雨水過濾系統

LOVE BINTI

RAINWATER FILTER SYSTEM

An Educational Manual on the Rainwater Filter System.

一本關於雨水過濾系統的教育手冊

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雨水過濾系統

RAINWATER
FILTER SYSTEM

LOVE BINTI

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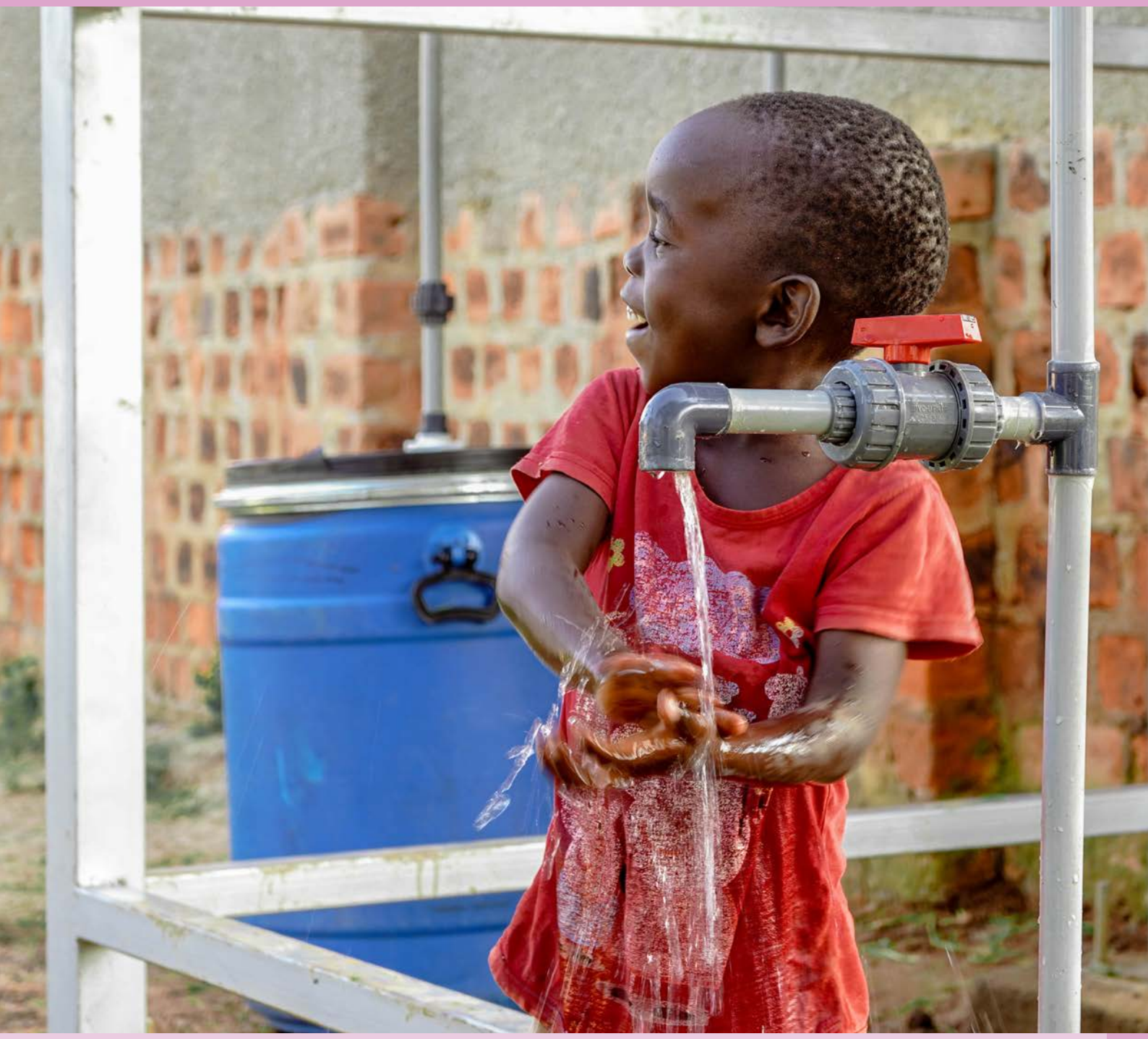
THE LIGHT
MUKONO



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INTRODUCTION OF THE RAINWATER FILTER SYSTEM

雨水過濾系統介紹

Why?

Clean water is essential for life. Yet, more than half of Ugandas population of 20 million people still lack access to safe drinking water.

Better access to water is also inseparable from the improvement of sanitation and hygiene. The immediate economic and social impact of investing in water, sanitation and hygiene is considerable.The rainwater filter system is providing another solution for people, and giving people the opportunity to access clean water to use in their household activities.

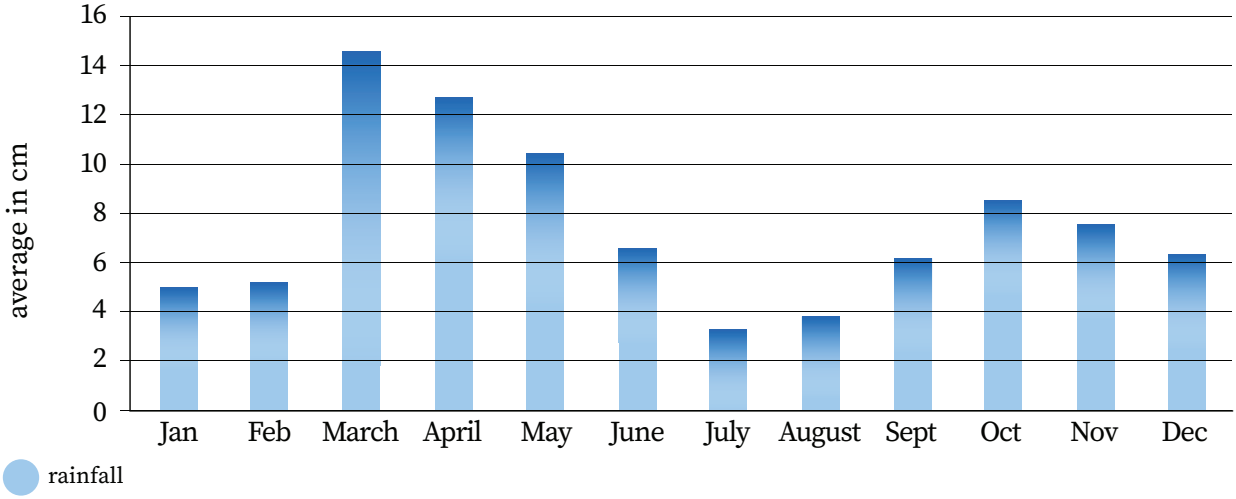
為什麼需要雨水過濾系統?

以提供乾淨的用水為目標，其中包括:掘井、匯集雨水、淨水過濾、煮沸、興建廁所、化糞池有效提升環境衛生與防止疾病散撥。人們缺乏衛生設施，和衛生條件(WaSH)，就招致痢疾，傷寒相關傳染疾病的威脅。在非洲的低開發地區，約十億人缺乏基本的衛生。乾淨的水源，能夠幫助偏鄉節省醫療支出，有效提升孩童與婦女受教育的權力與健康

其中收集雨水是相較容易的取水方式，透過雨水過濾系統，讓居民能夠有安全的水源作為日常的使用，也確保讓在偏鄉的居民都能擁有使用乾淨水源的權利

Average Rainfall in Uganda

烏干達每月的平均降雨量



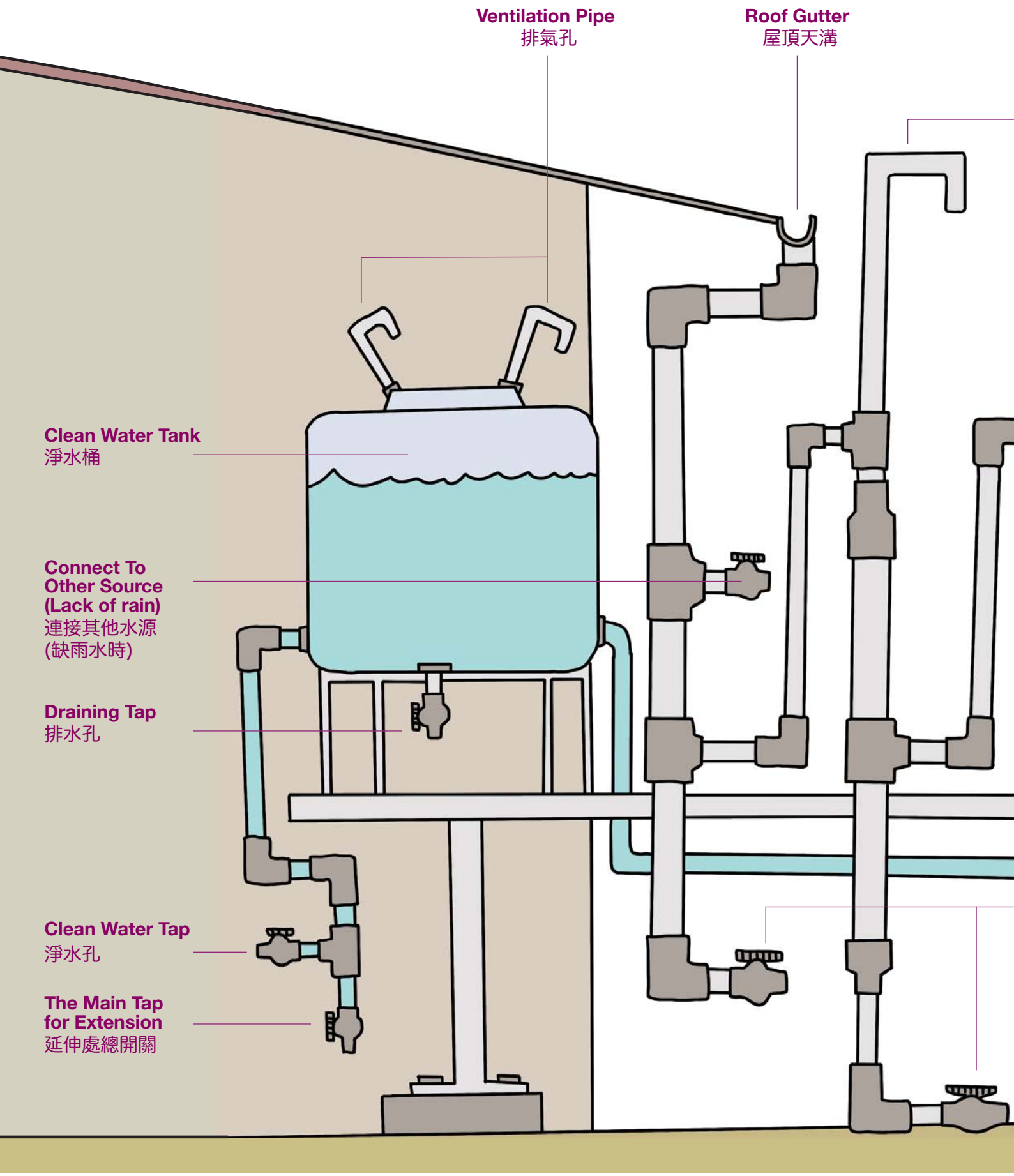
The advantage of rainwater filter system

1. The system will collect and filter the water from the rain. After the process, we will have clean water to use.
2. All the accessories can be easily removed in order to decrease the maintainance cost.
3. The system is easy to be assembled.
4. The system provides a cheaper solution of getting clean water, than drilling a borehole.

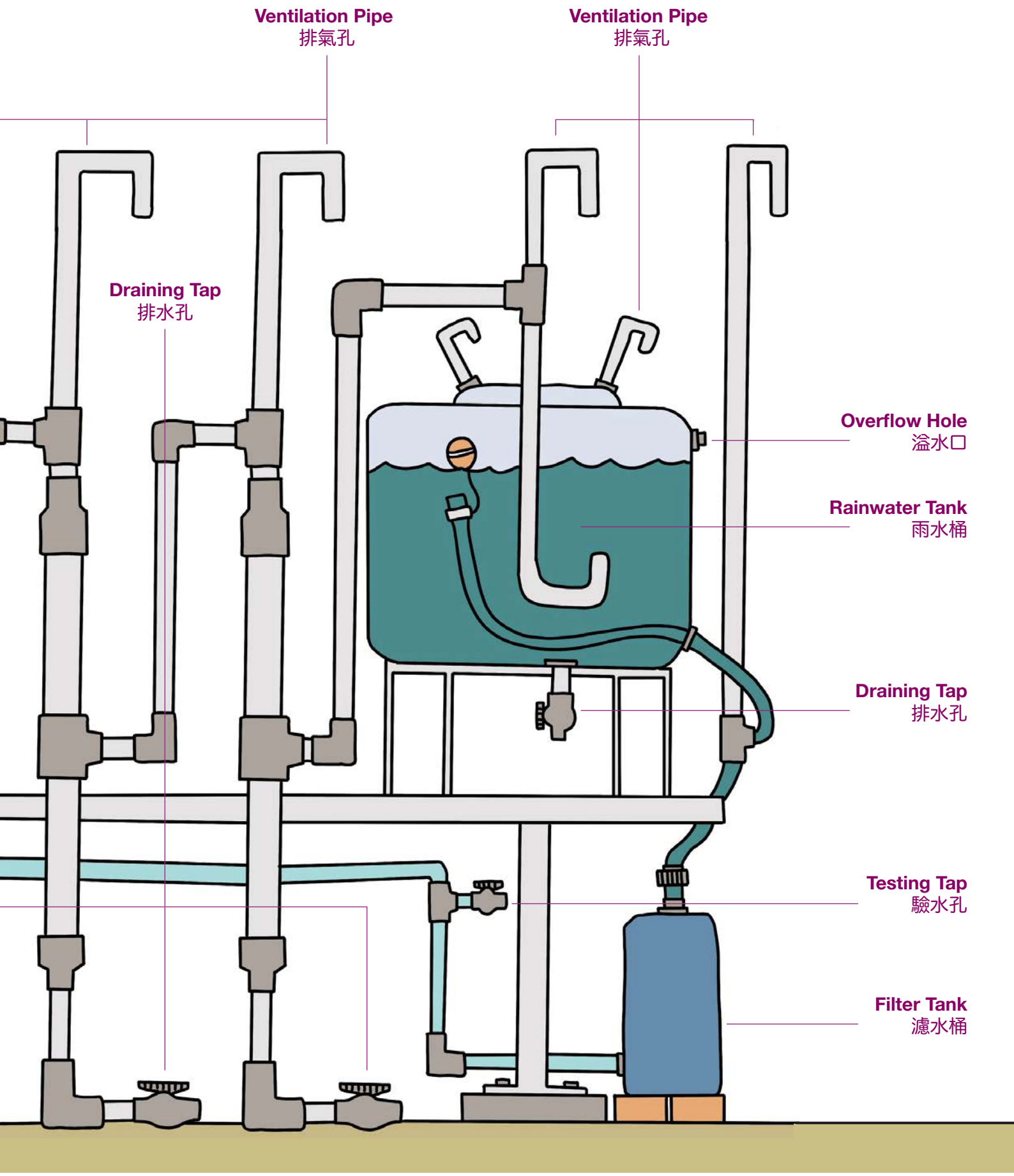
雨水過濾系統的好處

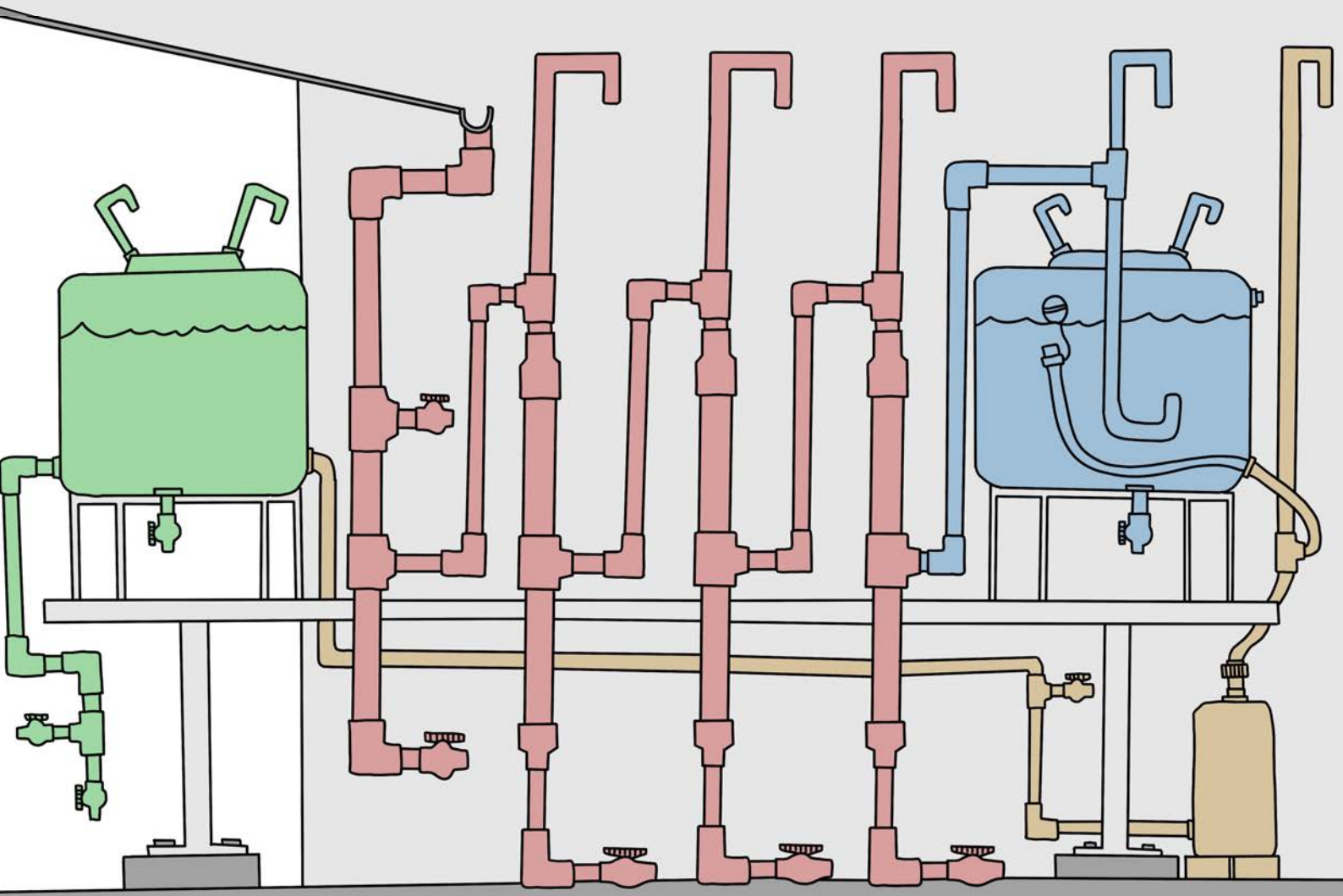
1. 只需收集雨水，過濾後即有乾淨的水源使用
2. 每個組件是分開的，降低維護成本
3. 邏輯簡單，組裝容易
4. 提供相對便宜取得乾淨水源的方式

HOW THE RAINWATER FILTER SYSTEM WORKS



雨水過濾系統是如何運作的





THE PROCESS OF THE RAINWATER FILTER SYSTEM
運作過程說明

Step 1
The system will collect the rain from the roof gutter and go through these four pipes. The dirt will settle down to the bottom of the pipes and clean water will continuously go to the Rainwater Tank. All taps(PVC Union Ball Values*) on the bottom should be turned on after a period in order to get rid of dirt.

步驟一
由屋頂的天溝接下來的是一組四根的連續水管，這部分主要負責的是將雨水中的沉積物，藉由沉澱的效應，沉澱到最底下，讓乾淨的水能繼續前往下一個階段，最底下為排水管，一段時間後需要開啟將沉澱物排出

Step 2
This tank is for storing the water from the rain. Since the water has only gone through the first step, means that the water is not clean yet. The dirt in the Rainwater Tank will settle down to the bottom after a short period of time. The Rainwater Tank needs to be cleaned every second month.

步驟二
由四根連續水管連接到此處的是第一個雨水桶，由於有大量未經過濾的雨水會停留至此處，所以也需要時常確認此雨水桶的內乾淨程度，每兩個月需要定期清潔打掃

Step 3
The Filter Tank is the most important part of the system. It filters most of the dirt in the rainwater and turns into clean and efficient water. The filter is composed by sand, gravel, stones and charcoal. After this process, the clean water will go on to the next tank for storing clean water.

步驟三
此處為此系統最重要的部分，即是將雨水過濾成乾淨的水，此濾水桶是由沙、石頭、炭、小碎石所組成，主要是要將雨水夾帶的雜質留在此處，而乾淨的水可以進到最後的淨水桶

Step 4
The Clean Water Tank is for storing the clean rainwater after the process in the Rainwater Filter System. The water that comes out of this tank can now be used directly. Have in the mind to always check inside of the tank after some time.

步驟四
有別於上一個雨水桶，此淨水桶是用來儲存乾淨的水，從此處連接出去的水龍頭，打開後即是可以使用的水，但須注意，也需要確認此桶內的乾淨程度，以及排出來的水質清晰程度

*Read the Tool & Accessories List on page 17

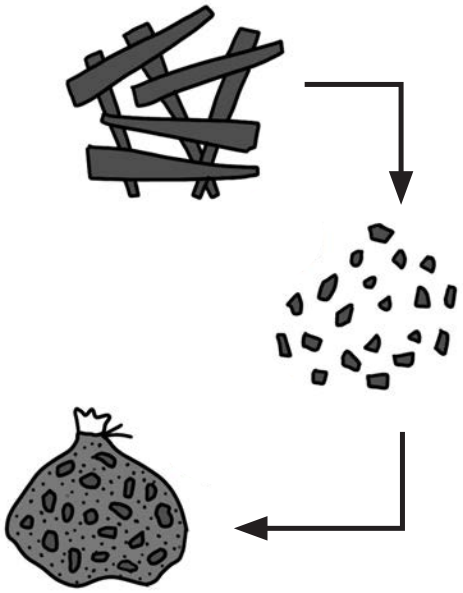
INTRODUCTION OF THE FILTER TANK

濾水桶介紹

How does the Filter Tank work:
濾水桶是如何運作的:

By using this Filter Tank system, you will filter all particles from the rainwater and it will become clean water. The materials in the Filter Tank will be placed from big to small to block the dirt when the rainwater runs through it.

利用設計後的過濾機制，將雨水中的雜質，由大到小，由粗到細，一層一層地留在此過濾桶當中，只排出乾淨的水



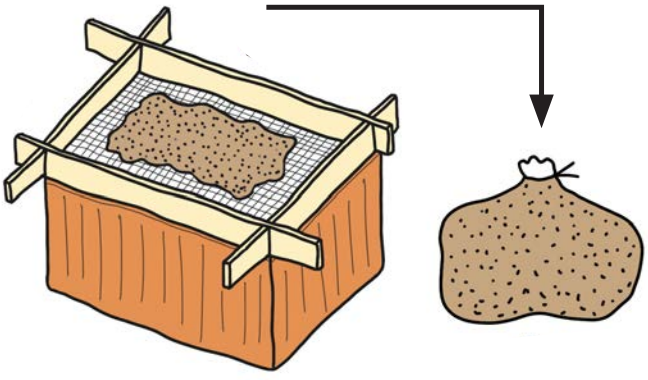
Preparation of the Filter Tank content:
準備放入濾水桶的內容物:

How to make a bag of charcoal:
如何製作濾水桶的炭:

Break the charcoal into small pieces. The size of the charcoal should be around 5mm.
敲碎木炭 / 竹炭至小塊狀 (非粉狀)

Put the charcoal pieces into a textile bag / 將炭放入至可透水的袋子

Flush the bag untill the water become clean before use / 沖水直到水變得乾淨再使用



How to make a bag of fine sand:
如何製作濾水桶的沙:

Filter the sand with a siever
過濾太大的雜質，留下細小的沙

Wash the sand afterwards
將沙清洗乾淨

Put the washed sand into a textile bag / 將乾淨的沙放入至可透水的袋子

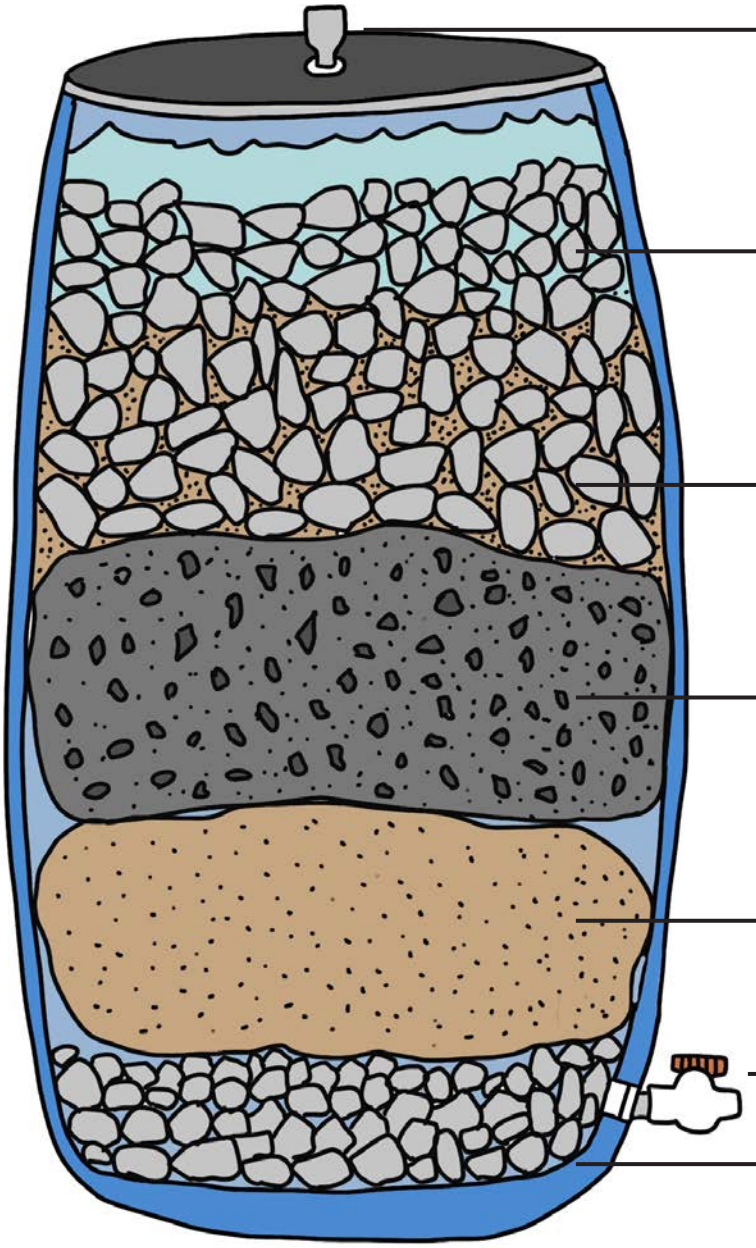
What does the Filter Tank contain: 濾水桶的內容物:

Gravel
(size: 0.5-1cm) /
0.5-1 公分的小碎石

Fine sand / 細沙

Charcoal
(size: 0.5cm) /
0.5 公分的炭

Stones
(size: 2-3cm) /
2-3 公分的石頭



Adapter attached on the top of the cover
在蓋子上安裝連接管

Stones 25%
石頭 (四分之一滿)

Sand fill up between stones
用沙填入石頭間的縫隙

A bag of charcoal 25%
一袋炭 (四分之一滿)

A bag of fine sand 25%
一袋沙 (四分之一滿)

Tap by the gravel section
出水口落在小碎石處

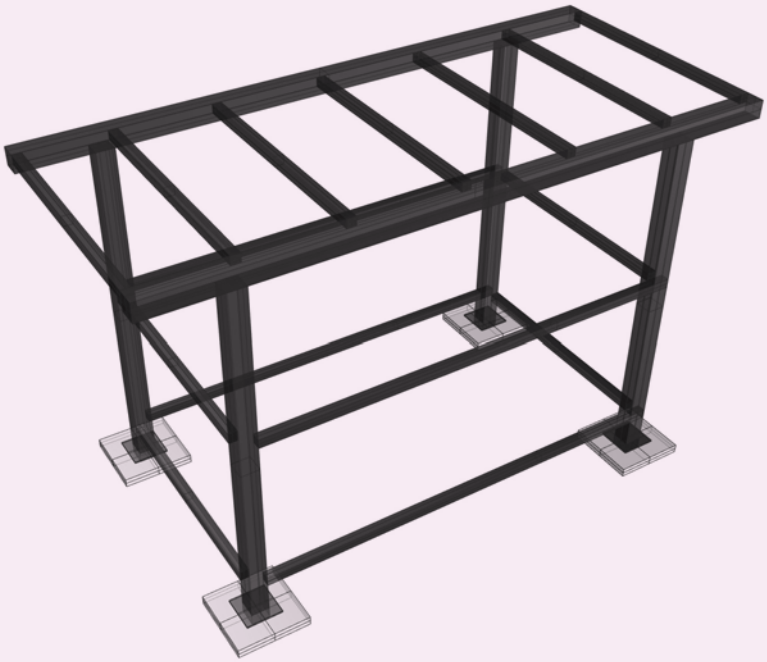
Gravel as foundation 25%
小碎石 (四分之一滿)

MATERIAL LIST FOR THE RAINWATER FILTER SYSTEM
雨水過濾系統的材料清單

Steel structure 基礎圖面

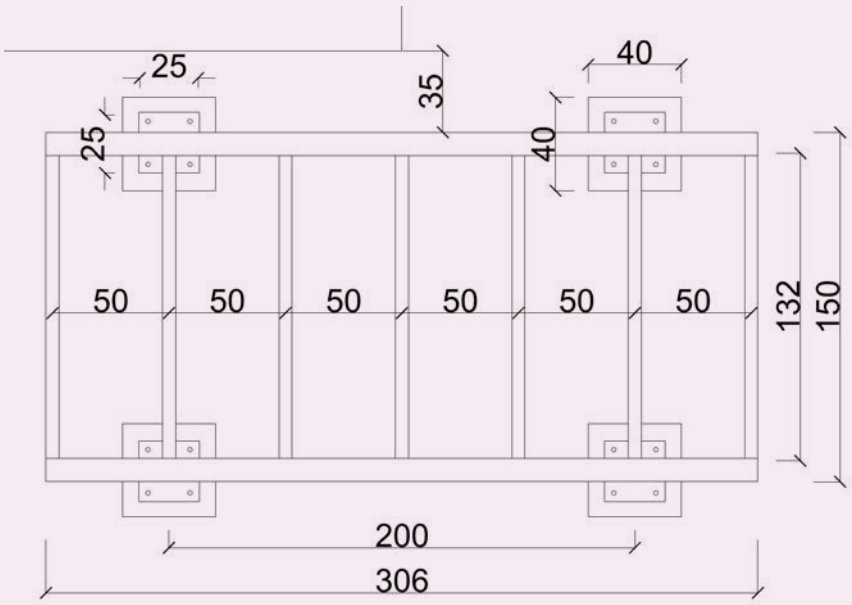
Steel pillars / 鋼條
9cm x 9cm @0.5cm, 200cm, 4pcs
9cm x 9cm @0.5cm, 306cm, 2pcs
5cm x 5cm @0.5cm, 190cm, 4pcs
5cm x 5cm @0.5cm, 132cm, 11pcs

Metal plates / 鋼板
25cm x 25cm @1cm, 4pcs

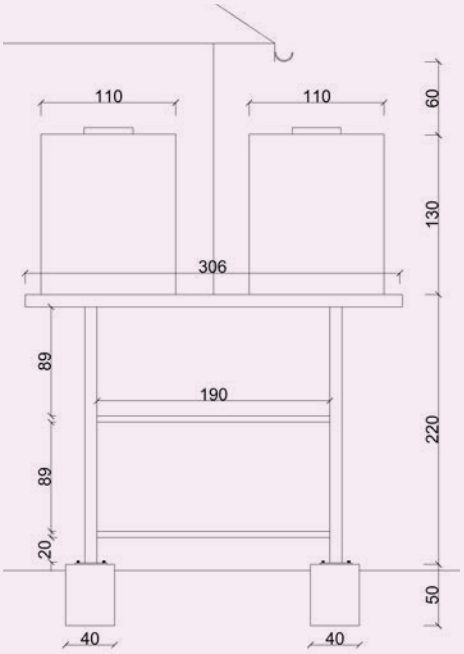


Drawings of foundation 基礎圖面

Plan 平面圖



Elevation 立面圖



Tools 工具

Measurement Tape / 捲尺
Shovel / 鏟子
Hoe / 鋤頭
Bowsaw / 鋸子 (木頭)
Brush / 刷子
Trowel / 抹刀

PVC Pipe Glue / PVC 管黏著劑
Hacksaw / 鋸子 (PVC 管)
Thread Seal / PVC 管防水膠帶
Drilling Machine / 電鑽
Gas Torch / 瓦斯噴槍
Scissor / 剪刀

Pipe Wrench / 板手
Silicone / 矽利康
Ladder / 梯子
Waterproof Tape / 防水膠帶
Hammer / 鐵鎚

Accessories 配件

① PVC Pipe	② PVC Pipe	③ PVC Pipe	④ PVC D.Elbow	⑤ PVC D.Elbow	⑥ PVC D.Elbow
size ¾"	size 1"	size 2"	size ¾"	size 1"	size 2"
quantity 16 M	quantity 18 M	quantity 12 M	quantity 10 pieces	quantity 14 pieces	quantity 2 pieces

⑦ PVC Tee	⑧ PVC Tee	⑨ PVC Tee	⑩ PVC Reducing Socket	⑪ PVC Union Ball Value	⑫ PVC Union Ball Value
size ¾"	size 1"	size 2"	size 2" to 1"	size ¾"	size 1"
quantity 2 pieces	quantity 4 pieces	quantity 5 pieces	quantity 12 pieces	quantity 10 pieces	quantity 5 pieces

⑬ PVC Union Ball Value	⑭ Roof Gutter	⑮ Running Outlet	⑯ PVC Down Pipe	⑰ Support Bracket	⑱ Join Bracket
size 2"	size 110 MM	size 110 MM	size 80 MM	size 110 MM	size 110 MM
quantity 1 piece	quantity 10 M	quantity 1 piece	quantity 1 piece	quantity 8 pieces	quantity 1 pieces

⑲ Stop End	⑳ PVC Clip	㉑ PVC Clip	㉒ PVC Clip	㉓ Connector	㉔ PVC Male Adapter
size 110 MM	size ¾"	size 1"	size 2"	size ¾"	size ¾"
quantity 2 pieces	quantity 8 pieces	quantity 10 pieces	quantity 10 pieces	quantity 14 pieces	quantity 14 pieces

㉕ PVC Union	㉖ PVC Coupler	㉗ PVC Coupler	㉘ PVC Coupler	㉙ 1000L Tank	㉚ 135L Tank
size ¾"	size ¾"	size 1"	size 2"	size 1000L	size 135L
quantity 8 pieces	quantity 2 pieces	quantity 2 pieces	quantity 2 pieces	quantity 2 pieces	quantity 1 pieces

建造過程

BUILDING PROCESS

1) Laying off the foundation

1) 放樣基礎

1. Lay off the foundation. It is important to follow the dimensions from the construction drawings. **2. Dig the holes 50cm.** Need to make sure the depth of holes is up to 50cm. **3. Put the concrete to the bottom.** Put 5-10cm concrete to the bottom of holes to have flat surface.

1. 放樣基礎，按照圖面上的尺寸，標記在基地上 **2.** 下挖50公分的洞，為了能夠讓基礎能穩固的站立，必須確保往下埋入的深度是足夠的 **3.** 在洞的底部鋪設水泥打底，鋪設5到10公分的水泥，讓之後的鋼結構能夠有較穩固且平整之處可以站立

2) Installing the foundation

2) 放置基礎

1. Cut the wood plank to 55cm. The long wood plank need to be cut in 55cm to make the wooden forms for the concrete foundation. **2. Assemble the forms**, and to place them into the holes. The forms need to be 5cm high above the ground. **3. Put the steel structure into the wooden forms.** Check the level of every corner and make sure it is stable.

1.將木頭切至55公分，以製作用來灌注混凝土的模板 **2.** 組裝木板成模板，將模板放置進已預先挖好的洞，摸版將會高於地面5公分 **3.** 將鋼結構放置進模板內，必須將鋼結構調整至水平的狀態

3) Fixing the foundation with concrete

3) 倒入混凝土至模板內

1. Make sure the steel structure level is horizontal, and is placed in the middle of the wooden forms. **2. Mix concrete and put it into the wooden forms.** Then use trowel to flatten the surface of the concrete and make it straight. **3. Clean and remove the concrete from the bolts. 4. Remove the wooden forms,** and fill up the empty space with soil.

1. 確認鋼結構的水平狀態以及被放置在模板的中央處 **2.** 將水泥、石頭、沙、水，攪拌成混凝土後，倒入至模板內，再將混凝土的表面抹至平整 **3.** 需將殘留在螺栓上的水泥清除 **4.** 放置混凝土至凝固且強壯後，即可將模板拆除，再將土回填

4) Installing the first part of Rainwater Filter System

4) 安裝第一部分的雨水過濾系統

1. Install the roof gutter to the roof. Make sure that the gutter is fixed properly and pour some water onto the gutter to test the direction of the rainwater. **2. Follow the construction drawing to assemble the 'pipe system'.** You will need PVC Pipe Glue when joining all of the accessories. **3. Fix the pipes to the steel structure to make sure it is stable,** and prevent it from being moved by the wind.

1. 安裝天溝至屋頂，安裝後需要確認水流是否能順利流至落水處 **2.** 按照圖面組裝第一部分的連續水管，記得在連接水管前需要塗抹水管用膠水，以確保連接狀態 **3.** 將安裝好的水管鎖固至鋼結構上，確保水管穩固且不會被強風破壞

5) Installing the second part of Rainwater Filter System

5) 安裝第二部分的雨水過濾系統

1. Install the accessories to the Rainwater Tank. Make sure all the accessories are fixed properly in order to avoid the tank from leaking. **2. Move the Rainwater Tank on top of the steel structure. 3. Connect the Rainwater Tank to the pipe system,** and prepare the pipes from the Rainwater Tank for connecting to the Filter Tank.

1. 安裝零件至水桶內，必須確認零件被鎖固至完好的狀態以避免漏水狀況的發生 **2.** 將水桶移至到鋼結構上至正確的位置 **3.** 連接第一部分的水管至雨水桶上，以及預留要連接至濾水桶的水管

6) Installing the third part of Rainwater Filter System

(See also Filter Tank instruction on page 12-13)

6) 安裝第三部分的雨水過濾系統

(看更多細節請至12-13頁)

1. Drill hole for tap on the Filter Tank at the bottom, by the gravel section for outlet of water and another hole on the top cover of the Filter Tank for inlet of water. **2. Break the charcoal into small pieces.** The size of the charcoal should be around 5mm. **3. Wash sand,** charcoal, stones and gravel carefully. Wash it until the water becomes as clear as possible. **4. Put the materials in the filter bucket step by step.** The sand and charcoal need to be put into cotton bags. **5. Fill the gap with sand in the stone section.** Confirm that the water is going trough the sections.

1. 在濾水桶頂部及底部開口，以連接來至雨水桶的雨水，及連接後續的水管 **2.** 敲碎木炭至碎片約5毫米，須避免敲至粉末狀 **3.** 清洗石頭、沙、木炭、小碎石至清洗的水是乾淨的為止 **4.** 將材料照順序地放置進濾水桶內，沙和木炭必須分別裝進可透水的袋子裡 **5.** 最上層石頭間的空隙，需用細沙填，，但須注意水能夠順利流出

7) Installing the fourth part of the Rainwater Filter System

7) 安裝第四部分的雨水過濾系統

1. Install the accessories inside the Clean Water Tank. Need to make sure all accessories are fixed properly, so there is no water leaking from the tank. **2. Place the Clean Water Tank on top of the steel structure. 3. Connect with other pipes and last install the tap for clean water.**

1. 安裝配件至淨水桶上，記得一定要固定至緊實，以避免水桶內的水溢出 **2.** 放置淨水桶至鋼結構上，確認放置在圖面標示的位置上 **3.** 連接從濾水桶接上來的水管，及安裝淨水口

Testing the Rainwater Filter System (1)

測試雨水過濾系統 (1)

1. Test the system from the roof gutter. Make sure the water flow goes through every pipe without any issue. **2. Observe if any water is leaking out from any part.** Make sure the Filter Tank is not leaking, especially around the cover of the tank.

1. 從屋頂天溝處開始測試系統，確保水能夠順暢地流至每一處 **2.** 觀察各處是否有漏水的情況發生，特別是過濾桶的蓋子處

Testing the Rainwater Filter System (2)

測試雨水過濾系統 (2)

1. Remove some of the sand from the Filter Tank if necessary. Too much sand in the Filter Tank can reduce the speed/pressure of the water going through to the Clean Water Tank. **2. Make sure the cover of the Filter Tank is tight enough.** It can be the main reason for the pressure leaking which is pushing the water to go on to the Clean Water Tank.

1. 如果需要的話，減少濾水桶內的沙量，因為濾水桶內的材料密度會影響到水流出的壓力，所以如果發現水壓太小，即需適量減少濾水桶的沙量 **2.** 必須一再確認濾水桶密閉情況，因為這是影響雨水會不會到達淨水桶的主因之一

Commissioning to the community

交接給社區使用

1. Test if the water is clean enough. 2. Pass on instructions and explain all details to the community. Teach the communuity how to use and maintain the Rainwater Filter System in the most efficient way.

1. 最後測試水流與水質的狀況 **2.** 向社區解釋所有細節，包含如何確認水質，如何維護，如何更換材料

HOW TO USE THE RAINWATER FILTER SYSTEM

如何使用雨水過濾系統

1. The system can be applied on any buildings with pitched roof.

2. After rain, the Rainwater Filter System will automatically start working and clean water can be used shortly after from the tap.

3. Make sure all taps, that are connected to the Filter Tank, are turned on.

4. Make sure the water from the Clean Water Tap is clear and without any particals before use.

5. The water from Clean Water Tap is clean. The tap can also be extended to any other places.

6. If there has not rained for a while, need to let the rain to wash the roof, and switch on the draining taps for 30 miniutes before to use it.

1. 只要是斜屋頂的建築即可應用此系統收集雨水

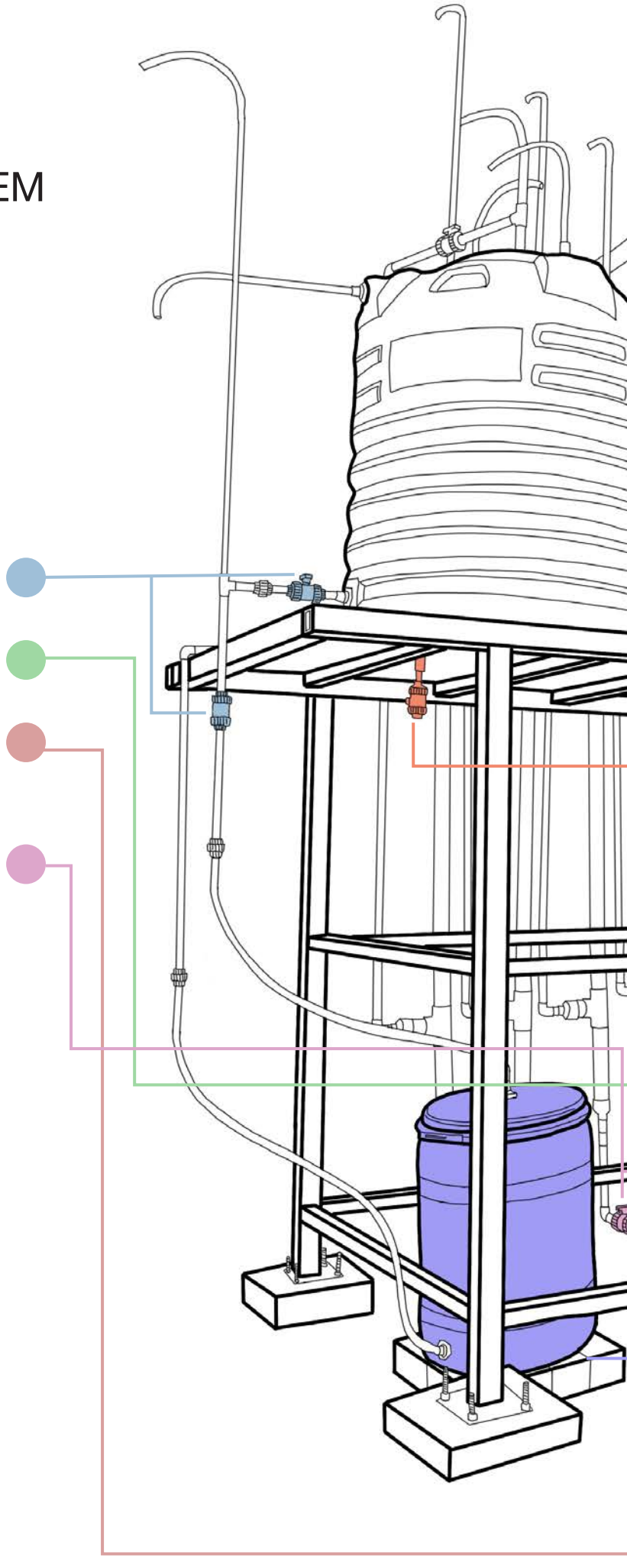
2. 在下雨過後，經段時間讓雨水中的物質下沉後，即可開始使用此系統

3. 確認各處連結到水桶的開關是開啟的狀態

4. 確認從用水口出來的水是乾淨無雜質後，再使用

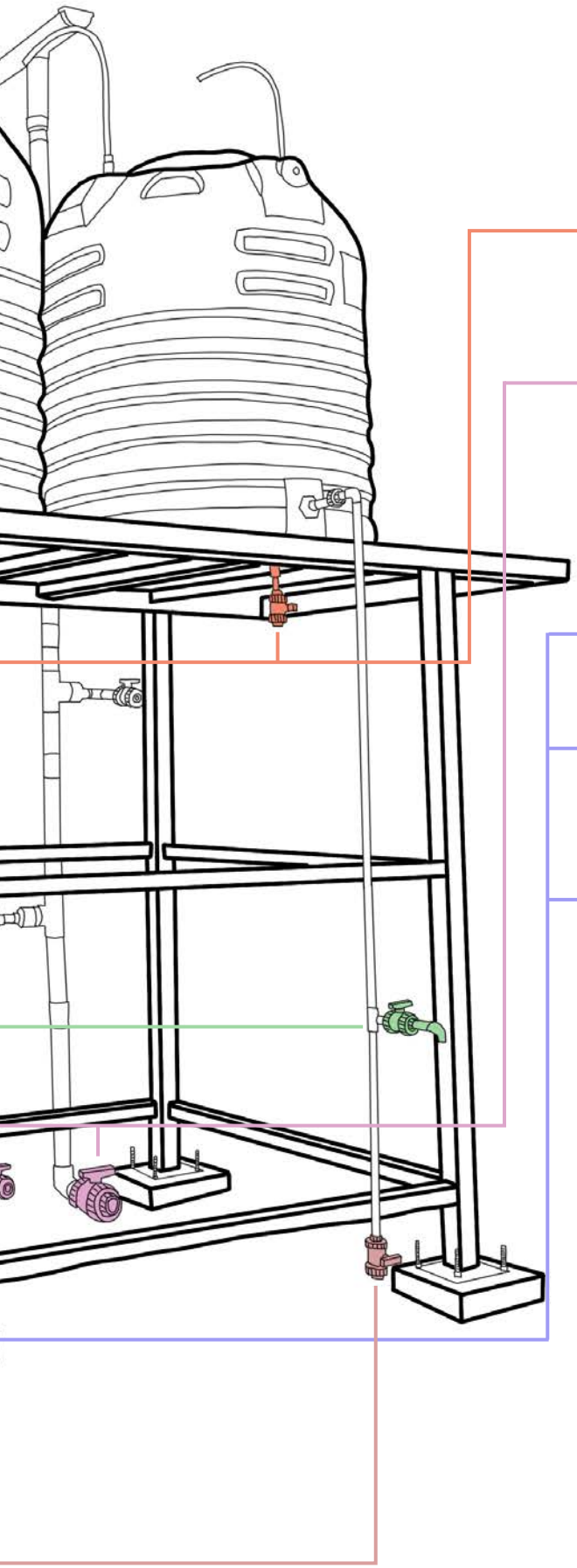
5. 可以直接從淨水口使用水，也可以從淨水口下方延伸至需要用水的地方

6. 一段時間未使用後(沒有下雨)，需讓雨水將屋頂及水管內的沈積物排出，且開啟底下的排水孔，約30分鐘後，即可開始使用



HOW TO MAINTAIN THE RAINWATER FILTER SYSTEM

如何維護雨水過濾系統



1. There are two draining taps under the two tanks. When the two tanks are too dirty or there remain too much dirt at the bottom. The taps should be opened to drain out the dirt at least once a month.

2. The four draining taps at the bottom of the pipe system needs to be opened for dirt to flow out after a period of one month.

3. When the tanks are being cleaned, all the taps have to be turned off. After cleaning drain out all the dirt by turning on the taps.

4. When the water from drinking tap is dirty, the system need to be stopped, and the materials in the filter bucket should be changed.

5. After a period of time all the materials in the Filter Tank needs to be rewashed carefully. The charcoal section is the only section that needs to be changed completely.

6. If the water in the Filter Tank can not pass to the Clean Water Tank, it means the pressure might be leaking from the Filter Tank.

1. 在兩個儲水桶底下有個排水孔，是用來將沉澱物排出的，如發現水桶內過於骯髒需要清洗時 (約一個月一次)，此孔是用來將髒東西排出，但記得在清洗時須將流至濾水桶的開關所斷開或關閉

2. 底下的四個排水孔，是用來將沉澱物排出的，每過一時間即需要將開關打開，讓沉澱物流出

3. 清洗時水桶時需要斷開或關閉與其他通路的連接

4. 當發現淨水孔的水是髒的，即代表濾水桶內的材料應該需要被替換了，即需要暫停使用此系統

5. 更換濾水桶的材料時，須將材料一個一個移出，然後清洗，木炭需要重新更換，之後再將材料一個一個放回至桶內

6. 如果濾水桶內的水回不到淨水桶，需確認是否有壓力從濾水桶溢出

TO KEEP IN MIND
注意事項

1. Remember to check if any water is leaking from the Filter Tank. If there is an amount of water leaking, the cover needs to be tighted again.

2. If there is no rain for a while, the system can also can be connected to other resources to fill up the water (by pumping).

3. The ventilation pipes need to be bend downwards.

4. Put a fine net on the ventilation pipes to prevent insects from getting in the pipes.

5. The roof gutter needs to be covered by a fine net to prevent dirt, leaves and insects getting into and block the system.

6. Put a security sign (fence) on the system to make sure that the system is used properly.

1. 記得留意濾水桶是否有大量的漏水狀況，如果有，需將鎖固環打開，重新安裝蓋子

2. 如果有急需用水的需求，可將其他水源連接至此系統 (以幫浦打入)，以暫時代替雨水使用

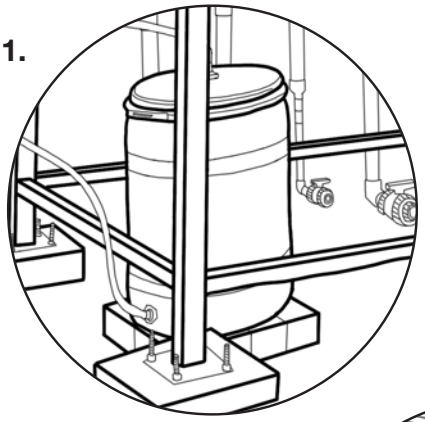
3. 排氣管必須被彎曲朝向下

4. 在排氣管增加濾網防止昆蟲進入

5. 屋頂的天溝落水處必須用細的濾網覆蓋住

6. 放置安全標語 (圍籬) 在雨水過濾系統的周圍

1.



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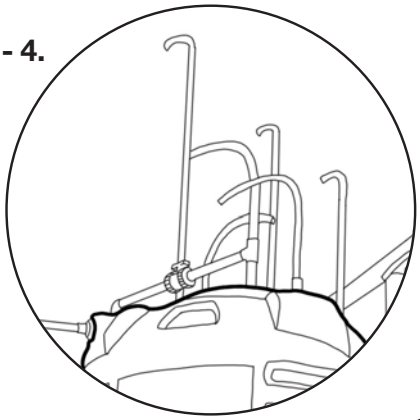

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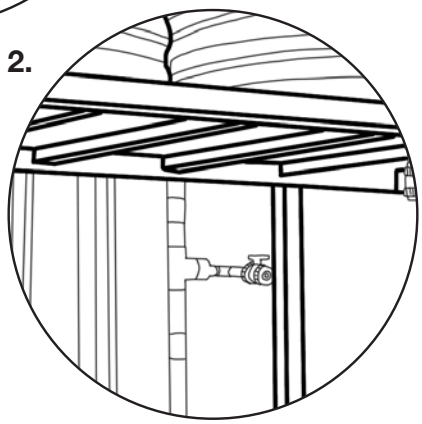

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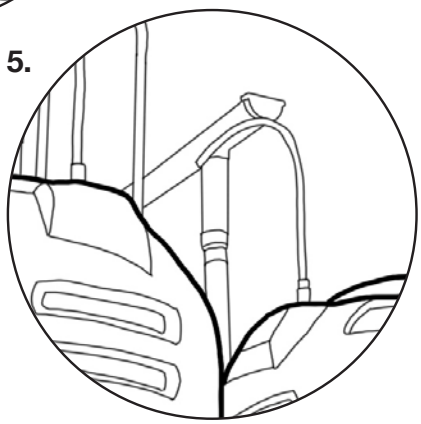

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