws will attach.

28. Apply 2nd 5 mm cement layer. Curve at top & base so level with mould edges.

29. After 30 minutes, remove bottom mould and smooth edges. Leave 1 day then remove the top mould.

To install water seal

30. Lower plastic seal into top of riser.

31. Turn upside down. Cement around top of riser. Leave for one hour to set.

32. Floor slab: Remove formwork from floor slab. Gently tap blank from hole.

33. Carry slab to the pit. Place it upside-down on top of the drums.

34. Cut a hole in the top drum and insert the vent pipe.

35. Place rocks under the slab. Ensure slab is level.

36. Install formwork at same height as floor slab - leave a 250 mm space each side of the slab.

37. Place rocks along the inner 150 mm.

38. Pour concrete into the base. Add more rocks around the slab, but not touching the timber.

39. Smooth the top. Tap the sides with a hammer.

40. Place the riser into the lip of the hole.

41. Add the cement/water paste around the top, so it is all the same height and smooth.

42. Use a paint brush to smooth the cement. Wipe clean with a rag.

43. Cement around the base of the riser, 75 mm high. Smooth with a trowel.

44. Cement over any rough surfaces of the floor slab. Smooth with a paint brush.

45. Install the toilet seat and lid. Leave to dry.

46. Build the toilet room from local materials. Extend the vent pipe 500 mm above the roof.

47. Add water supply, bucket and soap.

Operating and maintaining a pour flush toilet

The following information will help people use their pour flush toilet properly. In the long term, this will mean there are less problems and the toilet will require less maintenance and repairs.

Teaching users how to use their new toilet will save time, money and importantly, make them happy customers. A happy customer will tell their friends, and this will create more business, as well as leading to healthier people.

There will be times when you may have to repair or assist with the functioning of the toilet.

If something goes wrong

Because there are no mechanical parts, pour flush toilets rarely require repair. However, there will be times when you may have to repair or assist with the functioning of the toilet. Here's a list of common problems and solutions:

Problem	Solution
Water seal becomes blocked	Unblock and clean the water seal
Large objects are placed down the bowl and block the toilet	Educate users on what can be put down the toilet

Don't forget ...

Every toilet needs to include handwashing facilities with water and soap.
There are simple examples you can easily make on page 77.

4. Flush toilet with septic tank

What is a flush toilet (septic tank)?

This is a toilet where the waste is flushed into a sealed septic tank located in the yard of the house. The septic tank is an underground watertight settling chamber.

How does it work?

Inside the septic tank, solids that are flushed from the toilet either settle or float to form a sludge and scum layer. The remaining liquid passes through the tank and out to soakage trenches and then soaks into the ground. A septic tank is designed to always be full of liquid (effluent), so that as new wastewater enters, the equivalent volume exits to the soakage trenches.

The system works well where there is **i)** reliable water for flushing; **ii)** the solids in the tank are pumped out every few years before they build up too much; **iii)** the soil has good soakage ability (not a clay) and; **iv)** the ground does not get flooded or waterlogged. Problems often occur when trenches are too short and there is not enough room for liquid to soak away quickly enough.

Septic tanks are not suitable for all locations and soil types. They require specialised mobile vacuum pumping contractors to pump out the solids otherwise it has to be done by hand, which is very unhygienic. Local government offices should be consulted for designs that are appropriate and approved.

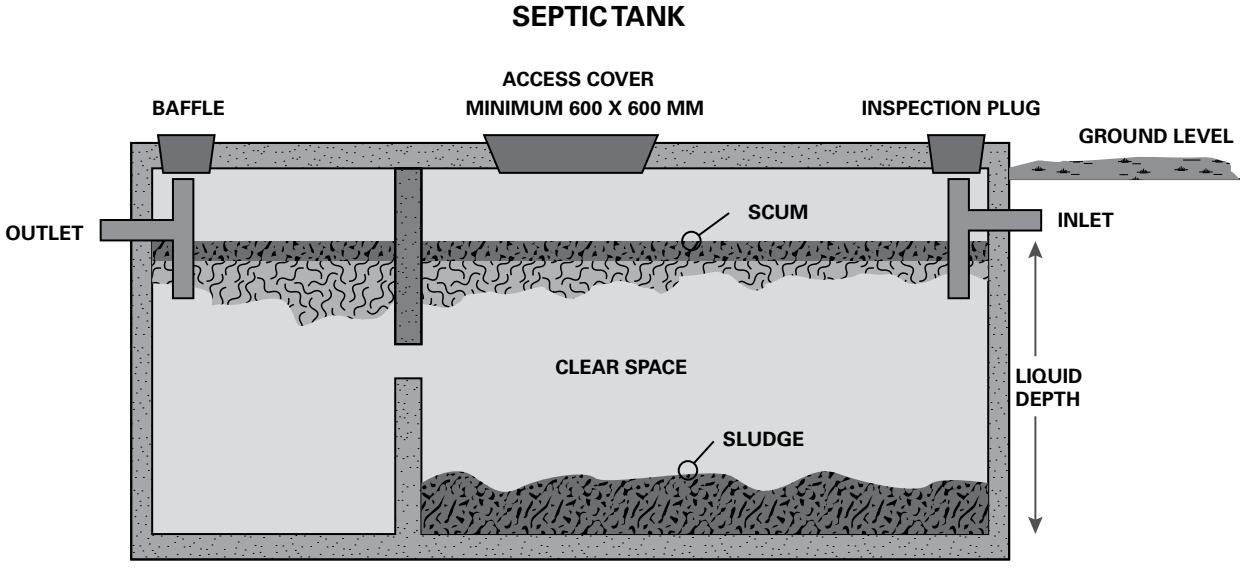
Advantages and disadvantages of flush toilets (septic tank)

Advantages	Disadvantages
Convenience and status of flush toilet	Costly to install
No smell or insects in toilet room	Needs reliable and adequate water supply (piped)
Can be located inside the house	Not suitable if only a small yard area for trenches
Easy to clean	Can pollute groundwater if high watertable or if trenches are not designed and installed correctly
	Needs occasional costly pumping of solid materials with a septic truck
	Sludge cannot be reused as fertiliser
	High cost to maintain. Lots of high service items.
	Soakage trenches need permeable soil

Flush toilet (septic tank)

Don't forget ...

Every toilet needs to include handwashing facilities with water and soap.
There are simple examples you can easily make on page 77.



5. Special needs toilets

Many people within the community (such as pregnant women, the elderly, young children and people with disabilities or illnesses) may have special needs which mean that their toilets may need to be tailored to ensure accessibility and ease of use. When designing the 'right' type of toilet, we need to ensure that all people's needs are met. This can be though the use of handrails, ramps, or portable toilets.

People with illnesses, physical disabilities, the elderly, or pregnant women may be unable to walk long distances to a toilet. They may have difficulty walking up steps or may not have the strength to lift themselves up and down from the toilet seat. To accommodate these special needs, toilets can be modified to include handrails for support. This may be on the outside of the building as well as next to the toilet seat (see pictures below). The toilet could also be built with a ramp instead of steps for easier access.

A key concern in many Pacific communities is the health and safety of women and children who need to use the toilet when walking to remote villages or markets away from their own village. Many actually wait until evening to go to the toilet due to feeling 'shame' at people seeing them use the toilet. Also at night many people won't go to use a toilet 20–30 metres away. Because of fear of attack and superstition, they prefer to hold on until early morning. This can result in health conditions such as urinary tract infections. Portable toilets can be positioned inside the house, so women or children don't have to go outside at night.

Handrails on either side of the toilet seat make getting on and off the toilet easier.

Photos courtesy of CARE Laos, Raymundo S. Rodriguez

This building has a handrail on the outside of the structure to provide support for those who may have trouble walking. The building is easily accessible as it does not have steps.

Special designs

The following section contains two designs for portable toilets:

1. The bucket composting toilet
2. The 'Comfort Seat'

The bucket composting toilet

What is a bucket composting toilet?

The bucket composting toilet is a portable toilet that can be constructed from a bucket and a toilet seat.

How to build a bucket composting toilet

Using a 20 litre plastic bucket (or clean plastic 10 litre paint buckets) fit a toilet seat to the lid with an insert cut out. If you don't have a toilet seat you can cut a hole in the lid, but you will need a spare lid to cover it when not in use.

You could also build a frame around the toilet by cutting a hole in an old chair or make a structure out of bricks or wood.

How to use the bucket composting toilet

- Place 20–30 mm of organic material such as sawdust or dry leaves inside the toilet before use.
- Every time the toilet is used, place more organic material or ash in the toilet, using enough to cover the urine and faeces.
- Check the toilet regularly. If it starts to smell or becomes water-logged (has too much fluid in it), add more organic material or ash to it.
- When the toilet is full, empty the bucket into a hole and cover with soil.

Adapted from design by David Lee, Wellington, NZ

20 litre plastic bucket

Fit toilet seat to bucket, or cut a hole in the lid.

The 'Comfort Seat'

What is the 'Comfort Seat'?

The 'Comfort Seat' is a portable chair-sized toilet with wheels. It is designed for indoor use and can be kept near the user for convenience. This toilet is designed to support people with special needs, and can also be used by girls and women who are under threat of harassment and attacks if they go outside their houses at night to use the toilet.

Why the need for the 'Comfort Seat'?

Toilets in rural PNG are mostly situated 10–30 metres away from their homes. It can be dangerous to walk to the toilets at night. People are afraid to go far from their houses due to superstitious beliefs such as fear of sorcery. Women also fear the threat of attack if they venture far from their homes at night.

A household survey was undertaken by Live & Learn PNG and the Rural, Water, Supply and Sanitation Program (RWSSP) in Kavui community, West New Britain, PNG, to learn more about people's current sanitation practices and needs. The results indicated that because the toilets are so far away, 40% of people wait until the morning to go to the toilet, 30% go near the house, 20% go solo, and 10% are accompanied. The survey highlighted that 95% of people with special needs in rural settings in Kimbe rely on their relatives for privacy purposes. The 'Comfort Seat' means that people with special needs can go about their business in the privacy of their own homes without needing help. The survey also indicated that women face the risk of harassment or attacks every night. The 'Comfort Seat' provides a safe alternative for girls and women to relieve themselves at night without the threat of harassment or attack.

Advantages and disadvantages of the 'Comfort Seat'

Advantages	Disadvantages
Supports people with special needs (including the sick, elderly, and pregnant women)	Have to empty on a daily basis
Provides dignity and privacy	Odours – if left for longer than 48 hours*
Addresses safety and security issues of going to the toilet at night time (particularly for girls and women)	Might reinforce gender stereotypes as women might have the role of empyting
Promotes local ownership through tailored design	
Pleasant to use and a novelty for some groups (including children)	
Designed to retain odour	
More hygienic. The 'Comfort Seat' design also includes a hanger for cleaning gloves and sponge	

** Further testing required*

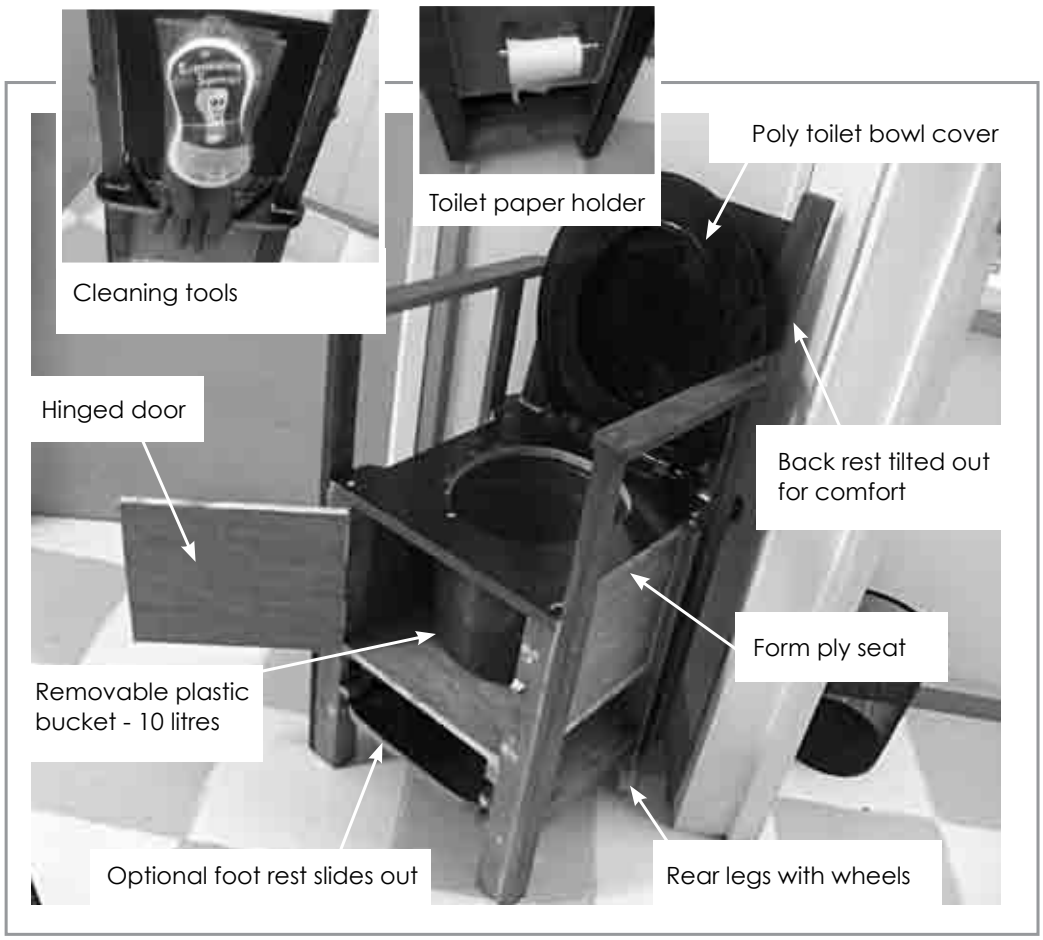
The 'Comfort Seat' has been designed by Live & Learn Environmental Education PNG to meet the special needs of their target communities in Kimbe, West New Britain. It is currently undergoing testing and will be further developed upon ongoing consultation with the communities.

How to build the 'Comfort Seat'

Materials list

Material description	Qty	Use
RS timber 50 mm x 50 mm x 3.6 m	1	Front and rear legs
RS timber 50 mm x 25 mm x 3.6 m	1	Arm and back rest
DAR Timber 20 mm x 20 mm x 2.5 m	1	Supports feet rest and bucket compartment
Form ply 17 mm x1 .2 m x 2.4 m**	1	Seat, feet and back rest
Common ply 12 mm x 1.2 m x 2.4 m**	1	Bucket compartment
1 ½ inch nails pkt*	100 gsm	Connecting braces and frame
Rubber Castor Wheels 50 mm pair	1	Rear leg rotates
PRD Butt Hinges 50 mm	1	Front door cover
10G x 40 mm chipboard screws pkt*	100 gsm	All joints
'Tuffa' poly toilet pan and seat	1	Toilet seat
Sandpaper 0.5 mm (smooth)*	1	Smoothing purposes
1 litre clear vanish*	1	Final touches
Rubber gloves 400 mm pair***	1	Cleaning purposes
Expandable gloves***	1	Cleaning purposes
Paintbrush 50 mm	1	Applying vanish
Toilet tissue holder***	1	
10 litre plastic bucket with lid	1	Waste collector
No More Gaps white 450 gm*	1	Patching holes
Bolt Barrel CP50 mm CD1	1	Connections frames etc.

* Can be used to make up to 4 Comfort Seats **One full sheet can make 2 Comfort Seats *** Optional



Construction steps (simplified) Dimensions similar to standard chair and to match chosen bucket.

1. Cut the ply for compartment wall sides, backrest and seat and sandpaper the edges. The dimensions should fit the chosen bucket and desired chair size. Using a saw, cut RS 50 mm x 50 mm timber to these lengths:

    - 510 mm (51 cm) x 2 pieces for front legs and 450 mm for rear legs (for wheel height of 60 mm)
    - 280 mm (28 cm) x 2 pieces for the braces

    Then strip 12 mm common ply into:

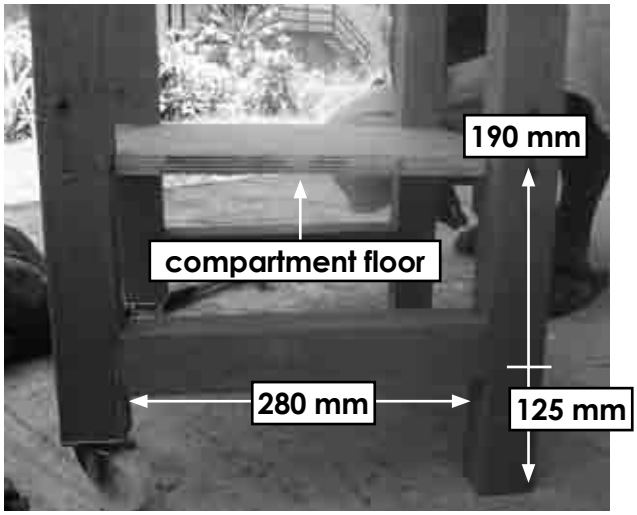
    - 240 mm x 275 mm x 2 pieces for compartment side walls
    - 305 mm x 240 mm x 3 pieces for rear wall and front wall (which will be the compartment door)
    - 305 mm x 275 mm rectangular cut for the compartment floor.

2. Shape the form ply to match that of a poly seat opening.

3. Once you have cut all the parts, start assembly. Assemble the frame of the bucket rest platform.

4. You can add rubber foot pads to the front legs to stop wearing on the floor and stop slipping. Add the braces near the bottom. Assemble the chamber and seat and assemble the chamber door with hinges and bolt. (The chamber door must be at the front as the screws for the toilet seat will restrict the opening if placed at the back. It will also fit perfectly at the sides.)

5. Add armrests. Fit the back rest at 95 degrees, tilted out towards the back. (2 pieces of 2 x 1 inch timber cut at 720 mm for the back rest.)



Allow 255 mm from legs up, to cater for the foot rest.

6. Screw the wheels to the bottom of the back legs.
7. Fit the toilet seat to the bucket, or cut a hole in the lid of the bucket.
8. Final stages: Sand all the wood. Fill in the gaps. Apply two coats of varnish. Screw the toilet paper holder on the right wall of the chamber. Add the screw for the gloves and sponge (insert the screw halfway so it acts as a hook). Insert the bucket.
9. Shut the chamber door and the 'Comfort seat' is ready to use!

Handwashing

Hands spread an estimated 80% of common infectious diseases like cold and flu. Handwashing with soap at critical times is considered the single most effective way of reducing diarrhoeal disease.

Handwashing with soap should be encouraged at critical times–after using the toilet, or cleaning a child, and before eating food. Washing hands with soap breaks down the grease that carries the germs. Using soap also increases the amount of time spent washing hands.

Handwashing is easy to learn, cheap and very effective at stopping the spread of germs. It is estimated that handwashing with soap can reduce the incidence of diarrhoea by almost half (Fewtrell 2005).

It is very important to wash hands with soap after using the toilet and before eating food.

Other times that you should wash your hands include: before preparing food, after touching animals, after sneezing/coughing, after outdoor work, before feeding your child/children.

No soap?

Soap is a very important product to buy for your household. Not only does it help to ward off disease, it helps to keep you and your family smelling clean and fresh.

A recipe for making soap can be found on page 80. Soap could also made by the business, community, or school groups to generate income.

Times to wash hands: after going to the toilet, before preparing food, before eating, after touching animals, after sneezing or coughing, after changing babies' nappies, or working in the fields.

Handwashing facilities

Simple handwashing options

Every toilet must have handwashing facilities with water and soap. Illustrated below are some simple handwashing facilities that could be set up in homes, schools or community centres. These are low cost and require minimal water.

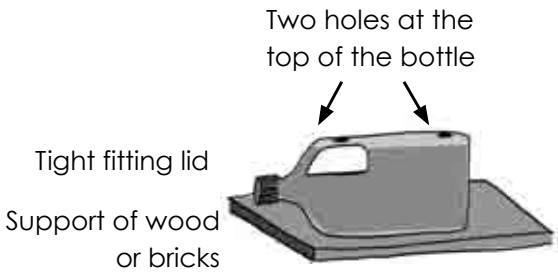
Over a bowl

Dipper with a hole and soap

Recycled container (Tippy-Tap)

Soap on a rope

A plastic or fabric net around the soap not only holds it, but also is abrasive which helps scrub the hands more effectively.



1. Horizontal position

2. Vertical position

Plastic bottle as a handwashing facility

Water collection for handwashing

If you have limited access to water, you could also consider collecting the run-off water from the roof of buildings by setting up a water harvesting system. Simple materials can be used to catch and collect water from the roof of the toilet or other buildings.

Examples of two chamber compost toilets fitted with rain catchment for handwashing.

Handwashing guide

Handwashing high-five!

Handwashing with soap is a simple, yet highly effective way to ward off infectious germs. Here are five very simple steps to take to keep your hands clean of germs.

START

1. Wet hands

2. Soap (15 seconds)

3. Scrub backs of hands, wrists, between fingers, under fingernails

4. Rinse

5. DRY on a clean cloth

Soap making

HOW TO MAKE SOAP

Recipe 1

There are 2 main soap ingredients–a fat and an alkali – to which scent and colour are often added.

The fat used in soap making can be animal or vegetable fat. In a very basic soap the alkali can be the ash left over from burning wood. The soap is made in the following way:

- Wash the ash with water and then drain.
- Add the ash to the fat and boil.
- Simmer to evaporate excess liquid and allow to cool.

As you can see the process is extremely simple. However, please note that this soap is not antiseptic and if you use too much ash, making the soap too alkaline, it will dry the skin, making it sore.

Recipe 2

You will need:

- 1 cup of coconut oil
- 1/6 cup of caustic soda (dry powder, flakes or pellets)
- 4 cups of water
- 1 large clean tin or pot (with a handle if possible)
- cooker/stove
- something to stir with, e.g. spoon or stick
- a bowl, dish or coconut shell to pour the soap mixure into. This will be your mould.

What to do

1. Pour the water and caustic soda into the tin.
2. Stir until the caustic soda dissolves.
3. Add the coconut oil.
4. Heat until the mixture boils.

Warning

Sometimes the mixture froths up and may run over the side of the tin. This is less likely to happen if you:

- use a large tin
- keep stirring all the time
- use a low heat so it does not get too hot.

If your mixture does froth too much, remove immediately from the heat and stir well.

5. Continue boiling and stirring for 15–20 minutes.
6. White lumps will appear on the surface. Soon after, if there has been too much heat, the mixture may 'dry out' and form an almost solid sticky mass. If this happens, add another cup of water and stir to keep it in liquid form.
7. Keep stirring until it has been boiling for half an hour altogether.
8. Let the mixture cool for a few minutes and then pour it into the mould (a bowl, dish or coconut shell). Leave until cold. When cold and hard it should be easy to remove.
9. Once it is cold, try to wash your hands with some of your product.

Lemongrass/lemongrass oil can also be added to the soap mixture for fragrance.

Communication materials

This section contains examples of posters and signs for each type of toilet. These can be photocopied or remade for customers to put in their toilets. If you don't have access to a computer, handwritten signs are also good!

How to use the toilets

Households need to know how to use their toilets properly in order to keep them clean. You can include signs in the toilets to teach people how to operate and maintain the toilets.

The following posters and signs are examples that show how to use the toilets.

How to use your compost toilet

This is an environmentally friendly compost toilet.
No pollution goes into the environment!

- Do not put chemicals or rubbish into the toilet.
- Do not put water, plastic or other non-organic wastes down the toilet.
- Regularly clean the toilet and floor. A bit of water in the toilet for cleaning is okay, but large amounts are not good!
- Women's sanitary napkins should be placed in a separate bin.

1. After every use, put used toilet paper and a handful of leaves in the toilet. Lime or ash can be added to reduce smells.

2. Close the lid and the toilet door.

3. Wash your hands with soap.

WHEELIE BIN COMPOST TOILET

- ✓ This is a compost toilet–it does not use water.
- ✓ It is sealed from its surroundings and will not pollute groundwater wells or rivers.
- ✓ It produces a compost fertiliser for use on gardens.
- ✓ Regularly clean the toilet and floor.
- ✓ A bit of water in the toilet for cleaning is okay, but do not put lots of water down the toilet.

- ✗ Do not put chemicals or rubbish into the toilet.
- ✗ Do not put plastic or other non-organic wastes down the toilet.
- ✗ Women's sanitary napkins should not go in the toilet.

How it works:

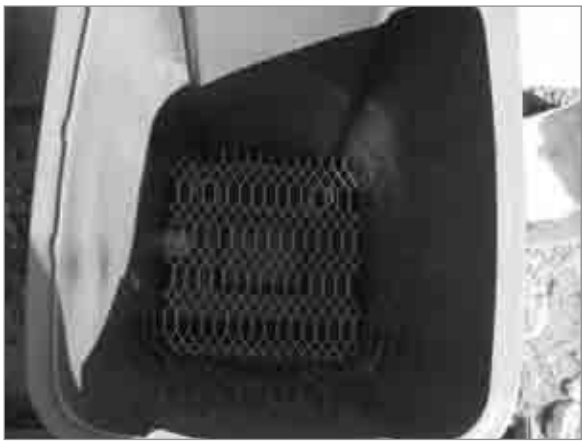
1. Toilet waste and leaves enter the wheelie bin.
2. This starts to compost down (break down, like on the forest floor) and germs die.
3. When the first wheelie bin is full, it is removed, the lid closed and it is stored safely for at least 6 months (6–18 months is recommended). The contents will continue to compost.
4. A second bin is used to replace the first.
5. After 6–18 months, the waste in the stored bin should be odourless and dry. This compost can be used on the garden (on non-food plants and fruit trees). The finished compost is safe to touch and use – germs and smell have gone.
6. The empty first bin is now ready to be used again when the second bin fills.

TOILET MAINTENANCE

Fixing smells in the wheelie bin toilet

If there are continuous smells in the toilet room, add extra leaves to the wheelie bin for several days. If this does not solve the problem, try the following:

Drainpipe



False floor in the bottom of bin

Drainpipe to soakage trenches

1. If the pile is wet and smelly, check the liquid can drain away okay.
2. Disconnect the drainpipe and check if it is blocked. Clear any blockage with wire and a rag. Use gloves.
3. Check that the bottom of the bin is not blocked under the false floor (use a torch to look in the pipe hole on the side of the bin).
4. Check that the false floor itself is not blocked. Poke a stick down to the bottom of the bin and loosen the base layer of compost and coconut husks.
5. Check that the soakage trench is not full. If is it full, extend the length of the trench.
6. If all of these are okay, mix more organic matter into the pile in the bin.
7. If the pile is too dry, add some water.

TOILET MAINTENANCE

Changing full wheelie bins

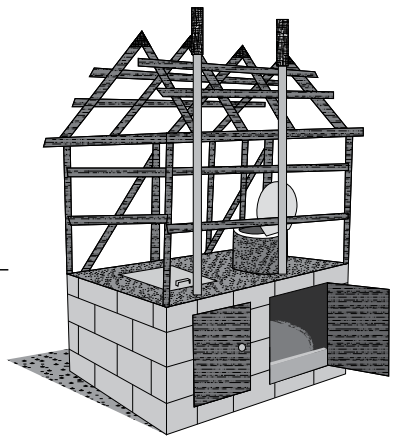
1. When one of the wheelie bins becomes full, disconnect the liquid drainpipe. Wear gloves when doing this.
2. Remove the full bin, close its lid and cap the drainpipe hole.
3. Swap the full bin with the second bin.
4. If the second bin still has compost in it from previous use, empty that compost out. If it has been sitting for at least 6 months it can safely be put on the garden (we recommend use on non-food plants and fruit trees). If it has been sitting for less than 6 months, it needs to be stored somewhere. If it has been sitting for at least 2 years, it can be used on food plants (WHO *Composting latrines*)
5. Make sure the second bin's false floor is properly in place and nothing is blocking the drainpipe beneath it.
6. Put a 10 cm layer of coconut husks or a piece of shade cloth on top of the false floor. This will stop toilet waste falling through.
7. Roll the second bin back under the toilet and connect the drainpipe. Close the bin room door.

HOW TO USE A COMPOST TOILET

This is an environmentally friendly compost toilet. No pollution goes into the environment and no water is required.

- After each use, put used toilet paper and a handful of leaves or ash in the toilet.
- Keep the toilet covered – either close the lid or cover the hole. Keep the toilet door closed.
- Wash your hands with soap and water after using the toilet.
- No chemicals or rubbish should go in the toilet. Menstruation cloths or pads should not go inside the toilet.
- Regularly clean the toilet and floor. A bit of water in the toilet for cleaning is ok, but large amounts are not good!

WHEN THE TOILET IS FULL – CHANGING THE CHAMBER



1. Before moving the toilet seat to the other chamber, open the access door and check the compost by looking over the baffle boards. If it is fully composted and inoffensive, remove the compost using a shovel. If the waste smells offensive, it has not been left for long enough. The toilet should be closed and not used for a minimum period of 6 months, before the waste is removed.
2. After removing the compost, check under the false floor to see if any compost fell through the false floor – this could block the drainage bed pipe. If there is any material, remove the false floor, remove the material and then replace the false floor. Repair any broken or damaged floor or door timber.
3. Prime the chamber by adding a thick layer (about 200 mm deep) of dry brown leaves onto the false floor. Then put the baffle boards back and close the access door.
4. Now move the toilet seat to the hole over the primed chamber. Before closing off the chamber that is full, fill it with dry leaves up to the bottom of the floor slab.

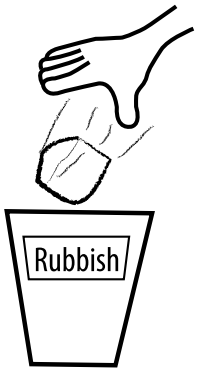
Sign for pour flush toilet: place inside toilet room

How to use the pour flush toilet

- ✓ Use 2–3 litres of water to flush the toilet
- ✓ Pouring from a height helps move waste.
- ✓ After using the toilet, wash hands with soap.

Maintenance

- ✓ The toilet should be cleaned regularly to prevent the build up of germs and or/stains.
- ✓ NO CHEMICALS SHOULD GO INTO THE TOILET!
- ✓ Put paper and other dry cleaning materials in a bin –not down the toilet. This will reduce the amount of water required, and prevent clogging.
- ✓ If water is scarce, collect rainwater or use recycled water.



Sign for all toilets

General cleaning and maintenance of toilets

It is important to regularly clean and maintain your toilet to ensure it can be used by you and your family.

Tips for keeping the toilet clean:

- ✓ Provide personal cleaning materials, such as toilet paper.
- ✓ Make sure there are handwashing facilities and importantly, SOAP.
- ✓ Provide a towel for drying hands and make sure the towel is washed at least every week.
- ✓ Each person should leave the toilet clean for the next user.
- ✓ Wash the whole slab every morning with water (and disinfectant if possible).
- ✓ Clean the toilet at least once a week, using cleaning materials (such as a disinfectant or bleach) to clean the top of the seat, under the seat or pan, door handle, walls and floor. Don't put these chemicals inside the toilet bowl.
- ✓ Do not use the toilet cleaning cloths for other purposes (e.g. washing the dishes).
- ✓ Make sure that the bins are cleaned regularly and waste disposed of properly.
- ✓ Make sure that the floor is not wet, so not slippery.
- ✓ DON'T USE too much water when cleaning inside the compost toilet – a little is okay.
- ✓ Try to keep rats and mice away from the toilet area. Block any small holes.
- ✓ Add some flowers inside for fragrance to freshen up the toilet!

Glossary

Bacteria: very small living things, some of which cause illness or disease.

Biodegradable: materials, chemicals etc that are biodegradable, and changed naturally by nature into substances that do not harm the environment.

Composting: the process of converting/ breaking down plant and animal waste into useful soil additives.

Contamination/contaminant: food, water, soil or air etc that is contaminated has come into contact with a substance that may be harmful or potentially poisonous.

Defecation/defecate: to pass faeces from the body.

Diarrhoea: frequent and watery bowel movements; can be a symptom of things such as infection, food poisoning, illness.

Evapotranspiration: the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces, and by transpiration from plants.

Faecal/faeces: solid waste products from the body.

Fertile: fertile land or soil is able to produce good crops.

Gender: being man or woman, the roles and responsibilities of men and women and how they are expected to behave. Gender roles are changeable between and within cultures.

Germ: a very small living thing that can make you ill.

Groundwater: water that is found below the ground.

Health: the general condition of your body and how healthy you are.

Hygiene: clean and healthy practices that maintain good health.

Infection: a disease that affects a particular part of your body and is caused by bacteria or a virus.

Menstruation: the regular monthly loss of blood and womb lining from a woman of child-bearing age.

Non-organic: not relating to or derived from (coming from) living matter.

Nutrients: a chemical or food that provides what is needed for plants or animals to live and grow.

Open defecation: defecating in the open and leaving faeces exposed.

Organic: living, or produced by or from living things.

Organism: an animal, plant, human, or any other living thing.

Parasite: a plant or animal that lives, grows and feeds on or within another living organism.

Parasitic infections: infections caused by a parasite (see infection and parasite).

Participatory: a way of organising or doing something, or making decisions etc that involves everyone who will be affected.

Pathogen: a disease-causing organism such as bacteria, virus or fungi.

Personal hygiene: maintaining cleanliness and grooming of our own body. In general, it refers to looking after yourself.

Rolling boil: when a liquid is boiling rapidly with lots of bubbling.

Sanitary pads: an absorbent item worn by a woman while she is menstruating (see menstruation).

Sanitation: safe methods to dispose of human faeces, urine and other household waste.

Sanitation enterprises: demand-driven small businesses that aim to improve sanitation.

Soakage trench: a trench that urine and liquids seep into.

Spirit level: a builder's instrument used to making sure that whatever you are constructing or installing is straight and/or level. It can be used for both horizontal and vertical jobs.

Tamp: to ram or pack something down firmly.

Toilet pan: the part of the toilet that receives the human waste (urine and faeces).

Waste water: water that has been used in homes, industries and businesses that is not suitable for reuse as a drinking source unless it is treated.

Water-logged: a term used to describe something that is full, or saturated with water.

Wheelie bin: an outdoor rubbish bin on wheels so it can be easily moved.

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Feedback form

Please help us to improve this handbook. Let us know what you think by answering the questions below and sending them to us. We suggest you photocopy this form or write/type out the questions and your responses, rather than tearing out this page, so other users of these materials can also tell us what they think. You can fax or mail this form to one of the Live & Learn offices listed on page 91.
Or you can provide feedback via email: resources@livelearn.org

Your name and location: _____

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1. Briefly explain how you used this handbook. (e.g. are you a builder, or business owner, or NGO worker?)

2. Is this guide easy to follow? (if not please tell us what was not clear)

3. Was there information that you think was missing?

4. How could this handbook be improved?

5. Please list any other comments or suggestions below:

Thank you!

Toilet talk!

Compost toilets: no water, no problem and no smells.

The whole family will benefit from having a toilet at home. And the business can help our community.

Toilets close to home are safer for girls and women.

We used to have to walk far for the toilet but now we have a compost toilet at the back of our house. It's easier, cleaner and safer.

Improved sanitation leads to clean communities and healthy, happy children!

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