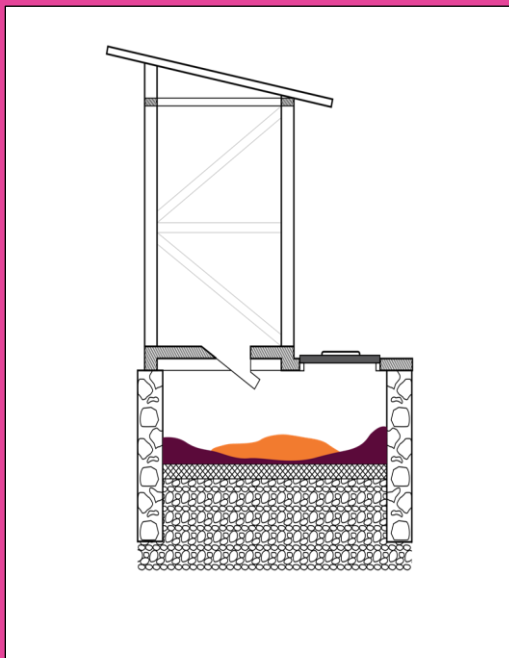


TIGER WORM TOILETS

What are they?

Are they a good solution for you?



OXFAM

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Introduction

Tiger Worm Toilets (sometimes known as vermifilter toilets) contain composting worms inside the toilet that digest faeces, reducing the accumulation rate and significantly extending the lifetime of the toilet. A worm colony can live inside the toilet indefinitely if the correct environmental conditions are maintained. This reduces the need to replace filled latrines and can therefore provide a more cost-effective solution in the long term.

This manual is intended to assist those implementing Tiger Worm Toilets (TWT), covering the community engagement undertaken, the physical design, the operation and maintenance and user’s satisfaction.

In urban, peri urban, rural and refugee camps TWT can provide a suitable sanitation to protect public health. Pit latrines are the most common sanitation solution because they are cheap and easy to build but are problematic to build in areas with high water tables, rocky or unstable soil, or to replace periodically. The logistics and cost of emptying of pit latrines is often not considered.

Tiger Worm Toilets could provide a more cost-effective solution in these situations as they have shallow, small vaults and very low filling rates. They also manage the faecal sludge “in situ” which is very beneficial.

The design philosophy of the toilet has been to balance cost, ease of construction, and user acceptability. The design does not require specialists to implement, and uses local or readily available construction materials, and local construction methods/capabilities. The cost needs to be comparable to that of a household latrine, as this is ultimately a major factor in the choice of sanitation solution, and in the long run the Tiger Worm Toilet may be cheaper.

The table below gives a simple comparison between the Tiger Worm Toilet and a typical household pit latrine. (These figures are based on experience from implementation in Gambella, Ethiopia.)

Quick comparison of Tiger Worm Toilets and ‘typical’ pit latrines

	Lifespan	Long term strategy	Best for
Typical Pit Latrine	Two – three years	Rebuild & Replace	Rural, lots of space, good ground conditions
Tiger Worm Toilet	Five – ten years	Reduced faeces build up, empty & rehabilitate	Crowded areas, long term use

In 2009, the Bill & Melinda Gates Foundation awarded a grant to the London School of Hygiene & Tropical Medicine to help find innovative solutions to the problem of pit latrine filling. The lead innovation to emerge from this project was the TWT. Laboratory studies were carried out and a prototype was developed and tested at the Centre for Alternative Technology in Wales. Then, TWTs have been trialled in different contexts (i.e. urban, rural and humanitarian camp) through individual projects carried out by Oxfam in Liberia and Ethiopia as well as via a joint consortia with Oxfam, ICCO-Cooperation, Water for People and Primove India; funded by USAID and which targeted trials in India, Myanmar and Uganda.

WHAT IS A TIGER WORM TOILET?

Tiger Worm Toilets (TWTs), sometimes known as ‘Tiger Toilets’ or vermifilter toilets, contain composting worms inside the pit that process and digest the faeces in-situ, processing the raw sludge into vermicompost. This removes the need for traditional desludging, as the vermicompost is simpler to remove and builds up at a slower rate. This can lead to a reduction of the long-term operating costs and removes the need for expensive desludging and sludge treatment infrastructure. A worm colony can live inside the toilet indefinitely so long as the correct environmental conditions are maintained.

In Liberia TWT consists of a pour flush latrine connected to a concrete chamber, i.e. the biodigester. The latrine is made of a low volume pour flush toilet with a water seal that prevents odours and flies back up the pipe. Waste is flushed through into the biodigester and trapped on top of the bedding layer, where the worms live. The worms feed on the waste, breaking down it and converting it into vermicompost. Then, the liquid effluent is filtered through the underlying drainage layer to further remove suspended solids and organic materials. Finally, the effluent is either discharged into a soakaway or collected in an external sump.

WHY MAKE THIS MANUAL?

To date, over 1200 TWT’s have been built and trialled across six countries by Oxfam in a range of settings including urban, peri-urban and refugee camps. Trials have also been run by other organisations as well as installations by the private sector. They have been proven to work in both individual household and shared communal camp settings.

This manual aims to build on the knowledge gathered by Oxfam and its partners over the last 10 years and present a range of Tiger Worm Toilets for different circumstances and to provide guidance for implementation with the host community. It aims to be a “One stop shop” for Tiger Worm Toilets and to consolidate Oxfam’s experience and learning in one place. However, the learnings show that TWTs are **not the solution to all sanitation problems** and it is important that the key considerations and the suitability of location is considered carefully before embarking on TWT implementation.

This manual will help guide you through the key decisions.

If you have the right elements to implement a TWT toilet project?

How to implement one. How to mobilise and engage the community.

How to source, breed and look after worms.

Designs for different TWT and how to operate them will be cover in part 2 and part 3 of the manual.

KEY FEATURES

Less frequent emptying

TWTs typically only require emptying every 3 to 5 years. Emptying is also easier as the vermicompost is at the top and can be emptied with a spade.

Lower Costs

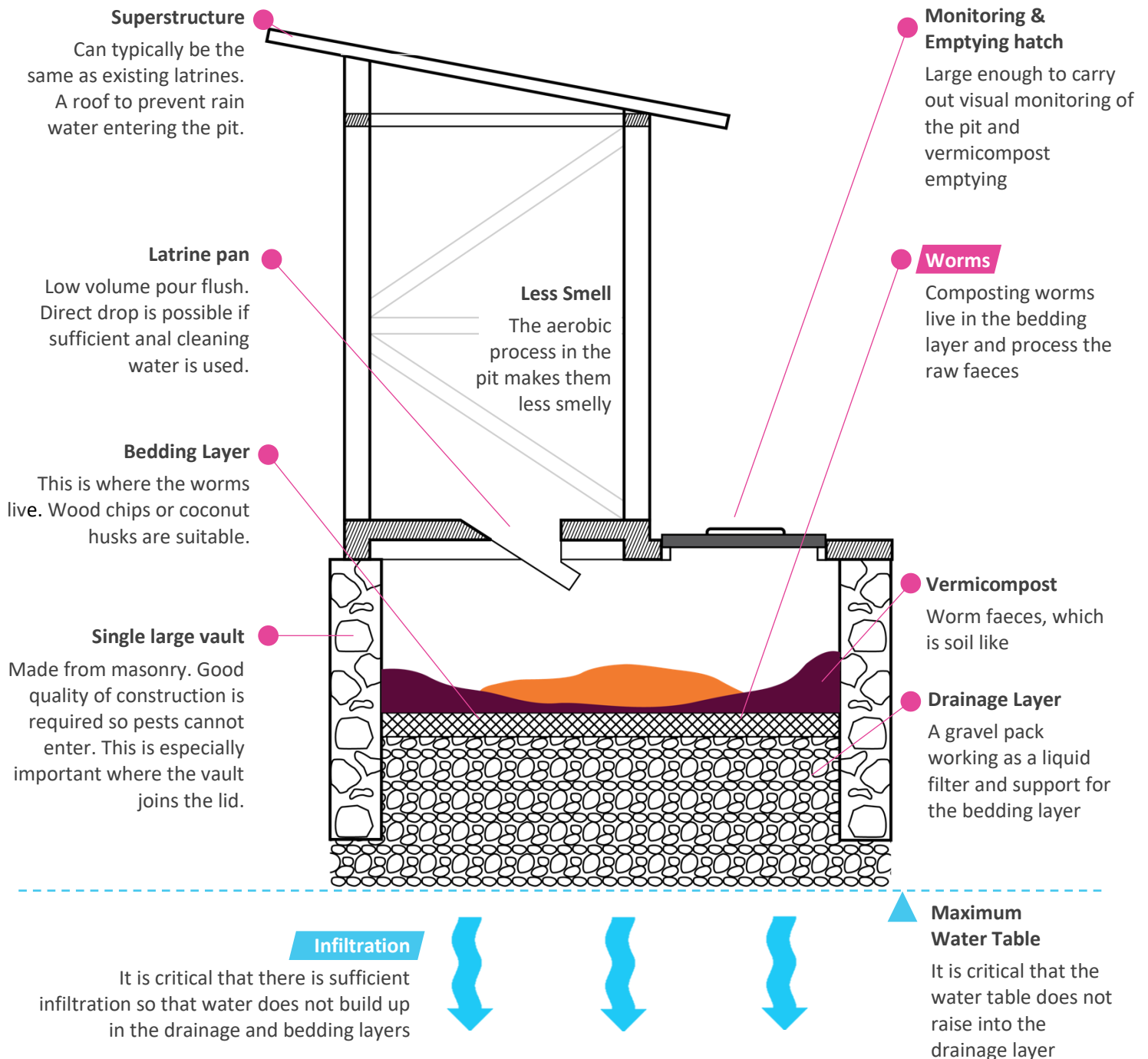
TWTs typically cost a similar amount to a typical latrine for materials and construction. However, due to less frequent emptying and not requiring desludging and sludge treatment infrastructure the overall lifecycle cost can be much lower.

Less Smell

The aerobic process within the TWT pit makes them less smelly than a standard pit which can help with promoting toilet use. They also have fewer flies, meaning less disease vectors.

KEY FEATURES

Of a direct drop 'Pour Flush' model



TWTs can be built from locally available materials. The specific design of TWTs varies based on the local context and application.

KEY CONSIDERATIONS

While TWTs have been proven to function successfully in a range of contexts they are not the solution to all sanitation problems. Careful consideration of some key factors is required before deciding to implement TWTs as a sanitation solution.



Water Availability

TWTs are not suitable in areas where water is scarce. TWTs require water entering the pit to ensure that the worm's environment remains moist. 1.0 to 1.5 litres per person per flush is desirable, making low volume water seal pans ideal. If the toilet is direct drop, users must use sufficient water for anal cleansing and pan cleaning to keep the worms environment damp/moist.



Worm Availability

While suitable composting worms are readily available in some countries, such as South Africa and India, their availability in sufficient quantity has proved limiting in several trial countries. Wormeries can be established to grow your own supply but this adds some cost and takes time; approximately two months to double the stock of worms by weight.



Soil Infiltration

It is critical that the pit does not fill with water. The soil must be able to absorb the daily fluid inputs and the water table must not rise into the bottom of the pit. Soil infiltration tests are essential before deciding on a TWT design. Raised designs would be needed in flood prone areas. Additional infiltration trenches may be required where the infiltration rate of the pit is insufficient. If high volume pour flush pans are used, the soil must be able to absorb the total daily input without flooding the pit.



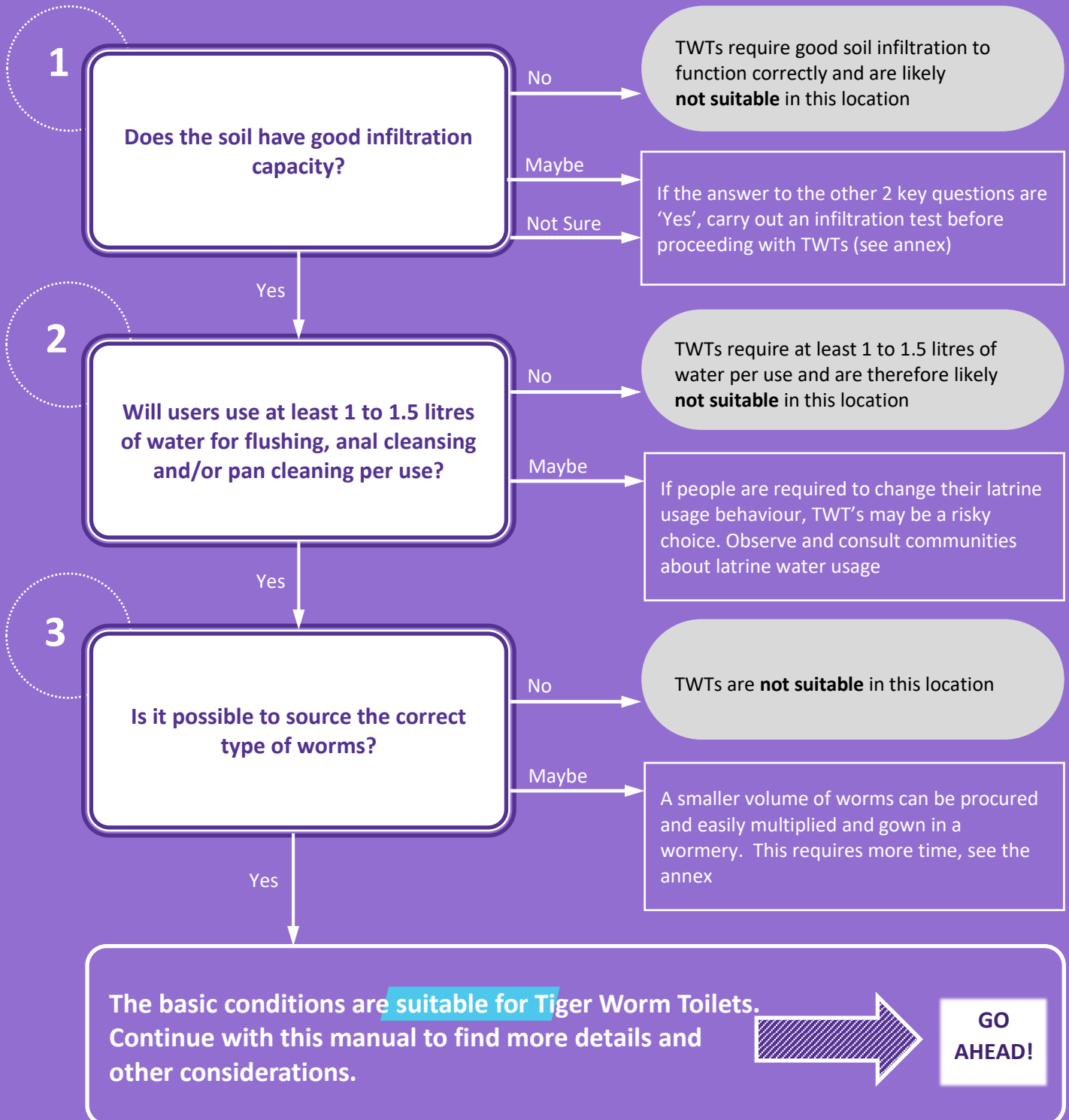
User Behaviour and Acceptance

It is essential to understand user current and expected behaviour prior to deciding on TWTs as a sanitation option. TWTs are not suitable in areas where the community uses only a very small quantity of water for anal cleansing and flushing. TWTs may not be suitable where communities are accustomed to throwing other waste into the toilet, unless this behaviour can be realistically changed.

Are Tiger Worm Toilets suitable in your location?

Before continuing, there are some key factors to consider if tiger worm toilets (TWTs) are suitable for your location:

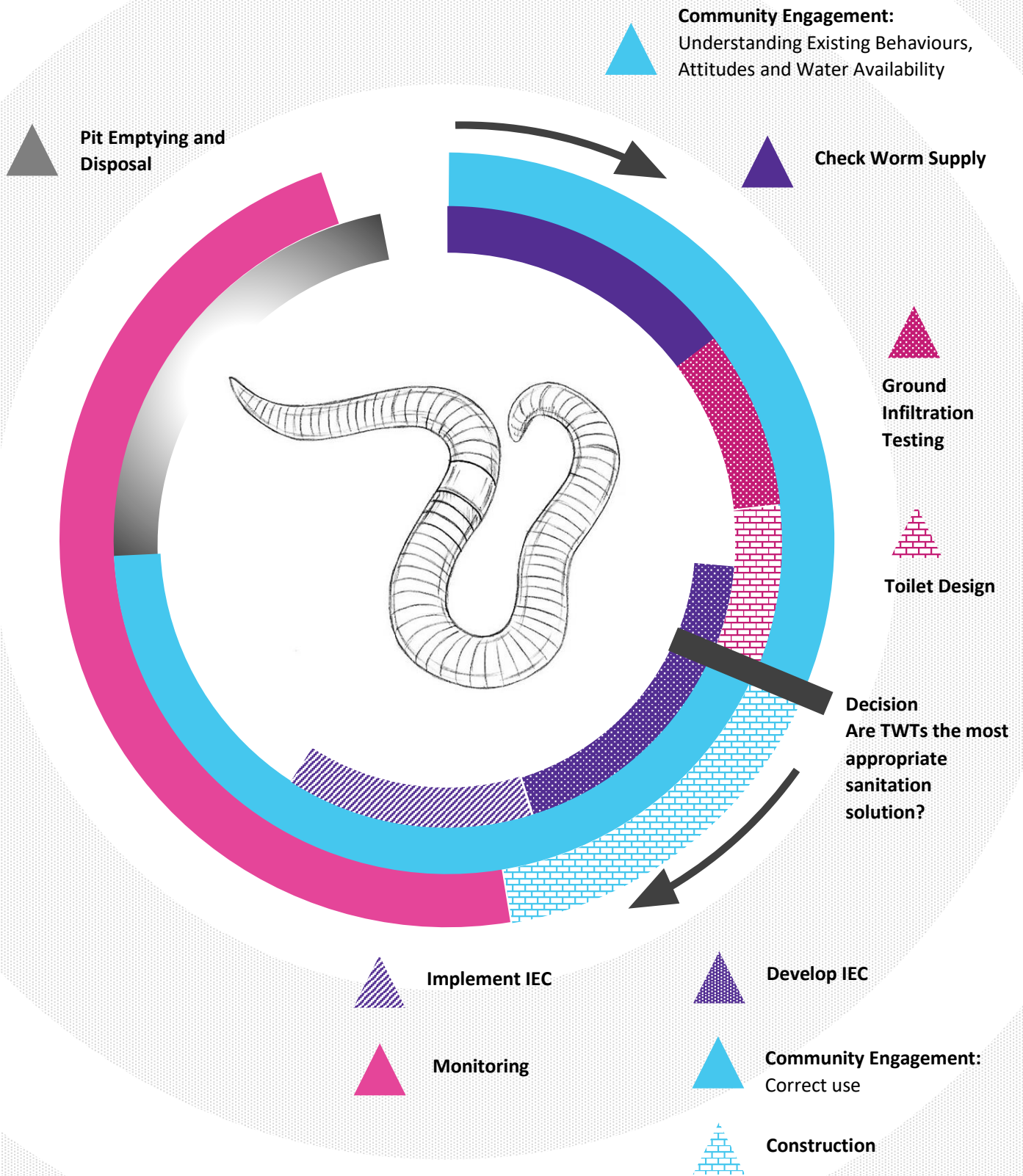
Key Questions





How to Implement a Tiger Worm Toilet Solution

TIGER WORM TOILET PROGRAM STEPS



Community Engagement

Initial Information Messages for Toilet Users

1. A tiger worm toilet is a special type of toilet that requires less frequent and easier emptying making it cheaper and more convenient. It also smells less than a traditional toilet.
2. Composting worms live in the pits and eat the faeces, turning it into a soil like vermicompost.
3. The worms live in the pit and cannot be seen. They cannot escape or climb up the pipe.
4. To the user, a tiger worm toilet may look no different to a normal toilet. The difference is all in the pit. However, there are some differences in how you use and look after a tiger worm toilet.
5. The vermicompost that the worms produce is dry and soil like. It can be easily emptied by hand with a shovel and the compost buried onsite.

Be sure to allow a lot of time for questions and answers to make sure they digest the idea and express any fears or concerns they may have.



Community consultation process in STMG camp, Sittwe, Rakhine, Myanmar.

Community mobilisation

Ensuring the correct use of a TWT is a much more involved endeavour than for a 'standard' pit latrine, thus a person experienced in engaging with communities must be involved throughout implementation. A comprehensive community consultation process is crucial to give people a sense of ownership and trust in the TWTs.

The worms feeding on the faeces help to reduce bad smell and flies and the toilet will last longer.

Step-by-step community engagement

1. Awareness creation on tiger worm toilets

Prior to construction, community meetings can be held to share information about how the toilet works, benefits and the proposed implementation. These community meetings provide a forum to identify and dispel rumours and myths associated with the latrine (based on culture), and offer feedback to any questions and concerns that the proposed users may have. Depending on the context, it's advisable to have flyers with pictures of the toilets or a demonstration toilet where the community can see the actual structure. Normally meetings with community leaders should happen first, but all members of the community must be involved afterwards: men, women, youth, and people with disabilities.

2. Training of community including community mobilisers to help with follow-up

Community engagement is effective when supported by people from within that community for it to be effective. While creating awareness the team from the implementing agency should identify (with the help of leaders) people that would be good community mobilisers. Typically, these people should be literate, with good communication skills. If community mobilisers are already employed it may be possible to use these for the toilets. Through the community mobilisers, the team should mobilise the community for trainings while construction goes on. Training should be provided directly to users on appropriate use and maintenance of the toilets, including proper explanation of the expected re-use of the by-products.

3. Community forums to train and support proper use

As soon as the construction of the latrines is completed, a handover ceremony to the community can be held. This event can be used for distribution of latrine kits for use and maintenance of the toilets and practical training on how to use them – demonstrations on squatting to use the urine & faeces holes respectively, anal cleansing (if applicable), addition of ash, cleaning excess ash with a broom before leaving the latrine and washing hands with soap as the final step. These community forums should be segregated by sex to encourage users to participate without inhibitions freely and understand proper use of the toilet.

4. Routine follow-up

Through the community outreach agents, both focus group discussions and house-to-house visits can be employed while carrying out routine follow-up on the use of the toilets.

For instance, in a refugee camp setting where 16 households make 1 community (Ethiopia), the best practice is to do house to house visits in the morning (say from 9-12 noon) to observe on-going practices and then conduct a discussion with same HH owners in the afternoon (say 3-4 pm) on challenges they could be facing or areas that need improvement. With appropriate skills and practice, it's possible to conduct a house-to house visit within an average of 10 minutes (all 16 HHs will take less than 3 hours) and the afternoon focus group discussions in less than 2 hours.

The routine follow-up should focus on sharing the key messages as well as the proper use of the items provided. For example, tiger worm toilets requires addition of water after every use - the observation during house to house visit should verify if there's adequate water stored in the toilet. Also, the area around the hole should be free from any dry faeces and ideally the latrine should be visibly clean (without smell/ flies).

Key aspects for community engagement

- Provide correct and accurate information on tiger worm toilets including expectations regarding contribution towards construction, operation and maintenance.
- Consult targeted households on the items to be included in the latrine cleaning kits – especially the appropriateness in relation to cultural beliefs.
- The requirements of men, women, young people, children, those with special needs and disabilities in relation to the toilet will be different. Therefore, consult these groups of people and address their needs as much as possible within budget limitations.
- Prioritise the right messages, reinforcing doable, practical and evidence-based actions, tailored to community member's information gap (based on monitoring over several months of use of the toilets by the community).

Look at Heath promotion guidance note **Annex 7**.

Involving stakeholders

Experience of stakeholder involvement in Sittwe camp, Myanmar.

Initial **information sharing** and **consultation** was carried out with key community stakeholders including community leaders, local authorities, religious leaders, youth and women's groups. Households to be included in the project were selected together with these groups. This broad initial engagement helped ensure ownership and awareness of the project.

Meetings were held with groups of households in the two camps to assess existing **behaviors**, share further information and raise awareness about TWTs. As the communities in the two camps were different, this was done separately in each site. No major change in sanitation habits was required in either location.

As TWTs were a new concept, an inception workshop was held with local authorities and NGO stakeholders to **raise awareness and acceptance**.

Men, women and children were consulted separately on the **design** and location of the TWT structures in each camp. Changes were made to the design based on the feedback from these sessions before being finalized with the selected households.

Consultations with the selected households were carried out to agree the **roles, responsibilities and contributions** of households and Oxfam; including materials, cleaning, monitoring and emptying.

Formative research was carried out with women, men and children separately in each camp to understand the key motivating factors and barriers to latrine use. Reduced desludging frequency and reduced smell were the most appealing features of a TWT. People were not interested in knowing more about the worms or how they work. Generally, a sturdy, wide and smooth latrine floor was most valued.




The formative research findings were used to inform various **IEC** ideas and sketches which were shared with the groups for feedback and discussion. Designs based on these ideas were developed for each camp. Changes were made based on the feedback and a final IEC poster and leaflet developed for each camp.





Close coordination was continued with the community leaders and other key power holders in the camp who had the potential to support or block activities.

Understanding Existing Behaviours and Attitudes

Ensuring the correct use of a TWT requires more community engagement and mobilisation than would be the case with 'standard' toilets. A person experienced with engaging with communities must be involved throughout design and implementation. A comprehensive community consultation process is crucial to give people a sense of ownership and trust in the TWTs.

It is important to understand existing behaviours, in line with the criteria in the table below, before deciding to implement TWTs. The behaviour of all intended users may not be uniform, particularly where intended for communal or shared use. It is therefore important to ensure that people within each group are considered. TWTs are most suited where existing behaviours and practises are already suitable for a TWT. Where existing behaviours need to be changed in order to use a TWT, it must be considered if such changes are realistic.

Existing Behaviour	Important because....	Consultation topics	What it tells us...
 <p>Availability and use of water</p>	Water is required when using the TWT	<p>Where do communities get water for toilet use?</p> <p>How do individuals practice anal cleansing?</p>	<p>What kind of water is being used. Saline water can harm the worms</p> <p>What is used for anal cleansing (i.e. paper, water, or other materials) and if behaviours need change</p>
 <p>Experience with flushing</p>	Ensuring enough water after each use to maintain a good level of moisture in the pit for the worms	<p>How do community members flush the toilet? How much water do they use?</p> <p>Community perceptions and current practices towards flushing toilets</p>	<p>If current flushing practices align with the required minimum of 1.0 to 1.5 litres of water per flush and if additional awareness is needed on how to flush the TWT</p> <p>Attitudes towards toilet flushing</p>
 <p>Latrine Use</p>	To understand if everyone currently uses latrines and if not why	<p>Who currently uses latrines; children, men, women, people with disabilities etc.</p> <p>Consultations to be held with each group separately</p>	<p>Are there any groups who do not currently use latrines and if so what are the reasons?</p> <p>Is there anything that can be changed in the TWT design to make them more accessible or desirable to these groups?</p>

Existing Behaviour	Important because....	Consultation topics	What it tells us...
 Greywater entering the system	Grey water will harm the worms	<p>Where do people bathe?</p> <p>Do they normally bathe in latrine?</p>	Does grey bathing water normally enter into existing traditional latrines? Do people have other places to bathe? Does the TWT design need to be modified to incorporate bathing where the water does not enter the pit?
 Items entering the system	There are restrictions on what can be flushed down a TWT toilet	In addition to faeces, what do community members put 'down' the toilet?	If other items are being put down the toilet (i.e. garbage, cigarettes, nappies, menstrual materials, bottles etc.) then additional awareness is required about how these items might damage the TWT and a convenient alternative waste disposal option provided
 Community opinions of worms	Communities may perceive worms in negative ways (i.e. lack of cleanliness)	Are worms used/accepted by the community for vermicomposting?	If the worms in the toilets will be accepted or if community sensitization is needed to explain what they are for and what they do
 Cleaning of latrines	Chemical cleaners should not be used on the toilet bowl as the run-off into the pit will harm the worms	How are the existing latrines cleaned? What kinds of supplies are used?	If chemical cleaners are traditionally used, would a switch to water-only cleaning will result in communities perceiving toilets as 'unclean'
 Desludging	Who will empty the pits when they fill up	<p>What do households currently do when pits fill up?</p> <p>Who would be willing to empty the vermicompost?</p>	<p>Can household empty the vermicompost by themselves and bury it onsite, or would there need to be an emptying system established?</p> <p>What would emptying likely cost if households expect to hire labour for this?</p>

KEY MESSAGES

Communication materials and methods need to be developed specific to the local context. In some contexts, word of mouth through local influencers may be most appropriate, while in others printed educational materials may be preferred. General best practices for developing IEC materials should be followed including:

1. Focus on the most important key messages and consider any difference in key messages for different groups of the population. Avoid having too many key messages at a time.
2. Consult different groups of the population separately to explore key barriers and motivating factors.
3. If possible, find a local artist who can quickly sketch up IEC ideas for rapid testing with the target groups before developing ideas or designs in detail.
4. Think about the type of media and the location of media that will be most impactful, such as possibly inside the latrine door.

KEY MESSAGES

As with any latrine program, users need to have access to sufficient cleaning and personal hygiene products such as a toilet brush, bucket, jug or lota where appropriate and soap for handwashing.

Benefits of a Tiger Worm Latrine



LESS EMPTYING

TWT's require less frequent emptying, saving you time and money. They are also easier and cleaner to empty.



LESS SMELL

TWT's smell less than normal toilets

In order to get these benefits, there are some things that need to be ensured:



Water

Use water to flush the toilet after every use, at least 1-litre (a lota)



No detergents or soap

Avoid using detergents that can kill worms - use only plain water to clean the latrine



Don't throw waste in the latrine

Do not throw solid waste, such as disposable pads, bottles, dry cell batteries, broken glass, metal etc., into the toilet, as these will stop the toilet functioning properly.



No shower or bathing

Avoid using the toilets for bathing or showering because excess water and soapy water isn't good for the worms

**Red (tiger)
worms**



**Indian Blue
Worm**

**African
Nightcrawler**



WORMS

Composting worms can eat up to their own bodyweight each day. They reduce the volume of faeces by converting it to carbon dioxide, water, ammonia, and vermicompost (worm faeces), which is dense and has less water.

In many countries, such as Thailand, Bangladesh, India and South Africa, composting worms are grown commercially for processing of organic waste into vermicompost. However, in Myanmar as in some other trial countries, the quantity of available worms available from suppliers has limited the speed at which TWTs could be installed. In some cases, worm supply can be expensive and therefore both the available quantity and cost must be considered before committing to TWTs as a sanitation solution.

What type of Worms can be Used?

If a worm can be confirmed as composting, then it is very likely be suitable for a tiger worm toilet. There are several different species of composting worm and they are widely available around the world. The Red (Tiger) Worm (*Eisenia Fetida* or its close relative *Eisenia Andrei*), the African Nightcrawler (*Eudrilus Eugeniae*) and the Indian Blue (*Perionyx Excavatus*) are common types. Identifying specific species of worms is difficult and is not necessary.

Sourcing composting worms in the country you are working in

You need to find out where you can get worms from and if the supply is sufficient for your needs. See Annex page 63 with list of countries with good worm supply. In you need to transport worms have a look at **Annex 2**, pg. 63.

Growing your own worms

Wormeries can be easily established to grow your own supply but this adds some cost and takes time; approximately 6 weeks to 2 months to double the stock of worms by weight. If the wormery is large enough, it is most efficient to wait until the entire required supply of worms has been grown rather than taking out some each month. Guidelines on setting up and operating a wormery can be found in **Annex 1**, pg62.

Predators

Worms have various predators including birds, snakes, small mammals and invertebrates. Predators of relevance for TWTs are mice, rats and centipedes. Ants can aggravate the worms. Care should be taken to ensure that the toilet is well sealed to avoid predators entering the pit. Flies, maggots, cockroaches and ants are not predators of composting worms.

Can the worms escape?

There is nothing physically trapping the worms in the toilet, but they will remain inside the pit if the environment created for them is suitable. One of the most significant aspects of this is ensuring that users flush the toilet with water, but that the drainage is adequate to prevent the bedding layer becoming too wet and saturated.

Bedding Layer

A bedding layer is necessary for the worms to live in whilst they are in the toilet. A good bedding material should retain moisture, retain its (porous, air-retaining) structure to prevent the toilet going anaerobic, and filter out the solids that are flushed. Possible bedding layers include woodchip, coconut fibre (coir) or compost (Figure 1). Lab tests have shown that woodchip may be the most effective bedding layer, although if it has too many fine particles then this could potentially cause clogging. Whichever bedding layer is chosen, it should be soaked overnight before installation in the toilet and be added at the same time as the worms to a depth of around ten centimetres (10cm).

Figure 1. Possible bedding layers: woodchip, coconut fibre (coir) or compost.



Sourcing and Growing Worms

In many places worms are grown commercially for use as fishing bait, for agricultural purposes converting organic waste, or for the processing of sewage sludge through vermifiltration. Alternatively, worms may be found living in the local environment, particularly in areas with high amounts of organic matter, for example in areas where cattle gather.

Sourcing worms in the quantities required for many toilets may be difficult or expensive, but once an initial batch of worms have been sourced it is relatively easy to grow more. A wormery should have approximately one square metre for every five kilograms of worms. The wormery needs to be covered to protect from birds, be in a shady area to prevent overheating, and should have controlled drainage to ensure that it does not flood.

Inside the wormery a layer of bedding material and food should be added, and the food should be periodically topped up as the worms process it. Cow manure has been found to be an excellent food. The wormery should not be allowed to completely dry out.

Harvesting the worms manually from the wormery is an involved process but gets easier with practice: material should be removed from the wormery in batches and sifted through to find the worms. As the worms are separated and weighed it is inevitable that some of the material, they are living in will remain with them, this is normal and even desirable to avoid causing unnecessary distress to the worms. After weighing the worms should be quickly returned into some bedding material.

To continue growing worms in the wormery, do not harvest all the worms at the same time. The material the worms are harvested from will also contain worm cocoons, so this should be returned to the wormery after the worms have been harvested from it.

Planning your worm supply is very important as is monitoring your wormery, please look at **Annex 3** and **Annex 10**.

Worms in the Toilet

There is nothing physically trapping the worms in the toilet, but they will remain inside the toilet so long as the environment created for them is suitable. One of the most significant aspects of this is ensuring that users flush the toilet with water, but that the drainage is adequate to prevent the bedding layer becoming saturated which will turn it anaerobic. To achieve this the bedding layer and worms must sit on top of a drainage layer, which allows the water to soak away without ever flooding the worms.

In this design the drainage layer consists of a sixty-centimetre (60cm) layer of gravel. Typically, around one kilogram of worms will need to be added to the toilet, and a family toilet will need around one square metre of surface area to support this quantity of worms.

Results of field trials in India show that the toilet will last longer than five years before completely filling with vermicompost, when emptying may be required.

The table 2 below shows the environmental conditions required by the species of worms used for the TWTs. Aerobic conditions are also important for the worms but also for other organisms such as aerobic bacteria that play an important role in the process.

Table 2: Environmental conditions for the worms (source: C. Furlong).

Parameter	Range	Optimal
Temperature (°C)	5-35	20-25
Humidity (%)	50-96	60-80
Feed rate (Kg feed/Kg worms)	0.8-2.0	1.0
Food layer depth (cm)	-	10-15
Worm loading (kg/m ²)	0.8-2.0	2.0

Acknowledgements

Oxfam has been working on Tiger Worm Toilets (TWT) for over a decade. Many Oxfam staff, consultants, private companies, have been involved in the gathering the information outlined in the manual. Numerous country programmes have implemented Tiger Worm toilet projects, Myanmar, Sierra Leone, Ethiopia, Liberia, Bangladesh and India. The experience gained and lessons learnt about design, operation and implementation are outlined in this manual.

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