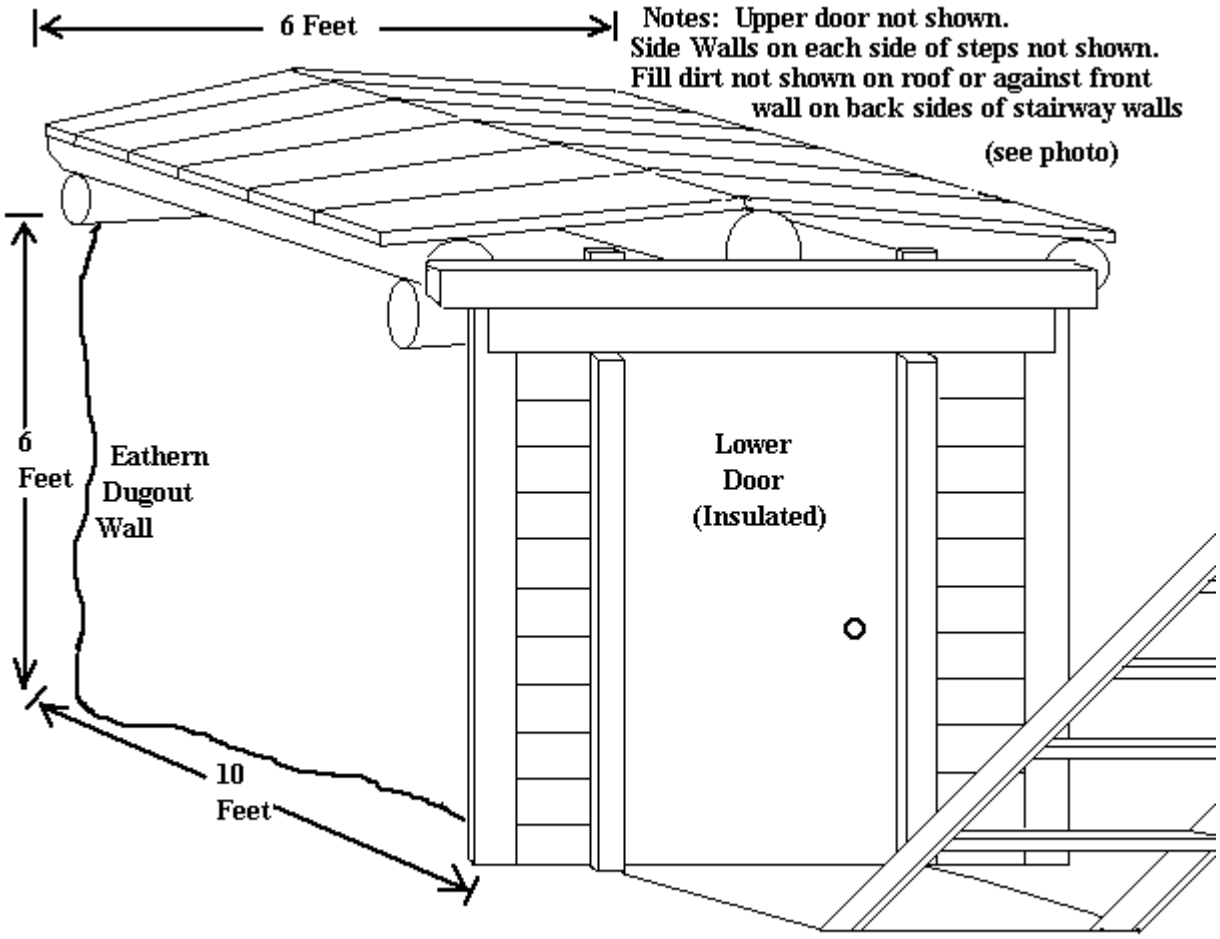
The Root Cellar

Root cellars are nature's way of storing fruits and vegetables. And they can be excellent storage areas for other things as well. A hundred years ago root cellars were one of the few ways they had of keeping things cool. People not only put potatoes and carrots in their root cellars, but their preserved meat, milk and cream, fruits and vegetables - literally anything they needed to keep cool. Even though root cellars didn't get nearly as cold as a refrigerator during summer months, root cellars generally were and are 30 to 40 degrees F cooler than daytime summer temperatures.

An Old Time Dugout Root Cellar

Root cellars have been a part of life here in Southern Alberta for a hundred years. And there have been some big ones. Mrs. Crest, who contributed to the meat curing page, told me when she was a kid her Uncle had a root cellar with over 500 bottles of fruit in it, along with the usual fare of vegetables. Although there are not as many root cellars around now, they are still extensively used here for storing potatoes, carrots, apples, and in the fall of the year, other garden produce as well.



Root Cellar Exposed View

How we used to do it...

As told by Glenn Adamson

The first root cellars were usually dug with a pick and shovel. (In 1965 I used the front end loader on my tractor to dig the root cellar I'm using now.) The only wall we had to build was the front wall the door was in. The other three walls were formed by the dirt from the hole we dug. I made the roof with three logs as supports, then I laid 2X10 planks over them and nailed them down (See illustration). Over the top of the roof I put about 2 feet of dirt, with grass eventually growing on top of it. The front wall was also made from 2 inch lumber. Unlike the drawing, this wall extends up another three feet (see photo). The stairs were made with these same planks, as well as the side walls on both sides of the stair case. The planks in the roof, stairs and front wall were all made from rough, unplaned lumber, actually 2 inches thick.

You will notice from the photograph there is an upper door and a lower door. It is important you do this as each door adds greatly to how cool the root cellar will be in the summer time and how warm it will stay in the winter. The lower door on my cellar is constructed with a sheet of 1/4 inch plywood on each side filled with insulation. The upper door is tilted slightly so water will run off when it rains, and so it will be easier to find in the snow. To prevent rain from dripping down between the outside of the cellar and the top of the door, I use a couple of pieces of tin that are wide enough to hang over the top of the closed door after being wedged in between a couple of the planks on the outside of the cellar. This helps a lot. The upper door is constructed from two layers of 3/4 inch rough lumber. There is no insulation in it, and it has a layer of tin nailed to the top of it to keep it water proof. This door is hinged to the stairs side wall on the left side and is hinged so it can swing all the way around and lay on the grass.

Our main reason for having a root cellar is to keep our vegetables from freezing in the winter. We have very cold winters. For example, last winter we had several days when the thermometer dropped down past 40 degrees below zero F. How well has out cellar worked over the years? Very well. Nothing ever froze, except for once, and then it wasn't the cellar's fault. On one of the coldest days last winter, I went to get some potatoes and carrots and was surprised to find the lower door open. Even with this, only a small part of the potatoes were frozen. After closing the lower door the temperature rose to above freezing again. I have never tested the temperature in the cellar during the winter time, but in the summers the temperature hovers around 51 degrees F. This is a bit cooler than the temperatures you would expect to find in a root cellar in the warmer parts of the USA. This is because our hottest days in the summer are only around 90 degrees F. And the cold winters tend to keep the ground a bit cooler throughout the year.

Last year my center cross beam in the roof broke right in the middle. The dampness from the earth above it had gradually rotted it over the years. I did not waterproof my roof when I built it, and should have. After it broke, we jacked up the center of the roof and put in a vertical support beam in the middle of the room. This should help the cellar last for several more years.

Root Cellar Basics

Information for this page was gleaned from chapters 7, 13 and 14 of
Root Cellaring: The Simple No-Processing Way to Store Fruits and Vegetables
By Mike and Nancy Bubel, Copyright 1979, Published by Rodale Press, Emmaus, Pennsylvania

Cool and moist conditions are required for storing most vegetables. Because of this, when planning a root cellar, several things need to be taken into consideration.

Temperature is your most important interest: As your root cellar needs to be kept as cool as possible, there are several things you can do to promote this:

- First, borrow cold from the ground. Earth, even two feet down, gives a remarkable year wide temperature stability. The further down you go the better it is. You must go down a full 10 feet before complete temperature stability is reached. But for the average builder, how deep you go is limited because of expenses.
- You can also borrow cool from the air. Often the night's air temperature will be cooler than the air in your cellar.
- And finally, you should do what you can to prevent heat from having access to your cellar. This includes:
- Having your root cellar in the shade throughout the day
- Building on the north side of hills
- Wise use of insulation

Your second most important consideration is humidity. Even if kept cool, in a low humidity environment, your vegetables will soften and shrivel up. Most vegetables require high humidities. A typical underground root cellar will generally maintain a high humidity all by itself if it has an earth or dirt floor.

Air circulation: The best root cellars have vents (although none of the old cellars here in Southern Alberta I have seen have them). This is because the vegetables in your cellar give off gasses that often are conducive to either spoilage or sprouting. For example, apples naturally give off ethylene gas which makes potatoes sprout prematurely. (This can be used to your advantage if you have potatoes that are slow sprouting. Put 'em both in a plastic bag.) Good venting fundamentals include:

- Have an inlet vent and an outlet vent.
- The outlet must always be at the highest level in the cellar with the outlet tube flush with the inner wall.
- The inlet should come into the cellar at the bottom. This is easily done if your cellar is built into a hill, but nearly as easy if it is buried in flat ground. With your inlet vent opening on top of the ground near your outlet vent, your inlet vent pipe must go all the way to the floor before opening into your cellar.
- Keep shelves a couple of inches away from the walls of the cellar. This will greatly promote circulation around the vegetables stored on these shelves.
- To prevent your potatoes from sprouting prematurely, keep your apples above them so the circulating air moves away from your potatoes.
- Have a system in place to close your vents in freezing weather. Something as simple as a big sponge can work for this. If you have very cold winters, you may wish to block off both ends of each vent pipe.

How big of a cellar should you build?

- A 5 foot by 8 foot root cellar will store 30 bushels of produce.
- An 8 foot by 8 foot cellar should hold plenty for the average family.
- A 10 foot by 10 foot cellar should take care of everything you can produce.

Shelves: We have already mentioned shelves should be kept at least a couple of inches away from the walls for increased ventilation. Other things to consider are:

- Use rot resistant or pressure treated wood. After several years they will be less likely to rot and break, tumbling your foods on the floor. (The book gave one example of a person who went down to her cellar one day to find a

good share of her canned fruit and vegetables broken on the floor. As the lids on canned goods rust after a couple of years, plan a dryer, cool place for these items.)
- Liberal use of shelves will enhance the storage capacity of your cellar considerably.

What kind of root cellar is right for you? Here are some possibilities with a few advantages/disadvantages:

Build your root cellar into a hill.

- You don't have to find a door lying on the ground when it is under 3 feet of snow.
- There is less chance of flooding during very wet conditions
- Your cellar can be graded so any water that should run or seep in will run out the door.
- Can be much more difficult to excavate.

Build your root cellar on flat ground.

- Availability: not everyone has a steep hill in their back yard
- Easier to excavate
- Easier and cheaper to build (you don't have to brace your cellar for all that extra weight from the hill). But that added dirt will keep your cellar cooler!
- You can build a vertical door around a staircase if you don't want to be shoveling snow to get at a horizontal door.

Build your cellar as part of your house: Our house which is only one year old had a root cellar built into it when the house was constructed. Many older houses have a section of the basement that has an earthen floor. It's primary reason was probably for vegetable storage. You can also:

- Build and insulate a room in this area.
- Dig a cellar next to the house with an entry way to your cellar through the basement.
- Put your cellar in an existing underground structure such as a pump house.

Construction methods:

- Dugout: The cheapest way to go in stable soil
- Wood construction: Be sure to use pressure treated wood.
- Cement
- Floors
    1. Dirt: the simplest way to go and excellent for humidity control.
    2. Gravel: In a very damp or very dry area you will want to put down three inches of gravel. If your cellar is unusually wet, you may want to even dig a sump in the middle of your cellar floor and fill this with gravel, along with the three inches on the floor. In very dry soil conditions you can sprinkle water on the gravel which will greatly increase the evaporation surface area.
    3. Wood: put gaps in your boards for a higher humidity cellar.
    4. Cement: If you want a storage area that is lower in humidity, this is a good way to go.
    5. You may wish to build two rooms in your cellar. One with a cement floor for lower humidity storage items, and another room with no floor for higher humidity storage items. If you did this, the wall between the rooms should be as air tight as you can make it. If you have a venting system, you should have a separate set of vents for each room. And lastly, the high humidity storage area should be the far room in the cellar.

Using your root cellar:

- Keep a thermometer and humidity gauge in your cellar.
- Keep the door(s) closed to your cellar as much as possible if it is warm outside.
- During the spring and fall of the year, open your vents (and even perhaps the door) at night when the temperature is dropping below the temperature of the air in your cellar. Close them early in the morning before the outside air warms up. (Be careful not to do this if the temperature is expected to drop below freezing.)

- If the humidity in your cellar is too low you can raise it by:
- Leaving at least the floor of your cellar exposed to the earth (a dirt floor or air gaps in your floor down to the earth).
- Sprinkle water on a graveled floor or lay out damp towels or burlap bags.
- Pack root vegetables in damp saw dust, sand or moss.
- One caution about high humidities: If you get much of a temperature fluctuation in your cellar, humid air as it cools past it's dew point will condense on the ceiling, walls, and produce. Excess water on your goods can induce spoilage. Cover vegetables with burlap, towels, etc. to absorb excess condensing moisture. Also, if your air is condensing inside, open your vents if the air outside is cooler than it is inside. Even if it is very humid air, as it warms in the root cellar, it's relative humidity will drop. Of course, the opposite can happen. If you let warm damp air in, moisture will condense out as it cools.
- During extremely cold weather, if your cellar is threatening to freeze, put a light bulb inside. If you do this, you need to cover your potatoes so they won't turn green. (Do not use a kerosene lantern. Kerosene lanterns produce ethylene, which is a fruit ripener.) Also remember that snow is an excellent insulator. Don't tramp down or remove the snow on top of your root cellar any more than you have to in order to gain entry.
- Keep a fairly close eye on your produce and remove any that has begun to spoil. (It is a true axiom that 'one bad apple with spoil the bushel.'

Vegetables and their optimum storage conditions

Cold and very moist (32-40 degrees F and 90-95 % humidity			
Carrots Beets Parsnips Rutabagas Turnips	Celery Chinese Cabbage Celeriac Salsify Scorazonera	Winter radishes Kohlrabi Leeks Collards Broccoli (short term)	Burssels Sprouts (short term) Horseradish Jerusalem artichokes Hamburg-rooted parsley
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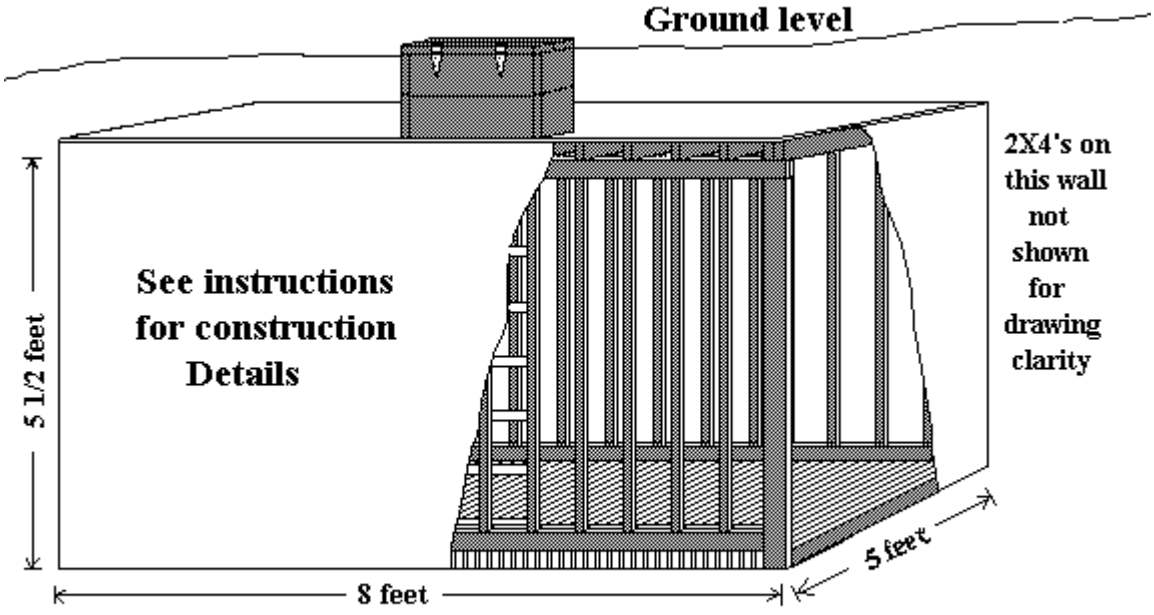
Cold and Moist 32-40 degrees F and 80-90% humidity	**40-50 degrees F and 85-90 % humidity**	**Cool and Dry 35-40 degrees F 60-70% humidity**	**Moderately Warm and Dry 50-60 degrees F and 60-70% relative humidity**
Potatoes Cabbage Cauliflower (short term) Apples Grapes (40 degrees F) Oranges Pears Quince Endive, escarole Grapefruit	Cucumbers Sweet peppers (45-55 degrees F) Cantaloupe Watermelon Eggplant (50-60 degrees F.) Ripe tomatoes	Garlic Onions Green soybeans in the pod (short term)	Dry hot peppers Pumpkins Winter squash Sweet potatoes Green tomatoes (up to 70 degrees F is OK)

A Modern Underground Storage Cellar

The underground storage area described on this page was constructed by one of the participants on the misc.survivalism news group. This is a great example of what can be done as just about anyone who owns even a small piece of ground can make and use it.



Underground Storage Room, Cutaway View

Things went well as he dug the hole by hand until he unexpectedly struck bedrock at seven feet down. He would have liked to go deeper. In actuality, (unlike the drawing) his floor has a step in it, following the uneven bedrock. The level of the bedrock also forced him to make his roof 6 inches lower than he planned. The entrance way is a box 2 feet square and centered on one of the long walls. It is made from 2X10 lumber with the hatch made of the same material and hinged to the entrance boards. A ladder descends to the floor of his cellar for easy entry and exit.

Construction: The floor consists of pressure treated 2x4s using the bedrock as a foundation. The 2x4s are spaced with gaps, to allow any spills to flow down into the bedrock. The walls are made of 3/4 inch plywood supported by 2X4's spaced on 9" centers. The bottom support beams (to the bedrock) are pressure treated 4x4s. The ceiling is supported again by 2X4s on 9 inch centers. The top is made from two layers of 1/2 inch plywood.

It was finished by waterproofing it with two layers of heavy duty landscaping plastic, staggered to overlap significantly. It was first wrapped around the sides, then draped over the top and down the sides. Finally, tarpaper was layered over the top and down the sides to protect the plastic from any rocks during the backfilling operation which just about completed this little project except for relandscaping the area. Only a foot of dirt covers the roof. Initially two feet was planned for, but again, the unexpected bedrock altered these plans.

Before the roof went on, two 55 gallon water barrels were set in one end of the shelter. After construction was complete, buckets of preserved foods were stacked on the other side. Between the barrels of water and the buckets, a set of deep shelves was made opposite the ladder for other goods. Note that none of these items are shown in the drawing.

A final note: Even with only 1 foot of dirt, the builder is getting a maximum temperature of 70 degrees in his shelter on 95+ degree F days with the cellar area in the full sun. As this only lasts for four months out of the year, it will be cooler during the other seasons.

The Granddaddy Of All Underground Storage Areas

There are root cellars and then there are root cellars. This web page covers an underground storage container made from culvert. This concept is extremely bold in every way. When it comes to underground storage, this may very well be the granddaddy of them all. I am convinced this is one of the finest underground storage ideas you will find anywhere. This page features one of these storage areas, which should help you understand their possibilities and perhaps even get you thinking about what you would like if you designed one for yourself.

A bold new concept: Whoever thought of this ranks as a genius of the simple. Basically, this underground storage area is made in a culvert that was designed for bridging creeks. Culverts are thin steel pipes that are very strong, light for their size, inexpensive when compared to other types of construction, galvanized and therefore rustproof. They come in a wide variety of sizes, from as small as one foot in diameter to 20 feet in diameter and bigger. Because of the huge size possibilities, culverts can fit into just about anyone's underground storage needs. Our showcase structure was built into an eight foot culvert, however, many people building this type of shelter are now using ten foot culverts.

Easily and quickly constructed: This photo shows the culvert as it was near the end of construction. It is made from an eight foot culvert 50 feet long. Steel plates were welded onto each end to enclose the culvert. A one foot in diameter vent tube, again made from culvert, was placed in the top of the culvert on each end (not shown). The culvert coming off the top side of the main culvert at one end in the photo is a four foot culvert. Before the shelter was set into place, the culvert was rotated down so the small attached culvert was on the side of the main culvert. Then a length of four foot diameter culvert was welded on which became the entrance way. Before it was set into place, the entire outside surface, especially the welded portions, were sprayed with tar to prevent rusting. The floor inside the culvert was constructed from 2X4s and 1 inch plywood. This was placed in the culvert at the five foot wide point, being about 10 inches above the bottom of the culvert. With the floor at this point, there is slightly over seven feet of head room when standing. Next came the door on the front of the entrance way. Our featured shelter has a small six by six foot porch built around the culvert entrance which has a wooden door to the outside. There is also a second inner door constructed from steel, enclosing the four foot diameter entrance culvert. All that remains to be done is to put in the walls and shelves.

Quickly set into place: The hole for this shelter was dug in one day. The shelter was brought in and set into place with the vents and entrance pipe welded into place the next day, then it was buried the third day.

Inexpensive for the size: The owner of our featured shelter spent $5,000 in 1990 on all aspects of constructing and burying this shelter. (It would cost about $10K now (1998) with the proper blast doors.) He did say that a lot of the wood for the floor and shelves was scrounged.

Plenty of room: Our featured shelter's 5 foot wide floor has 250 square feet of surface. Total storage area volume comes out to about 2,400 cubic feet.	**Easily adaptable** as an underground shelter: Our featured shelter has a bed, dresser, small living area, library, and a large storage area.	**This photo shows the end of the shelter next to the entrance.** Note the 4 foot diameter culvert coming off the left just before the bed. The entrance pipe wasn't put on the very end of the 50 foot long culvert for a very good reason - so the bed would fit. Note also the vent pipe in the ceiling. The owner said he would cut it off close to flush with the ceiling if he had to do it over again.

We show you the first photo again to explain the two rock towers on top of the shelter. These enclose the vents, and was done this way so kids couldn't shoot holes through them.

Your underground shelter can easily be hidden from view - no one even needs to know it's there: With a tiny bit of forethought and planning, the vents could be easily hidden by terrain, in shrubbery, a rock garden, or in carefully placed outbuildings. The same could be done with the entrance way.

Where to learn more: Sharon Packer, a nuclear engineer and the head of the Civil Defense Volunteers of Utah has written a 150 page 8 1/2 by 11 inch book called Nuclear Defence Issues. You should get one if you are contemplating building one of these shelters. This book sells for $25.00 and includes:

National Security Affairs
Weapons Effects
Building the Shelter
Post War Survival

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Revised: 15 Jan 98