HOW TO DRILL A WELL AND HARVEST RAIN AND GRAY WATER

How to Drill a Well and Harvest Rain and Gray Water

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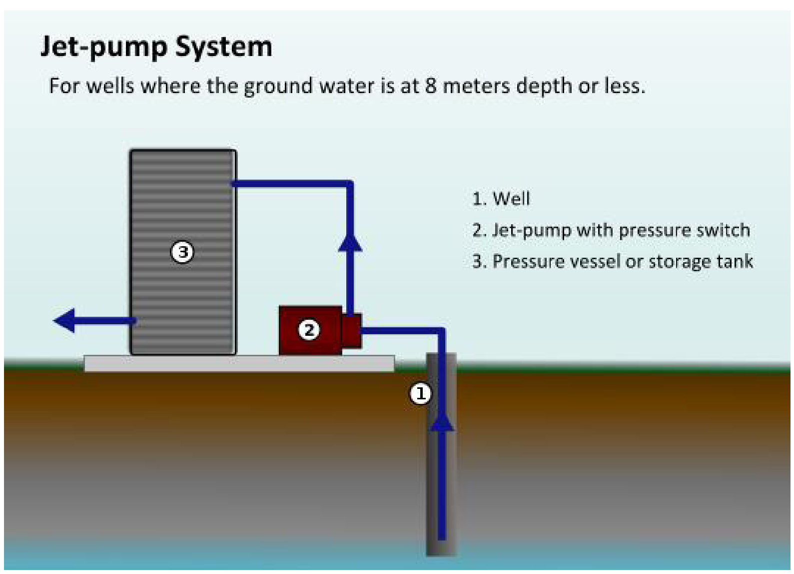
Types Of Wells

Water is a vital resource. Since not everyone is lucky enough to have a creek crossing his property, you'll find here how to drill your own water well. If you live in an area that has rainstorms then rainwater collection system will show you how to harvest the water. Plus, a grey water recycling system will take water from the sink or shower and use it in a garden, thus cutting in half the water consumption.

Dug Wells

Until recent centuries, all artificial wells were pumpless hand-dug wells of varying degrees of formality, and they remain a very important source of potable water in some rural developing areas where they are routinely dug and used today. Their indispensability has produced a number of literary references, literal and figurative, to them, including the Christian Bible story of Jesus meeting a woman at Jacob's well (John 4:6) and the "Ding Dong Bell"nursery rhyme about a cat in a well.



Hand-dug wells are excavations with diameters large enough to accommodate one or more people with shovels digging down to below the water table. They can be lined with laid stones or brick; extending this lining upwards above the ground surface to form a wall around the well serves to reduce both contamination and injuries by falling into the well.

A more modern method called caissoning uses reinforced concrete or plain concrete pre-cast well rings that are lowered into the hole. A well-digging team digs under a cutting ring and the well column slowly sinks into the aquifer, whilst protecting the team from collapse of the well bore.

Hand dug wells provide a cheap and low-tech solution to accessing groundwater in rural locations in developing countries, and may be built with a high degree of community participation, or by local entrepreneurs who specialize in hand-dug wells. They have been successfully excavated to 60 metres (200 ft). Hand dug wells are inexpensive and low tech (compared to drilling) as they use mostly hand labour for construction. They have low operational and maintenance costs, in part because water can be extracted by hand bailing, without a pump. The water is often coming from an aquifer or groundwater, and can be easily deepened, which may be necessary if the ground water level drops, by telescoping the lining further down into the aquifer. The yield of existing hand dug wells may be improved by deepening or introducing vertical tunnels or perforated pipes.

Drawbacks to hand-dug wells are numerous. It can be impractical to hand dig wells in areas where hard rock is present, and they can be time-consuming to dig and line even in favorable areas. Because they exploit shallow aquifers, the well may be susceptible to yield fluctuations and possible contamination from surface water, including sewage. Hand dug well construction generally requires the use of a well-trained construction team, and the capital investment for equipment such as concrete ring molds, heavy lifting equipment, well shaft formwork, motorized de-watering pumps, and fuel can be large for people in developing countries. Construction of hand dug wells can be dangerous due to collapse of the well bore, falling objects and asphyxiation, including from dewatering pump exhaust fumes.

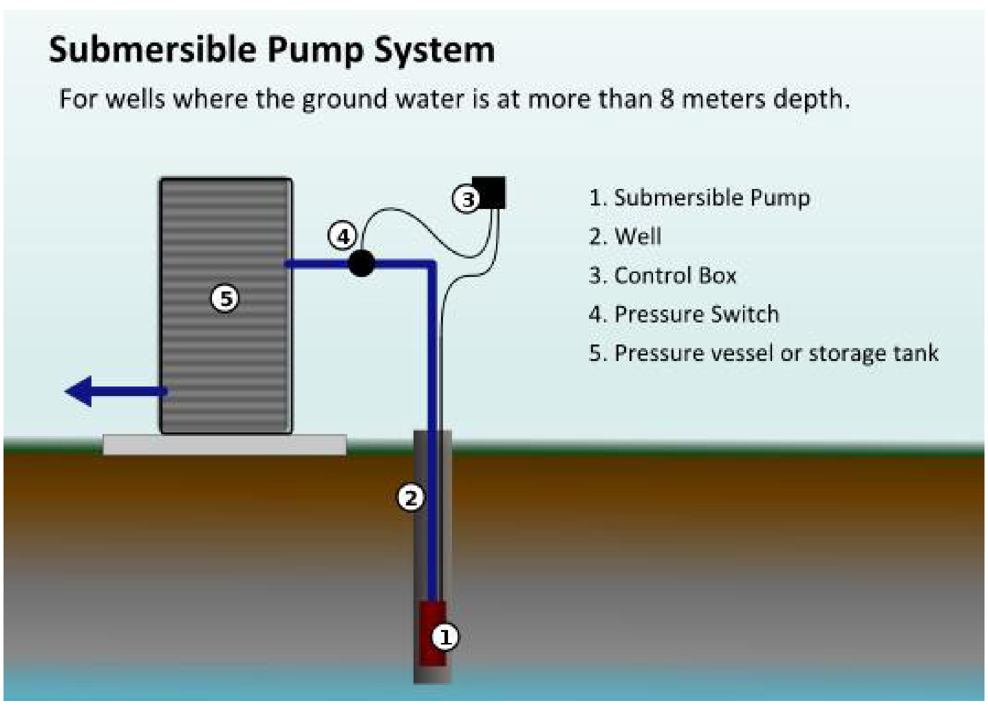
Driven Wells

Driven wells may be very simply created in unconsolidated material with a well hole structure, which consists of a hardened drive point and a screen (perforated pipe).

The point is simply hammered into the ground, usually with a tripod and driver, with pipe sections added as needed.

A driver is a weighted pipe that slides over the pipe being driven and is repeatedly dropped on it.

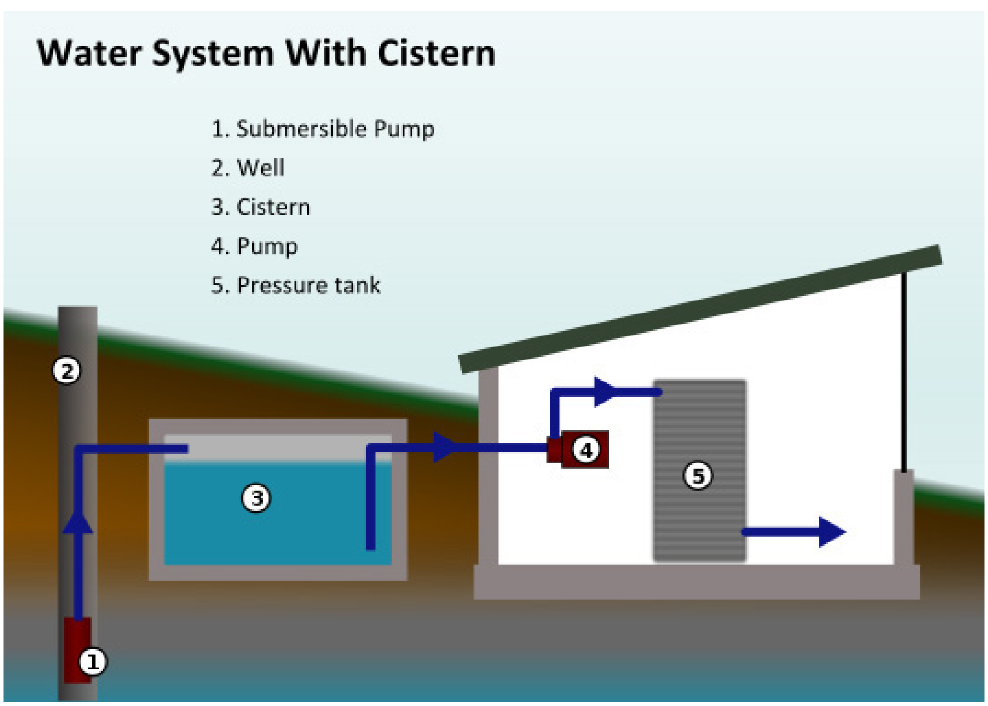
When groundwater is encountered, the well is washed of sediment and a pump installed.



Drilled Wells

Drilled wells are typically created using either top-head rotary style, table rotary, or cable tool drilling machines, all of which use drilling stems that are turned to create a cutting action in the formation, hence the term drilling.

Drilled wells can be excavated by simple hand drilling methods (augering, sludging, jetting, driving, hand percussion) or machine drilling (rotary, percussion, down the hole hammer). Deeprock rotary drilling method is most common. Rotary can be used in 90% for formation types. Drilled wells can get water from a much deeper level than dug wells can—often up to several hundred metres areas can go deeper than 900 metres (3,000 ft). Drilled wells with electric pumps are used throughout the world, typically in rural or sparsely populated areas, though many urban areas are supplied partly by municipal wells. Most shallow well drilling machines are mounted on large trucks, trailers, or tracked vehicle carriages.



Water wells typically range from 3 to 18 metres (9.8–
59.1 ft) deep, but in some

Drilled wells are usually cased with a factory-made pipe, typically steel (in air rotary or cable tool drilling) or plastic/PVC (in mud rotary wells, also present in wells drilled into solid rock). The casing is constructed by welding, either chemically or thermally, segments of casing together. If the casing is installed during the drilling, most drills will drive the casing into the ground as the bore hole advances, while some newer machines will actually allow for the casing to be rotated and drilled into the formation in a similar manner as the bit advancing just below. PVC or plastic is typically welded and then lowered into the drilled well, vertically stacked with their ends nested and either glued or splined together. The sections of casing are usually 6 metres (20 ft) or more in length, and 6 to 12 in (15 to 30 cm) in diameter, depending on the intended use of the well and local groundwater conditions.

Surface contamination of wells in the United States is typically controlled by the use of a surface seal. A large hole is drilled to a predetermined depth or to a confining formation (clay or bedrock, for example), and then a smaller hole for the well is completed from that point forward. The well is typically cased from the surface down into the smaller hole with a casing that is the same diameter as that hole. The annular space between the large bore hole and the smaller casing is filled with bentonite clay, concrete, or other sealant material. This creates an impermeable seal from the surface to the next confining layer that keeps contaminants from traveling down the outer sidewalls of the casing or borehole and into the aquifer. In addition, wells are typically capped with either an engineered well cap or seal that vents air through a screen into the well, but keeps insects, small animals, and unauthorized persons from accessing the well.

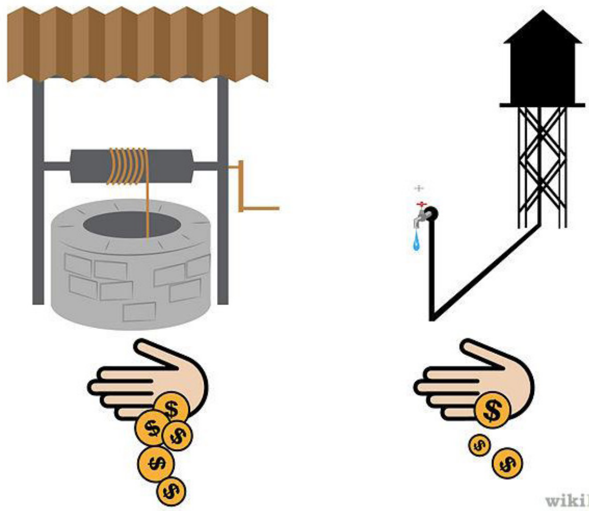
At the bottom of wells, based on formation, a screening device, filter pack, slotted casing, or open bore hole is left to allow the flow of water into the well. Constructed screens are typically used in unconsolidated formations (sands, gravels, etc.), allowing water and a percentage of the formation to pass through the screen. Allowing some material to pass through creates a large area filter out of the rest of the formation, as the amount of material present to pass into the well slowly decreases and is removed from the well. Rock wells are typically cased with a PVC liner/casing and screen or slotted casing at the bottom, this is mostly present just to keep rocks from entering the pump assembly. Some wells utilize a filter pack method, where an undersized screen or slotted casing is placed inside the well and a filter medium is packed around the screen, between the screen and the borehole or casing. This allows the water to be filtered of unwanted materials before entering the well and pumping zone.

How To Drill A Well

Method 1 Of 2: Planning A Well

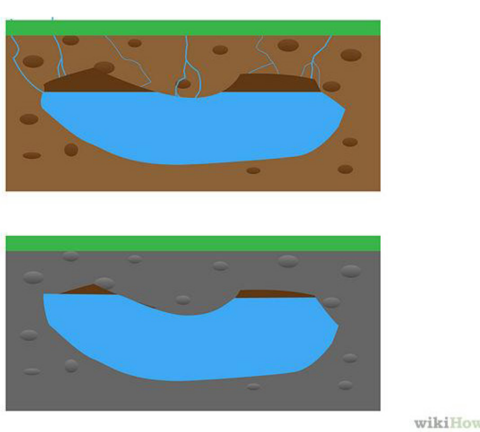
Step 1:Consider the costs and benefits of drilling a well against piping or shipping water in.

Drilling a well involves a higher initial cost than connecting to a public water supply, as well as risks of not finding enough water or water of sufficient quality and ongoing costs to pump the water and maintain the well. there is enough groundwater at a reasonable depth.



However, some water districts may make residents wait years before they can be connected to a public supply, thus making well drilling a viable option where

Step 2: Know the specific location of the property where the well is to be drilled.



You'll need to know the section, township, range and quarters to access land and well records through your state's geological survey.

Step 3: Find out what previous wells have been drilled on the property.

Geological survey records will record the depths of previous wells in the area and whether or not they found water. You can access these records in person, by telephone or online. These records can help you determine the depth of the water table, as well as the location of any confined aquifers.

Most aquifers are at the depth of the water table; these are called unconfined aquifers, as all the material above them is porous. Confined aquifers are covered by nonporous layers, which, although they push the static water level above the top of the aquifer, are more difficult to drill into.

Step 4: Consult geologic and topographic maps.

Although less useful than well-drilling records, geologic maps can show the general location of aquifers, as well as the rock formations in an area. Topographic maps show the surface features and their elevations and can be used to plot well locations. Together, they can determine whether an area has sufficient groundwater to make drilling a well viable.

Water tables are not uniformly level, but follow ground contours to some extent. The water table is nearer the surface in valleys, particularly those formed by rivers or creeks, and is harder to access at higher elevations.

Step 5: Ask people who live near the property.

Many older wells have no documentation, and even if records exist, someone who lived nearby may remember how much water those wells produced.

Step 6: Get assistance from a consultant.

Your state's geological survey personnel may be able to answer general questions and direct you to resources beyond those mentioned here. If you need more detailed information than what they can provide, you may need the services of a professional hydrologist.

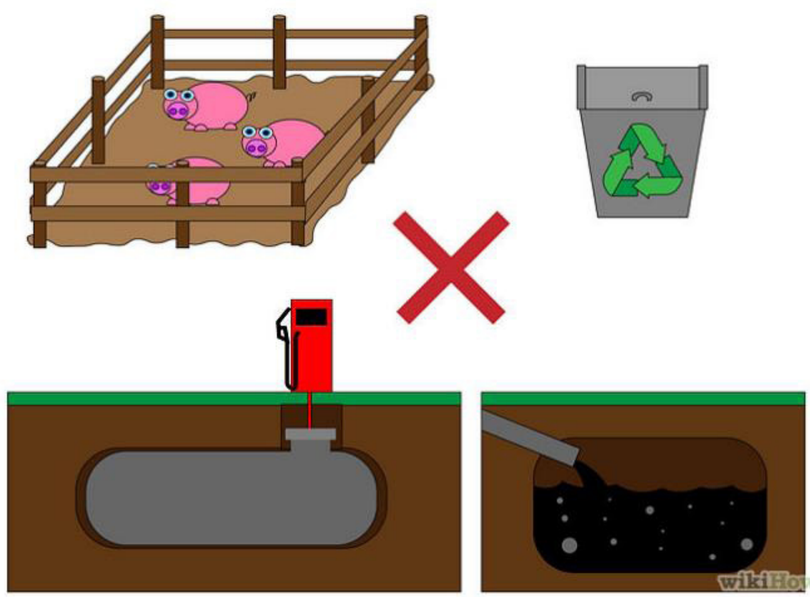
Step 7: Get whatever well-drilling permits you need.

Consult the appropriate municipal and state agencies to find out what permits you need to obtain before drilling and any regulations that govern drilling wells.

Method 2 Of 2: Drilling The Well

Step 1: Drill the well away from any potential contaminants.

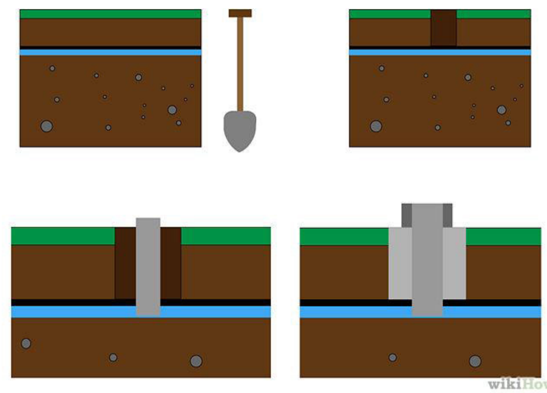
Animal feedlots, buried fuel tanks, waste disposal and septic systems can all pollute groundwater. Wells should be drilled in places where they can easily be reached for maintenance, and located at least 5 feet (1.5 meters) from building sites.



Step 2: Choose the appropriate construction method.

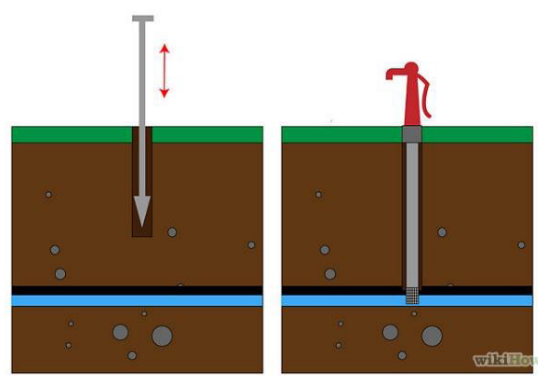
Most wells are drilled out, but wells may also be dug or driven, if conditions warrant. Drilled wells may be bored with an auger or rotary tool, smashed out with a percussion cable or cut with high-pressure jets of water.

- Wells are dug when there is sufficient water near the surface and no intervening dense rock. After a hole is made with shovels or power equipment, a casing is lowered into the aquifer, and the well is then sealed against contamination. As they are shallower than driven or drilled wells, they are more likely to go dry when drought lowers the water table.



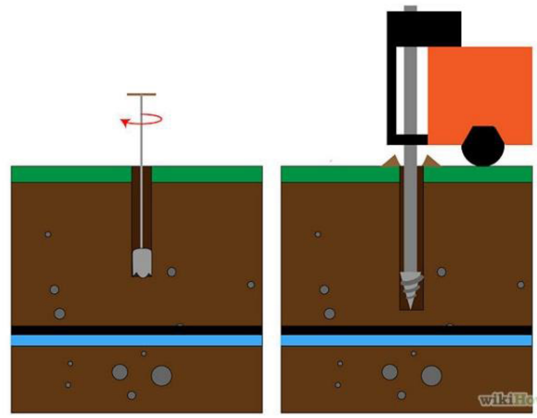
- Wells are driven by attaching a steel driving point to a stiff screen or perforated pipe, which is connected to solid pipe.

An initial hole wider than the pipe is dug, then the assembly is pounded into the ground, with occasional turnings to keep the connections tight, until the point penetrates the aquifer.



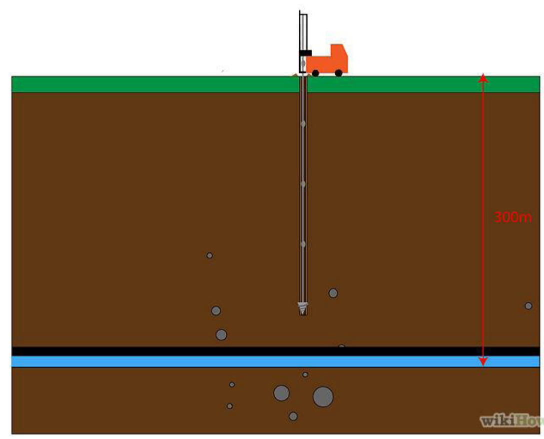
Wells can be hand-driven to depths of 30 feet (9 meters) and power-driven to depths of 50 feet (15 meters). Because the pipe used is of small diameter (1.25 to 12 inches, or 3 to 30 centimeters), multiple wells are often driven to provide sufficient water.

- Augers can be either rotating buckets or continuous stems and can be turned either by hand or with power equipment. They work best in soils with enough clay to support the auger and don't work well in sandy soil or dense rock. Auger-bored wells can be drilled to depths of 15 to 20 feet (4.5 to 6 meters) by hand and up to 125 feet (37.5 meters) with power augers, with diameters ranging from 2 to 30 inches (5 to 75 centimeters).



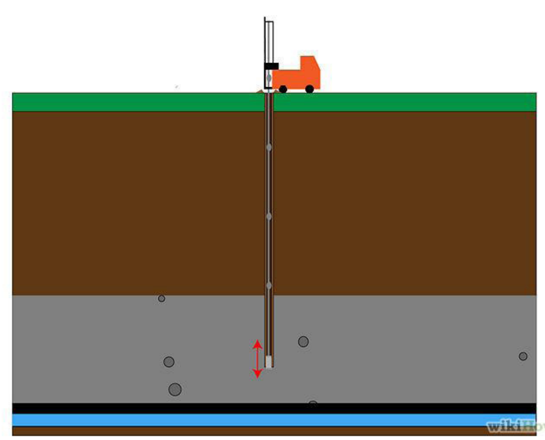
- Rotary drills exude water based drilling fluid or compressed air from holes in a rotating bit to make drilling easier and pump out the drill cuttings.

They can drill to depths of 1000 feet (300 meters), creating holes from 3 to 24 inches (7.5 to 30 centimeters) wide.



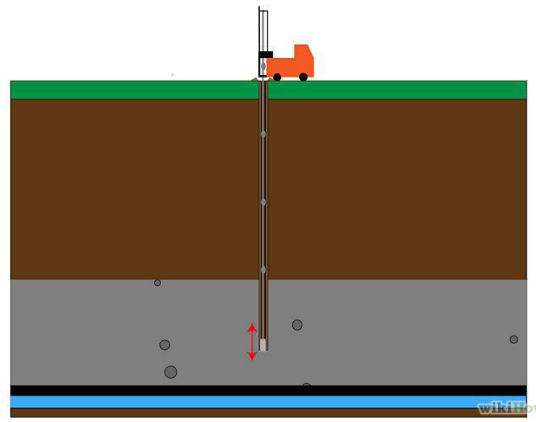
While they can drill faster than other drills through most materials, they have trouble drilling through rock, and the drilling fluid makes it tough to identify material brought up from water-bearing strata.

- Percussion cables work like pile drivers, with bit or tool moving up and down on a cable to pulverize the ground being drilled into. As with rotary cable drills, water is used to loosen and remove intervening materials. Percussion



cables can drill to the same depths as rotary drills, albeit more slowly and at higher cost, but they can smash through materials that would slow rotary bits.

- High-pressure water jets use the same equipment as rotary drills, without the bit, as the water both cuts the hole and lifts out drilled material.

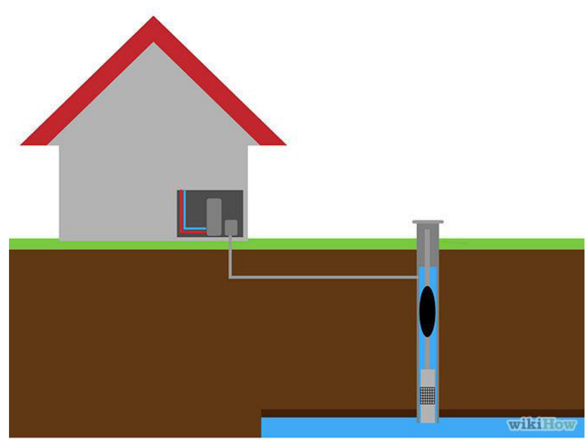


This method takes only minutes, but jet-drilled wells can be no more than 50 feet (15 meters) deep, and the drilling water needs to be treated to prevent it from contaminating the aquifer when the water table is penetrated.

Step 3: Finish the well.

Once the well is drilled, casing is inserted to prevent the water from wearing away and being contaminated by the sides of the well. This casing is usually narrower in diameter than the well hole itself and sealed in place with a grouting material, commonly either clay or concrete.

Casing usually runs to a depth of at least 18 feet (5.5 meters) and may run the entire length of a well drilled in loose, sandy soils. Screens to filter out sand and gravel are inserted in the casing, then the well is capped with a sanitary seal and, unless the water is already under pressure, a pump is attached to bring the water to the surface.



Tips

More than likely, you'll want to hire a reputable well-drilling contractor to do the actual drilling work. Check with state or local contractor or groundwater associations for information about drilling contractors.

How To Harvest Rainwater

Rainwater is an excellent source of free water, or so you'd think, right? Apparently not, though. For example, some Western states including Utah, Washington and Colorado outlawed home owners from collecting rain water on their own properties. According to the good' ol government, the water that falls from the skies belongs to someone else and you're essentially stealing if you collect it. So check your laws before moving forward.

Well, that being said, collecting rain water can be very important for your survival, if SHTF and your regular water supply runs dry. In a societal collapse scenario, don't expect for the regular chains of supply, i.e. utilities like power, gas or water to work efficiently, if at all. Therefore, survival will be up to you.

A clean and reliable source of water is absolutely critical when it comes to survival. You can last for weeks without food, but without water, you'll kick the bucket in a matter of days (three-four days tops) and you'll be non-functional within just a couple of days.

Now you can see how rainwater collection can become a survival issue. In normal times, the average American uses almost 100 gallons of water per day (according to the US Environmental Protection Agency). In reality, though, you only need just about a gallon to survive if you're just going to drink it. Plan for another 1-3 gallons for hygiene purposes. Still, that's a lot of water to save in buckets or gallons if you're stockpiling for a month or even a week.

Collecting and storing rainwater may sound weird for all of us that are used with wasting water on a daily basis, since water seems to be an abundant resource at the present time. However, if SHTF a rainwater collecting system will be an excellent (and maybe the only) alternative for providing you and your family with good quality water for drinking, cooking, and hygiene.

You can use rain water for various purposes: besides drinking, rainwater can be used for washing your clothes, feeding your livestock and even to flush your toilet.

Harvesting Rainwater

Now, if you choose a dedicated rainwater collecting system, which is very easy and straight forward to build, you can DIY from readily available materials.

Its advantages, besides providing you with a good quality water source, are its simplicity of construction, the ease of maintenance and its convenience.

Though it may sound simple, harvesting rain water is not as simple as putting a bucket under your gutters; things are actually a bit more complicated than that. To begin with, contrary to popular belief, rain water is not as pure as an angel's tears.

The air is filled with pollutants nowadays, not to mention the filth that lies on your roof (you'll harvest the rainwater from your roof, generally speaking) : dead bugs, birds feces, dust, arsenic, lead, and a variety of other not-so-delicious toxins accumulate up there and will run right into your bucket along with the rainwater.

Filter It First!

Depending on the type of the roof you have, you must filter the rain water thoroughly. Only if you have a steel/glazed tile roof, you can collect rain water without filtering it. A roof made of asphalt shingles, concrete tiles or galvanized metals will require you to filter the water before storing it in order to remove debris. We recommend filtering it regardless of what type of roof you have.

Aside from the rainwater collecting system, you should also consider investing in a high quality water filtration system. Or you could use natural water purification methods as described in one of our previous articles.

If you already decided to collect rain water directly from the roof, remember to let the rain to wash your roof for 10 minutes before starting to collect it; that way you will prevent larger debris and at least a layer of contaminants from getting into your water supply.

You should use a screen to capture the larger particles from the water, like leaves and bugs. In the next step, if necessary, you will use a dedicated water filtration system before storing it.

The rainwater should be stored for later use in a 50+ gallon barrel. You don't need anything fancy: just a regular barrel painted black to minimize algae growth and to block sunlight. In a SHTF situation, it would be a good idea to hide your rain barrel from your neighbors or passersby using trees or plants. Hiding your stockpile from strangers is another article you should check out too.

If you have anything you'd like to add to this information, please feel free to leave a comment below.

How To Choose The Right Rainwater Tank

People can go on for weeks without food, but not without water. During hot conditions like drought, dehydration can set within hours, and hot conditions may pose certain hazards to health. Heat stroke, heat cramps, heat rashes, etc. are some heat-related illnesses.

Anyone who has physically exceeded under the heat without replenishing can actually die in a period of several hours. The same is true with anyone who is locked inside a hot car for long hours. We need water to live, period. But when shit hits the fan, no one is on the easy street.

Rainwater is evidently a great water resource during climatic disturbances and on many regular days. Many studies have proven such even centuries back.

Although some countries don't recognize rainwater as a sustainable alternative to water streaming out of the mains water system, it however offers a large scale off the grid remedy especially in times when water is insufficient to meet everyone's needs, in all aspects around the world.

How To Use Rainwater?

The decision of using rainwater is a matter of choice which may be attributed to the initial outlay and necessity. Installing rainwater tanks may or may not require large one off installation expenditures as it would entirely depend on water practices of each household and the location of the dwelling. These two factors generally influence the design and type of maintenance required for the tanks.

For those whose budget is in consideration, going off the grid with rainwater at a minimum cost is also possible with other tank substitute, i.e. food storage barrel and big garbage bins. Think out of the box, there could be something else that could possibly be customised into a rainwater tank or can be purchased at a lower price from bulk stores nearby.

Besides, sustainable alleviation during emergencies should be cost effective at the same time causing minimal adverse impact in the environment.

If you're requirements would necessitate you to pull extra amount out of your pocket as you would generally be using the rainwater as a main source of water at home, consulting professionals for variations and proper installation would be the best thing to do. You should also check the government guidelines for specific requirements and possible rebates and subsidy.

Types Of Rainwater Tanks

Underground Water Tank

This is ideal for those who have limited space and want to keep their barrel out of sight.

This type of water tank hence expected to sit underground should be placed in a light traffic areas where heavy loads and vehicles are not regularly driven.

This is also perfect for those who have large storage requirements i.e. school, agricultural and manufacturing business, etc.

To avoid structure failure, maximum groundwater level, structural integrity of the ground, drainage capability of the soil as well as the types of load which may occur (if installed underneath a drive way or regularly driven area) must be checked prior to installation.

Since installing these types of tanks generally involves excavation, the price is relatively high compared to the aboveground tanks. In any circumstances these tanks must be well ballasted otherwise, it would pop out of the ground when empty.

Less commonly, rainwater that is collected in underground tanks can be subject to microorganisms associated with animal and human faeces which may contaminate the water if not fully enclosed. That is why most rainwater from underground tanks is not recommended for personal hygiene and drinking where sufficient main water supply is available, unless properly treated and maintained.

Aboveground Water Tank

When it comes to installation, this does not require much of work as this can be erected anywhere above ground. This should be sufficiently elevated to provide adequate pressure to appliances.

Unlike underground water tank, this type of tank is more susceptible to microbial contaminants i.e. bacteria, protozoa, etc. which are acquired from faeces of birds, reptiles and amphibians that have free access to roof or tanks. Rainwater may also accumulate contaminants from dust washed off the roof surface.

Other contaminants may also generate from leaf litter, lichen, moss, roofing materials. As such, this type of tank should be filtered and treated properly to eliminate the presence of bacterial contaminants. Gutter guards or mesh filters are recommended to be installed.

Readiness Checklist

1. Purpose – You have to decide what you will use the rainwater for. Would you be using it for food preparation, flushing the toilet and drinking? For rainwater used as the main source of water, additional mandatory equipment is required like taps, filtration and pumping system. For rainwater tank to be used for outdoor purposes like gardening and washing vehicles, smaller tanks of 1,000 L with taps are just fine. In addition to determining the purpose of the tank, you also need to consider how it should be connected to the storm water pipes and downpipes to identify possible extra cost.
2. Users – Water consumption will largely depend on the number of individuals using rainwater for different purpose. So, aside from considering the reason of the installation, identifying the number of people within the household will also help determine the capacity of the tank to be purchased.
3. Area – Different areas has different regulations which are based upon the location of the dwelling, accessibility to centralised water system and precipitation frequency. Since rainfall pattern varies year on year everywhere, this should be considered before investing in rainwater system. The length of stay in the area, if rented should also be considered as moving the tank from one place to another can be a hassle.
4. Space – The design of the house should be factored in before purchasing a tank. Small, slim line lightweight polyethylene and underground tanks are ideal for those who have limited space at home and wanted to keep the barrel hidden from view.
5. Roof catchment suitability – Roofing materials should be checked prior to installation. Gutters should have sufficient and continuous water flow to downpipes to prevent pooling of water that could increase

accumulation of various contaminants. Paints and coatings may not be suitable for roofs to collect rainfall too due to possible hazardous content. Asbestos fibres on the other hand are no longer used in new houses as it has proved to cause danger to health when inhaled in sufficient quantities. Maximizing the roof catchment means maximized water savings.

6. Approval – Before purchasing a rainwater tank, the local community and regulatory authorities should be contacted to determine specific requirements like planning, installation permit, operation approval and other guidelines needed to be accomplished prior to and after the installation. Depending on local conditions, policies for using rainwater may be emphasized within the food security or the environmental protection policy context. Standalone tanks that are not connected to downpipes do not generally need approval, except if you are under the roof of a government that completely restricts the use of rain barrels.

7. Cost – Tanks can cost as little as few hundreds to thousands of dollars, depending on the size, design, color and material of the tank. Extra cost may also be incurred during the installation for additional materials (level indicator, first flush device, etc.), delivery and setup charges.

8. Design – Rainwater tanks comes in a wide variety of designs (shapes, sizes, materials and color). Slimline type has become the most preferred due to its compact and sleek style. As internal and external hydrostatic pressure of the tank affects the water's flow and volume the size of the tank should be highly regarded. The wider the tank the better. Standalone lightweight empty barrels that are not connected to downpipes can be easily blown by the wind during gusty season, placing a clean rock in the bottom of the tank may prevent this.

9. Location – Rainwater tank can be installed underground or aboveground. In designing rainwater system, the location should be first

investigated especially if excavation is required as structural integrity and materials are regulated through building codes and standards in some areas of jurisdiction. When installing aboveground rain barrel, the ground should be level and full packed to provide a solid foundation.

10. Installation and Maintenance – Ground rainwater service pipes must be clearly labelled "rainwater" continuously along their length. Tank, covers and plumbing pipes and fittings should be light proof to reduce daylight penetration and potential growth of algae. When connecting numerous barrels it is vital to make sure the connected pipe is large enough to provide smooth and quick flow between the barrels In any circumstances, the choice of using rainwater is at the risk and responsibility of the owner therefore it should be in compliance with the regulations of the responsible authorities.

Irrespective of how it is being utilised proper maintenance is recommended to keep the quality of the water and efficiency of the tanks.

Cleaning And Maintenance

Cleaning and maintenance of the rainwater tanks can be achieved by these few tips.

1. Check the sides and the bottom of the tank for accumulated sludge
2. Keeping roof catchments free from animal and insect faeces
3. Regular cleaning of gutter and tank inlet for any build ups
4. Cut back trees and branches that extends beyond the roof
5. Test the water periodically to determine appropriate and adequate treatment
6. If pumping system is attached, inspect that it is in good functional condition

7. Replace roofing and other material as needed
8. If adequate access to the tank is impossible, contact the tank cleaning company
9. Regularly check and clean the tank's inlet and overflow screens

Final Words

In summary, the use of rainwater tank is entirely reliant on the water practices of each individual within the household and the location of the dwelling.

Weather-related issues in any country that includes earthquakes, floods, cyclones, landslides, severe storms, tsunami, and decreased rainfall can threaten lives, jeopardize yield quantity of crops and induce extensive damages to assets as well as disruption in facilities like power, communication, transportation and most importantly water. These weather abnormalities that occur year on year is something everyone should be prepared for.

Although there are different sectors in the regime that can aid in our survival during these times, disconnecting our dependency from government and private facilities through off the grid solution with rainwater tanks is by far the best solution.

How to Harvest Greywater

Elimination of greywater

Sewage can then be treated to limit pollution and health risks, before being returned to the environment at large. Most greywater ends up as effluent in rivers and oceans in this way.

There are other alternatives to eliminating greywater that allow for efficient use; using it to irrigate plants is a common practice.[1] The plants use contaminants of greywater, such as food particles, as nutrients in their growth. However, salt and soap residues can be toxic to microbial and plant life alike, but can be absorbed and degraded through constructed wetlands and aquatic plants such as sedges, rushes, and grasses.

Recycling

Most greywater is easier to treat and recycle than blackwater, because of lower levels of contaminants. If collected using a separate plumbing system from blackwater, domestic greywater can be recycled directly within the home, garden or company and used either immediately or processed and stored. If stored, it must be used within a very short time or it will begin to putrefy due to the organic solids in the water. Recycled greywater of this kind is neversafe to drink, but a number of stages of filtration and microbial digestion can be used to provide water for washing or flushing toilets. Some greywater may be applied directly from the sink to the garden or container field, receiving further treatment from soil life and plant roots. Given that greywater may contain nutrients, pathogens, and is often discharged warm, it is very important to store it before use for irrigation purposes, unless it is properly treated first.

Systems

At present, several water recycling systems exist which can be used to:

- Recycle the water without purifying it
- Recycle the water while purifying or decontaminating it

Water recycling systems without purification

Water recycling without purification is used in certain agricultural companies (e.g., tree nurseries) and dwellings for applications where potable water is not required (e.g., garden and land irrigation, toilet flushing). It may also be used in dwellings when the greywater (e.g., from rainwater) is already fairly clean to begin with and/or has not been polluted with non- degradable chemicals such as non-natural soaps (thus using natural cleaning products instead). This water system also needs a supply of water to recycle and reuses water as well. It is also not recommended to use water that has been in the greywater filtration system for more than 24 hours or bacteria builds up affecting the water that is being reused. Water purification/decontamination systems are used for applications where potable water is required (e.g., to allow drinking, and/or for other domestic tasks as washing, showering).

Water recycling with purification

For filtering the water to become potable (or near-potable), there are numerous systems based on soft processes. These include natural biological principles such as mechanical systems (sand filtration, lava filter systems and systems based on UV radiation) biological systems (plant systems as treatment ponds, constructed wetlands, living walls) and Bio reactors or compact systems as activated sludge systems, biorotors, aerobic and anaerobic biofilters, submerged aerated filters, biorolls[vague][2]

Finally, "hard", direct processes, such as distillation (evaporation) or mechanical processes such as membrane filtration, (typically ultrafiltration and reverse osmosis, which are capable of treating high volumes of grey water) can create potable, or near-potable water. In order to purify the potable water adequately, several of these systems are usually combined to work as a whole. Combination of the systems is done in two to three stages, using a primary and a secondary purification. Sometimes a tertiary purification is also added.

Some municipal sewage systems recycle a certain amount of grey and blackwater using a high standard of treatment, providing reclaimed water for irrigation and other uses.

Application of recycled greywater

Irrigation

Greywater typically breaks down faster than blackwater and has lower levels of nitrogen and phosphorus[citation needed]. However, all greywater must be assumed to have some blackwater-type components, including pathogensof various sorts. Greywater should be applied below the surface where possible (e.g., via drip line on top of the soil, under mulch; or in mulch-filled trenches) and not sprayed, as there is a danger of inhaling the water as anaerosol.

In any greywater system, it is essential to put nothing toxic down the drain—bleaches, bath salts, artificial dyes, chlorine-based cleansers, strong acids/alkali, solvents, and products containing boron, which is toxic to plants at high levels. Most cleaning agents contain sodium salts, which can cause excessive soil alkalinity, inhibit seed germination, and destroy the structure of soils by dispersing clay. Soils watered with greywater systems can be amended with gypsum (calcium sulfate) to reduce pH. Cleaning products containing ammonia are safe to use, as plants can use it to obtain nitrogen.[3] A 2010 study of greywater irrigation found no major health effects on plants, and suggests sodium buildup is largely dependent on the degree to which greywater migrates vertically through the soil.

Indoor reuse

Recycled greywater from showers and bathtubs can be used for flushing toilets in most European and Australian jurisdictions and in United States jurisdictions that have adopted the International Plumbing Code.

Such a system could provide an estimated 30% reduction in water use for the average household. The danger of biological contamination is avoided by using:

- a cleaning tank, to eliminate floating and sinking items
- an intelligent control mechanism that flushes the collected water if it has been stored long enough to be hazardous; this completely avoids the problems of filtration and chemical treatment

The Uniform Plumbing Code, adopted in some United States jurisdictions, prohibits greywater use indoors.

Heat reclamation

Devices are currently available that capture heat from residential and industrial greywater, through a process called drainwater heat recovery, greywater heat recovery, or hot water heat recycling.

Rather than flowing directly into a water heating device, incoming cold water flows first through a heat exchanger where it is pre-warmed by heat from greywater flowing out from such activities as dishwashing, or showering. Typical household devices receiving greywater from a shower can recover up to 60% of the heat that would otherwise go to waste.

Ecology

Because greywater use, especially domestically, reduces demand on conventional water supplies and pressure on sewage treatment systems, its use is very beneficial to local waterways. In times of drought, especially in urban areas, greywater use in gardens or toilet systems helps to achieve some of the goals of ecologically sustainable development.

Benefits

The potential ecological benefits of greywater recycling include

- Lower fresh water extraction from rivers and aquifers
- Less impact from septic tank and treatment plant infrastructure
- Topsoil nutrification
- Reduced energy use and chemical pollution from treatment
- Groundwater recharge
- Increased plant growth
- Reclamation of nutrients
- Greater quality of surface and ground water when preserved by the natural purification in the top layers of soil than generated water treatment processes[5]

In the U.S. Southwest and the Middle East where available water supplies are limited, especially in view of a rapidly growing population, a strong imperative exists for adoption of alternative water technologies.