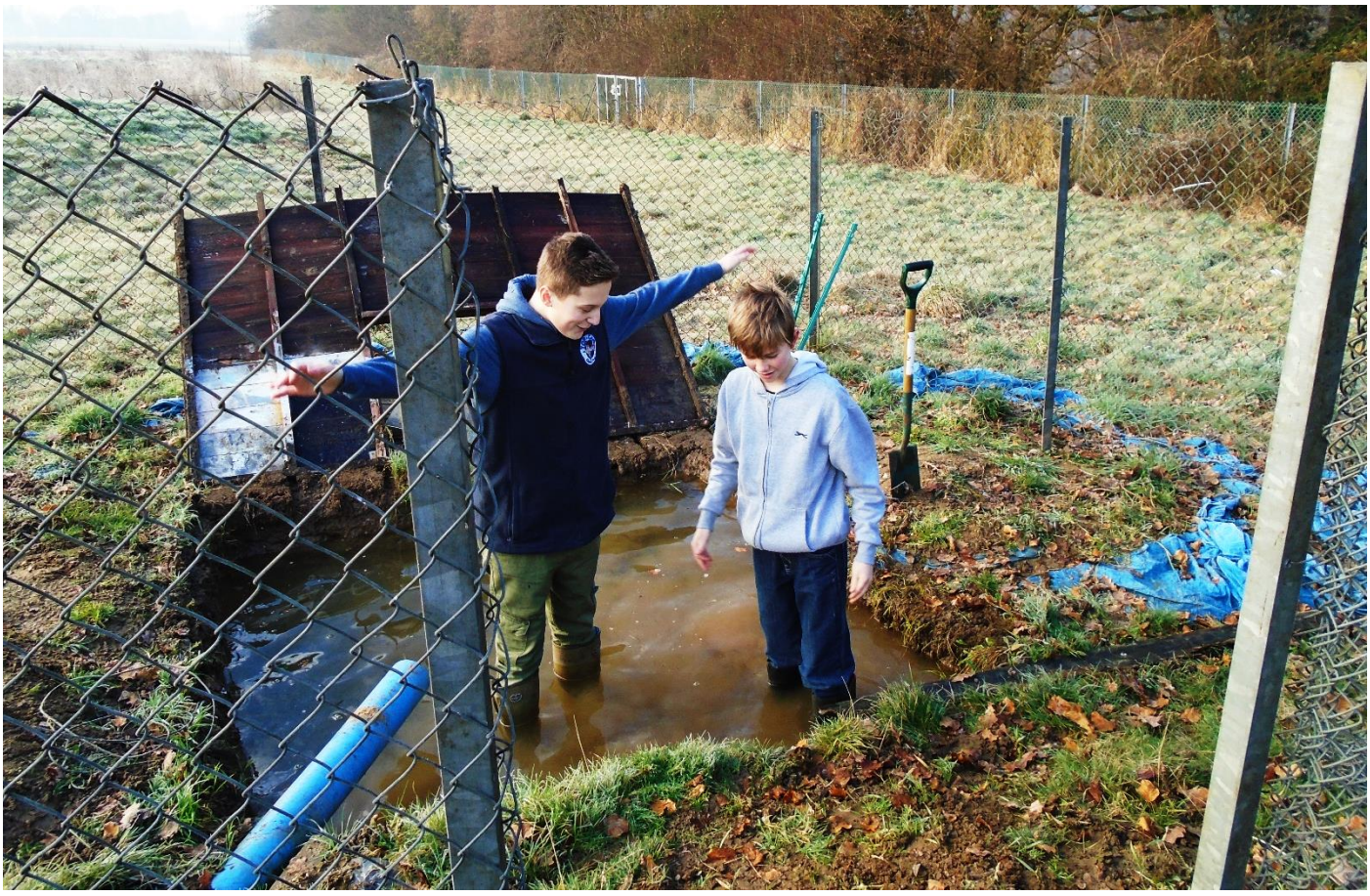
THE PAPILLON PROJECT

Sustainable Water and Irrigation on a School Allotment

By Simon Waller, Water Engineer
and Former Health and Safety Inspector



Introduction

In the spirit of permaculture and sustainability, it is best not to use valuable and expensively purified water from the local mains water supply to water an allotment. Your options will therefore be:

- rainwater (directly captured and stored)
- surface water (if you are lucky enough to have a large enough pond or lake nearby)
- ground water (if the water table is high enough to enable the construction of a shallow well up to around 4m deep, with a high enough yield for your demands)

When you first start to consider your options for water supply, remember: gravity is your friend! If at all possible, collect and store your water near the top of your site – it will save you hours of effort in onward distribution and you may even be able to distribute it by gravity via a hosepipe rather than having to fill and carry buckets and watering cans around the site.

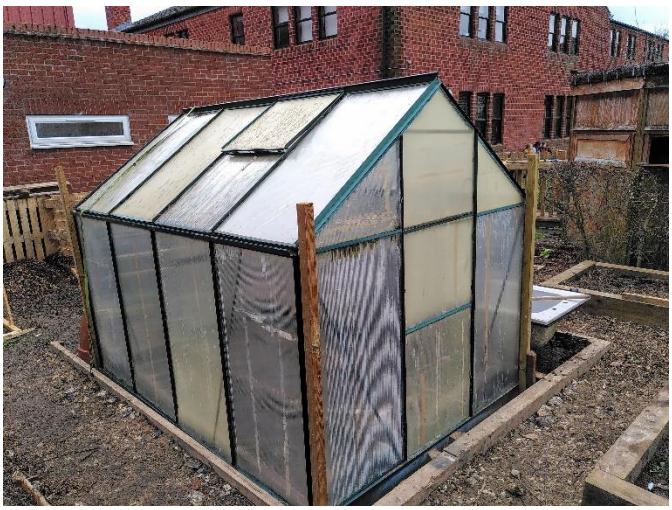
Second thing to consider is "how much water do we need?" It is important to try to make a rough estimate of this so that you can then set about fulfilling your needs without spending more time, effort and money than is strictly necessary. Work out roughly how many watering cans you will need per plot or bed per day, do the addition and see if you can get a figure for daily needs.

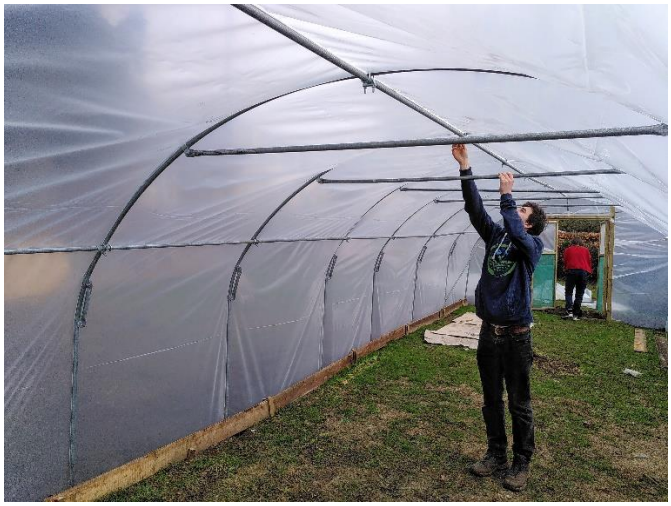
Now you can think about where that water will come from and also whether you will need to include storage facilities as part of the system.

Rainwater catchment

If you have a sloping site you are in luck! You can set up a rainwater catchment system at the top of the site (using high ground), using some sort of impermeable material, e.g. an old yacht sail or a tarpaulin, and funnel the water into a tank or series of tanks for onward distribution. Try to get some rainwater data for your area from the internet to establish how big your catcher needs to be to fulfil your needs. You will also need to estimate how much storage volume you will need in order to see you through periods when the rain doesn't fall. Geography and maths!

If your allotment site is completely flat, you might consider using elevated structures to catch the rainfall, e.g. the roofs of greenhouses/polytunnels, sheds, or nearby school buildings. If nothing like this is available, you can construct your own rainwater catcher made from a wood or metal frame with a tarpaulin stretched over it – a large funnel in the sky!

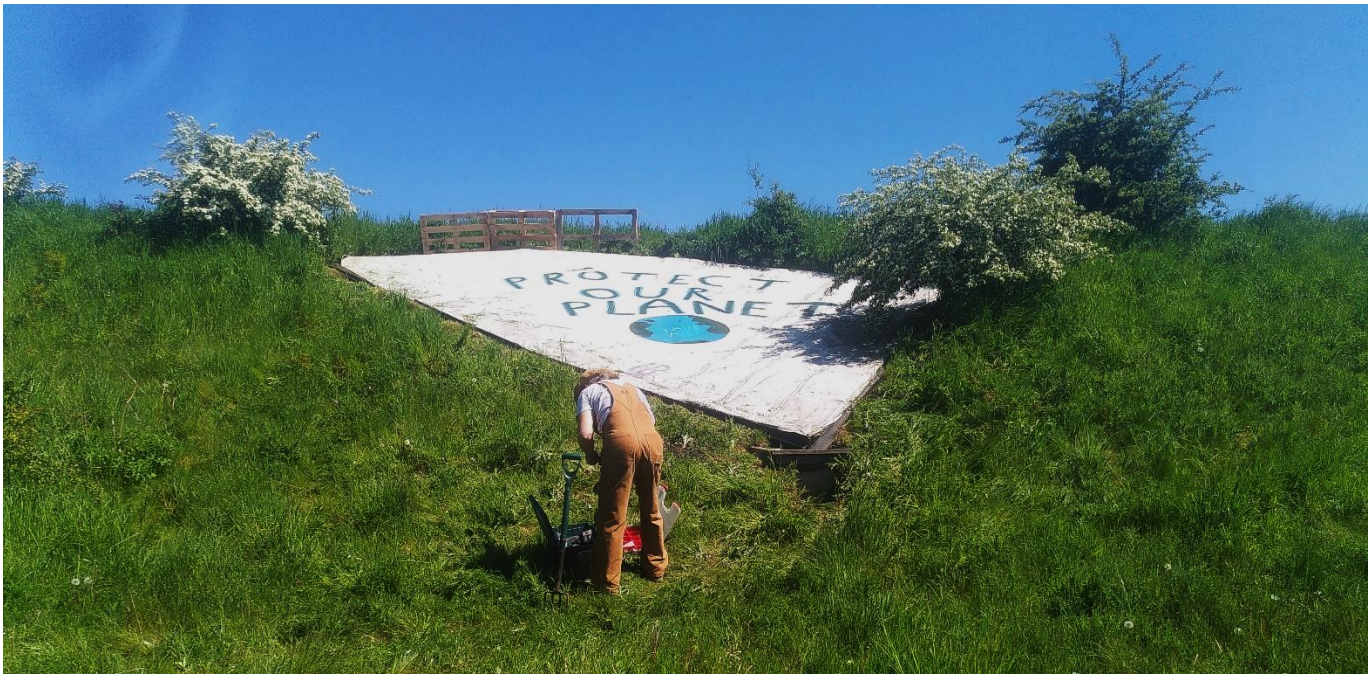


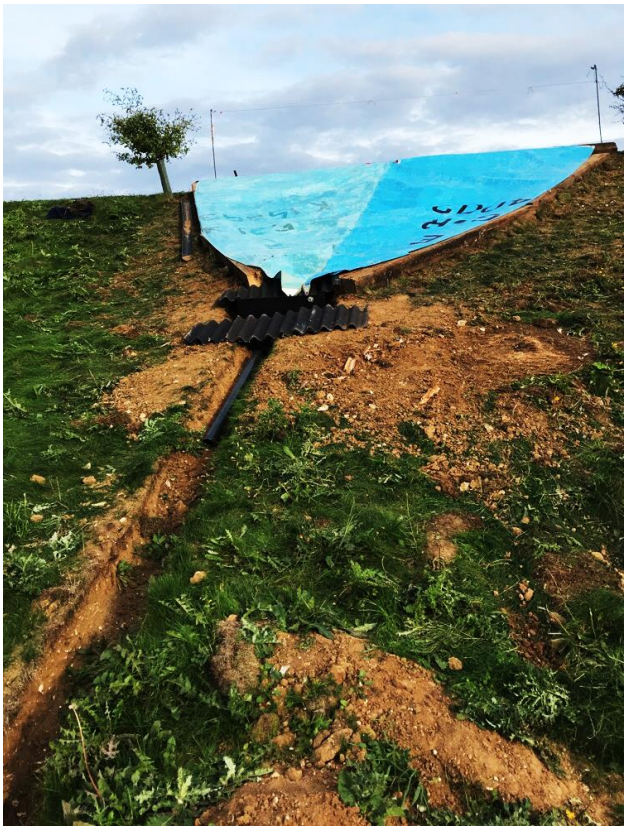


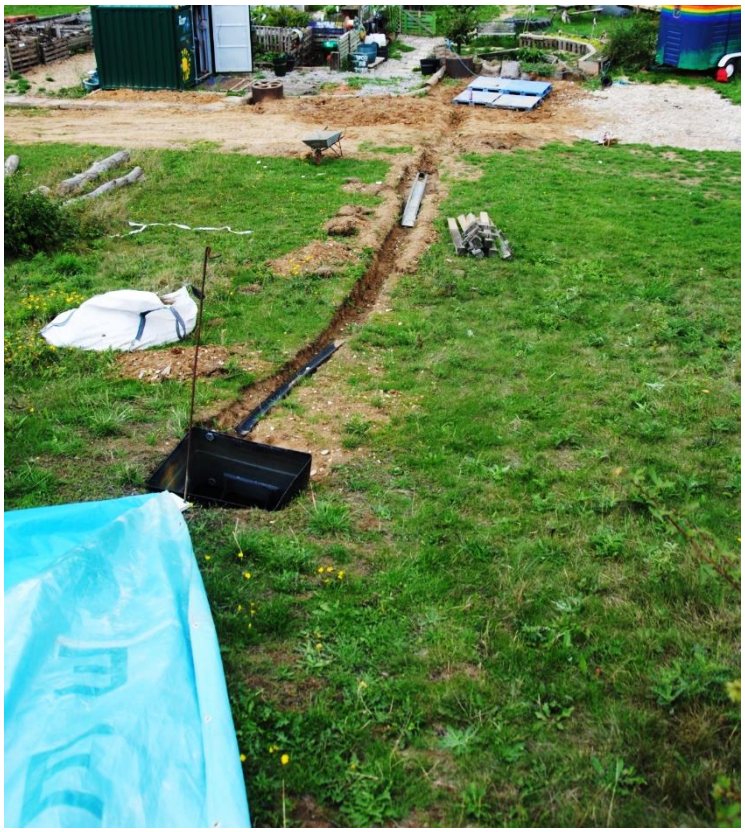
Above: Always think about pre-existing structures – they could be potential rainwater catchers such as greenhouses and polytunnels. Guttering can be purchased to collect rainwater from these two structures.

Sail rainwater catcher

Sail cloth is an excellent material; super strong and super water repellent. If you obtain a whole sail and secure firmly to some nearby high ground you will have yourself a very efficient way of collecting a great deal of rainwater. When it rains the sail acts as a giant leaf that catches rainwater incredibly well. In the examples below, rainwater lands on the sail which then transports it to an old loft tank as a ‘holding reservoir’.

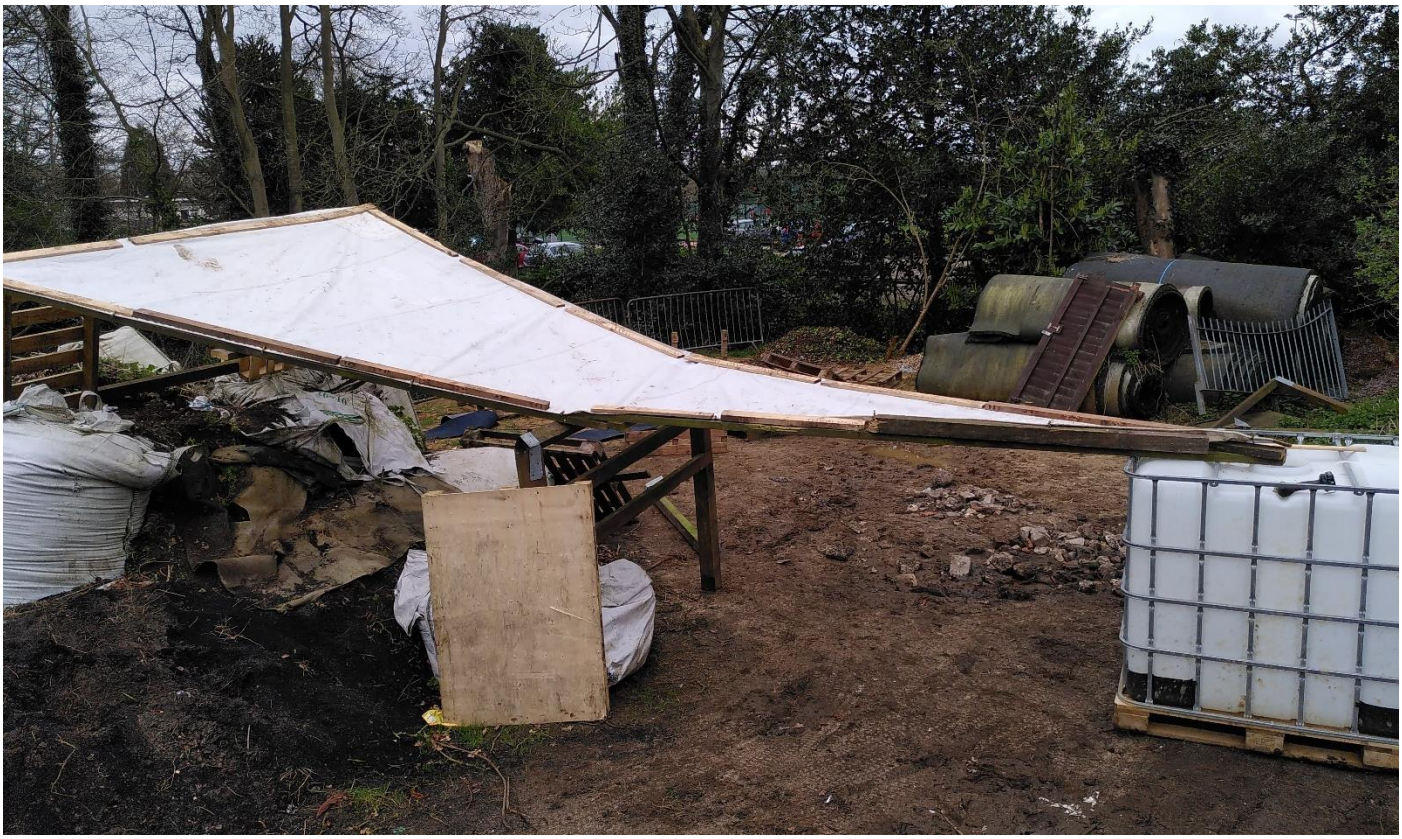






Above: The loft tank (the black box in images above) is merely a holding tank for the thousands of litres that a sail catcher can collect. Thinking sensibly about water storage and where all this water goes is essential. Please read the storage section of this article for ideas about this along with the health and safety behind storing water too.

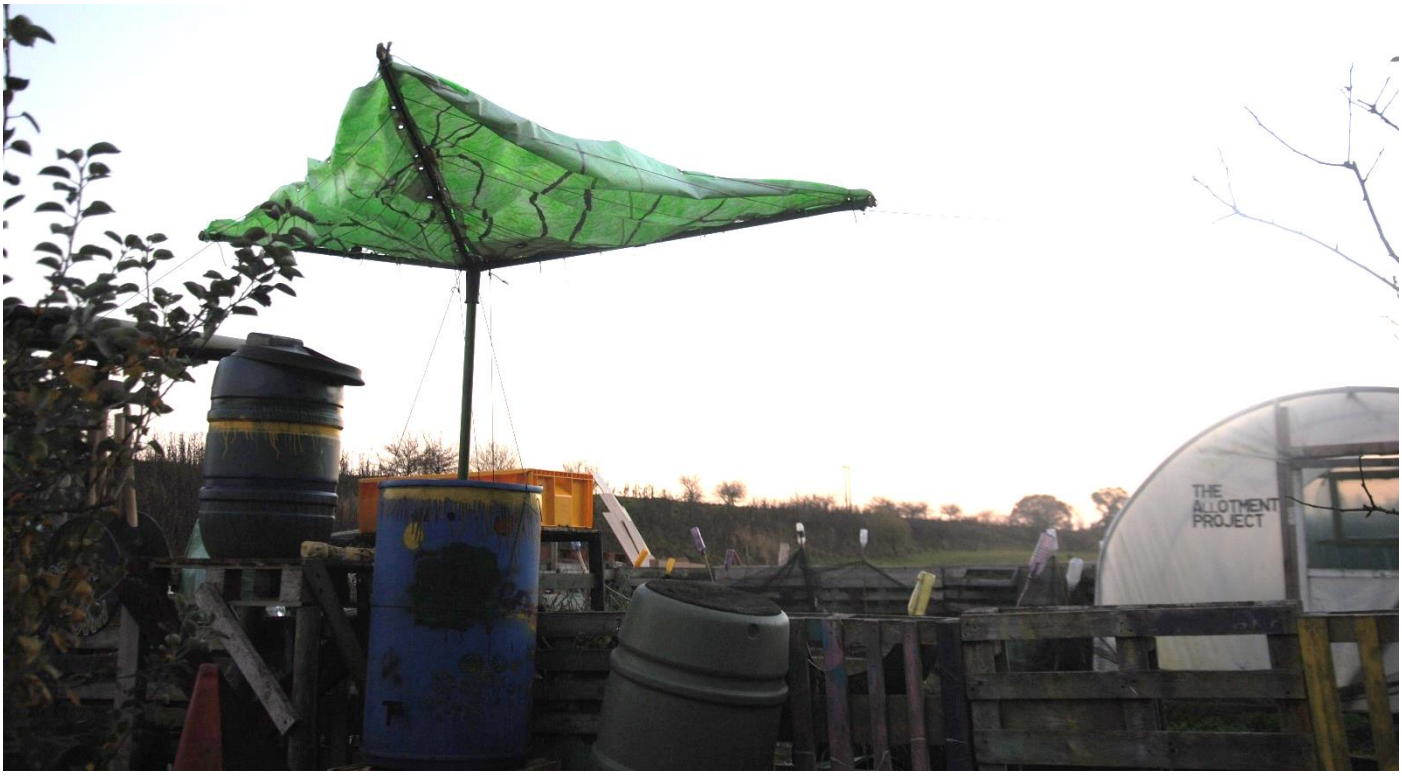
It’s paramount that the sail is pinned down very firmly otherwise, being a sail, if the wind catches it, it will certainly blow away. Pinning a sail to heavy railway sleepers would be ideal. You can also attach side guttering to the railway sleepers to avoid rainwater running off the sides of the sail and not into the loft tank where you want it to go.



If you are unable to utilise some high ground, you could always create a frame and supports to hold a sail catcher above the ground, making sure, of course, the water flows downhill and where you want it to go!

Other rainwater catcher ideas

Washing line rainwater catcher



You will just need some strong waterproof material (old sail cloth is ideal) cut to fit the 'Vs' of the washing line frame. Insert the washing line post into a water butt through a hole in the lid and support with guide ropes to make sure it doesn't fall down. Making a wooden support, inside the barrel, is also recommended too. Stowing the washing line away during very windy conditions would also be sensible. This is also a classic example of upcycling and will certainly inspire young people. The design is copied from nature's example of how plants catch water using their leaves and flower heads.

Left: Don't forget to look to nature for inspirational ideas. Leaves, as an example, have been designed by nature to be both catchers of sunlight (for photosynthesis) and for rainwater too! Human beings should certainly look to nature for more inspirational examples and to 'mimic' what nature does. **Permaculture** is an incredible concept that looks into using nature's example to help us lead better and more sustainable lives.

Water butts

It's a classic idea for any allotment and, if you have enough of them, they can collect a good amount of rainwater throughout the year. If done safely, having them up high and with a tap means that harvesting water is much easier than dunking watering cans and buckets into them by hand, but, of course, this works too! Consider also having some netting over the tops of the water butts to prevent leaves and animals from getting in and causing blockages.

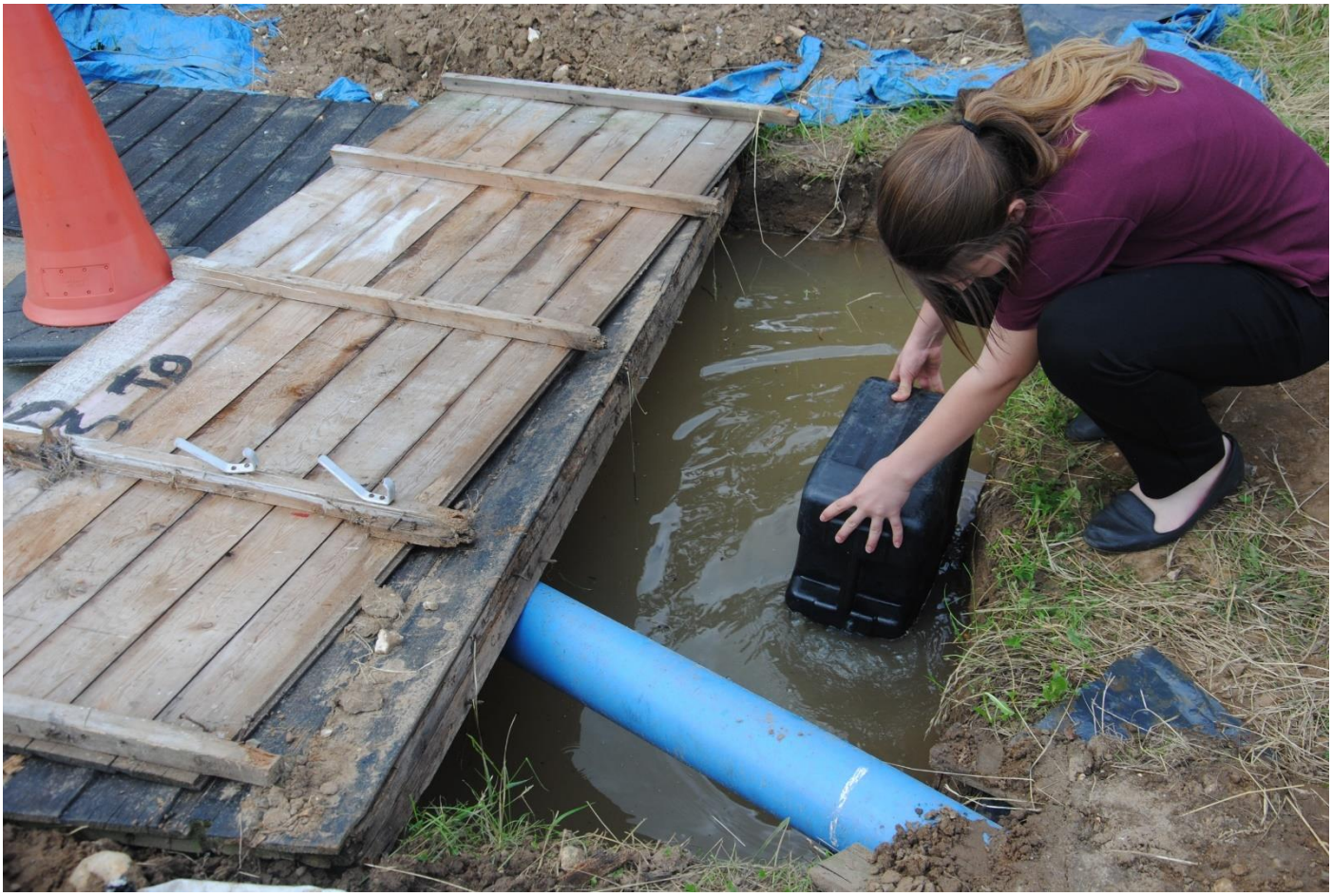
Above: Water butts with taps are the best!

Above: Have areas where water can be collected is always very helpful and clear to young people and adults too!

Surface Water

If you have a largish pond or lake nearby, you might want to consider taking your water from there. You will first need to establish if the pond has a high enough “yield” to meet your demands. In other words, will the level of the pond be significantly lowered when you take your water, or will the natural recharge (direct and indirect run-off from the surrounding land) be sufficient to stop this from happening? You don’t want to ruin a local ecosystem just to water your tomatoes!

A word about the law: you are allowed to abstract (technical word for collect) up to 5,000 litres per day from a well, stream or pond without needing permission, providing it is for private use and not to be supplied to anyone else. This will be more than enough, even for a large allotment.



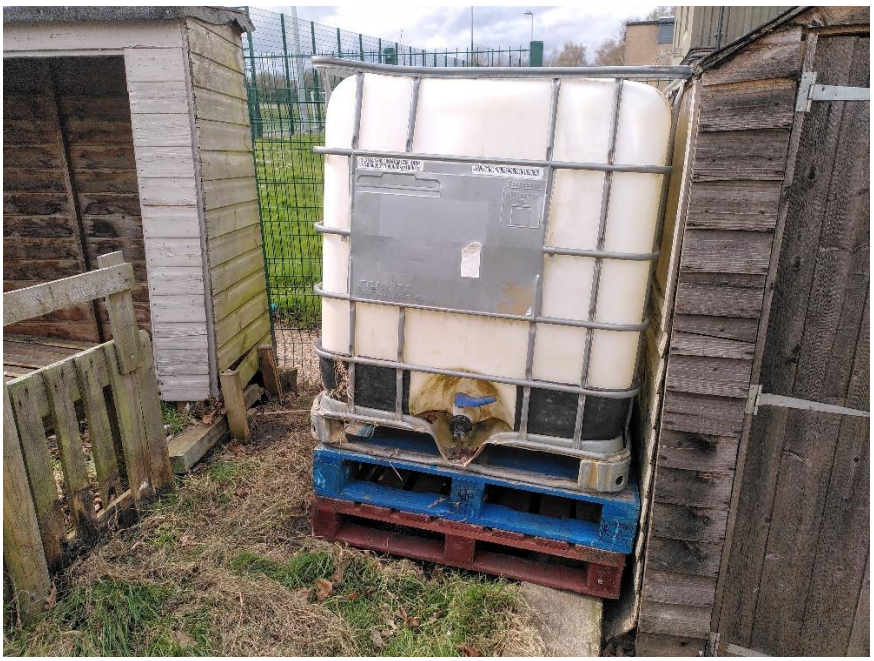
Above: A purpose dug water reservoir with a water pipe installed to also help collect surface water. This example was dug into heavy clay soil which naturally held the water, but a pond liner could also be used to do just the same. Notice the make shift cover to make sure than animals and people don’t fall in by accident.

Groundwater

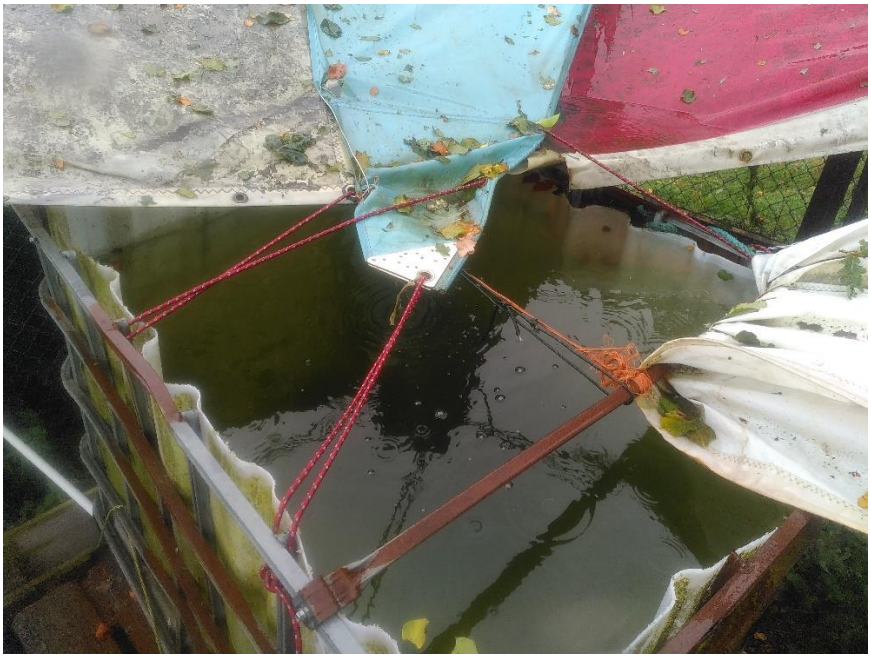
Your third option for water supply is groundwater, which is hidden in large volumes within the earth/rock formations beneath you. It is only really viable in the context of an allotment if the water is no more than 3 metres below ground surface, and even then it is a tricky and potentially dangerous operation to dig a well – but very exciting and satisfying nonetheless! It is only really to be contemplated if for some reason rainwater can’t be harvested on site, but it does have one major advantage: your source of water is also your storage facility.

Storage

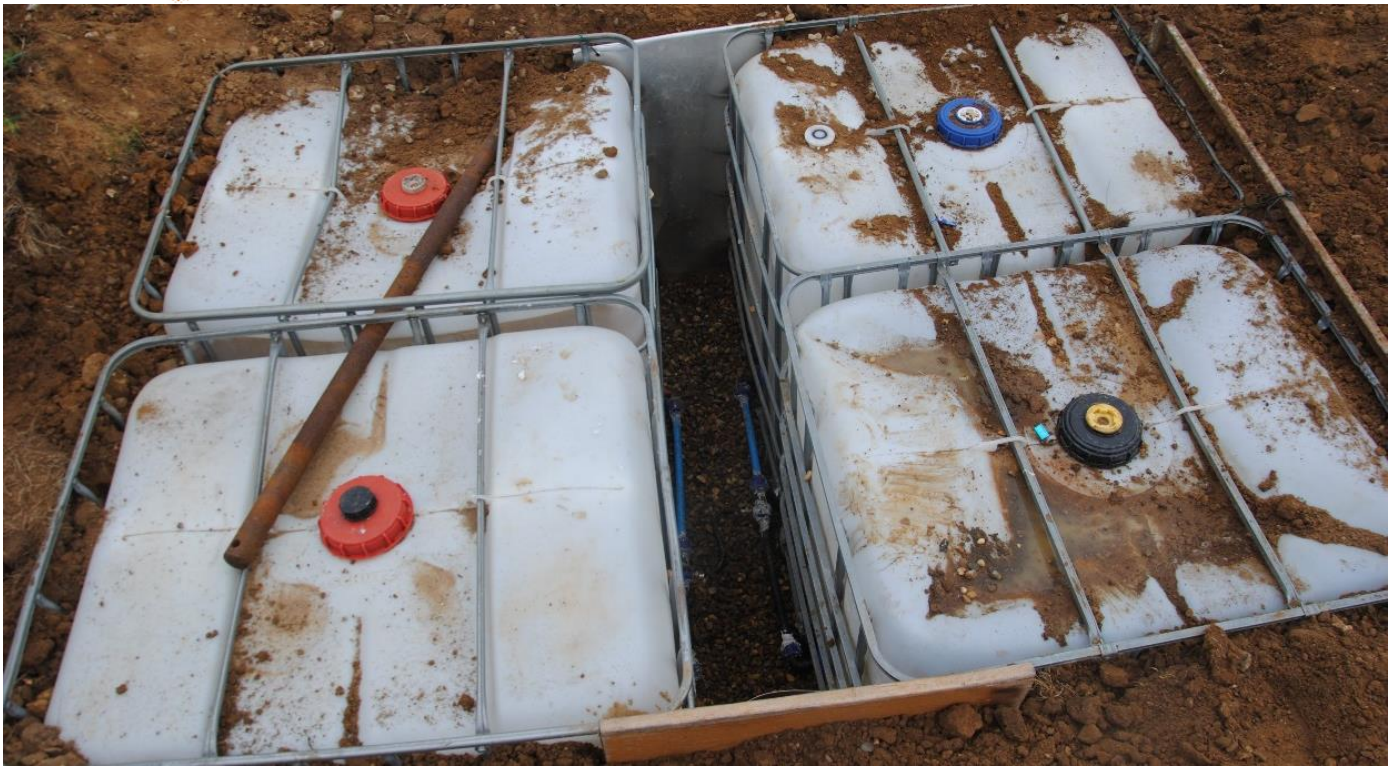
Unless you end up with a well, you will need to store the water you collect, until it is needed. Any large watertight container can be considered, but the most widely available is the IBC tank (IBC = Intermediate Bulk Container). These can be located on the ground (easiest), elevated on some sort of structure e.g. a stack of pallets (useful for filling watering cans or for onward gravity distribution by hosepipe) or buried in the ground (good for keeping the water cool, a factor in the prevention of legionella, a potentially harmful bacteria, more about which later).



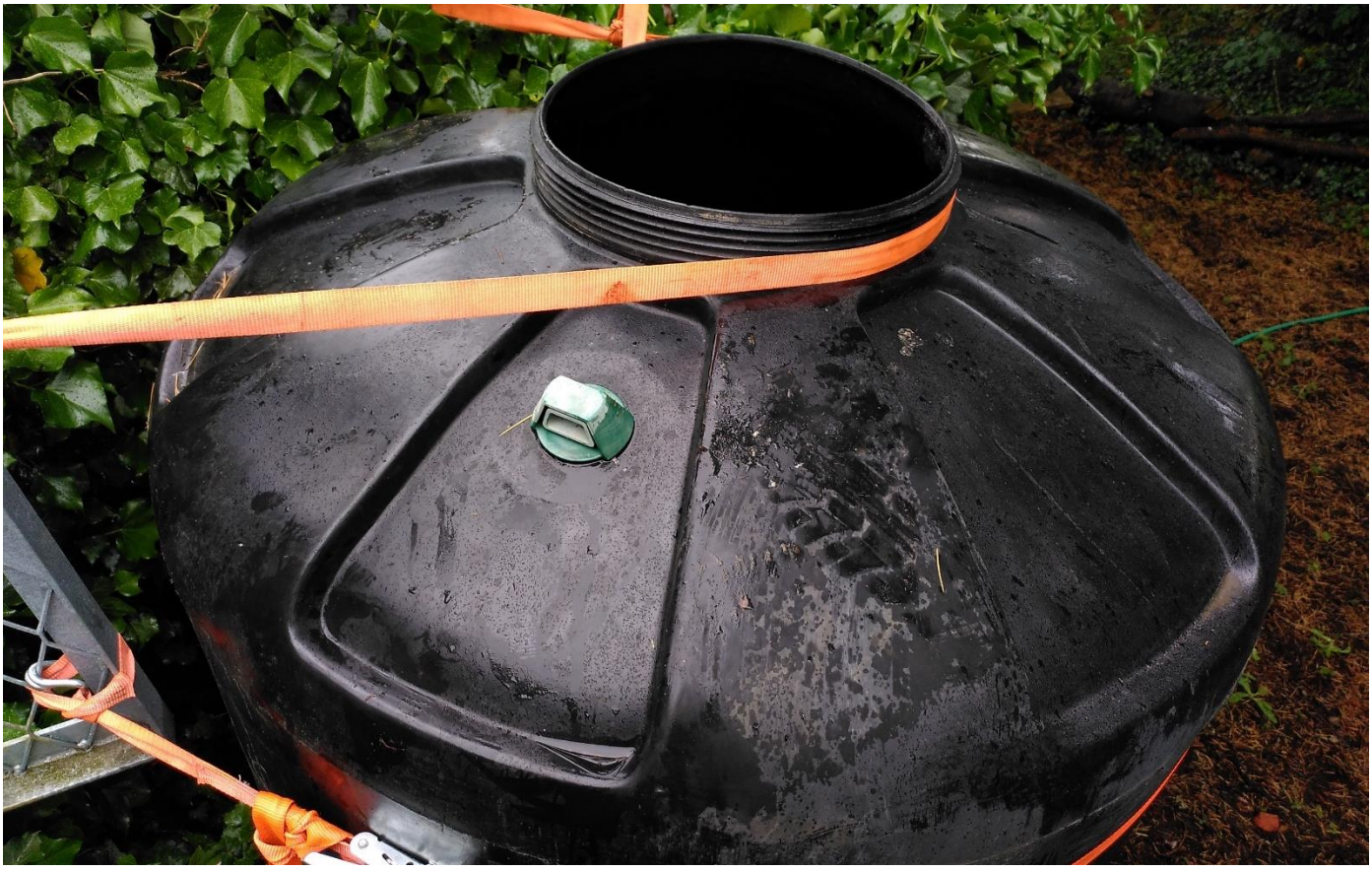
Left: IBC tanks can hold up to 1000 litres of water which means, when they are full, they are extremely heavy. The greatest care and thought must go into where these tanks are positioned and, of course, what they rest on too. Strong and sturdy pallets, which are designed to hold heavy items, are ideal. Plastic ones are better as more long lasting than wood, but, regardless of what an IBC sits on, they should be inspected on at least an annual basis to make sure there is no risk of an IBC tank breaking the pallets below or sliding off.



Left: The tops of IBC tanks can also be removed to collect more rainwater like a water butt does. Although the metal cage does continue to provide structure, it does mean that, with the lid off, there is more of risk of leaves, animals and people falling. The example opposite shows how old sails, fixed and aimed downwards towards the IBC, are incredibly effective at collecting rainwater.



Above: Here's an example of four IBC tanks sunken into the ground deliberately for two reasons: 1) to create an opportunity to install a sustainable water pump (please see pumping section of this article) and 2) to eliminate the chances of legionnaires disease as the water will be kept cool when stored underground.



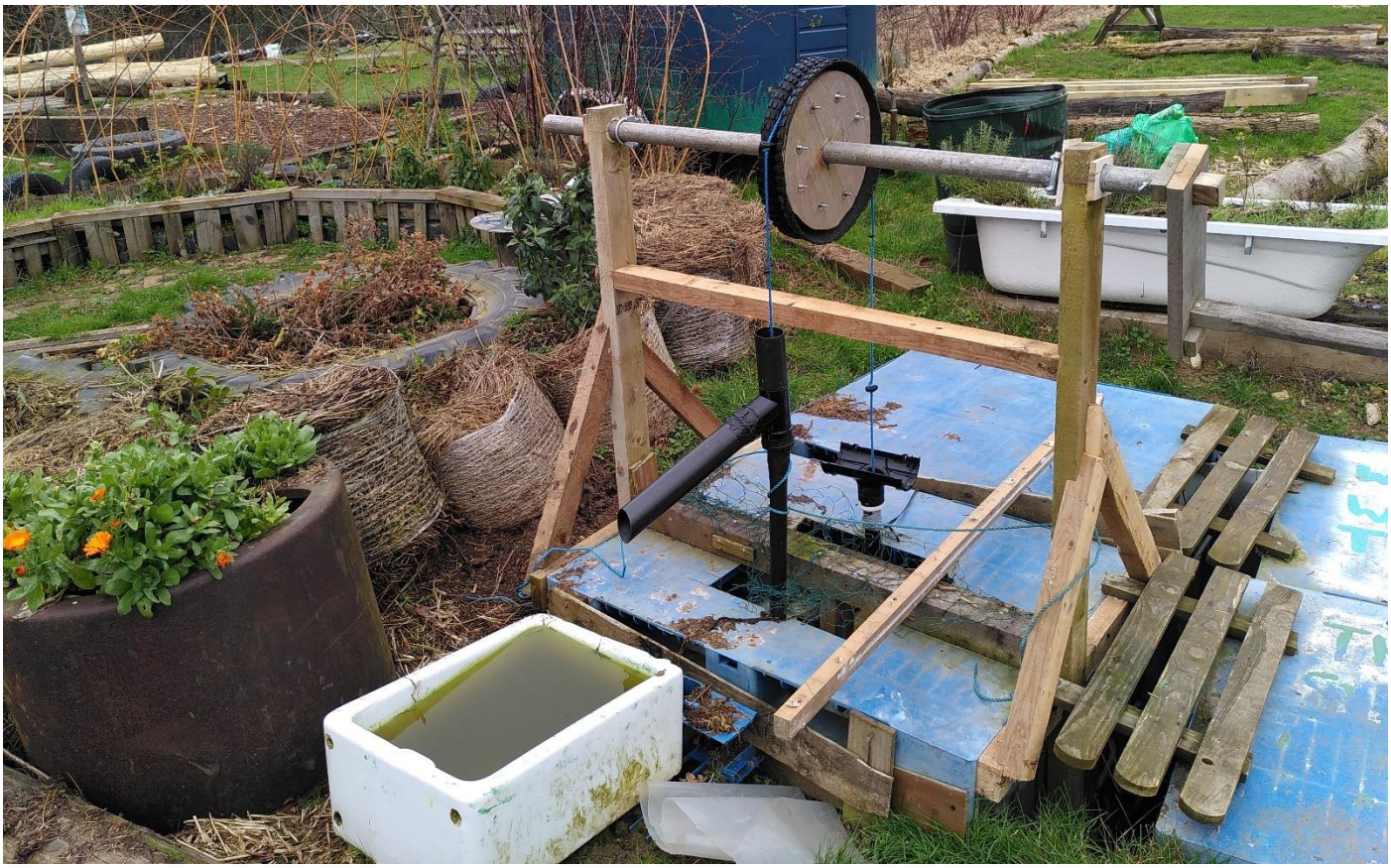
Above: Here's another type of tank that could be used. These water tanks used to contain either concentrated fruit juice or sauces for commercial use. Black is an idea colour to store any liquid, especially water, as it prevents UV light from reaching the liquid and, in the case of water, prevents it from turning green with algae. Also notice the rachet straps holding the tank in place to keep it sturdy; it's always important to think about safety and risk (please see risk section in this article for more information).

Pumping

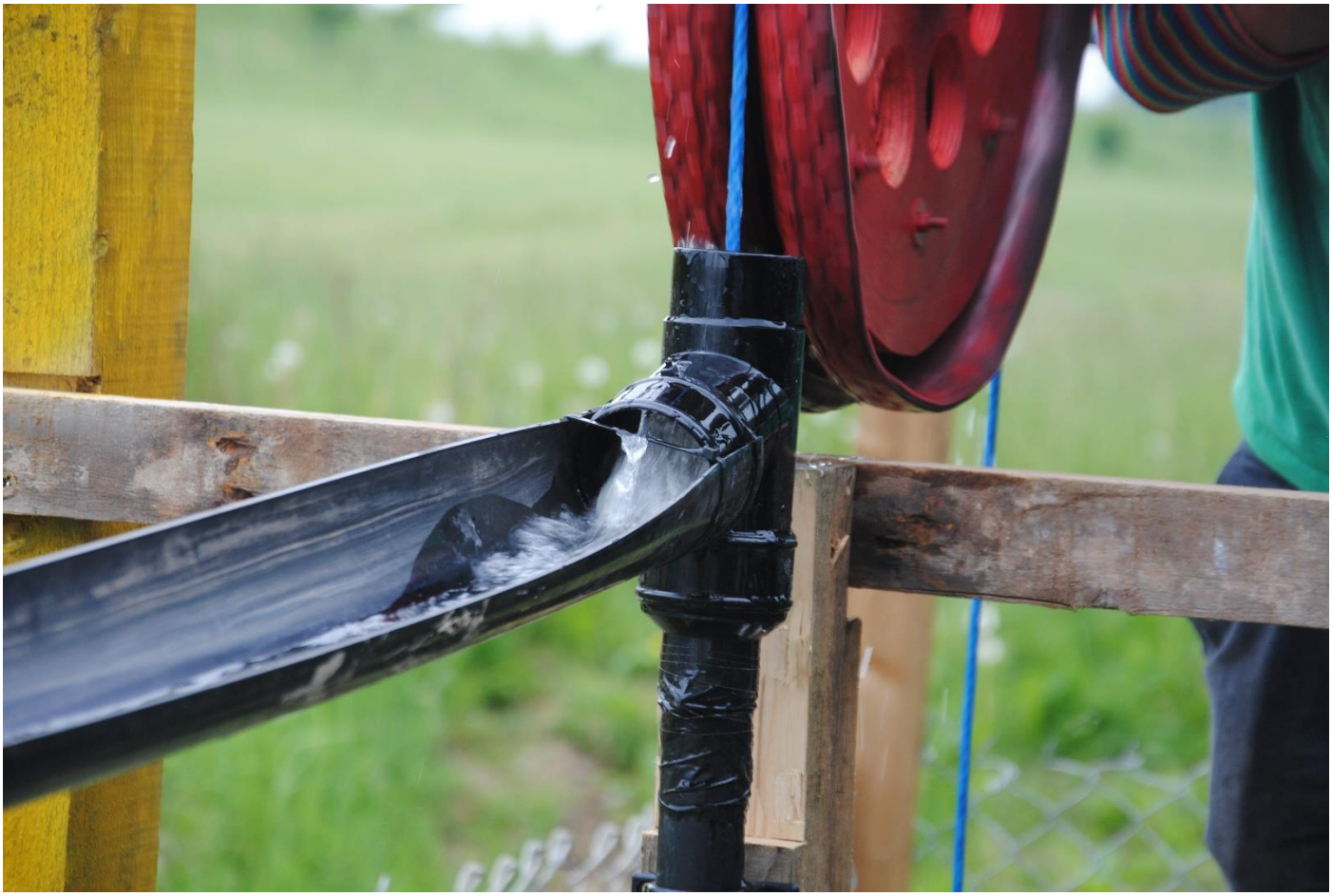
In the event that your water ends up in a lower location than you want it (e.g. in underground tanks or a well), you will have to employ a method of raising it to the required height for onward distribution, commonly known as a pump! In considering your pump, you need to think about cost of manufacture or purchase and cost of running, both to the environment and to your funds.

All pumps need an energy source to run them. Some use electricity or diesel (likely to be unsuitable on an allotment on the grounds of sustainability, cost of purchase, running cost etc.), some are powered by wind or the sun, but one potential source of energy which you should have in abundance on any school allotment is young fit human beings! Add to that the possibility of making your own pump from scratch and you could have a winning formula.

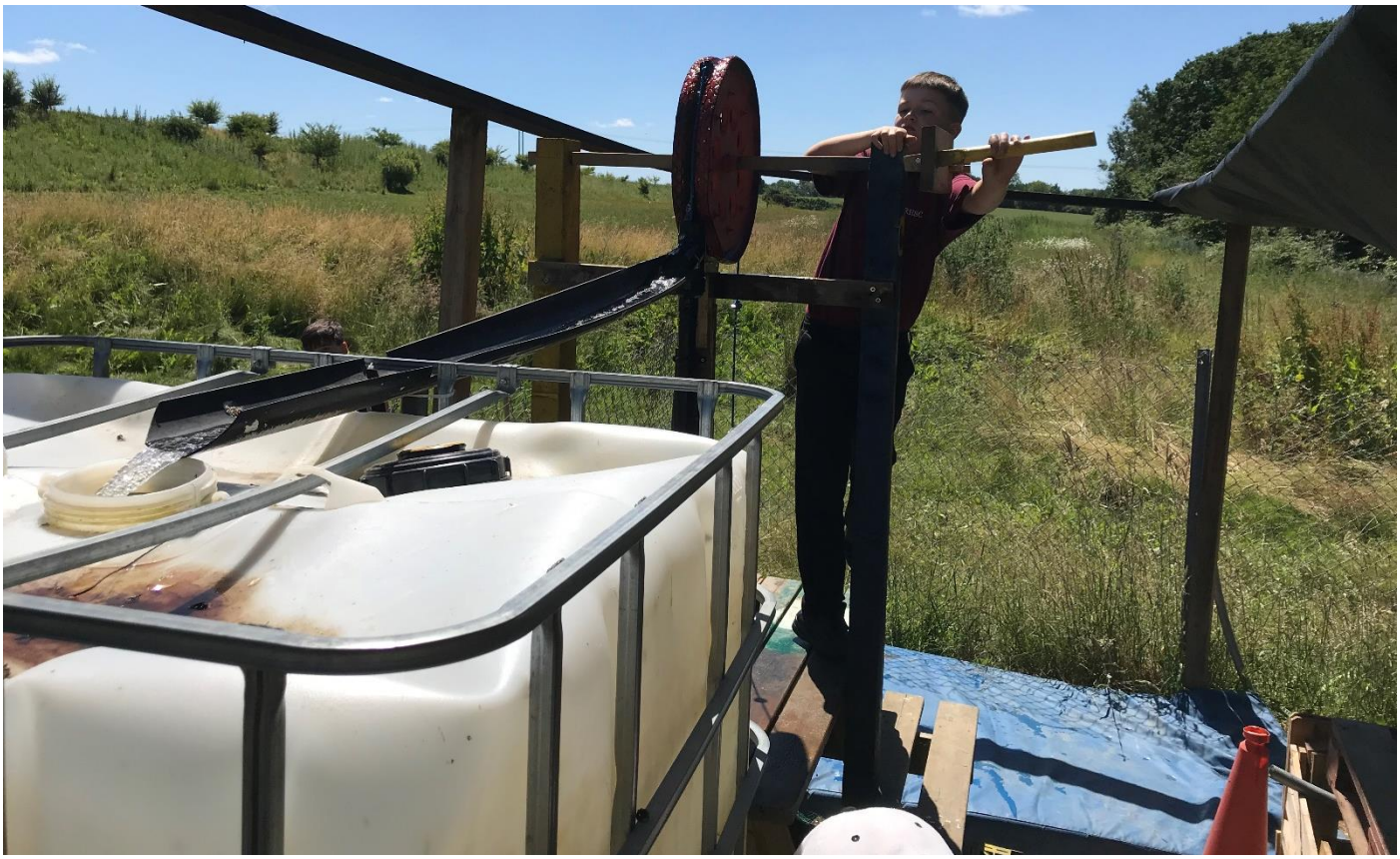
One such pump is the “rope pump”, an ancient Chinese design which involves winding a rope around a wheel rim above, down into the water source where it enters a tube and back up, bringing the water with it. Google “rope pump” and you will see many variations of this fairly rudimentary idea in use all around the world, including at Reepham High School & College Allotment Project. It is something most competent DIYers (ideally a collaboration between adults and students) should be able to make from scratch using cheap and readily available materials and hand tools, with a little help and guidance along the way. A very handy source of information is a slim volume entitled “How to Make a Rope-and-Washer Pump”, written by Robert Lambert and published by Practical Action.



Above: Rope pump, constructed by Duke of Edinburgh Award volunteers with some adult guidance too. Please **click here** to see the rope pump in action. It’s an inspirational sustainable example of how to pump rainwater to the surface using an inverted motorbike tyre, some rope and rubber washes from an old tyre.



Above: A rope pump in use!



Above: Rope pumps are a really fun way for young people to learn about rainwater collecting, harvesting, irrigation and also how precious water is, especially when a school allotment has no access to mains water.

Pipework

In the event that you have to connect various remote components of your water system together with pipework (e.g. a rainwater catcher and a tank) it is highly advisable to bury the pipework 300mm or so beneath the ground. This will protect it from being accidentally kicked or driven over, the frost won't get to it and it makes for a tidier site. Don't forget to make a note of where it runs!

Risks

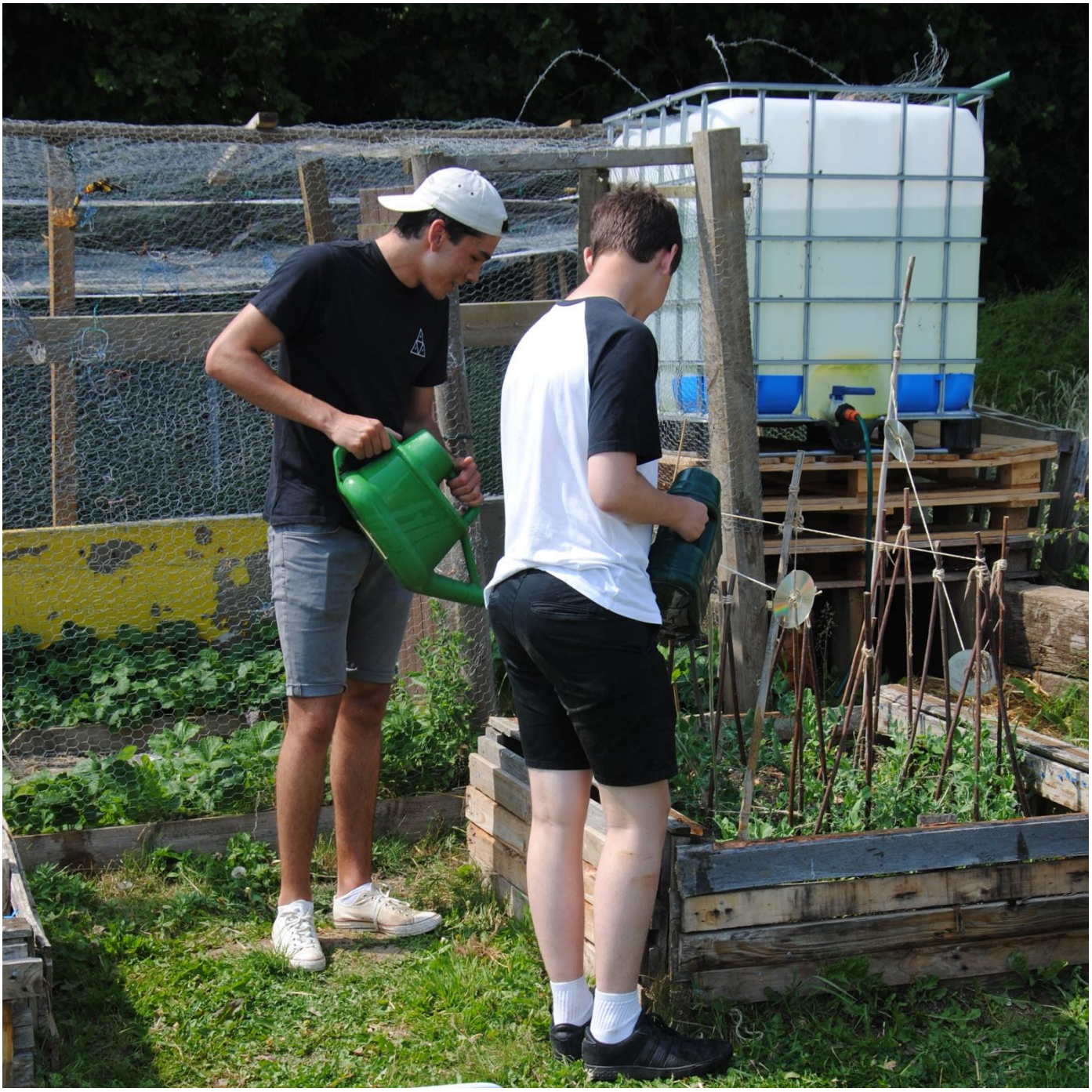
In the mid 19th century, the great Dr John Snow made the discovery that many diseases (in particular cholera and typhoid) were transmitted through dirty water. His ideas informed (the also great) Joseph Bazalgette, civil engineer, to construct the world's first sewer network beneath the streets of central London, to separate human waste from water supplies. Thus, was the city relieved of its repeated cholera outbreaks. History lesson over, and while we don't face the challenges of cholera or typhoid on today's allotments, we must be aware of other water-borne diseases which may be lurking.

The two main threats are Weil's Disease, which is spread by rats through dirty water, and Legionnaire's Disease, which is spread through fine droplets of water containing the legionella bacteria. Fortunately, neither disease is common. In all things personal hygiene plays a key role, as does tidiness on the allotment – not easy but worth the effort to persuade rats to make their home elsewhere. The mechanism of transmission of Weil's Disease is by ingestion of infected water into the human gut. With Legionnaire's Disease it is the inhalation of infected water droplets into the human respiratory system. The simplest way to prevent the spread of Legionnaire's Disease is to keep any stored water below 25°C and to avoid the creation of sprays, i.e. to use a watering can or low pressure hosepipes.

Above: It's always incredibly important to be mindful of the potential risks and dangers that come with collecting, storing and using water. Drowning and diseases should certainly appear on a risk assessment.

Watering effectively and conscientiously!

Water is *incredibly* precious and most people take clean running water for granted, especially young people. It's therefore really important that **a)** young people are helped to water things correctly and **b)** they have an understanding how important it is to be much more mindful of where their water comes from, as some young people in the world do not have access to clean water.



Above: It's *really* important that young people are shown how to water plants correctly as part of their school allotment experience. Most young people think a 'quick splash' will do; and not watering plants correctly can lead to water wastage. Please see our article 'Horticulture Basics' (please click here) to learn more about this.

Above: Using plastic bottles, with their bottoms cut off, is an excellent way to help guide young people to watering plants effectively and to ensure no water is wasted. Water can be poured directly into bottles which are sunken down to be close to the roots of plants. This means that water will go exactly where it is needed, especially in a hot polytunnel where water evaporates quickly on the surface.