

# COMPOSTING TOILET INSTRUCTIONAL MANUAL

A COMPREHENSIVE GUIDE FOR INSTALLING  
DRY COMPOSTING TOILETS

# TABLE OF CONTENTS

Introduction .....	3
How to Get Started.....	4
The Basics.....	5
How they work.....	5
Preparing your space.....	7
Obtaining materials.....	8
Design Option.....	9
Design: Compost Bin.....	11
Design: Ventilation System.....	13
How to Install a Composting Toilet.....	15
Pedestal.....	15
Ventilation System.....	16
Composting Bin.....	18
Putting it all together.....	19
How to Maintain a Composting Toilet.....	20
Additives.....	21
How to empty the bin.....	22
Compost Use.....	23
Trial and Error.....	24
Troubleshooting.....	26
Frequently Asked Questions.....	28
Resources.....	29

## Introduction ☀️

Despite 70% of the Earth being covered in water, water scarcity is a global challenge. At the turn of the 21st century, nearly four billion people faced some degree of water scarcity. By 2025, it is estimated that 1.8 billion people will experience absolute water scarcity. In particular, Central America has experienced a steep increase in water scarcity since the 1960s largely due to sporadic weather caused by climate change.

When thinking about climate change, one's first thought is not the bathroom. It may not even be the tenth thought. However, using the bathroom has significant impacts on the planet. When a toilet is flushed, water is wasted in the transportation process as well as in the treatment and disposal of human waste. During this process, energy is also wasted transporting and treating the water. Instead of flushing human waste, what if it were reused?

Composting toilets are a sustainable solution to water scarcity. They save water, reduce pollution and energy consumption, and are easy to install in your home!



Examples of composting toilets already installed in Monteverde.

## How to get started

Composting toilets have amazing environmental benefits over their septic system counterparts. These benefits however, require additional steps that conventional toilets do not need. Composting toilets must be maintained and updated as your needs change over time. These changes are easily achieved with only a small amount of ingenuity.




Before you decide that you're ready to own a composting toilet, there are three key things to keep in mind. Composting toilets require **PLANNING**. A proper space needs to be prepared! Adequate space must be present near your toilet for the composting bin. Composting toilets also require **BUILDING**. They can be installed by yourself or with the help of a hired professional. Lastly, composting toilets require **MAINTENANCE**. There is a certain amount of upkeep that your new system will require.

**This manual will go into detail on all of these topics so you can have a better composting toilet experience!**

<b>PLAN</b>	<b>BUILD</b>	<b>MAINTAIN</b>
Select a design and prepare your space for the composting toilet	Obtain the proper materials for the design  Install the composting toilet system	Do the required upkeep to keep your toilet working properly  Update your system as needed

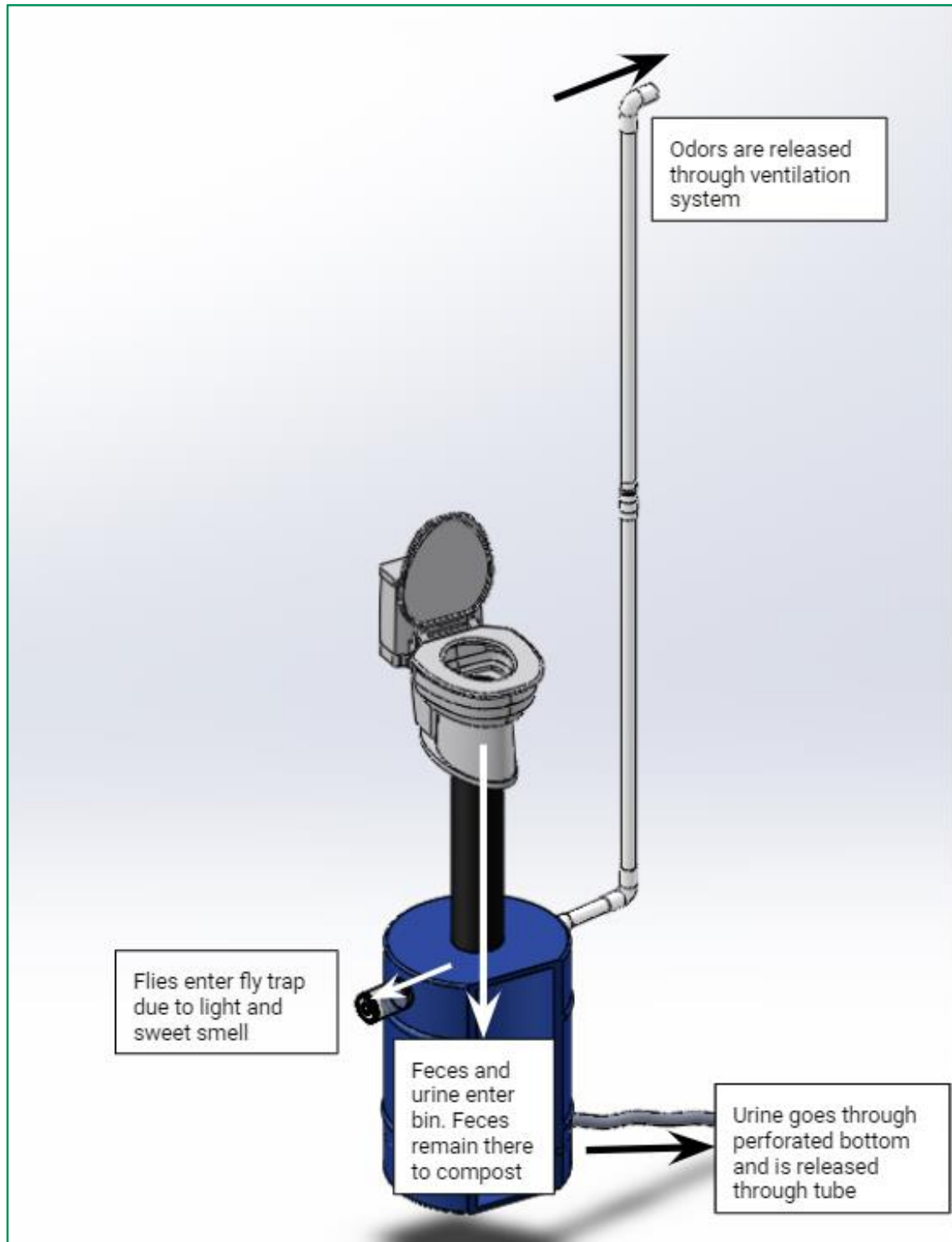
# The Basics: How they work ☀️

**A dry composting toilet is a type of toilet that treats both solid and liquid human waste through composting without the use of water.**

-  Waste enters the dry composting toilet the same way as a flushing toilet. Since the designs require little to no water, it relies on gravity instead of water to move the waste.
-  The waste will break down within the tank. Additives, such as sawdust and leaves, aid the composting process.
-  After sitting for a minimum of six months, the compost can be used as fertilizer for vegetation.



## How they work: A system diagram ☀️



## The Basics: Preparing your space


### You've decided you want a composting toilet...now what?

Composting toilets require a space beneath your toilet pedestal for the composting bin. Because it does not use water to flush, the system relies on gravity to move waste from the bowl to the bin.

A two-story house, one with a basement, or one with an elevation change is ideal for a composting toilet. However, even creating a small drop is sufficient for a system as long as you can fit a tank underneath.

#### Helpful tip:

Composting toilets are easily installed in a location that was planned for.

-  If you're in the middle of an addition, think about creating a space underneath your bathroom to install the composting bin.

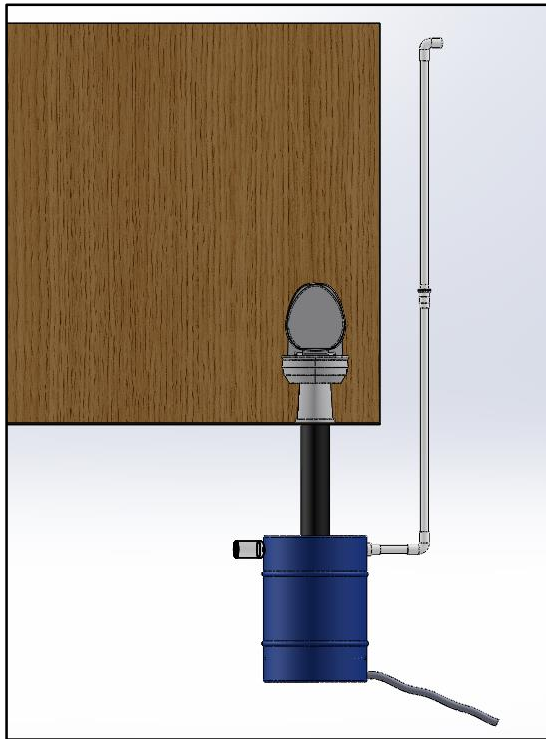
## The Basics: Obtaining the materials

These materials can be obtained from local hardware stores. The tools required to cut these materials can also be found locally.

Quantity	Material
1	Toilet Pedestal
1	300 Kg Capacity Empty Plastic Barrel
1	Black Tube (Approximately 180mm in diameter)
1	Empty Clear Bottle (Any Size)
1	Long Plastic Tube (Small diameter)
1	2" PVC Male Adapter
1	2" PVC Pipe (Approximately 320mm in length)
2	2" PVC Elbow
2	2" PVC Pipe (Approximately 1,500mm in length)
2	2" PVC Square Housing (54mm x 54mm)
1	12V Computer Cooler Fan ( 52mm x 52mm x 15mm)
2	2" PVC Connector
1	Circular Mesh (2" Diameter)
4	2" PVC Pipe (Approximately 120mm in length)
1	Circular Mesh (640mm in Diameter)
1	Toilet Pedestal
1	300 Kg Capacity Empty Plastic Barrel
1	Black Tube (Approximately 180mm in diameter)
1	Empty Clear Bottle (Any Size)
1	Long Plastic Tube (Small diameter)
1	2" PVC Male Adapter
1	2" PVC Pipe (Approximately 320mm in length)
2	2" PVC Elbow



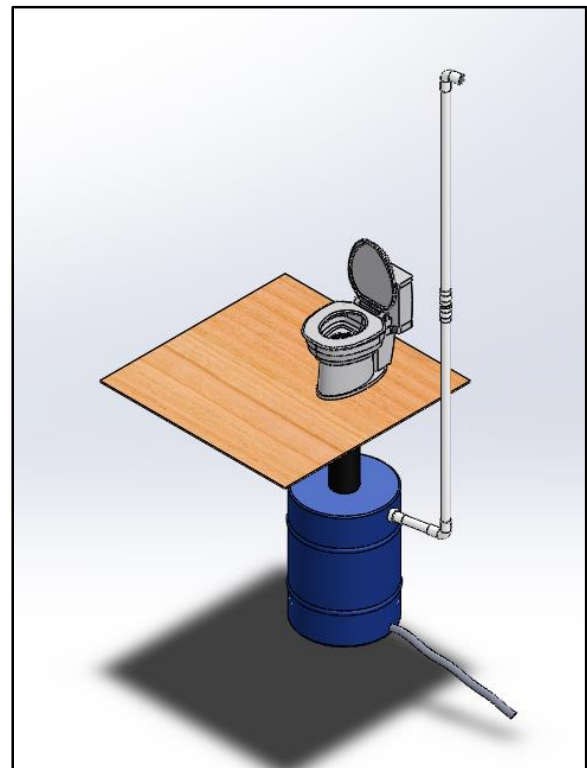
## Design Option ☀️

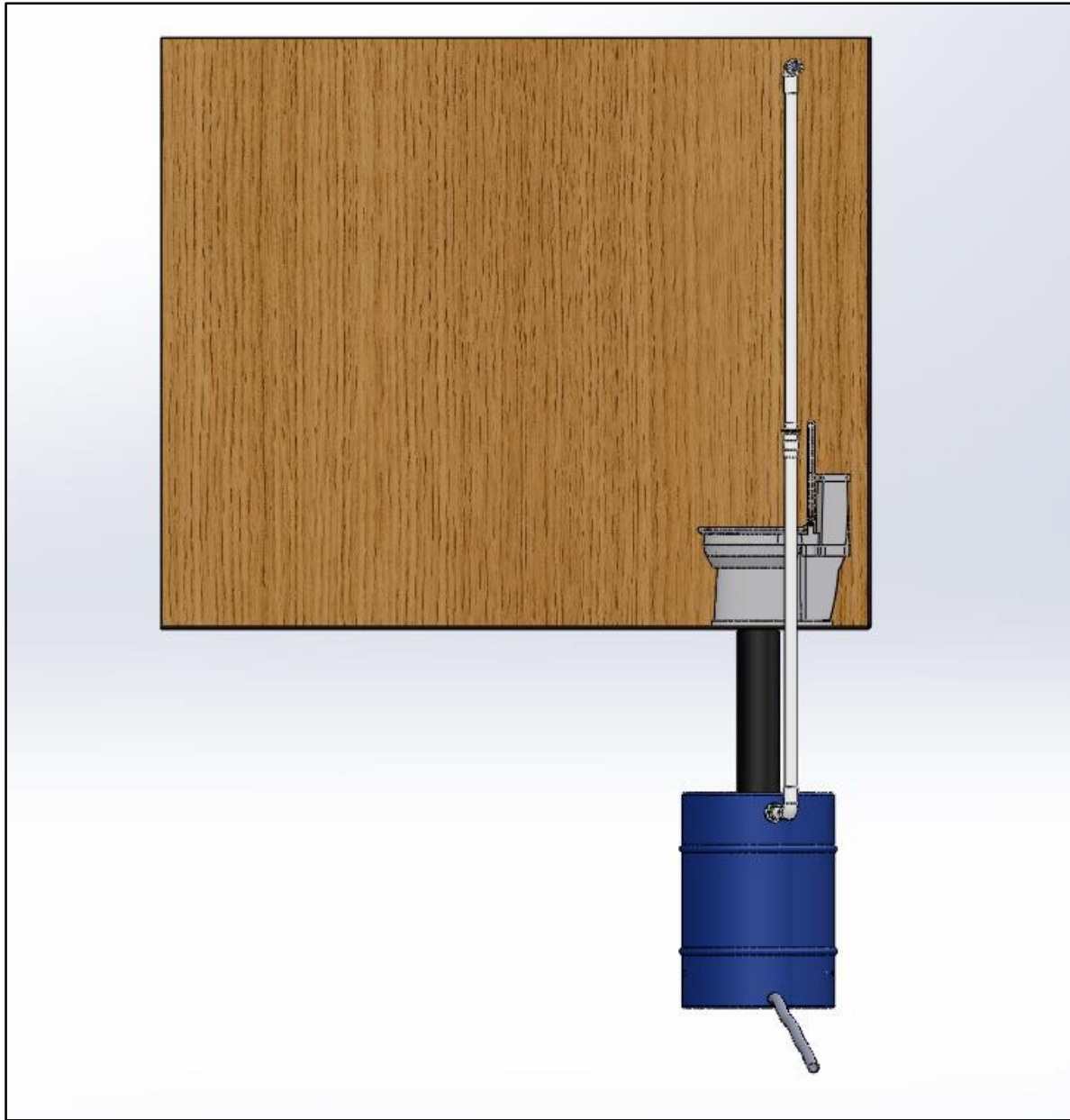


The design to the left depicts a multi-story composting toilet model. The toilet bowl shown on top is a recycled flushing toilet, but this could be swapped out with a variety of options, such as a wooden box with a toilet seat and lid on it. A hole of at least 120mm in diameter needs to be cut into both the toilet bowl and the floor below that it sits on.

Below the toilet bowl is a black plastic tube that will act as the chute. The diameter of it should be the same as the holes that were cut into the floor and bowl so that it can be placed inside them. It is recommended that a length of at least 800mm is used to help prevent users from seeing into the bin.

Attached to the black plastic tube is the composting bin, where the composting process takes place. This model has a composting bin with a perforated bottom, which catches the feces but allows the majority of the urine to pass through. Once the urine goes through the perforated bottom, it leaks out through a small tube that is attached lower than the perforated bottom on the bin. This helps to eliminate the smell.





The ventilation system shown uses PVC pipes and a small computer fan. The ventilation system should be attached near the top of the composting bin. The ventilation system should extend out of the house, preferably above the level of the roof. It is recommended that a PVC elbow piece and mesh are added to the top of the system to prevent rain and bugs from entering the system.

A fly trap is also incorporated into the design. This can be made easily using some sort of clear plastic container with a sweet smelling substance in it. The plastic container should then be attached near the top of the composting barrel where the light and smell will attract and trap flies.

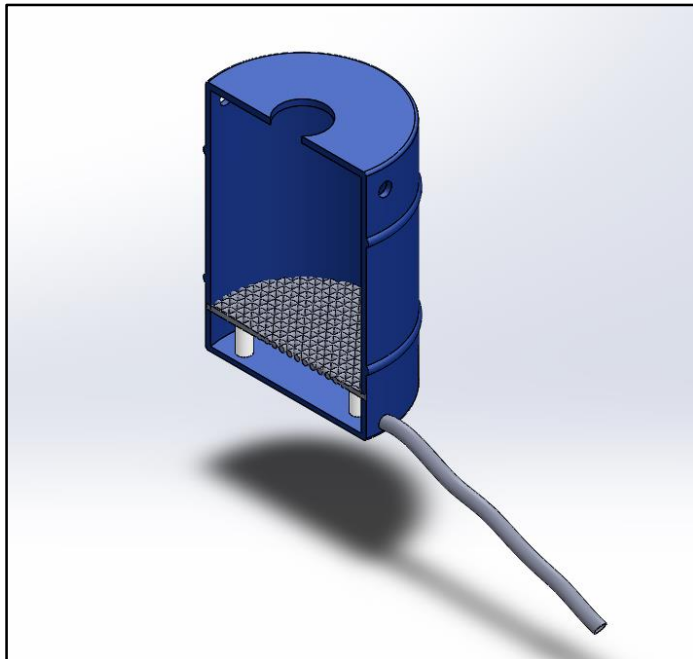
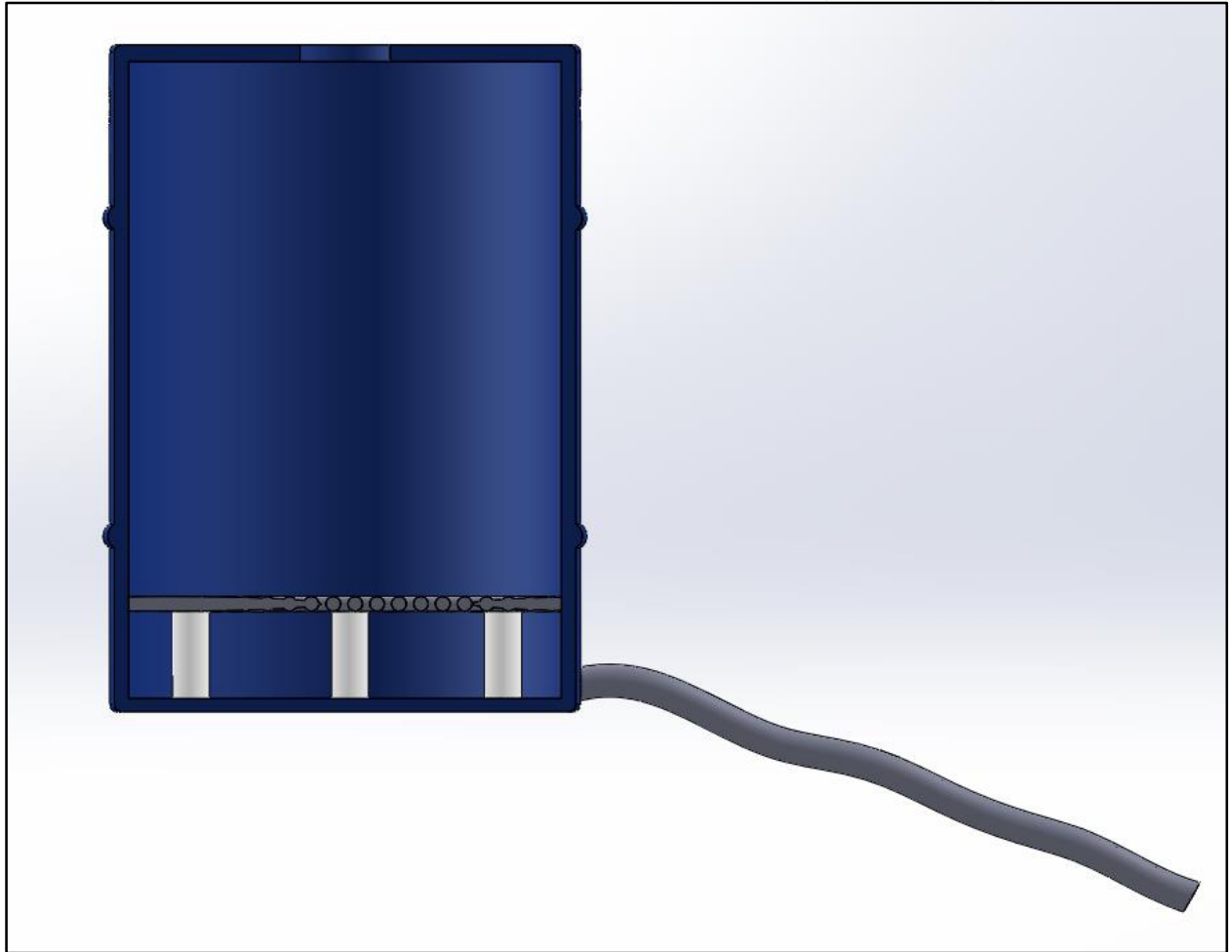
## Design: Composting Bin ☀️



For this portion of the design, we created a gap using PVC pipes and a metal mesh to allow for liquids to drain out the bottom through a perforated tube. This gap also aids in the ventilation process due to the different densities of dry and moist air.

\*It is important to not damage the ventilation pipes when emptying the bin.

## Cross-sectional View of the Composting Bin



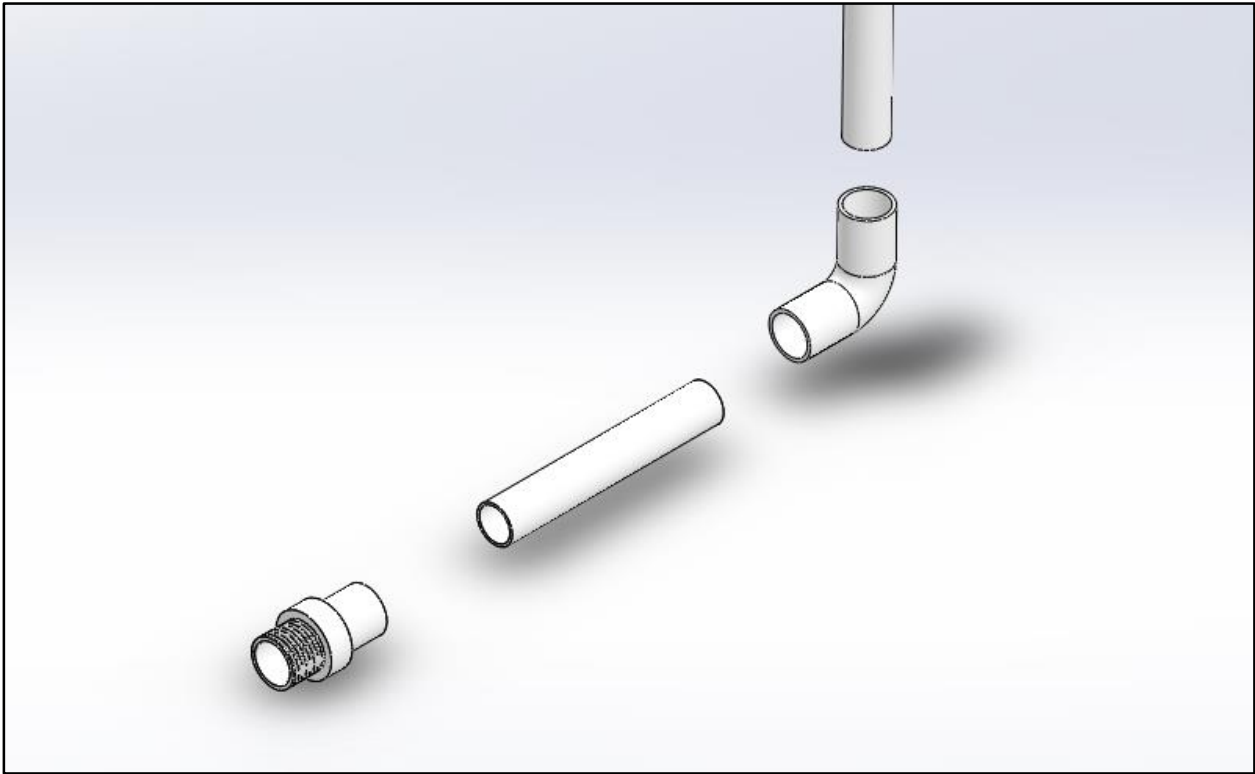
Alternate View of  
the Composting Bin

## Design: Ventilation System ☀️

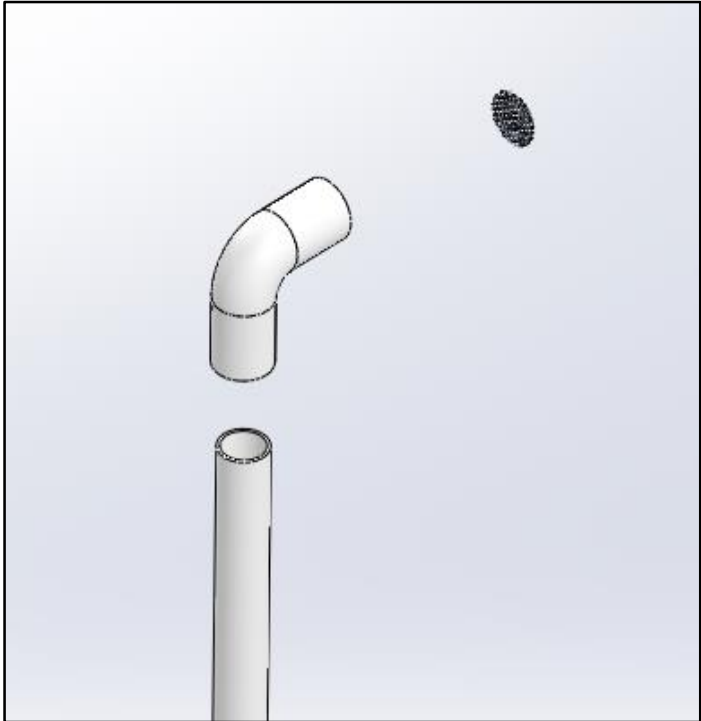


PVC pipes work well as the main component of the system. The PVC pipe should stem out horizontally from the composting tank before using an elbow piece to turn the PVC pipe vertically upward, ideally above the level of the house's roof to prevent any odor from venting near windows. The top of the PVC pipe should have both a metal mesh sheet cover to keep out vermin and a metal roof or elbow piece to keep out rainwater. To optimize the ventilation system, a small fan, such as one from a computer, can be utilized inside the PVC pipe to help circulate air.

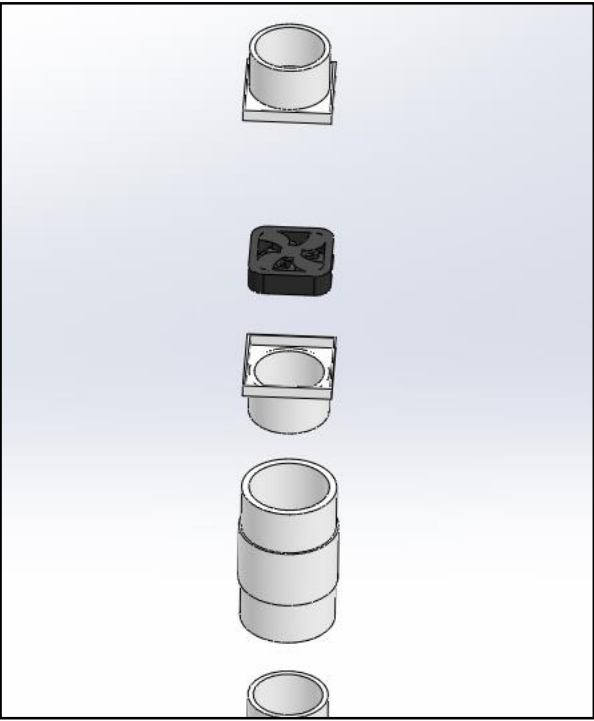
# Elbow and Connector Portion of the Ventilation System



Top part with mesh segment

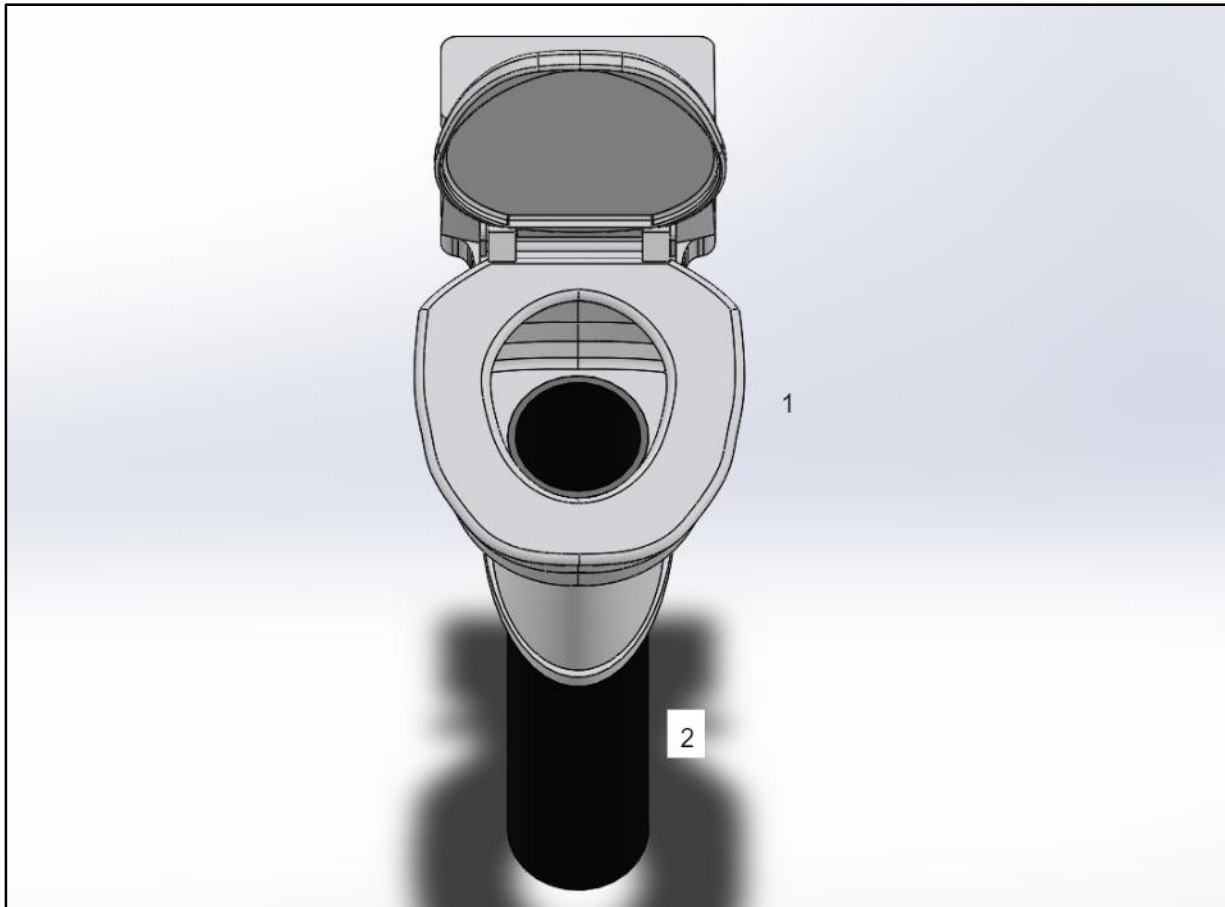


Fan segment



# How to Install a Composting Toilet ☀️

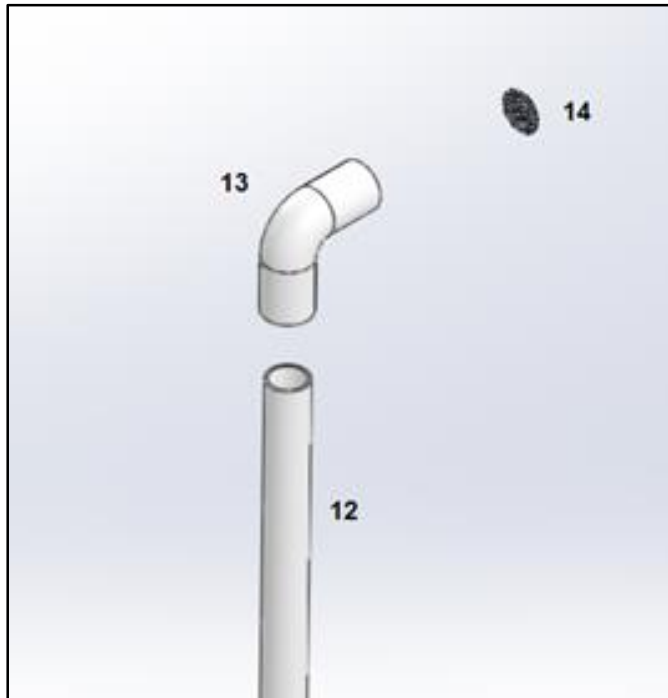
## Set up the pedestal



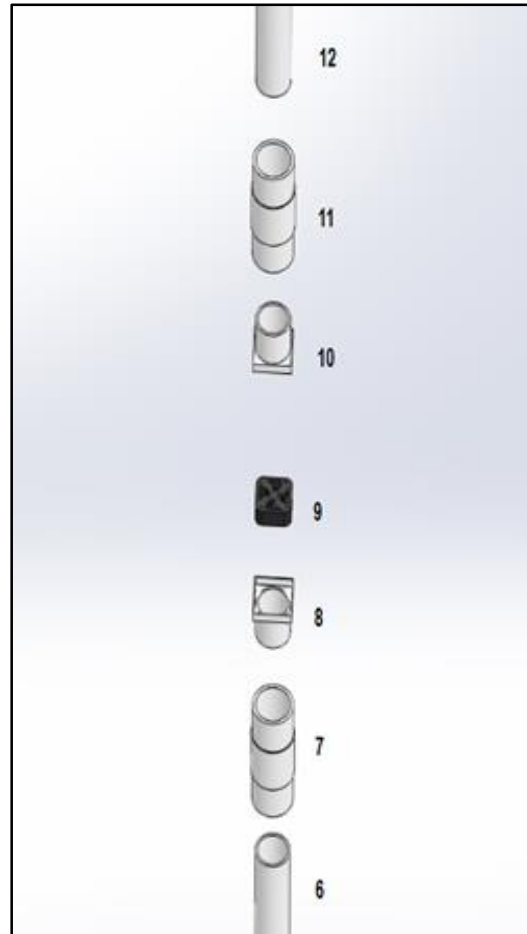
1. Find an old ceramic toilet [1] that is no longer in use.
2. Use a glass cutter to drill a hole with a 180mm diameter into the bottom of the bowl.
3. Insert the 1,000mm black plastic tubing [2] through the newly cut hole.
4. Secure the black tube [2] and the toilet bowl with a water-proof sealant.

# Set up the ventilation system

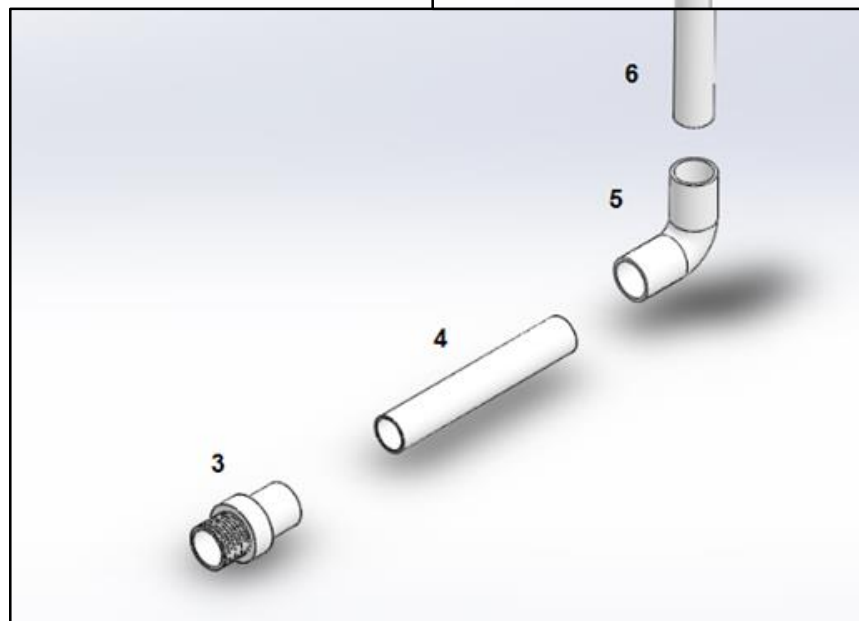
Top



Middle



Bottom

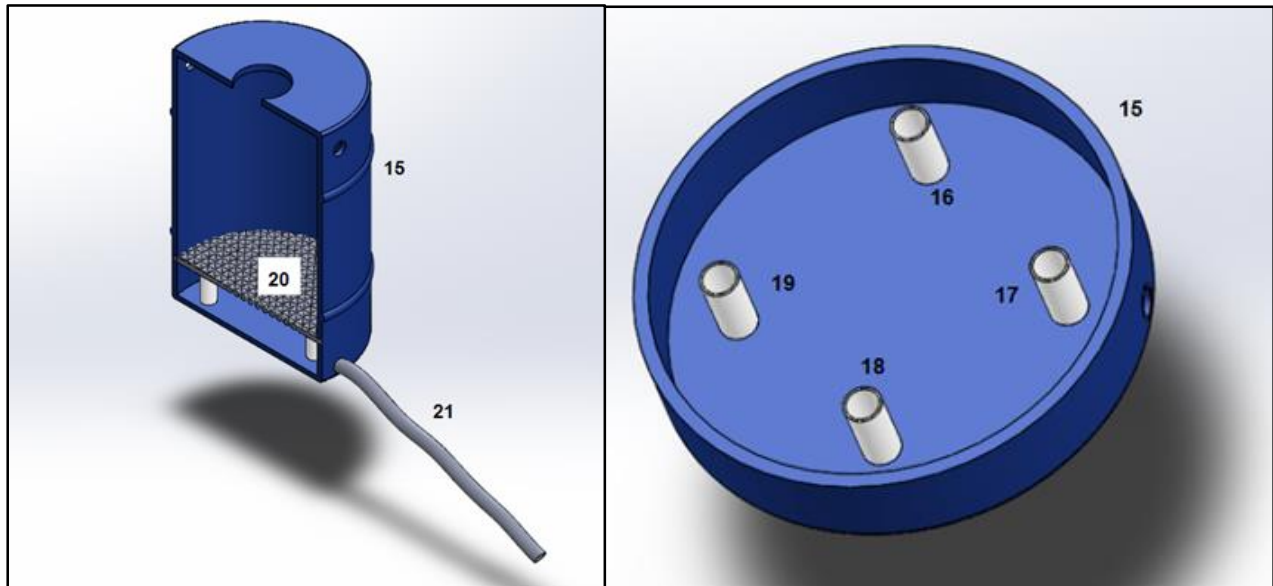




## Set up the ventilation system (continued)

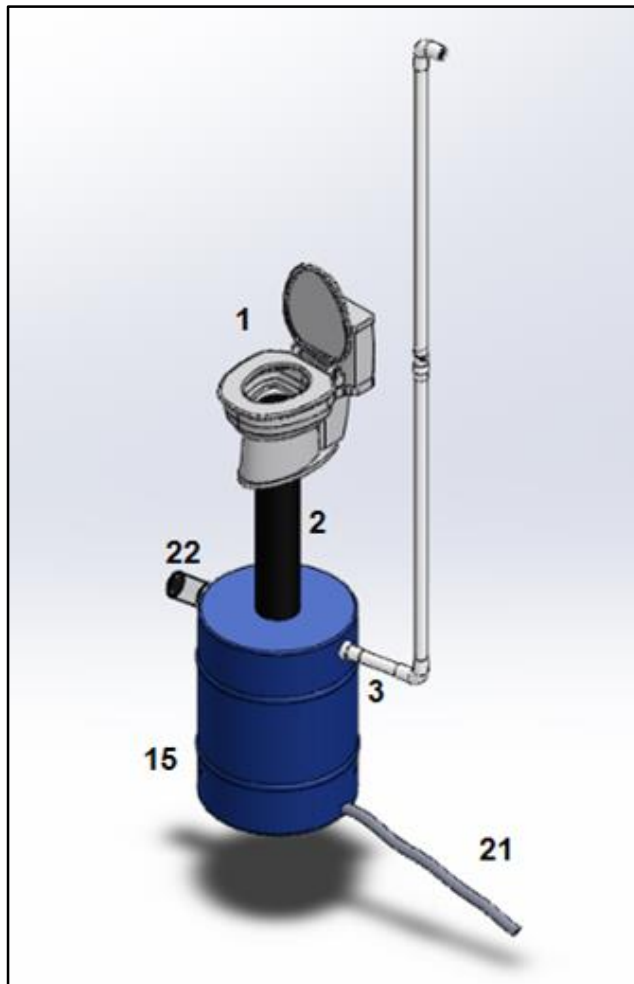
1. Attach the PVC Male Adapter [3] to one of the 320mm PVC pipe [4].
2. Attach the 320mm PVC pipe [4] to one of the PVC elbows [5].
3. Attach the previous PVC elbow [5] to one of the 1,500mm PVC pipes [6].
4. Attach the previous 1,500mm PVC pipe [6] to the PVC connector [7].
5. Attach the previous PVC connector [7] to the PVC square housing [8].
6. Insert the fan into computer fan [9] into the PVC square housing [8].
7. Attach the second PVC square housing [10] on top of the computer fan [9].
8. Attach the second PVC connector [11] to the second PVC square housing [10].
9. Attach the second 1,500mm PVC pipe [12] to the second PVC connector [11].
10. Attach the second PVC elbow [13] to the second 1,500mm PVC pipe [12].
11. Insert the 2" diameter circular mesh [14] inside of the second PVC elbow [13].

## Set up the composting bin



1. Drill a 180mm diameter hole into the center of the composting bin [15] lid
2. Remove the lid of the composting bin [15]
3. Using water-proof sealant, attach the four 120mm PVC Pipes [16-19] equal distance from each other around the bottom of the bin [15]
4. Insert the 640mm diameter mesh circle [20] into the composting bin [15] so it is resting on top of the four PVC pipes [16-19] on the bottom
5. Drill one hole with a 2" diameter 60mm from the bottom of the composting bin [15]
6. Attach the long plastic tube [21] to the 2" hole
7. Drill another 2" hole directly above the previous 2" hole approximately 120mm from the top of the bin [15]
8. Drill a third 2" directly across from the second hole so that it is located 120mm below the lid on the opposite side of the composting bin [15]

## Putting it all together



1. Put some sugar and water into the clear empty bottle [22] and attach it to the third hole that was drilled into the bin
2. Attach the whole composting bin system [15] to the 1,000mm black plastic tube [2] (Place the composting bin on an elevated object if it will not reach it standing alone)
3. Attach the whole ventilation system [3] to the second hole that was drilled in the composting bin [15], so that it is going vertically upwards the long way

# How to Maintain a Composting Toilet

Composting toilets require different maintenance than flushing toilets that the owner must acclimate to. Composting, updating, additives, and emptying the bin are all pieces of the composting toilet puzzle!

Like any toilet, a composting toilet will get dirty. When it's time to clean it, be sure to use a biodegradable detergent so you don't hinder the composting process.

## Composting

Compost can be used in any garden or yard after it has sat for at least 6 months!

## System updates

As your needs change, your toilet can too! Design features can be added or adapted

## Additives

Organic materials need to be added in order for the waste to be break down properly.

## Emptying the bin

The composting bin needs to be emptied every 6 months.

## Additives

Due to the high nitrogen content of human excreta, you must add supplemental materials to aid the composting process.

A 1:30 nitrogen to carbon ratio is needed for good compost. However, a 1:8 nitrogen to carbon ratio is reached from solely feces.

In order to achieve a good ratio, you must include additives to homogenize your compost. These additives also create air pockets in the human waste in order to ease aerobic decomposition. Additives can be any somewhat dry plant material, as long as it is ground into the appropriate consistency, such as coco coir, paper products, or cardboard. Below are our recommended additives.

### Recommended Additives:

- **Sawdust**
  - Sawdust is the most popular additive for composting toilets. It has a nitrogen to carbon ratio of 1:60, so just a handful will bring the ratio to where it needs to be.
- **Dry leaves**
  - Dry leaves are also a popular option since they are extremely inexpensive and easy to find.
- **Wood or Bark Chips**
  - Wood and bark chips also soak up moisture during the composting process, helping to mitigate odor.

### Disclaimer:

There are some additives that we advise against including in your compost.

- **Lime**
  - Lime often kills all important microorganisms that allow the composting process to occur.
- **Food Waste**
  - You should only include food waste in your compost if you feel comfortable with potentially attracting animals.

## How to Empty the Bin

1. Prepare a space for the compost to be dumped out.
2. Unscrew the leach tube from the bin.
3. Unhook the ventilation pipes from the bin.
4. Unhook the chute from the composting bin.
5. Bring the composting bin to where the compost pile will be.
6. Be sure to not damage the perforated bottom.
7. Open the lid of the bin and turn it on its side.
8. Dump all the contents from the bin into the pile.
9. Add some compost to the bottom of the empty bin to provide a base for new composting to happen.
10. Screw on the leeching tube.
11. Hook up the chute to the composting bin.
12. Reattach the ventilation pipes.

### Helpful Tips:

- Don't reattach a completely empty compost bin. Your compost needs microorganisms and organic material to get started again.
- Always detach the ventilation pipes, leaching tubes, and chute before trying to move the compost bin!

## Compost Use 🌞

The compost from your toilet can be used like any other compost! Make sure you let your compost completely break down (at least 6 months, but we recommend a year) before you disperse it. Otherwise, there is a risk of spreading harmful bacteria. If you are concerned that the compost has not finished breaking down, you can add organisms such as worms to the mix to help the process along. But once it's fully composted, feel free to spread it wherever you want!

### Here's a few ideas to get you started:

1. Mix it with other compost
2. Topsoil
3. Lawn
4. Around fruit trees
5. Scatter it in the forest
6. Indoor plants
7. Flower Garden
8. Vegetable Garden\*

\*While fully composted human waste is safe, many people prefer to avoid using the compost on food crops.



## Trial and Error

This is by no means a perfect design. When building your own composting toilet, there can be some growing pains. While this is the design we think is easiest to build, install, and maintain, feel free to make your own modifications!

### Vermicomposting

Vermicomposting is composting with the use of earthworms to aid in the composting process. If you want to speed up your composting add a few handfuls of earthworms to your composting bin.

### Urine diverter in the seat

People have had varying degrees of success adding a urine diverter to the seat. If the urine diverter is too large, solids will get caught. However, if the diverter is too small, it can be difficult to use. Depending on the needs of your household, you could add a urine diverter to the toilet seat to collect the urine in a separate bin. This urine can be diluted with water and used as a fertilizer (approximately 1:50 ratio).

A resident in Monteverde has seen success using a car tire to divert urine in his system. Another has a modified toilet seat with hole in the front of their toilet with a pipe to collect urine.

### Compost stirrer

Some composting toilet systems have a stirrer to stir the compost in the bin. Depending how your compost is forming, you can stir your compost every few weeks. This is entirely up to your preferences.



## Multiple Bins

Constructing a second or third composting bin eliminates the need for open compost piles. You can put your bins on a rotation so when one is full and the compost is forming, another one can be attached to your system.

## Troubleshooting

### **My composting toilet smells bad!**

1. Make sure the lid is closed when not in use.
2. Make sure the lid is tightly fitted to the opening to stop any odor from escaping.
3. Try a different additive. Depending on your system, different additives may work better at absorbing liquids or masking the smell.
4. Check your ventilation system, make sure it isn't clogged and your fan is still functioning.

### **There are flies.**

1. Make sure the lid is closed when not in use.
2. Check the fly trap, it might be full.
3. Add more additives after every use, the ratio may be off which results in a bad odor that can attract flies.
4. Get an additional fly trap.

### **My fan broke.**

1. Replace it with a fan you can buy from a local electronics store.
2. Remove the fan completely. While it is a helpful addition to the ventilation system, they aren't necessary.

This can happen because there's too much condensation in your ventilation pipe due to Monteverde's climate.

### **There's too much liquid in my compost.**

1. Add more additives! They improve your compost by absorbing excess liquid.
2. If your regular additives are not working, try adding soil to add more solids to your system.
3. Check your drainage system and urine diverter, one or more may be clogged.

## FAQs

### **What if my composting toilet smells?**

Composting toilets require the use of additives, such as sawdust or dry leaves, in order to adjust the carbon to nitrogen ratio. Adjustment of this ratio also results in a significant reduction in odor.

### **Will it be more expensive?**

The upfront cost of installing a composting toilet is greater than that of installing a flushing toilet if you already have the infrastructure to accommodate them. However, owning a composting toilet saves money over time.

### **Will it require more maintenance than my flushing toilet?**

You can design your composting toilet with maintenance requirements in mind. Larger tanks are often tied to a much lower necessary emptying frequency. As long as you continue including additives, the waste will naturally detoxify and become compost on its own.

### **Are composting toilets sanitary?**

Any potentially dangerous bacteria is destroyed in the composting process. As long as the waste has time to rest and enough additives are included, humanure compost is just as sanitary as any other type of compost.

## FAQs

### **Can I put toilet paper in?**

Adding toilet paper to your compost bin is completely fine. In fact, it's better for your compost! It aids in balancing the carbon to nitrogen ratio. Higher ply toilet paper will take longer to compost but will break down eventually.

### **How long will it take to fill the barrel?**

For an average family of four, the composting bin will take approximately six months to fill. Depending on how often it is used and how much additives you are using, the bin could fill faster. If you find your bin is filling up too quickly, you can upgrade to a larger bin.

### **How does the composting process work?**

The waste that you produce is 70-90% water. During the composting process, this water evaporates and exits the composting bin through the ventilation system. The compost pile reduces to 10-30% of its original volume. Any pathogens present in the compost pile is destroyed by the aerobic breakdown.

### **How do I know when the compost is ready to use?**

You know your compost is ready to use when it looks and smells like very dark, rich soil.

## Resources

- *The Humanure Handbook* by Joseph C. Jenkins
- *The Composting Toilet System Book: A Practical Guide to Choosing, Planning and Maintaining Composting Toilet Systems, an Alternative to Sewer and Septic Systems Book* by David Del Porto and Carol Steinfeld
- “Do It Yourself” *DIY Compost Toilet Manual* by Nature Loo
- Blog Post about Composting Toilets on [corclima.org](http://corclima.org)

**Special thanks to the members of the Monteverde community who shared their knowledge with us.**