Water

Finding, purification and storage

Sheet O.4

Version 1.1, September 2008. Produced by the Free Range *Energy Beyond Oil* Project 'Great Outdoors' Initiative
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20p (where sold)

Clean and reasonably sterile water is important to living outdoors, and finding more of it is essential after a couple of days. We can go hungry for a few days, but a day or two without water can make us very ill. This unit looks at how we can carry find, purify and store water.

Getting sufficient water

"*Water, water everywhere nor any drop to drink*". That line from a Coleridge's *Rhyme of the Ancient Mariner* sums up the importance of drinkable water. Only a few percent of all the worlds accessible water is 'fresh water' that we can drink, and quite a bit of that is locked up in the world's ice caps and glaciers, or deep in underground rock strata.

At a minimal level of consumption, for drinking, cooking and a little washing you might get through three or four litres of water per day. In Summer, especially when carrying heavy loads, that might increase to five or six. Again, thinking about the purpose of the 'Great Outdoors' initiative, we can contrast this minimal level of water use for wild camping with the average home which uses a few hundred litres of drinking water per day, a large proportion of which is thrown down the toilet.

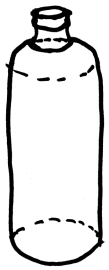
In this unit we look at the subject of water – how to transport it, how to find more of it, and how to purify it and keep it fresh.

Carrying water

Water is comparatively heavy! Each litre (or 1¾ pints) of water weights a kilo (about 2.2 lbs). An average person weighs about 70 kilos, and it's recommended that you carry no more than a third of your body weight for a long distance – so that's about 23 kilos (about 50 lbs). Assuming that in hot weather you're carrying at least six litres of water that's about a quarter of all the weight you're transporting.

To make life easier it's a good idea to split up your water provisions. Using one five-litre container is more convenient, but it's a very dense mass making it difficult to carry. Instead:

- Most of the water should be carried in at least two bottles, one either side of the rucksack (or in opposite cycle panniers) to provide a more balanced load;
- A lesser amount can be carried in small bottles in the top or bottom pocket of the rucksack (or in bottle holders on the frame of a bike) to allow easy access when you need a drink;
- If comfortable whilst wearing a rucksack (or cycling) you can also get water containers that fit on a waistband so you can take a drink without having to unpack.



The ideal cheap water container is an old two litre fizzy water or fizzy drinks container made of the plastic PET. It's slightly more hard and flexible than the HDPE plastic containers often used for milk and still water, but t hose are OK if you're stuck for a carrier – it's just they're inclined to split when it's most inconvenient. You can also buy rigid HDPE containers made for camping, which are a little heavier, but much more hard wearing than reusing PET/HDPE drinks bottles (but you have to buy them!).

Another popular container sold in camping shops are 'bladders' – plastic bags which collapse as you use up the water inside. The main problem with these is that they can hole easily if you drop them on a sharp rock or accidentally press then up against a thorn in a hedge. It might seem easier for the water bottle to shrink, but if you pack your rucksack tightly having your water bottles taking up a constant volume can be useful as it stops other things getting lose and sliding around.

Finding more water

Today it's quite easy to get water – most shops and supermarkets sell it in large bottles, albeit it the cost per litre is astronomically high! If you're camping on a site water isn't a problem as a tap is included in the facilities. The problems arise when you're wild camping, backpacking or cycle touring because places to fill up are getting harder to find.

Years ago people rarely bought water in bottles. In any case most public toilets had taps where people could fill up an old pop bottles, and water drinking water fountains were a commonly found in cities and towns. Today, as public toilets have closed or have been refurbished to be vandal proof, and as water meters have made having a public tap an expensive option if the local kids leave it turned on, drinking water is becoming harder to find.

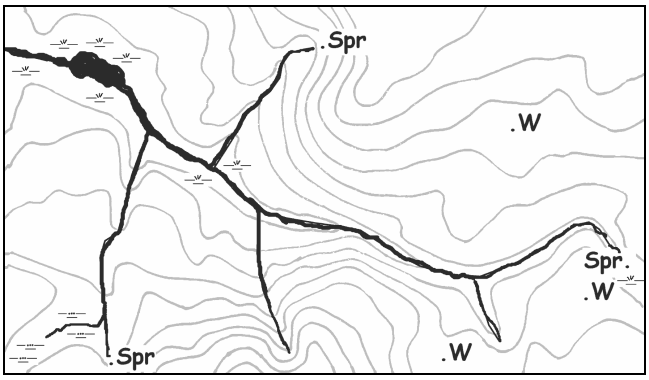
Simple alternative is to go and eat in a pub or café (which, if you can afford it, makes your food reserves last a little longer when backpacking or touring) and ask them to fill your bottles for you – if you've bought something most eating places will do this.

If you can't find water in these ways then your only alternative is to take the water that you can find in the environment around you and use that. This requires that you can find it and, if required, treat it to make it drinkable.

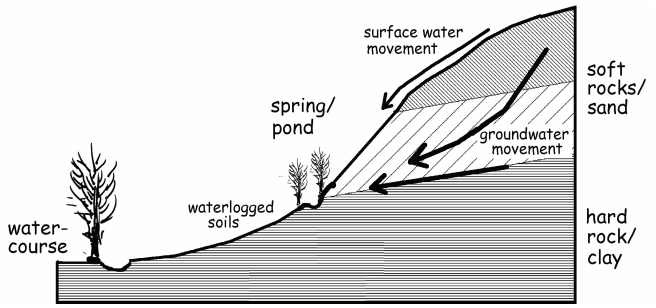
Water doesn't just turn up anywhere!

Water is everywhere in the environment, but for us to use it we need to find a body of free water we can tap – to filling our bottles or slowly extracting water a cup at a time.

Rather than look specifically for water you need to understand the land. It's the soils and rocks – the *geology* – of an area that determines how easy or hard it is to find water, and whether that water will be flowing all year round or just in the wet Winter months. If you look at the Ordnance Survey map you can see how the shape of the land and valleys determines where you can find water:



The map above shows the contours on a map defining the lines of equal height around a valley. The springs ('Spr') and three wells ('W') are all at roughly the same height. The reason for this is that at this point the rock types underground probably change from a softer, porous rock to a harder or less porous type. The excess groundwater water then 'issues' to the surface as springs or it collects and saturates the underlying rock strata to allow wells to be dug and water extracted. This line on the land is called the “spring line”, and you can sometimes see this visibly in the landscape as a pattern of regular small ponds along the valley side (usually highlighted by scrub and vegetation) with a zone of waterlogged ground below it (unless the pond drains to a ditch). Often, even where there are no springs, you can see a change in the rock types by a change in the slope of the land/valley side which forms a line across the countryside – and it might also be shown up by a change in vegetation too.

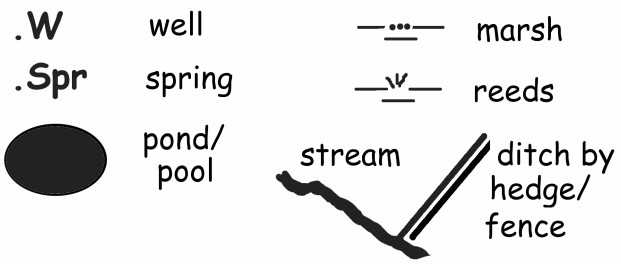


In some areas where the rocks are very porous (such as limestone or chalk) large streams emerge from the side of the hill. This allows you to take buckets of water with ease! The important thing about groundwater is that it's pretty much sterile (there are no 'bugs' in it) because it's been filtered through the soil and rocks. The principle hazard with groundwater is that if there's a landfill site nearby, or if there's a history of mining in the area, then toxic compounds can be suspended in the water – but usually you have to drink the water regularly to get any ill effects (with concentrations high enough to cause acute toxicity you'd be able to taste the difference, although some toxins from landfills, and especially from agricultural run-off, can be tasteless).

Surface water is a problem because all that wildlife pee-ing, poo-ing and decomposing in the environment can give rise to biological contamination that can make you sick. On hillsides, especially after heavy rain, water can run across the surface of the ground and collect in ditches, taking all the contaminants on the surface of the ground with it. For this reason getting water during periods of heavy rain requires a little more care as both surface water movement, and the over-spilling drains of farms, buildings and the local sewage works, can all add nasty things to the water. The biological part of this pollution can be easily treated, as we'll see later, but the chemical part of this pollution is more difficult to remove.

Finding water on the map

As noted above, your eyes can give you a lot of information about where we can find water in the countryside. When travelling another source of information is the map. As well as the obvious rivers and streams where we can extract surface water, other symbols on the map also show where we could extract more palatable groundwater using methods such as the 'gypsy well' (see below). The symbols to look out for on the map are:

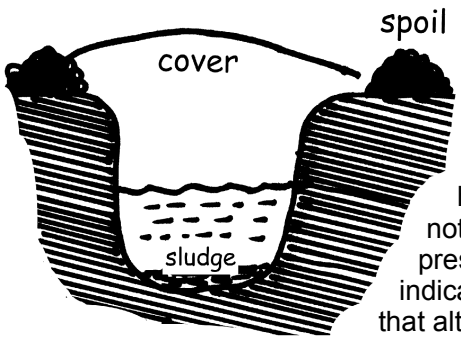


In hilly areas small surface streams are easy to come by, and you'll find many more springs and small ponds. The greatest problem is usually in flat and lowland areas where the water is mostly stationary (and so more polluted) or it's been piped underground by agricultural engineers installing land drainage systems. In these areas you need to concentrate on any marshy and boggy areas as these present the simplest way of extracting water from the ground. Reeds and mosses are natural cleaning agents (as demonstrated by the popular use of reeds at the moment for water treatment) and so extracting water from a small well amongst the reeds often yields far better quality water than the streams and ponds on the drier land that surrounds the wet areas.

Water from the ground – the '*gypsy well*'

We don't want to take drinking water from still pools – it contains far too much microscopic wildlife to be drinkable. So where we find ponds or small springs we need to make a small well in the satu-

rated ground to get at the more sterile groundwater beneath the surface. This is commonly know as a 'gypsy well', as it's been a technique used by travelling people throughout history for getting safe drinking water from the ground.



Using the trowel that you (of course!) packed into your kit, you begin digging a hole. If there's not a lot of water present, usually indicated by the fact that although wet and muddy the hole doesn't fill with water right away, dig a small narrow hole, just big enough to get a cup inside. If the ground is well saturated, and the hole fills as you dig, then a larger hole can be excavated to fit a saucepan into. Go down as far as you can easily go, say to the depth of your elbow. As you dig compact the excavated spoil around the hole in a ring. This will stop any contaminated surface water flowing into your hole if it rains.

Now you wait and allow the hole to fill with water. This will be quite cloudy and sludgy, and the first time you empty the hole, using a cup or saucepan, try and carefully remove the thick sludgy water from the bottom of the hole without spilling it on the sides. Each time you empty after that do so carefully, taking care not to disturb the layer of sludge in the bottom. It might take two or three goes at emptying to get the water clear enough to drink, but if you're desperate you could feed it through a mesh filter or still (see later).

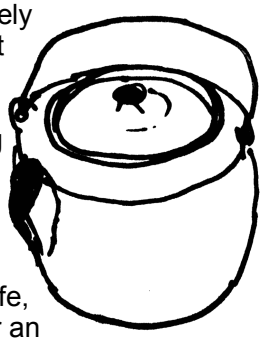
The important thing about a gypsy well is to keep it covered between each emptying. This stops leaves, bugs and small animals from falling in and spoiling the water.

Surface water and chemical treatment

Ground water in very rural and moorland areas is usually pretty good quality, and is unlikely to need treatment. Surface water is another issue. In the mountains, unless you have the proverbial 'dead sheep' in the stream up the hill from you, surface water can be drunk without ill effects – although in prolonged hot weather, or after heavy rain, it's a good idea to treat it as you're more likely to get micro-organisms building-up in the water. In lowland areas, especially where farming causes more nutrients/animal wastes to run into the water, the amount of microscopic wildlife means that the water will have to be treated.

The standard method of treatment available over the counter is very pure bleach (the stuff you clean your home with is far too noxious). For camping this usually comes in the form of an iodine- or chlorine-based powder or liquid solution that you add to a certain volume of water. This of course makes it taste foul, and so you can also buy a masking agent to take the taste of the bleach away again – so you get a double dose of chemicals, let alone what's in the water!

The obvious draw-back to using chemicals is that you have to *have* them – and what happen if/when you run out? In these situations you've got three options: you can boil the water; you can pass it through a filter bottle; or you can distil the water. Which option you use depends upon how dirty the water is.

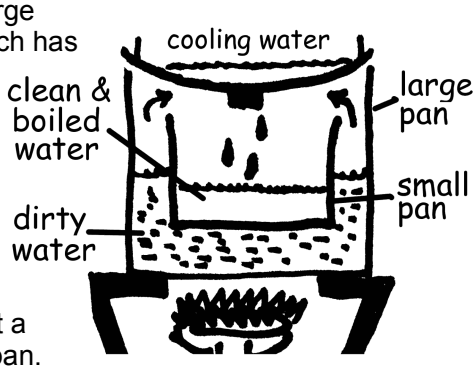


If the water is clean, but is likely to contain micro-organisms, just boil it for a minute or so. That will kill pretty much everything biological, but as with bleaching treatments it won't deal with any agricultural or industrial toxins in the water. You could take a 'bottle filter' (these are expensive, and have a limited life, so we don't cover them here) or an activated carbon water filter along too, especially in lowland areas, to try and take some of the nitrates and pesticides out, but it's a lot of extra kit to carry (although you can make your own filter using a container with a hole in the bottom, and then fill it with alternating layers of crushed charcoal (from a camp fire to actually clean the water) and moss or sand as a filter to take-out the lumpy bits).

More energetic treatment

Sometimes you just can't find clear, silt free water. Even if you treat it it's not a good idea to drink silty water (or the extremely brown, tannin-rich water from peat bogs) because it irritates the stomach. Without fancy filters, the simplest way to clean it is to distil the water. This will also lower the level of agricultural toxins like nitrates, volatile oils and solvents from drains, and even heavy metals from mineral workings. Note that (returning to the *Ancient Mariner*) if all you have available is salt water then this method will produce drinking water from that too! The only issue is that it's quite energy intensive.

Distilling water involves boiling it to produce steam and then exposing it to a cold surface to cool, condense and collect the fresh water. To be very efficient you would use a proper condenser and plumb it onto the spout of a kettle. In this case, as we've only camping equipment to play with, we use two saucepans and a saucepan lid (see diagram below).



You put a large saucepan (which has a curved lid) on top of a fire or stove and fill it a quarter or so full with contaminated water. Inside of this you float a smaller saucepan. When the water begins to boil stick the lid of the saucepan upside down on the top and fill it full of

cold water. You can use dirty water for cooling, but you have to take care not to get any in the small saucepan (but it's not the end of the world if you do because the water in the centre will be just about boiling too, so any biological contaminants will be killed, and anything else will be fairly dilute). At intervals you need to keep throwing away and replacing the water in the lid in order to keep the steam efficiently condensing.

As the water boils the stream driven off hits the saucepan lid and cools to produce sterile, boiled water which, by a process of distillation, has also had its sediment and a large amount if its pollution load removed. This runs down the lid to the centre and drips into the small saucepan. Any solvents and/or petrol/light oil in the water will also be driven-off out of the container as gas because the lid is too hot for them to condense properly.

Eventually you collect the water from the small saucepan and you could cook/wash with it immediately whilst it's hot, or after it's cooling you could put it into your storage bottles. The only problem with this system is the amount of heat required. It's rather impractical to use fuel or gas to heat so much water, and for this reason it's better to use a wood fire.

Rainwater, dew and fog

The other significant source of water is rain. If you had a clean fly sheet or plastic sheet (such the tarp. of the cook tent) by stringing up the sides off the ground to make a large bowl shape you can collect rainwater and then transfer it to your containers. If you could fold the sheet along the 'long' side of the cook tent into an improvised guttering you could also collect water and channel it to a storage container – although you might have to dig a hole to put the collection container into or the bottom edge of the tarp. would be so high up it would give no shelter.

When it first begins to rain it's not advisable to collect water from roofs or gutters (or you tarp./fly sheet if it's not been washed by the rain for a while). Allow half and hour or so of constant heavy rain in order to wash off the pollution, dust and bird excrement. Even then, for fixed roofs/gutters, it's advisable to boil the water as bird faeces often contain harmful bacteria such as salmonella.

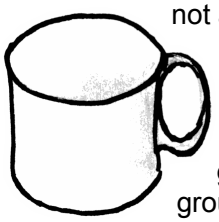
It is also possible to collect dew. At night in the Summer and early Autumn the ground is often warmer than the air and as water vapour is given off by the soil and plants it condenses to form water droplets at ground level – *dew*. Theoretically you could suspend a plastic sheet just above the level of the soil to collect the condensing water on the surface of the sheet, but it's very tricky to do because it needs a gradual incline towards the centre of the sheet so that the water can run down and drip into a container.

It's also possible to collect water from thick fog or mist, such as the low cloud found at the top of mountains or sea fog. To do this you need a fine mesh, such as a mosquito net (as noted in the kit list in unit 7) that you string-up perpendicular (cross-ways) to the wind direction. As the fog drifts through the mesh droplets of water will form. All you have to do is go along every now and then and 'wring out' the water into a container. Provided that your mosquito net is clean (you could always dunk it in boiling water to make sure) this water should not require any treatment.

Keeping water fresh

Finally, once you have water you need to keep it fresh. The simplest way is just to drink it as soon as you possibly can!, but if you need to keep some in reserve for a two or three days you'll need to store it carefully. The simplest way to do that is to keep it sealed in containers. Just in case you have any bacteria or algae in the water, and you're going to keep the water in a transparent or white containers for a few days, you should also try and keep the containers in the dark or you'll start getting a build-up of algal growths on the inside wall of the container (it's something that happens over time rather than instantly).

The biggest problem with keeping water fresh, especially in Summer, is keeping it cool to prevent bacteria or algae growing. The simplest option is to put the containers in a fast flowing stream – slow or still water risks the possibility of contamination so it's not a good idea. The simple alternative, which is useful in static camps, is to bury the container in the ground, perhaps in a box or larger container – rather like a 'fridge in the ground'. Even in Summer the ground temperature a foot or two beneath the surface varies very little during the heat of the day, making it an ideal place to store food and water.



The final option, more suited to mobile/short-lived camps, is to find a shady place to put the water containers where the breeze can move over them (e.g., under a hedge/in bushes or under some large rocks) and throw a damp towel over the top of the containers. As the breeze moves over the towel the evaporating water will cool the containers.