SKILL GUIDE · WATER

Storing Water Correctly

The Water chapter covers how much water to store and roughly what to store it in. This guide covers what's easy to get wrong: what the standard 1 gallon/person/day figure actually assumes and doesn't, how to prepare a container before you fill it, whether the water needs treating first, and how to keep a stored supply safe to drink months or years later. For treating water that's already questionable, see Water Purification; this guide is about water you're storing while it's still known-good.

How much should you actually store

The manual's own 1 gallon/person/day figure comes from FEMA and CDC guidance, and it's built the way most people have heard it described: roughly half a gallon for drinking, and the rest for food preparation and minimal hygiene. That's a real, defensible number, but it's a **survival floor**, not a comfort target, and it's worth knowing exactly what it does and doesn't cover before you treat it as the whole plan.

What it assumes: rationed drinking, no laundry, and no toilet flushing at all, which is exactly why this site's own sanitation approach uses a no-flush bucket system instead of trying to keep a flush toilet running. A single flush of an older toilet is 3.5–7 gallons; even a modern EPA WaterSense low-flow toilet is 1.28–1.6 gallons. Flushing more than once or twice would consume the entire household's daily ration by itself.

The fuller number: WHO / Sphere humanitarian standards

Humanitarian relief agencies plan water supply using the Sphere Handbook, the standard reference for disaster response and refugee camps, which breaks the same problem into three categories:

Use	Amount per person, per day
Drinking (survival minimum)	2.5–3 liters (~0.7–0.8 gal)
Basic hygiene	2–6 liters (~0.5–1.6 gal)
Basic cooking	3–6 liters (~0.8–1.6 gal)
Total	7.5–15 liters (~2–4 gal)

Sphere is explicit that 7.5 liters is only the acute-emergency floor, the number used in the first days of a crisis response, and that 15 liters (about 4 gallons) is the real target once things stabilize even slightly, and even that "is never a maximum." That's up to **four times** FEMA's 1-gallon figure.

What this means for a 14-day supply

The manual's Tier 1 target of 14 gallons/person over 14 days is internally consistent with the FEMA floor, and it works specifically because the household's sanitation plan avoids flush water and doesn't assume laundry. At the WHO/Sphere comfort target, the same 14 days works out to roughly **56 gallons/person**, not 14. Neither number is "wrong"; they're answering different questions; treat 14 gallons as the minimum floor and build toward the higher figure with any storage capacity you have beyond it.

What neither number includes

- **Laundry.** The single biggest line item people forget. Hand-washing one load costs roughly **2 gallons for the wash alone**, and **15–20+ gallons once you add rinse water** using the three-basin method in the hygiene guide above. One load of laundry can cost more water than one person's entire daily ration.
- **Dishwashing.** Smaller per instance, but it happens multiple times a day and adds up over weeks.
- **Illness.** Fever, vomiting, and diarrhea all increase water needs, and anyone you're isolating needs a higher personal ration than the household average, not the same one.
- **Hot weather.** CDC guidance states plainly that water needs can double in high heat.
- **Pregnancy and breastfeeding.** Baseline drinking-water needs run roughly 2.4 liters/day (~0.6 gal) pregnant and 3.1 liters/day (~0.8 gal) breastfeeding, independent of and on top of the hygiene/cooking share above.
- **Physical exertion.** Hauling water, clearing debris, or walking out on foot meaningfully raises the drinking-water floor above what a sedentary household member needs.

- **Children.** CDC specifically flags children as needing more water relative to the standard figure, not less, contrary to the instinct to scale down for smaller people.
- **Wound irrigation.** Proper wound care calls for irrigating thoroughly with clean water; real, if occasional, consumption.
- **Pets.** Already factored into this site's shopping list: roughly 0.5–1 gallon/day combined for a dog and two cats, on top of the household's own figure.

None of this means the manual's 14-gallon Tier 1 target is wrong, it's the floor, and it's a reasonable one for the first two weeks of nearly any disruption. But if your household includes anyone pregnant, nursing, sick, doing hard physical work, or if you're planning past the first couple of weeks, plan your Tier 2 bulk storage toward the WHO figure rather than just multiplying the Tier 1 number by more days, and treat laundry as its own explicit planning line rather than something the daily ration is supposed to quietly absorb.

How fast should you actually drink it?

The daily totals above answer how much; they don't answer how fast it's safe to drink it, and that turns out to matter. Healthy kidneys can only clear water at roughly 0.8–1.0 liter (about 27–34 oz) per hour. Drink faster than that and the extra doesn't add hydration, it dilutes your blood's sodium level faster than your kidneys can correct it, the actual mechanism behind hyponatremia (water intoxication).

WARNING

More water, faster, is not always safer

The U.S. Army learned this the hard way. After pushing "drink constantly" heat-injury messaging hard enough, hospitalized hyponatremia cases spiked, 190 cases between 1989 and 1999 alone, soldiers had out-drunk their own kidneys. The fix wasn't less water, it was a ceiling: current Army heat-stress doctrine caps intake at 1 quart/hour under most conditions, up to 1.5 quarts/hour under the most strenuous conditions, and 12 quarts/day. Early hyponatremia symptoms, headache, nausea, confusion, swollen hands or feet, are easy to mistake for dehydration itself, which pushes people to drink even more and makes it worse.

The 2.5–3 liter drinking figure in the table above is a per-day target, not a per-hour instruction. Spread evenly across a day it lands well under the per-hour ceiling on its own; the real risk shows up when someone tries to "catch up" on a missed day or force-drinks a large volume at once out of an instinct that more must be better.

Current sports-medicine and wilderness-medicine guidance favors drinking to thirst over a fixed schedule for most people, precisely because forced-hydration protocols are what caused problems like the Army's in the first place. Thirst is a reasonably good real-time regulator; the hourly figures above exist as a backstop against over-correction, not a target to hit. In practice that means small, frequent sips, roughly 4–8 oz every 15–20 minutes, rather than large, infrequent gulps, which keeps intake under the kidneys' clearance rate the whole time so more of what you drink actually gets retained instead of passing straight through. During real heat or exertion, adding electrolytes rather than only water also matters, since sodium dilution, not water itself, is the actual problem. For how to actually gauge whether you're hitting these figures without a marked container, see Measuring Your Water Intake.

Calculate your own numbers

Worksheet: fill in your own household. Each row multiplies straight across to a subtotal, so the only addition left is the Total row. People get three rate lines, since the target itself spans three real scenarios; dogs and cats use one flat rate regardless of scenario, so that same pet subtotal gets added to each of the three people subtotals, once per line, to produce three separate totals.

	Count	× Rate (gal/day)	= Gal/day
People		1 (survival floor) 2 (comfortable, lighter use) 4 (comfortable, fuller use)	
Dogs		0.3	
Cats		0.1	
Total daily need		Add People + Dogs + Cats (same pet subtotal each time), once per People line above	

Gallons of water stored, or considering storing: _____ gal. Days covered at each level: that number ÷ the matching Total above. More water used per day always means fewer days covered from the same stored amount, not more, so the fuller-use total gives the shortest day count of the three, not the longest.

Worked example: a household of 4 with no pets, storing 224 gallons. People row: 4 × 1 = **4 gal/day** (survival), 4 × 2 = **8 gal/day** (comfortable, lighter use), 4 × 4 = **16 gal/day** (comfortable, fuller use). No pets, so the Total row matches exactly. Days covered: 224 ÷ 4 = **56 days** at the survival floor, 224 ÷ 8 = **28 days** at lighter comfortable use, 224 ÷ 16 = **14 days** at fuller comfortable use, the same 4x

spread the WHO/Sphere standards themselves are apart, just read as three plain numbers instead of a range.

Enter your own household and however much water you actually have stored, or are considering storing, to run the same math instantly at both levels.

People in the household

e.g. 4

Dogs

0

Cats

0

Gallons of water stored

e.g. 56

Count every food-grade container you'd actually use, barrels, jugs, sealed commercial bottles, not water you're relying on a tap or well to keep providing.

Calculate

Why pets get one flat number instead of a range

A dog's or cat's water need doesn't have a "survival minimum" separate from a comfortable one the way a person's does, it's just what keeps them healthy, so the worksheet above adds one flat estimate per animal rather than scaling it with the rest of the range: about 0.3 gal/day for an average ~40 lb dog and 0.1 gal/day for an average ~12 lb cat, based on the standard veterinary guideline of roughly 1 ounce of water per pound of body weight per day for dogs and slightly less for cats. A much larger or smaller pet, hot weather, or an all-wet-food diet will shift this in either direction, treat it as a planning estimate, not a precise figure.

Choosing a container

Use **food-grade containers only**. These carry a recycling number 1 (PETE), 2 (HDPE), or 4 (LDPE), or are explicitly labeled food-grade, and won't leach chemicals into water over long storage. 55-gallon food-grade barrels work well for whole-household bulk storage; stackable 5–7 gallon jugs are easier to move and better for a portable, grab-and-go subset.

Never reuse a container that held a toxic chemical

A container that previously held bleach, pesticides, motor oil, or any other chemical is never safe to reuse for water storage, even after washing. Residue and absorbed chemicals in the plastic itself can leach into the water. This includes most household chemical jugs, don't repurpose them no matter how thoroughly they're rinsed.

Cleaning and sanitizing a new container before its first fill

A brand-new food-grade container still needs this step; dust, manufacturing residue, and open-air storage before purchase are all reasons to sanitize before the first fill, not just reused containers.

1. Wash the container with dish soap and rinse it completely with clean water.
2. Make a sanitizing solution: **1 teaspoon of unscented household bleach** (5–9% sodium hypochlorite, no added scent or dye) per **1 quart (4 cups) of water**.
3. Pour the solution into the container, cap it tightly, and shake well so it touches every interior surface.
4. Let it stand for at least **30 seconds**, then pour the sanitizing solution out.
5. Let the container air-dry completely before filling it with water for storage.

Does the water need to be treated before storing it?

Water source	Treat before storing?
Municipal tap water (already treated by your water utility)	No, store as-is
Private well water, tested and known safe	No, store as-is
Any untested, questionable, or outdoor source	Yes, treat first using the same bleach dosing in the Water Purification guide before storing it
Commercially bottled water	No, use the manufacturer's own sealed container and printed date; don't decant it into another container

Filling and protecting the container

- **Leave headspace.** Water expands roughly 9% when it freezes. Leave about 10% empty space at the top of a rigid container, or store it somewhere that stays above freezing, to keep it from cracking.
- **Store out of direct sunlight**, in as cool a location as practical. Heat and light both accelerate plastic degradation and make algae growth in the container more likely if any light reaches the water.
- **Label every container with the fill date**, the same FIFO habit the rest of this site uses for food storage. A container without a date is a container you can't trust without re-testing it.
- **Store away from gasoline, pesticides, solvents, and other chemicals.** Some plastics can absorb vapors from nearby chemical storage over time, even through a sealed cap.

Rotation: how long stored water actually stays good

Properly sanitized and sealed water has a very long practical shelf life, but taste and confidence both degrade over time. **Replace stored tap water every 6 months** for best taste and peace of mind; some guidance extends that to 12 months for water that's been correctly sanitized and sealed. Tie the swap to a date you'll actually remember, the same daylight-saving-time habit the rest of the site uses for food rotation, so it doesn't quietly slip past a year unnoticed.

When you rotate, dump the old water (it's still fine to use for non-drinking purposes like plants or cleaning) and repeat the full clean-and-sanitize process before refilling, don't just top off an old container.

TIP

Fix flat-tasting stored water by pouring it back and forth

Water that's sat sealed for months loses dissolved oxygen and can taste flat even though it's perfectly safe. Pour it back and forth between two clean containers a few times right before drinking, or shake a partly-full bottle, to reintroduce air and restore a normal taste. It's a taste fix, not a safety step; it doesn't replace treating water you actually suspect is contaminated.

Dispensing without contaminating the supply

Draw water off with a barrel spigot or a siphon pump rather than dipping a cup directly into bulk storage. Every hand or cup that touches the stored water introduces new contamination risk to the

entire container, not just the portion removed.

Northern Utah note: unheated storage

Garages and sheds along the Wasatch Front regularly drop below freezing in winter. If your bulk storage lives in an unheated space, either move it somewhere conditioned for the winter months or make sure every rigid container has the full 10% headspace described above; a cracked barrel loses its entire contents at once, right when you're least likely to have a backup.

Write your own plan, in one sentence

A container sitting untouched for years isn't the same as water you can actually trust. Finish this sentence with your own real plan:

"The next time *I do my six-month water check* , I will actually

check every container's fill date and rotate anything overdue ."

Know someone this guide would actually help? Being the person who's ready includes being the person who says something.

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Sources

- CDC, "How to Create and Store an Emergency Water Supply" (container type, cleaning and sanitizing steps, bleach dosing, rotation interval): CDC
- Utah State University Extension, "Storing Water for an Emergency": USU Extension
- University of Florida IFAS Extension, preparing and storing an emergency safe drinking water supply: UF/IFAS
- FEMA / Ready.gov, the 1 gallon/person/day drinking-and-hygiene guidance: Ready.gov
- Sphere Association, minimum water quantity standards in humanitarian response (drinking, hygiene, cooking breakdown): Sphere; WHO, "How Much Water is Needed in Emergencies": WHO
- CDC, increased water needs for illness and hot weather: Ready.gov
- Institute of Medicine drinking-water guidance for pregnancy and breastfeeding: WebMD

- EPA WaterSense, toilet water use by age/generation (older vs. low-flow fixtures): EPA
- Flat taste from lost dissolved oxygen in long-stored water, and pouring/aerating to restore it: Oxygen SuperCharger; Oregon State University Extension
- Maximum kidney water-clearance rate and the hyponatremia mechanism: Wikipedia, water intoxication
- U.S. military hourly and daily fluid intake ceilings: Montain, "Current U.S. Military Fluid Replacement Guidelines"; TB MED 507
- 1989-1999 Army hyponatremia hospitalization data and the "drink to thirst" shift in guidance: "Ad libitum water consumption prevents exercise-associated hyponatremia," PMC

SKILL GUIDE · WATER

Measuring Your Water Intake

Storing Water Correctly sets real daily targets, and how fast to drink them, in liters, gallons, and quarts. None of that is useful if you can't turn it into something you actually observe. Most people don't own a marked measuring cup and have never tried to picture what 8 ounces looks like in an unlabeled mug. This guide covers exact ways to measure intake with a tool you likely already own, and a real, sourced fallback for estimating it with no tool at all.

With a measuring tool

Any of these gives you an exact number, not an estimate, and each only takes a few seconds once you know the trick.

- **A marked measuring cup, or a bottle with printed volume lines.** Read it directly. The most common printed markings are fluid ounces, cups, and milliliters, often all three on the same cup.
- **A kitchen or postal scale.** Water weighs almost exactly 1 gram per milliliter at normal temperatures, so 1 liter of water weighs 1 kilogram and 1 US gallon weighs about 3.78 kilograms (roughly 8.34 lb). Tare an empty cup, mug, or bottle on the scale (most scales have a "tare" or "zero" button that cancels out the container's own weight), pour in water, and the number on the display is your volume: grams for milliliters directly, or ounces-of-weight for fluid ounces closely enough for everyday tracking.
- **Calibrate an unmarked container once.** Use a measuring cup, a labeled bottle, or a scale a single time to find out how full a specific mug, jar, or water bottle needs to be to hold a known amount, say, 16 oz. Mark that fill line with a permanent marker or a rubber band, or just remember it ("halfway up this mug is 8 oz"). You never have to re-measure that same container again.

A scale reads mass, not volume, but for water the two numbers match

This only works because water's density is almost exactly 1 g/mL across the range of temperatures anyone actually drinks it at. Don't use the same shortcut for other liquids, oil, syrup, and most drinks with dissolved sugar or fat are measurably lighter or heavier per milliliter than water, so a scale reading for those needs the liquid's own density, not water's.

Without a measuring tool: known container capacities

Pick whichever real container you actually reach for and use its standard capacity as a stand-in for a measuring cup. It won't be exact if yours is an off-brand size, but it gets you close enough to actually track a day, which no amount of picturing "12 ounces" in the abstract will do.

Container	Typical capacity
Standard disposable water bottle	16.9 oz (500 mL)
Soda or beer can	12 oz (355 mL)
Large disposable water bottle	33.8 oz (1 liter)
Standard drinking glass	8 oz (240 mL)
Coffee mug	8–12 oz (240–355 mL)
Pint mason jar	16 oz (473 mL)
Quart mason jar	32 oz (946 mL)
Gallon jug	128 oz (3.78 L)

Once you've matched your own container to the closest row above, tracking a day is just counting refills: three 16.9 oz bottles is about 50 oz (1.5 liters), for example, no measuring cup required.

Write your own plan, in one sentence

A daily target only means something once you can actually check yourself against it. Finish this sentence with your own real plan:

"The next time *I fill my water bottle today* , I will actually

count refills against my real daily target instead of guessing ."

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Estimating without any container: counting swallows

This is the least precise method here, worth knowing for exactly the situation where you're drinking straight from a stream, a shared jug, or cupped hands with nothing to measure with at all, but treat it as a rough field estimate, not a number to plan a medical fluid target around.

Reference	Approximate volume
One swallow	15–30 mL (roughly ½–1 oz); studies put the average closer to 21 mL for men and 14 mL for women
One small mouthful	≈43 mL (≈1.5 oz)
One large gulp	≈77 mL (≈2.6 oz)
Five mouthfuls	≈157 mL (≈5.3 oz)

Ten to fifteen average swallows works out to roughly 8 oz, a rough mental benchmark, not something to count precisely mid-drink.

WARNING

Individual variation here is large, don't rely on swallow-counting for a real medical fluid limit

Swallow and gulp volume vary heavily by sex, age, the size of the cup or bottle you're drinking from (a bigger vessel produces roughly 15% larger sips on its own), and straw versus direct drinking, a two-fold swing between individuals is normal, not an error. That's a fine margin for casual day-to-day tracking, but it's the wrong tool for anyone on a doctor-ordered daily fluid restriction (common with heart failure, kidney disease, or liver disease), where the actual number of milliliters matters. Use a real measuring cup, a marked bottle, or a scale for that, not a swallow count.

Putting a full day together

Pick one method above as your baseline for the day rather than switching between them: the measured-container methods for anyone who wants an exact number, or a matched everyday container (a specific water bottle, a specific mug) as a good-enough reference otherwise. Tally every refill, then multiply by that container's capacity to get your running total against Storing Water

Correctly's daily drinking targets (2.5–3 liters at the survival minimum) and its hourly pacing guidance (spread across the day, under roughly 1 quart/hour). A tally on a piece of paper or a phone note works fine; the goal is a running count you can check against a real target, not a device or an app.

Sources

- Water density and the mass-to-volume relationship used for scale measurement: Wikipedia, water (data page)
- Standard bottled and canned water container sizes: CrystalQuest; GlacierFresh
- Average single-swallow volume by sex, and vessel-size effects on sip volume: Rathinam & Bateman, "Dysphagia"
- Mouthful and gulp volume estimates: PEM Source; PubMed, toxic liquid ingestion volume estimation study

SKILL GUIDE · WATER

Sourcing & Hauling Water

Storing Water Correctly covers water you already have, and Water Purification covers making questionable water safe to drink. Neither covers the step in between: what to actually do once the stored supply is running low and you need to find, and physically move, more.

Where to actually find more water

- **Official emergency distribution.** After a declared disaster, FEMA runs Disaster Recovery Centers that can point you to water access; find the nearest one with FEMA's own DRC locator. Local 211 (dial 211, or 211.org) is a second, often faster route to the same information, since it covers local and county-level services a national locator won't always have yet. Know both exist before you need them, look-up time matters when you're already low.
- **A private well, if you have one.** Most residential wells need electricity to run the pump, so a well without backup power is only as useful as your generator or battery setup; see Fire-Starting & Generator Safety for running one safely. Check now, not during an emergency, whether your specific well has any manual or bucket-accessible option.
- **Open sources: streams, lakes, reservoirs.** Usable, but always treat before drinking or storing, see Water Purification above. In Northern Utah specifically, check the Utah DEQ's harmful algal bloom advisories before drawing from Utah Lake or the Jordan River; a bloom can make water dangerous even after normal disinfection. How you actually collect it matters too: draw from moving, flowing water rather than a still or stagnant edge, dip from a straight, uniform stretch of the channel rather than a backwater or eddy, and scan the area upstream first, a beaver dam, grazing livestock, or a heavily used campsite upstream all raise contamination risk. Dip the container slowly and lift it out without letting it touch the streambed; microorganisms concentrate in bottom sediment, and stirring it up puts more of them in your container, not less. Avoid collecting for a day or two after heavy rain if you can wait, runoff washes surface contamination into the water and raises the bacterial load right when it's hardest to see.
- **Neighbors and your local network.** Someone nearby may have a well, a cistern, or stored water to share, especially once a real local network exists before you need it, not improvised after.
- **Rainwater, where it's legal.** See Legal Rainwater Harvesting in Utah for the actual rule and a basic collection setup, set up in advance, this isn't something you can build mid-emergency.
- **No source at all nearby.** See Collecting Water From Snow, Dew & Condensation for melting snow correctly, dew collection, transpiration bags, and an honest look at solar stills as a genuine last resort, rated for how much they actually produce rather than survival-show hype.

Hauling it home

Water is heavy, and that fact alone shapes every decision here: how much you bring back per trip, whether you carry it or wheel it, and how many trips a day are actually realistic.

Container (full)	Approximate weight	How to move it
1 gallon	~8.3 lb	Carry by hand, no problem
5-gallon jug	~43–44 lb	Carry short distances; use a dolly or cart for longer ones
8-gallon wheeled container	~70 lb	Built for wheeling, not carrying
15-gallon container	~125 lb	Near the limit of what one person should move alone; use a cart or two people

A working rule of thumb

Use a dolly or wheeled cart for anything over 5 gallons, and keep any load you're actually carrying by hand under about 50 lb. A garden cart, a hand truck, or even a sled in snow all beat repeated trips carrying a heavy jug, especially once hauling becomes a standing weekly task rather than a one-time trip.

If hauling by hand is genuinely the only option, a shoulder yoke, a wood or bamboo bar carried across the shoulders with a bucket balanced on each end, is the real historical answer to why hand-carried water is traditionally split into two containers rather than one big one. It shifts the load off your hands and forearms onto your shoulders and torso, which handle sustained weight far better, and a balanced load on both ends stops water from sloshing out with every step the way a single unbalanced bucket does. Two 5-gallon buckets on a yoke is a genuinely easier carry over distance than the same 10 gallons split one-handed.

For repeat trips rather than a single big haul, collapsible containers, water bladders, or fold-flat jugs pack smaller on the way out and are easier to fill from an awkward source (a shallow stream, a distribution point's own spigot) than a rigid barrel. Keep at least one rigid container too, a collapsible one is easy to puncture and harder to move once it's damaged.

WARNING

A Garden Hose Left in a Bucket or Barrel Can Contaminate Your Whole House's Water

A garden hose left submerged in a bucket, a kiddie pool, a rain barrel, or a chemical sprayer tank is a real contamination route into your entire household water supply, not just a theoretical risk. If municipal pressure drops, from a water-main break, nearby firefighting, or your own well pump failing, that contaminated water can get siphoned backward through the hose and into the same plumbing everyone in the house drinks from. Install an inexpensive hose-bibb vacuum breaker on outdoor faucets (frost-proof versions exist for cold climates), never leave a hose submerged in standing or chemical-treated water, and disconnect hoses when they're not actively in use; backflow can't happen without a connection.

Treat it before you drink it, treat it again before you store it

Water from any source outside your own sealed, known-good storage is untreated by default, regardless of how clear or clean it looks. Treat it using the methods in Water Purification before anyone drinks it. If you're bringing it home to add to your bulk storage rather than drinking it immediately, follow Storing Water Correctly's container-cleaning and treatment steps too, don't just top off a storage container with untreated water because it's going to sit for a while first.

This is also the task the Surviving's Tier 2 weekly rhythm means by "water sourcing": a standing, planned trip, not a scramble the day the stored supply finally runs out.

Write your own plan, in one sentence

Knowing where water is doesn't help if you've never actually planned how to get it home. Finish this sentence with your own real plan:

"The next time *I think through my water plan* , I will actually

figure out my household's real backup source and how I'd haul it ."

Know someone this guide would actually help? Being the person who's ready includes being the person who says something.

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Sources

- FEMA, finding water and other assistance after a disaster (Disaster Recovery Center locator): FEMA; FEMA DRC Locator
- 211, local emergency and community service referrals: 211.org
- Utah Division of Water Quality, harmful algal bloom advisories for Utah Lake and the Jordan River: Utah DEQ
- Water weight and container capacity figures: CrystalQuest; manufacturer specifications, 8-gallon wheeled container
- Safe stream-water collection site selection, sediment disturbance, and post-rain contamination risk: USGS; Take a Hike UK
- Shoulder yoke mechanics and balanced two-bucket carrying: Digging in the Driftless; Lehman's
- Backflow prevention, cross-connection, and garden-hose backsiphonage risk: City of Rockville, MD

SKILL GUIDE · WATER

Legal Rainwater Harvesting in Utah

Rainwater harvesting in Utah isn't illegal, the way the old rumor goes, but it is regulated, and the rule itself is simple enough to just know. This is a Stage 3 self-sufficiency skill from Preparing's Water chapter and its addendum, and unlike most of what's in that stage, the "how" here is a bureaucratic process, not a hands-on course, so it's genuinely teachable on one page.

The two tiers of Utah's rule

Storage amount	What's required
Up to 200 gallons (2 covered containers, 100 gallons each, max)	Nothing. No registration, no paperwork, completely legal on its own.
Up to 2,500 gallons total, on one parcel	Free registration with the Utah Division of Water Rights
More than 2,500 gallons, or water for other parcels	A full water right, a genuinely different and more involved process

Read these as two separate options, not additive tiers: two 100-gallon covered containers requires nothing at all, while a setup you register can hold up to 2,500 gallons total on its own. Almost every household system fits inside the 2,500-gallon registered tier without ever needing an actual water right.

How to register

1. Go to waterrights.utah.gov/forms/rainwater.asp.
2. Fill out the form: your name, phone number, property address, and email. That's the whole information requirement.
3. Submit it. Registration is free, and you'll get a certificate to print and keep with your other household documents.
4. Register again if you significantly increase your total storage capacity later; the registration covers the capacity you declared, not an open-ended allowance.

Where you can use it

Collection and use are limited to the same parcel of land where the water is captured and stored. You can't collect rainwater at one property and truck or pipe it to use on another, registered or not.

Building a system that doesn't create a mosquito problem

The legal part is the easy part; a poorly built system creates a real, separate problem: standing water breeds mosquitoes within days. A few basic components prevent that instead of causing it.

- **A gutter screen** at the inlet catches leaves, sticks, and roofing debris before they reach the container.
- **A first-flush diverter** routes the initial, dirtiest runoff (dust, pollen, bird droppings that accumulated on the roof since the last rain) away from your storage, before clean water starts filling it. The standard design is a vertical standpipe mounted on the downspout: it fills with the dirty first flush, a floating ball inside then rises and seals off the pipe once full, and subsequent clean water diverts past it into the tank. A small bleed hole, roughly 3–5mm, drilled at the base of the standpipe slowly drains it between storms so it resets on its own before the next rain. A rough sizing rule: divert at least 12.5 gallons for every 1,000 square feet of roof area being collected from.
- **Screened openings and vents**, 1/16-inch mesh or finer, on every point where the container is open to the outside. Bond rigid mesh to vent caps and openings with PVC cement or an adhesive sealant rather than just laying it over the opening, and caulk any remaining gaps around lids, vents, or pipe penetrations. This is the single most important anti-mosquito measure; an unscreened or loosely-fitted opening is an invitation.
- **A "dry" system**, meaning no standing water left sitting in exposed pipes or fittings between rains. Stagnant water anywhere in the system, not just in the main container, is a potential breeding site.
- **Overflow routed away from your foundation**, with a real minimum size: at least 1½ inch in diameter, since anything narrower clogs easily, positioned 2 to 4 inches below the container's rim, sloped at least ¼ inch per foot, and routed at least 10 feet from the foundation.

Connecting the gutter to the container itself usually means a mid-downspout diverter kit: drill a hole in the downspout (the front face for a 2x3 inch downspout, the side face for a 3x4 inch one), fasten the diverter fitting in place with the self-tapping screws it comes with, and run the included fill hose down to the container's inlet, positioned level with the intake so the diverter's own overflow works correctly once the container is full.

Use an opaque, UV-stabilized, food-grade HDPE container (often sold in the industry-standard blue for exactly this reason) rather than an unrated plastic drum, even for water you don't plan to drink without treatment first: food-grade plastic won't leach chemicals into stored water over time, and opacity blocks the sunlight that would otherwise grow algae inside the tank.

Where to find it: first-flush diverters, gutter screens, and mesh screening are sold at hardware stores, home improvement retailers, and specialty rain-barrel suppliers online; a basic setup for a single rain barrel costs well under $100 in parts.

Watch it: Utah State University Extension, "How to Install a Rain Barrel Diverter".

Winterize the system before the first hard freeze

Water left in a tank, diverter, or fittings expands as it freezes and can crack a tank or split a fitting outright, a real, avoidable loss for a system that cost real money to build. Before winter sets in, drain the tank completely (tilt or prop it to get the last of the water out), disconnect it from the downspout, lock the diverter to route water straight down the downspout as it would without a harvesting system at all, and drain any exposed hose or fitting so nothing is left holding standing water through a hard freeze. Reconnect everything in spring once the freeze risk has passed.

This water isn't automatically safe to drink

Registering and collecting rainwater legally doesn't make it potable on its own; roof runoff picks up whatever was sitting on your roof. Treat it with one of the methods in the water purification guide before drinking it, the same as any other questionable source. It's genuinely useful untreated for irrigation, flushing, or other non-drinking uses without that extra step.

Write your own plan, in one sentence

The registration itself takes about five minutes once you actually sit down to do it. Finish this sentence with your own real plan:

"The next time *I have five minutes free this week* , I will actually

register my storage with the state and order the parts for a first-flush diverter ."

Know someone this guide would actually help? Being the person who's ready includes being the person who says something.

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SKILL GUIDE · WATER

Building a Biosand Water Filter

A commercial gravity filter (Berkey-, Sawyer-style) is a stored, finite resource: the cartridge eventually wears out and needs replacing. A properly built biosand filter is the renewable alternative Preparing's Water chapter's Tier 3 has in mind, sand and gravel don't run out, but it only works if it's built to the real specification, not the popular internet shortcut.

The real design, and the one that isn't

Two very different things get called a "sand and charcoal water filter." The one with decades of field deployment and published pathogen-removal data behind it is the **biosand filter (BSF)**, a design standardized by CAWST (the Centre for Affordable Water and Sanitation Technology) and used by aid organizations worldwide. The one that shows up in most online tutorials, a bucket layered with sand, gravel, and charcoal that drains at a normal gravity-fed pace, is a different device. It's a reasonable sediment pre-filter. It is **not** a tested purification method, and no credible source has published pathogen-removal data for it. The difference between the two isn't the materials; it's the flow rate, and that's the entire subject of this guide.

What the biosand filter actually is

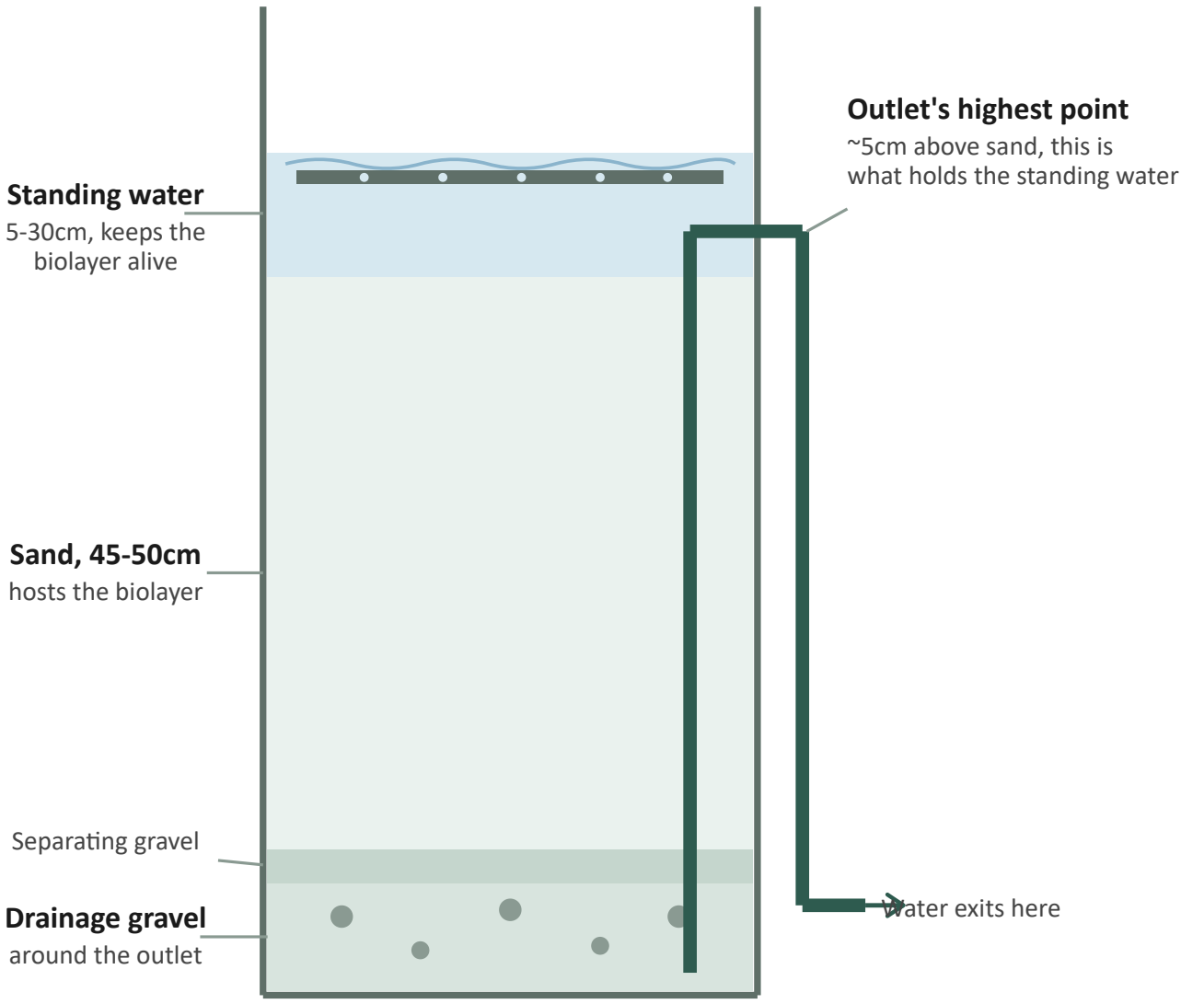
A biosand filter is a container of sand and gravel that water passes through slowly enough for a living biological layer, the **schmutzdecke** (German for "dirt layer"), to establish on top of the sand and do most of the actual pathogen removal. It's the same principle municipal water utilities have used since London's Chelsea Waterworks first installed slow sand filtration in 1829, scaled down to a household container.

Component	Specification
Housing	A tall, narrow container, roughly 0.3m square or in diameter and 0.9m tall: food-grade plastic buckets, a 55-gallon food-grade drum, or CAWST's standard concrete or high-density plastic housing all work, as long as the proportions hold
Sand layer	Effective size 0.15-0.30mm, uniformity coefficient 1.5-3.0, at least 45-50cm deep. This is the layer that hosts the biolayer; it is not just a strainer
Separating gravel	0.7-6mm, a thin layer between the sand and the drainage gravel so sand doesn't wash down into it
Drainage gravel	6-12mm, at the base, surrounding the outlet pipe
Diffuser	A flat plate drilled with a uniform pattern of small holes, mounted roughly 70mm (2.8in) above the sand surface, so incoming water spreads out and drips instead of jetting straight down and cratering the sand
Standing water	5cm of water always sitting above the sand at rest, refilled to 20-30cm when you add water; this layer keeps the biolayer organisms alive between uses

Building it

1. Screen your sand and gravel to the sizes above. This is the step people skip, and it's the one that determines whether the finished filter actually works: a controlled comparison found 99% Cryptosporidium removal with well-graded sand versus just 48% removal with coarser, poorly-graded sand of otherwise the same design. You can check your own screened sand against the CAWST specification with a home sieve analysis: run a weighed sample through a graduated stack of sieves, then find the sieve size that let through the smallest 10% of the sample by weight, that opening size is your **effective size (ES)**. Do the same for the size that let through the smallest 60%, that's your **d60**. Divide d60 by ES to get your **uniformity coefficient (UC)**. If ES falls outside 0.15-0.30mm or UC falls outside 1.5-3.0, re-screen before building.
2. Wash all media thoroughly before loading it, sand and gravel straight from a source carries fine silt that will cloud your first several batches of water and can clog the bed prematurely.
3. Layer from the bottom up: drainage gravel around the outlet, separating gravel above it, then the full sand depth on top.
4. Mount the diffuser plate roughly 70mm above the finished sand surface, not resting directly on it, so poured water sprays through its holes and lands as a spread-out drip rather than a jet that digs a crater in the sand and disturbs the biolayer underneath.

5. Build the outlet as a tube whose highest point sits inside the container roughly 5cm above the sand surface: from the drainage gravel at the base, the tube rises up inside the housing to that height, bends over, and runs back down and out through the wall or base. That rise is what physically holds 5cm of standing water above the sand at rest, water can't drain below the height of the tube's highest point, which is what keeps the biolayer wet and alive between uses. There is no flow-control valve to buy or install; the slow flow rate itself comes from the resistance of the sand bed plus the height of water pushing down on it (the head), not from anything restricting the outlet pipe.



WARNING

Flow rate is not a limitation, it's the mechanism

A properly built biosand filter runs at roughly **0.4 liters per minute or slower** (CAWST's own maximum for its standard unit), regardless of how large the container is. That slowness is what gives the biolayer enough contact time to actually remove pathogens; a filter built the same way but allowed to run faster is not a faster biosand filter, it's a device with no biological treatment happening at all. If your build drains in a few minutes instead of tens of minutes, it is functioning as a sediment filter, not a purifier, no matter what media you loaded into it. If flow ever drops below about 0.1 liters per minute, the surface has clogged and needs maintenance (see below), not a redesign to make it flow faster.

What size actually gets you what flow rate

CAWST's maximum safe loading rate works out to roughly **400 liters per hour per square meter** of sand cross-section, a physical constraint tied to contact time, not to container size. That means output scales with the footprint of your sand bed, not with how big or dramatic the container looks. Before building, it's worth knowing what you're actually going to get:

Container	Approx. sand cross-section	Physics-derived maximum output
5-gallon bucket	~0.066 m^2	~26 L/hour (~6.9 gal/hour)
55-gallon drum	~0.26 m^2	~102 L/hour (~27 gal/hour)
CAWST standard unit (concrete/plastic housing)	n/a	0.4 L/minute (~24 L/hour), CAWST's own directly published maximum, the reference figure the estimates above are derived from

Those are ceilings, not targets, running at the maximum starves the biolayer of contact time the same way an oversized outlet does. Claims online of a single household filter producing over a thousand liters a day are not consistent with this physics and shouldn't be relied on; a single 5-gallon-bucket-scale unit is realistically a slow, steady household supplement, not a whole-family primary water source on its own. Multiple units run in parallel, not one unit run faster, is the correct way to scale up output.

Ripening the biolayer

A freshly built filter does not work yet. The schmutzdecke takes roughly **2 to 4 weeks** to establish, and pathogen removal during that window is meaningfully worse than once it's mature: one study

found bacteria removal rising from about 63% in an unripe filter to 98-99% once fully matured. Build and start ripening a filter well before you need to depend on it, not during an actual emergency.

Between uses, let the standing water sit for **6 to 12 hours** (minimum 1 hour, maximum 48 hours) before drawing the next batch. This pause is when the biolayer organisms actually feed; too short a pause doesn't give them time to work, and too long a pause in a hot, dry climate risks the standing water evaporating away and the biolayer drying out and dying.

What it actually removes, and what it doesn't

A mature, correctly built biosand filter is genuinely effective against bacteria and, especially, protozoa like Giardia and Cryptosporidium, often exceeding 99% removal once ripened. Virus removal is the real weak point, and it's worth being honest about rather than repeating a confident-sounding percentage: published results vary enormously by virus type and filter maturity, with at least one peer-reviewed bench study finding reductions as low as 50% for some virus surrogates, well short of the World Health Organization's own minimum performance target for household water treatment.

WARNING

Never rely on filtration alone if you suspect viral contamination

This is the same rule this site's Water Purification guide already gives for commercial filters, and it applies here without exception: no filter, biosand or commercial, should be trusted alone against a water source that might carry human sewage (a flooded municipal line, a compromised septic system). Pair this filter with a disinfection step, boiling, bleach, or chlorine dioxide tablets, on the same schedule you'd use for any other filtered water. Treat the biosand filter as the sediment and bacteria/protozoa stage of a two-stage system, not a complete one by itself.

Charcoal's real role: taste and odor, not purification

Some biosand builds add a charcoal layer, and it's worth understanding exactly what that layer is doing, because it isn't purification. Raw charcoal from a wood fire has a surface area of roughly 2 to 5 square meters per gram; commercially activated carbon, steam- or chemically-treated specifically to open up its pore structure, reaches 500 to 1,500 square meters per gram, a hundred to a thousand times more adsorption surface. Homemade charcoal will noticeably improve taste and

odor and adsorb some organic compounds. It will not reliably remove bacteria, viruses, or protozoa, and it does nothing for dissolved minerals, nitrates, or most chemical contamination.

If you're pairing a charcoal stage with chlorination, order matters

Activated carbon and raw charcoal both adsorb free chlorine. If a charcoal layer sits after your disinfection step, it will strip the chlorine residual you just added, the exact thing meant to keep the water safe through storage. Put any charcoal stage before disinfection, never after.

Maintenance: swirl and dump first, scrape only as a last resort

When flow slows to a crawl, the sand surface has clogged, not failed, and the fix that actually preserves the biolayer is "swirl and dump," not scraping. Pour about a gallon of water into the empty filter, use a clean hand to gently swirl just the top layer of sand so the trapped dirt suspends in the water, then pour that dirty water off the top before it settles back down. Smooth the sand surface flat again and repeat two or three times until flow noticeably improves. This works because it resuspends and removes the clogging sediment without stripping away the living schmutzdecke itself, the way scraping does.

Reach for scraping only when repeated swirl-and-dump no longer restores flow. Drain the standing water, then scrape off the top 1 to 3 centimeters of sand, the clogged schmutzdecke layer, and remove it. Refill with water and let it sit and recirculate for several hours before returning to normal use, giving a new biolayer time to begin establishing. Municipal slow sand filtration plants run this same scrape-and-rest cycle on a rotation of multiple beds so treatment never fully stops; a household filter just goes offline for a few hours instead. Once repeated scrapings have thinned the sand bed down to within about 10cm of the minimum 45-50cm depth, stop scraping and add fresh, properly screened sand back on top instead, continuing to scrape a bed that's gotten too shallow starves the biolayer of the depth it needs to work.

Placement: pick the spot before you build, not after

Two practical realities decide where a biosand filter belongs, and both are easy to discover only after it's too late to fix cheaply.

WARNING

A full-size unit is genuinely too heavy to move

A 55-gallon drum filter loaded with sand, gravel, and standing water commonly weighs over 700 lb once it's built and operating. Build it in its final location, on a surface and support structure that can actually bear that load, a concrete slab or a well-supported floor, not a spot you plan to move it from later. A 5-gallon-bucket-scale unit is a different story and stays genuinely portable if you'd rather keep that flexibility.

The biolayer is also a living thing, and cold hurts it twice over: freezing temperatures slow the schmutzdecke's own biological activity, so a filter left outside through a cold winter removes pathogens less effectively even before anything freezes solid, and if the standing water and wet sand actually freeze, the ice can crack a plastic housing or split the outlet tube outright. Keep the filter somewhere that stays above freezing, an insulated shed, a garage, or indoors, in any climate that sees a real winter; a design that has to live outside year-round needs real insulation around the housing, not just a lid.

Before you need it

The Water addendum's own goal is owning at least two independent water treatment methods so a single point of failure doesn't leave a household without safe water. A biosand filter is a strong second method precisely because it doesn't depend on a replaceable cartridge, but only if it's already built, already ripened, and already tested with your own water before an emergency is the first time you need it working. Build it now, run water through it for the several weeks the biolayer needs, and confirm your own flow rate matches what you'd expect from the table above before counting on it.

Write your own plan, in one sentence

A filter that isn't already built and ripened is still a plan, not a working backup. Finish this sentence with your own real plan:

"The next time *I have a free weekend* , I will actually

screen my sand, build the filter, and start ripening the biolayer ."

Know someone this guide would actually help? Being the person who's ready includes being the person who says something.

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SKILL GUIDE · WATER

Collecting Water From Snow, Dew & Condensation

The Sourcing & Hauling Water guide covers finding more water from a well, an open source, rain, or a neighbor. This guide covers what's left when none of those exist nearby: pulling water from snow, dew, and the air itself, rated honestly for how much they actually produce.

Melting snow: the real technique

In a Utah winter, snow is often the most abundant water source on the property, but doing it wrong costs you more than it gives.

WARNING

Don't eat unmelted snow as a water source

Snow is mostly trapped air, and how much water you actually get back varies a lot by snow type: typical snow runs close to a 10:1 ratio (roughly a tenth of its volume as water), dry powder can run 15:1 to 20:1 or worse (a twentieth or less), and only unusually wet, dense, already-compacted snow approaches a quarter to a fifth. Plan on gathering far more snow than the water volume you actually need, especially for fresh powder, not the wet-snow best case. On top of that, your body has to supply the heat to melt it if you're not using an external source. Eating snow directly, or relying on it in any real quantity, uses body heat and calories fast enough to work against you, a real, documented contributor to hypothermia and net dehydration, not just an old wives' tale.

1. Melt snow with an external heat source, a camp stove, fire, or any other heat source not coming from your own body, whenever one is available at all.
2. Start with a small amount of water or already-melted snow in the pot before adding more snow; melting straight from dry snow with nothing already liquid in the pot risks scorching the pot and wasting fuel.
3. Treat the resulting water the same as any other untreated source, see Water Purification, before drinking it; snow isn't sterile just because it's frozen.
4. If no heat source exists at all, packing snow into a bottle and holding it inside a jacket against your body is a genuine last-resort trickle, not a real strategy, plan to have a stove or fire available rather than relying on this.

Dew collection

On a clear night with a real temperature drop, moisture in the air condenses on any surface that cools faster than the air around it. A large plastic sheet or tarp, laid flat and propped slightly off the ground on sticks or rocks so air can move underneath, collects that condensation; angle it gently toward one low corner with a container underneath to gather what forms.

Realistic yield is roughly 0.1 to 2 liters per square meter of sheet per night, depending on humidity and how much the temperature actually drops overnight; a clear sky and a big day-to-night temperature swing produce more than an overcast or unusually mild night. Treat this as a genuine, repeatable supplement rather than a primary source, scale it by using more sheet area, not by expecting a small tarp to produce a household's daily needs.

Without a sheet or tarp on hand, an absorbent cloth (a t-shirt, a bandana, a chamois) dragged or dabbed over dew-soaked grass at first light works as a real backup: wring the collected moisture into a container and repeat across a wider patch of grass than you'd think necessary, since each pass picks up relatively little. Avoid dew collected near roads or from lawns that may have been chemically treated.

Dew and any water condensed this way is not automatically safe to drink: it forms on whatever surface it touches, which can carry dust, pollen, or animal droppings. Filter or boil it the same as any other untreated source before drinking, see Water Purification.

Transpiration bags

A clear plastic bag sealed tightly around a healthy, leafy, non-toxic branch, with a low corner weighted down to form a collection point, captures the water vapor the plant naturally releases through its leaves as it condenses on the inside of the bag. Gather the open end of the bag around the branch and tie it off snugly with any cordage on hand, paracord, string, a twist tie, even a rubber band, so vapor can't escape around the seal.

Detail	What to know
Bag choice	Clear, not colored or opaque; sunlight needs to reach the leaves for the plant to keep transpiring at a useful rate
Branch choice	Stick to easily identified, non-toxic broadleaf trees like oak, maple, or birch; avoid poison oak, poison ivy, and sumac entirely, a bag sealed around one of those still concentrates their irritant oils in the vapor and on the bag's outside
Realistic yield	Up to roughly 900mL per bag over a full day in good sun; a few hundred mL is a more typical result
Foliage amount	More leaves generally means more water, but packing in so much that the bag shades itself cuts yield
Plant care	Move to a different branch after about 48 hours; leaving one branch bagged longer risks real damage to the plant

Transpiration water is generally lower-risk than dew since it's been filtered through the plant's own tissue, but treat it as questionable rather than automatically safe, particularly if any leaf or bark debris ends up in the bag; filtering or boiling before drinking is still the safer default.

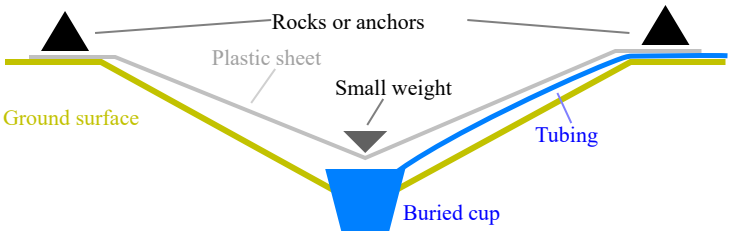


U.S. Army photo by Sgt. John Onuoha, public domain, via Wikimedia Commons.

Solar stills: a real last resort, not a real strategy

A pit still, a hole lined with plastic sheeting over a container, with a clear sheet stretched over the top and weighted in the center so condensation drips down into the container, pulls moisture out of the ground itself using the sun's heat. It's a genuinely well-known survival technique, and it's also genuinely overrated.

1. Dig a bowl-shaped hole roughly 3 feet across and 2 feet deep in a sunny spot, ideally somewhere the soil is visibly damp.
2. Set a clean container in the center of the hole's bottom.
3. Line the inside of the hole with non-toxic green vegetation, kept clear of the container itself, to add extra moisture through its own transpiration as it heats up.
4. Stretch a clear plastic sheet across the top of the hole and seal its outer edges by piling excavated soil or sand over them, so the humid air trapped inside can't escape around the perimeter.
5. Place a small weight (a rock) at the center of the sheet, directly over the container, so condensation running down the underside drips into it instead of back onto the ground.
6. If a length of tubing is available, run one end into the container and out under the sealed edge, so the still can be sipped from a straw without breaking the seal and losing the built-up heat and humidity each time it's opened.



Smack, public domain, via Wikimedia Commons.

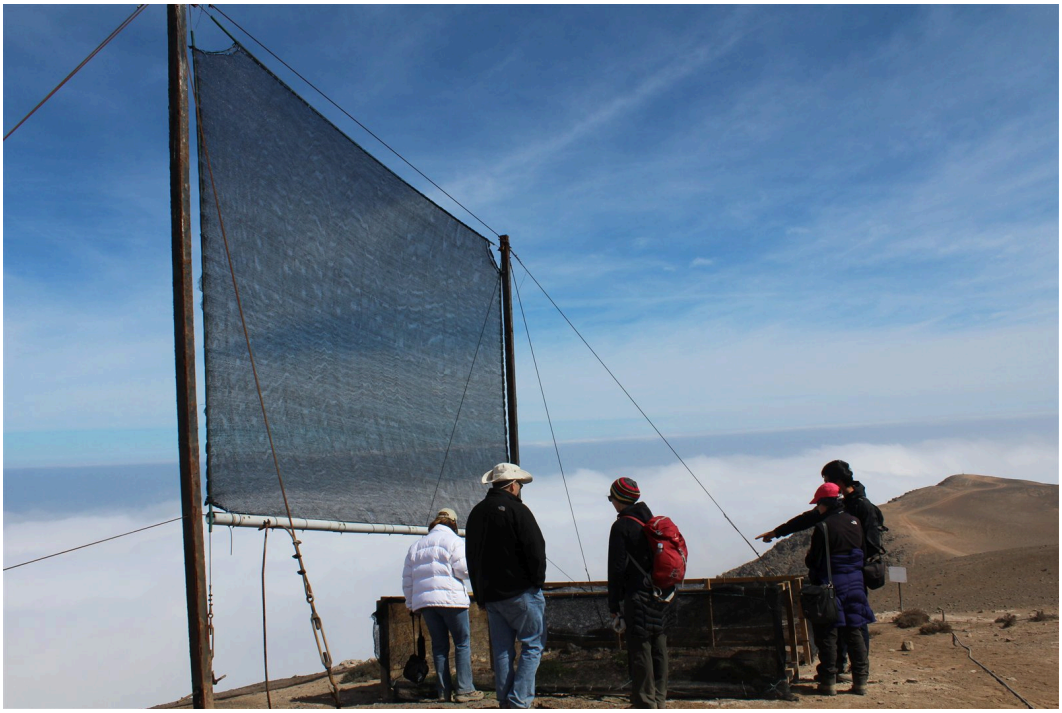
The honest yield, and the real criticism

A well-built pit still commonly produces only about 0.25 to 1 liter of water per day, and output drops further in cold, cloudy, or windy conditions. A real, widely-discussed criticism among experienced survival instructors is that the sweat spent digging the pit itself, especially in hot conditions, can cost more water than the still eventually produces. Treat this as a technique to know for a genuine survival emergency, not a household water strategy to plan around. Water condensed in a still is effectively distilled and safe to drink without further treatment, which is also what makes urinating directly into the pit itself, never into the collection container, a legitimate way to add moisture to the system in a genuine survival emergency: the still purifies it on the way to the container.

Two you may have heard of, rated honestly

"Atmospheric water tower" designs like Warka Water have gotten real press attention for a bamboo-and-mesh tower claimed to pull over 25 gallons a day from fog and humidity. Those numbers come from the project's own field reports; independent, third-party verification of that output is thin. Treat the claim as unproven rather than either confirmed or debunked, and don't plan around it as a real household solution.

Fog nets, large mesh panels that comb water droplets out of fog as it blows through, are a real, deployed technology with genuine success in places like coastal Chile and Morocco. They depend entirely on a climate with regular, reliable fog, which the Wasatch Front generally doesn't have; this is a real technique worth knowing about, just not one that fits Northern Utah's climate.



Pontificia Universidad Católica de Chile, CC BY-SA 2.0, via Wikimedia Commons.

Write your own plan, in one sentence

These methods only work if the technique is right; done wrong, snow especially can cost you more than it gives. Finish this sentence with your own real plan:

"The next time *it snows and my water source is out* , I will actually *melt it with a real heat source instead of eating it straight* ."

Know someone this guide would actually help? Being the person who's ready includes being the person who says something.

Send them this page ›

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SKILL GUIDE · WATER

Water Testing: Strips, Labs & Field Methods

The Water chapter's Water Testing Kits item names test strips for pH, chlorine, and bacteria in one breath, but they don't work the same way. This guide separates the three real tiers, strips, a mail-in lab, and field-expedient bacteria testing, and covers what each one honestly can and can't tell you.

Three tiers, not one test

Tier	What it tells you	Turnaround	Best for
Color-match strips	pH, chlorine residual, hardness, lead, nitrate, present/not-present rather than a precise value	Seconds to minutes	A fast field screen, or confirming a treatment step (like chlorination) actually worked
Mail-in lab panel	Precise, quantified results across a full contaminant panel, the most accurate option that exists	Days, and requires a working postal or courier system	An annual private-well test, or any time real precision matters and normal shipping is running
Field-expedient bacteria test	Presence/absence (or a quantified estimate) of fecal-indicator bacteria, with no lab or mail required	24-48 hours, incubated at a warm temperature	Exactly the situation this manual plans around: mail-in isn't an option, but you still need to know if a source is fecally contaminated

WARNING

Most consumer lead test strips can't actually detect a dangerous lead level

A peer-reviewed study testing 16 at-home lead test kit brands found 12 of them unsuitable for real drinking-water analysis, with detection limits of 5-20 mg/L, hundreds of times higher than the EPA's 15 parts-per-billion (0.015 mg/L) action level. A strip that only flags lead at concentrations hundreds of times above the level that actually matters can read "clean" on water with a genuinely dangerous amount of lead in it, and give real false reassurance, especially for a household with young children, where lead exposure risk is highest. A color-match strip is a reasonable fast screen for pH, chlorine, hardness, and nitrate, but don't rely

on one for lead specifically; if lead is a real concern (older plumbing, known lead service lines), send a sample to a certified lab instead.

Reading a strip correctly, not just dipping it

A strip's own reagent pads are sensitive enough that sloppy technique gives a genuinely wrong answer, not just an imprecise one. Handle the strip by its non-reactive end, dip the pads in the water for about one second, don't leave it soaking, and shake off the excess without blotting it on anything. Wait the exact time printed on the bottle, typically 15 seconds to a minute depending on the product, before comparing colors, reading too early or too late both distort the result. Hold the strip flat and level rather than tilted, since colors from adjacent pads can bleed into each other at an angle, and compare against the chart in natural daylight rather than under artificial light, which shifts how colors read. Never touch the pads themselves with your fingers, oils transfer easily and throw off the reaction.

Your annual baseline: what to actually test for on a private well

Test annually for total coliform bacteria, nitrate, total dissolved solids, and pH, the EPA's standing recommendation for any household on a private well, not just a Tier 3/4 household. Test the full chemical panel every 3-5 years, and retest immediately after a flood, a well repair, a new baby in the house, or any change in taste, smell, or appearance. This baseline matters regardless of whether an emergency ever happens; most private wells are never tested at all otherwise.

Find a certified lab through your state health department's environmental lab directory or a national mail-in service like Tap Score or National Testing Laboratories, both ship a sterile sample kit to you first. Collect a bacteria sample with real sterile technique: use only the sterile bottle the lab sent (discard it if the seal was already broken), remove any aerator screen from the faucet, run the water for 2-3 minutes to clear the line, and fill the bottle without letting the faucet touch the bottle or your fingers touch the inside of the bottle or cap. Ship it back the same day if possible; most labs want a bacteria sample analyzed within 24-30 hours of collection.

WARNING

High Nitrate Is a Specific Danger for Infants Under 6 Months

Nitrate above the EPA's limit of 10 mg/L is a particular risk for babies under six months old. Water with high nitrate used to mix formula, or given directly to an infant, can cause methemoglobinemia, sometimes called blue baby syndrome, a real reduction in the blood's

ability to carry oxygen. Watch for blueness around the mouth, hands, or feet, and treat it as a medical emergency if you see it. This is exactly why a new baby in the house belongs on the retest-trigger list above, right alongside a flood or a well repair. Boiling does not help here, it concentrates nitrate rather than removing it, since the water evaporates and the nitrate doesn't. If a test comes back high, switch to bottled water or another verified nitrate-free source for formula and infant feeding until the well is fixed. Reverse osmosis, distillation, and nitrate-specific ion exchange remove it; a standard carbon filter or a water softener does not. Breastfeeding itself has no reported cases of this condition.

Field-expedient bacteria testing: no lab, no mail, real methods

Two real, well-documented methods exist for exactly the situation where a mail-in lab isn't reachable. Both only detect fecal-indicator bacteria, see the warning below, but both are genuine, not improvised.

Method	How it works	Where to get it
H2S test	A WHO/UNICEF-recommended paper-strip or bottle method built specifically for low-resource and disaster settings with no institutional lab access. The sample culture turns black within 24-48 hours if hydrogen-sulfide-producing (fecal indicator) bacteria are present. Costs roughly $1-1.50 per test to produce.	Sold pre-made in the U.S. as part of Aquagenx's CBT product line, available on Amazon and directly from Aquagenx, explicitly marketed for disaster and emergency use
Coliscan Easygel / compartment bag tests	A self-contained culture medium; add the water sample directly, no filtration or transfer step, and incubate 24-48 hours at a warm temperature. Coliform colonies turn pink, E. coli colonies turn purple.	Micrology Labs sells Coliscan Easygel directly; Aquagenx's Define/CBT II kits do the same job and are sold on Amazon, both explicitly designed for on-site field use with no lab required

You don't need a real incubator

Both methods need a warm, stable temperature (roughly 90-98°F) for 24-48 hours, not a lab incubator specifically. A warm windowsill in summer, a spot near a wood stove, or even body heat (carried in an inner jacket pocket) can hold a sample at an adequate temperature in a real off-grid situation.

WARNING

A clean result is not the same as safe water

Both the H2S test and Coliscan-style tests detect fecal-indicator bacteria only. Neither detects viruses, protozoa like Giardia or Cryptosporidium, heavy metals, or chemical contamination. A clean result means the water isn't fecally contaminated by this test's sensitivity, not that it's safe to drink untreated. Use these tests to screen a source or catch a clear red flag, and still run any questionable water through the Water Purification guide's treatment steps rather than treating a clean bacteria test as a green light to skip treatment.

Write your own plan, in one sentence

Most private wells are never actually tested. Finish this sentence with your own real plan:

"The next time *I order a mail-in test kit* , I will actually

send in a real sample instead of assuming the water's fine ."

Know someone this guide would actually help? Being the person who's ready includes being the person who says something.

Send them this page ›

Sources

- Strip test types and what each contaminant test covers: Fresh Water Systems; Water Filter Guru
- Peer-reviewed study finding most at-home lead test kits unsuitable for drinking-water analysis, and EPA's 15 ppb lead action level: Environmental Science & Technology
- EPA private well testing recommendations: EPA; CDC
- Nitrate in well water and infant methemoglobinemia (blue baby syndrome) risk: LactEd
- H2S test method, WHO/UNICEF recommendation, and field use: World Health Organization; post-earthquake Haiti field study, PMC
- Coliscan Easygel mechanism and incubation: Micrology Labs; King Conservation District
- Aquagenx CBT/Define kits, U.S. retail availability and disaster/field-use design: Aquagenx
- Test strip dip time, reading window, and technique: Outdoor Fixes; ScienceInsights

- Sterile bacteria sample collection procedure: Missouri Department of Natural Resources; Illinois Department of Public Health