

# Underground Utilities

Unless your house is on a steep slope, water, gas and sewer utility lines are almost always buried:

- The sewer pipe is a gravity drain so needs to be located below grade.
- Water pipes need to be located below the frost line to prevent damage from freezing weather.
- Natural gas pipes, along with the water line, are protected from physical damage by placing them under ground.

Electrical power, phone and cable TV wires may be routed to the house from a utility pole overhead. However, in most modern suburban neighborhoods these utilities are underground.

This gives homes a cleaner look but also complicates work in the yard. More utility lines in the ground means more opportunities for damaging the pipe, conduit or cable when digging.

When digging is planned on your property it is important to locate these underground utilities to avoid damage or disruption of your service (and potentially your neighbor's utilities).



**Always determine the location of underground utilities before digging in the yard.**



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**Clean Look of All-Underground Utilities**

## Underground Utilities

State law and local regulations regarding digging are fairly consistent in the United States. Generally, they require that prior to any powered excavation work, a utility survey is conducted to mark all the underground pipes, conduit and cables.

After marking of the utility lines, excavation can proceed outside a margin on either side of any markings. Careful hand digging can take place within the strip as needed.

Rules may vary by local jurisdiction, so make sure to determine requirements with your city or county code agency.

If you accidentally damage an underground utility by digging without locating the lines, you will have to **pay for repairs**, which could amount to substantial money.

In addition, you are **subject to fines** ranging from hundreds to thousands of dollars.

Even if you intend to dig with hand tools only, and even if you intend to dig a shallow hole or trench, it's still a good idea to have all lines located. Responsible contractors have the utilities located before digging even shallow holes or trenches. They recognize the consequences and liability resulting from unintended utility disruption, and so should you.

While the more hazardous gas and power lines should be buried rather deep in the ground, they may be more shallow than expected. The finished grade against which pipe depth is measured may have changed over time due to erosion or landscaping work. Also, not all installation work is done to code and an inspector may miss this, so you can't be sure how deep an underground utility line actually is.



**Call 811 before you dig !**

## Underground Utilities

Cost should not be your excuse for neglecting this, since the underground utility survey is **free!** Utility companies would much rather spend a little money on locating your lines than spend a lot more money to repair damaged pipes.

At least three days before digging, contact your regional excavation utility location service to request the lines be marked.

In most areas of the country, **calling 811** on your phone will connect you to this service. There may also be a regional “one-call” toll-free number listed in your phone book. For example, in Texas, you can call 1-800-DIG-TESS to reach the Texas Excavation Safety System, the largest such service in the USA. A web search is also a good way to find your local service.

Be aware that not all underground utilities are marked on your property using this free service. Generally, wastewater (sewer) lines are not located. Also, water supply lines—if they are located at all—may only be marked up to the water meter. This means that a long run between an in-ground meter and the house may not be marked. Phone and cable lines may not be located either, depending on whether or not your local utility participates in the location service.

Also consider pipes and wires which may be underground but are not actual utilities. Irrigation systems, landscape lighting and exterior power may also be present which have their own pipes, wires and conduit. These are often fairly shallow, so are more subject to damage. A diagram from the installer or paid locator service are the only solutions to marking these hazards.

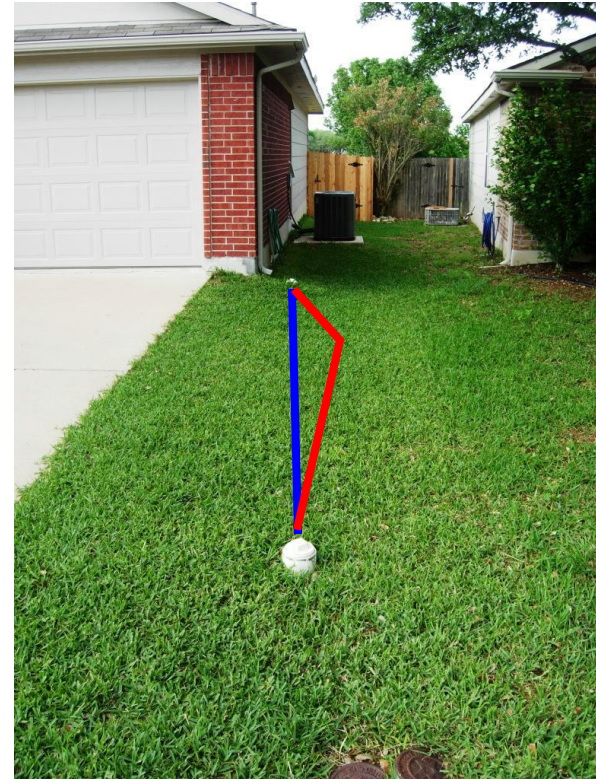
## Underground Utilities

The good news is that the two most hazardous utilities, gas and electrical main, are always marked.

To further locate the unmarked lines, your local utility or city may be able to help directly. You can also hire a paid locator for the remaining pipes or cables.

Often you can get a good idea of the general path of an underground utility by assuming a relatively straight line from its box near the street to the point of connection at your house. This is not necessarily reliable, since the path may not be direct, but it may give a general location if that is all you really need.

Likewise, for the sewer line you can get an approximate location by marking a straight line between the two cleanouts on your lot. There might be 45 elbows in the line, but if it is perpendicular to the curb, it probably runs straight.



**Likely Sewer Line Locations**

# Underground Utilities

The result of a utility location survey will be multi-colored spray paint on your curb, sidewalk and grass. Each utility type has a color code as shown below.

Powered excavators must avoid these marked lines within a specific distance. Careful hand digging can take place over or near these markings.



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# Underground Utilities

## General Notes

In most cases, any utility boxes in your yard are located just outside your legal property line (see HandyHomeowner topic, [Property Lines and Easements](#)) and do not belong to you.

The utility companies may need to work in or around them at any time and disturb landscaping around them as needed.

Some homeowners like to hide the utility boxes in their yard with screens, structures or plants. Keep in mind that when the utility needs to access any boxes, they will remove any obstacles as needed. With that in mind, do not make it extra difficult for the utilities to work on their boxes by building or planting in front of utility boxes.

**Disguising of utility enclosures is at your own expense and at risk of removal**, with no promise of restoration.

When any work is planned on your underground utilities, it is wise to know how to properly shut them off to your house.

For more information, refer to the HandyHomeowner topic, [Utility Shutoff](#).



**Examples of Utility Box Screening**

# Underground Utilities

## Water

Water main details vary significantly by location. Generally the utility supply comes from the street with a  $\frac{3}{4}$ " or 1" water supply pipe running to the house.

Threaded iron pipe will be found in older homes while copper pipe is more common in modern settings. White PVC pipe may also be used, sometimes in between sections of copper at the ends.

Pipe depth depends on the prevailing climate where the house is located. Cold weather regions require deeper pipes to avoid damage from freezing temperatures. In warmer climates where the frost line is superficial, the water pipes may be less than a foot deep.

In cold climates, the water meter is located near the house for protection. Here the water main pipe (lateral) will be marked when the utility locating service is used.

In mild climates, the water meter is often located near the curb at the property line. In this case a locating service may not mark the water main between the meter and the house, as this is the owner's property and responsibility.



**Typical In-Ground Water Meter**

# Underground Utilities

## Water

Water pressure should be in the range of 50-70 pounds per square inch (psi) inside your home. Below this you will have limited water flow; the utility should boost your pressure or repair a problem.

Above 70psi there is a greater risk of leaks and damaging piping or appliances in your home. In this case a simple remedy is to put an in-line pressure regulator on your main water supply line. Depending on your local code, this may be a standard or required feature of all homes in your area.



**Water Pressure Regulator**

To test water pressure at your home, purchase a water pressure test gauge which screws on a hose faucet to measure line pressure.

Some versions have a second pointer which indicates the maximum level the gauge reached. It is useful for monitoring pressure drops or other changes.



**Water Pressure Test Gauge**



# Underground Utilities

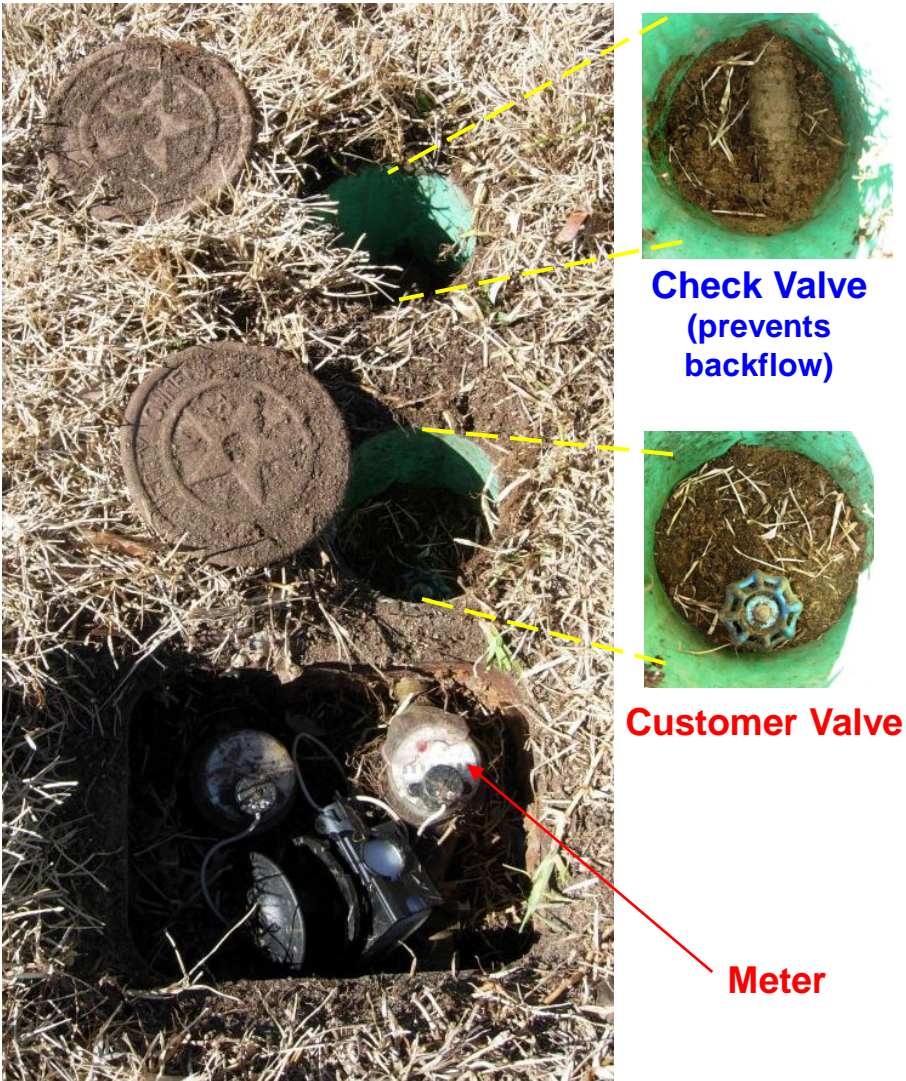
## Water

Regardless of water meter location, there should be a customer shutoff valve after the meter.

Newer homes will also have a one-way (check) valve which prevents water on your property from flowing back into the neighborhood supply.

These items are depicted at right for a typical in-ground installation.

If a water pressure regulator is used, it is probably located in the same area.



# Underground Utilities

## Sewer

Sewer lines are found in urban and suburban homes with a local drainage and treatment system. In rural areas and some suburban settings, a septic tank is used on-site. In this case, some of the discussion applies, since the home still has a wastewater pipe to the septic tank.

The sewer pipe (lateral) is typically 4" diameter and runs from the home to the sewer main in the street. Because it is a gravity drain, the pipe must slope for wastewater to flow.

Older home will use cast iron pipe. Iron pipe joints are prone to root incursion and blockage. Newer homes have PVC pipe laterals which are lighter and easier to work with, and resist roots.

Lateral depth can vary significantly. The house pipe will be higher than the sewer main depth in the street. If you have a basement and it has a wastewater drain without a pump, your sewer lateral is probably at least 10 feet below grade. At the other extreme, if your house is on a slab over rocky soil in a mild climate, the lateral could be rather shallow, 1 foot or less to the top of the pipe.

The easiest way to determine sewer pipe depth is to open the cleanout cap and measure straight down to the horizontal lateral pipe (see photo on page 11).

The sewer lateral is not normally marked by the utility locating service. However, the pipe is often easily located per the note on page 4.

# Underground Utilities

## Sewer

There should be two sewer lateral cleanout ports on your lot. One is typically right near the house and the other near the property line towards the street. These are used to run a plumber's snake down the pipe to remove clogs in the house sewer line.



**Typical Sewer Cleanout**

According to most regulatory codes, these cleanouts must remain accessible. Generally this means they should be visible (or at least easily located) and have working space around them.

Additionally, to meet code and just for common sense, the cleanout covers should be in place and intact to prevent the escape of smelly (and potentially explosive) sewer gas. This also prevents debris from falling into the sewer.

# Underground Utilities

## Sewer

Unfortunately, the location of these cleanouts often puts them right at lawnmower blade height where they can be damaged. Fortunately, broken closure plugs can be easily replaced. Damaged pipe ends require more extensive repair, although this is still a fairly easy job for a handy homeowner.



**Broken Cleanout Cover**

When installing these vertical cleanout pipes, plumbers frequently misjudge finished grade on new construction, or they err on the side of caution and install pipes which are too tall. So we frequently see large white pipes sticking up in the grass, which is not only unattractive, but a nuisance for mowing and trimming.



**Cleanouts Are Too Tall**

For more info on repairing cleanouts or adjusting their height, refer to the HandyHomeowner topic, [Sewer Cleanouts](#).

# Underground Utilities

## Gas

Not every home has a natural gas connection. Instead, some locations rely on electricity for heating, cooking, hot water and laundry drying. In this case there is no natural gas supply to the dwelling.

In rural areas or in certain suburban settings, natural gas is not available as a utility. The alternatives here are all-electric appliances or an on-site propane (LP gas) tank. In this case some details presented here apply, but the gas supply will be from a tank instead of a utility pipe in the street.

The homeowner should know if they have natural gas, propane, or neither by their utility bill. A meter will be located on the side of the house if there is a utility-supplied natural gas connection.



**Typical Natural Gas Connection**

# Underground Utilities

## Gas

If a home has a utility-supplied natural gas service line, it probably has black iron pipe running from the street main to the meter. Copper pipe is gaining acceptance for gas, so you may find this as well. Plastic pipe might be used, although it is not common for residential service.

Service line diameter depends on the demand (number and size of gas appliances) as well as the distance between main and meter. A 1" pipe is very common for single-family homes with several appliances.

Pipe depth also varies but 18" is probably the minimum expected depth. Gas is one of the really hazardous utilities to damage when digging, so the pipe by code is laid reasonably deep. Yellow caution tape may also be placed above the pipe to alert casual diggers of the hazard.

Gas pressure from the street is in the 4-20psi range. After the supply pipe shutoff valve, there is a large disk-shaped piece called a pressure regulator. This controls the pressure in the home at around 0.5psi.

Gas pipes, meter and regulator often get rusty after years of exposure. Painting this should be no problem, although you should check with your utility for any restrictions. Obviously you should mask the dial area to prevent coverage there. Get rid of rust with chemicals and brushes before painting or the paint will not adhere. Unless you smell gas, a little abrasive work will not spark an explosion.

# Underground Utilities

## Gas

You should see a white insulated copper wire coming up from the ground with the gas supply pipe.

This is called a **tracer wire**.

The tracer wire is wrapped around the gas pipe all along the buried path. It is used by utility survey people to locate the gas pipe underground when marking the path.

An electronic signal is applied to the exposed end of the wire, allowing a special sensor to follow the wire's path underground.

It may be tempting to cut off or hide this wire, but this tracing feature is very important, so don't remove it. If it is a nuisance (trimming grass) or a particular eyesore, you can coil it up neatly and secure it behind the pipe.

Pressure  
Regulator

Supply  
Valve

Tracer  
Wire

Supply  
Pipe



**Typical Natural Gas Connection**

# Underground Utilities

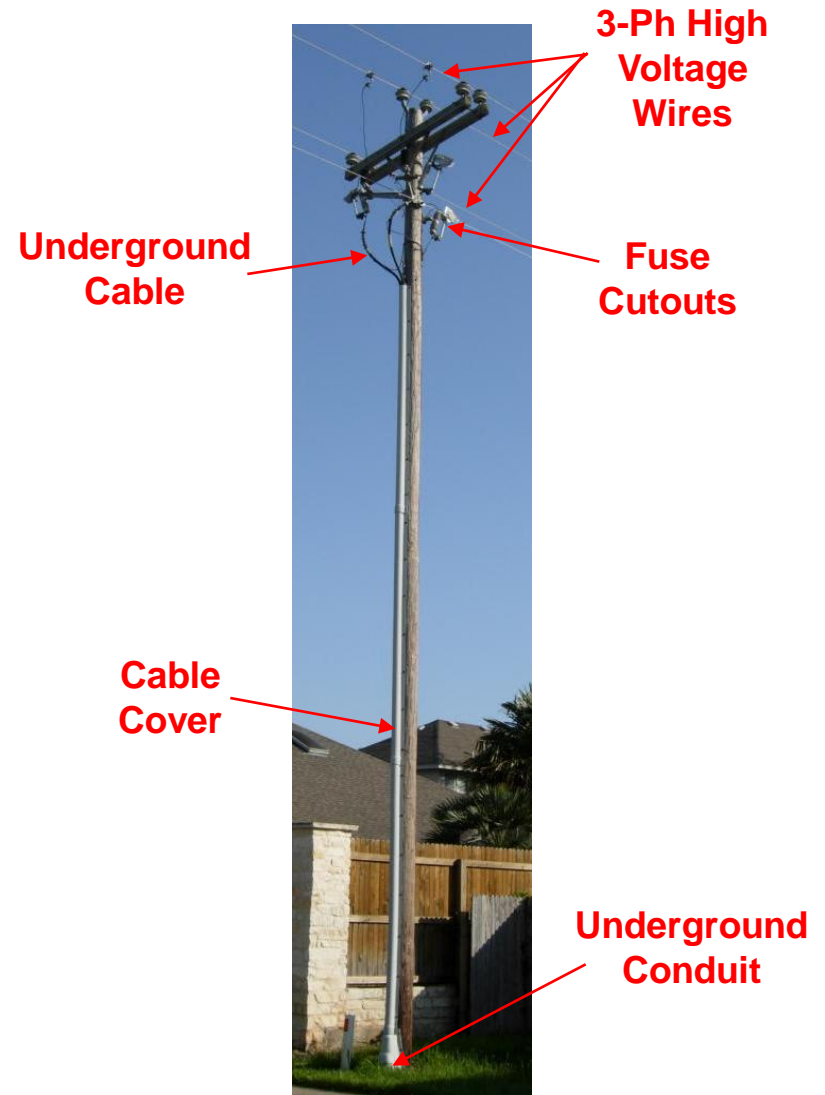
## Electricity

Underground Residential Distribution (URD) is the technical term which describes a common scheme to get electrical power to homes with no overhead power cables.

It all starts at a 3-phase high voltage power line running overhead somewhere in the neighborhood, typically 7200 or 14,400 volts. An underground substation feed is possible, in which case there would be no overhead lines, but these are expensive and uncommon.

Large cables tap into these distribution lines through expulsion fuse cutouts which allow easy disconnection and fuse replacement. The three cables run down the utility pole behind a protective cover, then dive underground through plastic conduit.

This arrangement is shown in the photo at right.





# Underground Utilities

## Electricity

The high voltage cable then routes underground through the neighborhood to transformers which serve three to six houses each, depending upon the transformer size and the electrical demands of each house.

Transformers convert the utility high voltage supply to the 120/240V nominal voltage we use in our homes. They may be in underground vaults or in pad-mounted cabinets. A typical pad mounted transformer is a big green box, as depicted at right. It is identified by scary hazard labels and typically has a low-frequency vibration or audible hum. Sometimes they have fins for radiating heat.

In addition to the transformers, some utilities also install boxes for wiring connections or other electrical switchgear.

Because they contain extremely hazardous electrical power, a transformer or electrical box must always remain locked closed and its cabinet be intact and undamaged. Any damage or unlocked boxes should be reported to the power utility immediately.



Transformer



Connection Box



Connection Box

Transformer

# Underground Utilities

## Electricity

From the transformer, supply wires are run to each house through underground conduit. Conduit depth is at least 18" below grade and sometimes deeper, unless covered by 4" of concrete. Cables to each house are sized per the electrical load, typically 100 to 200 Amperes. This means conduit size varies with the electrical service; 1-½" to 2" conduit is common.

To simplify underground cable distribution, utilities often install an in-ground service box, also called a hand box. This is normally a gray plastic or fiber cement enclosure measuring approximately 1' by 2', as depicted at right.

The electrical service box can be opened by utility personnel with a special tool to access wire splices for repair or replacement. The contents are very hazardous and should never be opened by homeowners or the general public.



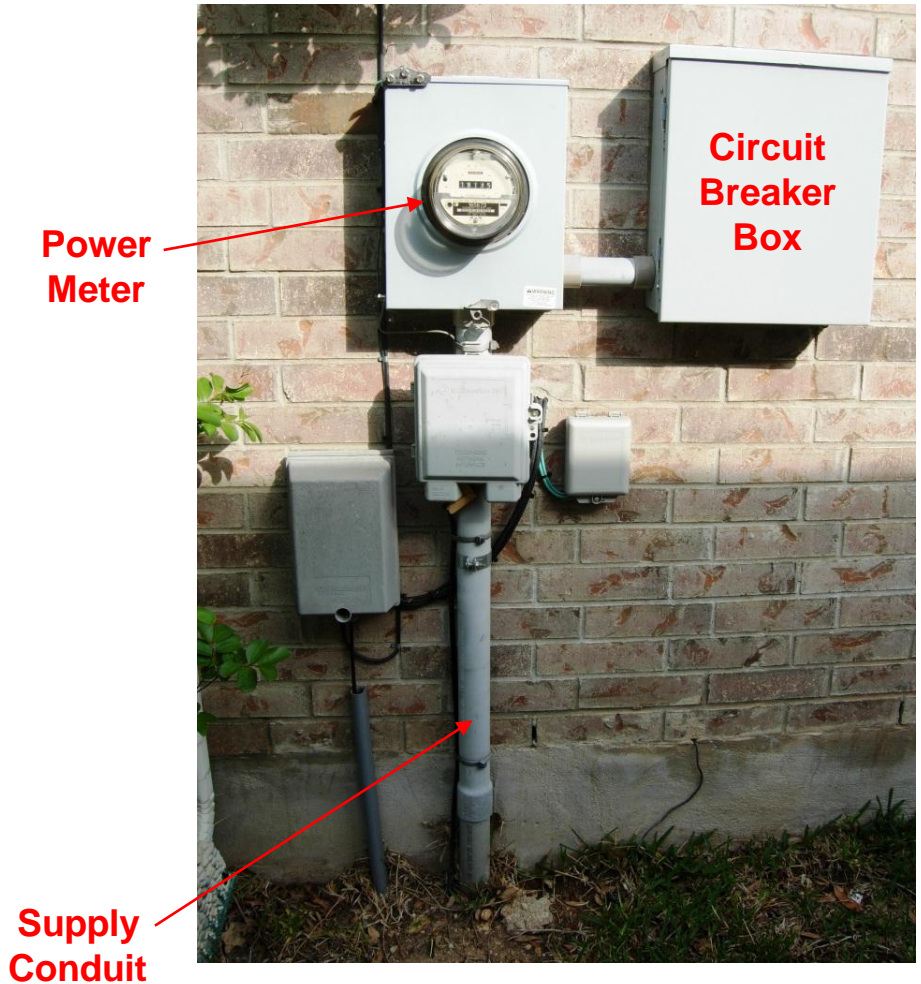
**Typical Service Box**

# Underground Utilities

## Electricity

With a meter on the house, the utility is responsible for the conduit and wiring up to the meter. Here cables in conduit run underground from the transformer to one side of the house. Again, these cables should be at least 18" deep. The conduit emerges below the meter where it protects the utility wires up the wall. Note that telephone and cable TV boxes are often attached to the electrical conduit.

The meter box and circuit breaker boxes must remain accessible with good working room in front of them. Along with the conduit, they can also be painted to suit the owner's taste.



# Underground Utilities

## Electricity

If the power meter is in a pedestal in the yard, the utility brings power wires to the meter and main circuit breaker.

Conduit between the meter and house is the owner's responsibility. The wires travel underground to a circuit breaker box on an exterior wall, protected by conduit all the way.

Once again, the supply wires in conduit should be at least 18" below grade.



**Pedestal Meter**

# Underground Utilities

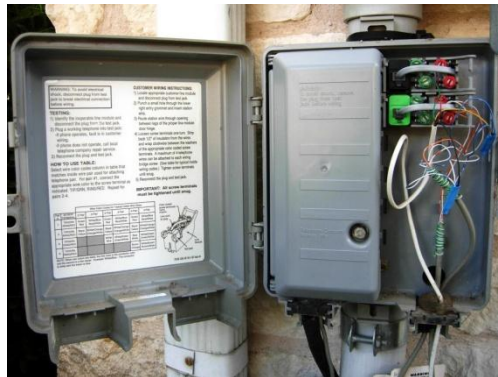
## Telephone

Most homes still have landline telephone service for communication and perhaps for internet service.

Phone cables are usually black, and can be round, flat or oblong and measure no larger than ½” diameter.

Telephone service normally connects at one side of the house in a gray plastic box such as shown in the photos below. This box is officially termed the Network Interface Device (NID). It provides a simple way of isolating and testing your house phone wiring.

The service cable comes up from the ground below the NID. The cable routes to the nearest phone distribution box close to the street. The utility distribution box is usually an above-ground pedestal, typically green, as shown the photo below.



# Underground Utilities

## Telephone

The telephone cable between the service box and the house is often laid fairly shallow, so care is required when digging along the cable path. Main phone utility cables are normally much deeper, but care should still be exercised when digging around the pedestals.

Your telephone utility pedestal may be in front of a neighbor's house, since one box may serve several houses.

If the pedestal is not straight and it bothers you, it can be pushed straight or properly situated. If you are uncomfortable doing this yourself, the phone company should be able to help.



**Phone Pedestal Can be Straightened**

# Underground Utilities

## TV Cable

Many urban and suburban homes have a coaxial cable service for entertainment and perhaps internet or phone service as well. These cables are round, measure about 1/4" diameter and are usually black.

Cable service normally connects at one side of the house in a gray plastic box such as shown in the photos below. Inside the box is a splitter for distribution of the cable signal to individual cables entering the house. To prevent tampering, a special tool is usually required to open this box.

The service cable comes up from the ground below the connection box. The cable routes to the nearest TV distribution box close to the street. The utility distribution box may be in-ground or a short pedestal, typically green, as shown the photo below.

The cable is frequently laid very shallow, just below the surface, so care in digging is required in the vicinity of the cable path.



**Cable Boxes**



**Cable Distribution Pedestal**

# Underground Utilities

## TV Cable

Your cable utility distribution box or pedestal may be in front of a neighbor's house. The box may also be larger than the simple, short pedestals. These have more connections and sometimes other equipment in them. An example box is shown below.



**Cable  
Distribution  
Box**

If the pedestal is not straight and it bothers you, it can be pushed straight or properly situated. If you are uncomfortable doing this yourself, the cable company should be able to help.



**Cable Pedestal Can  
be Straightened**



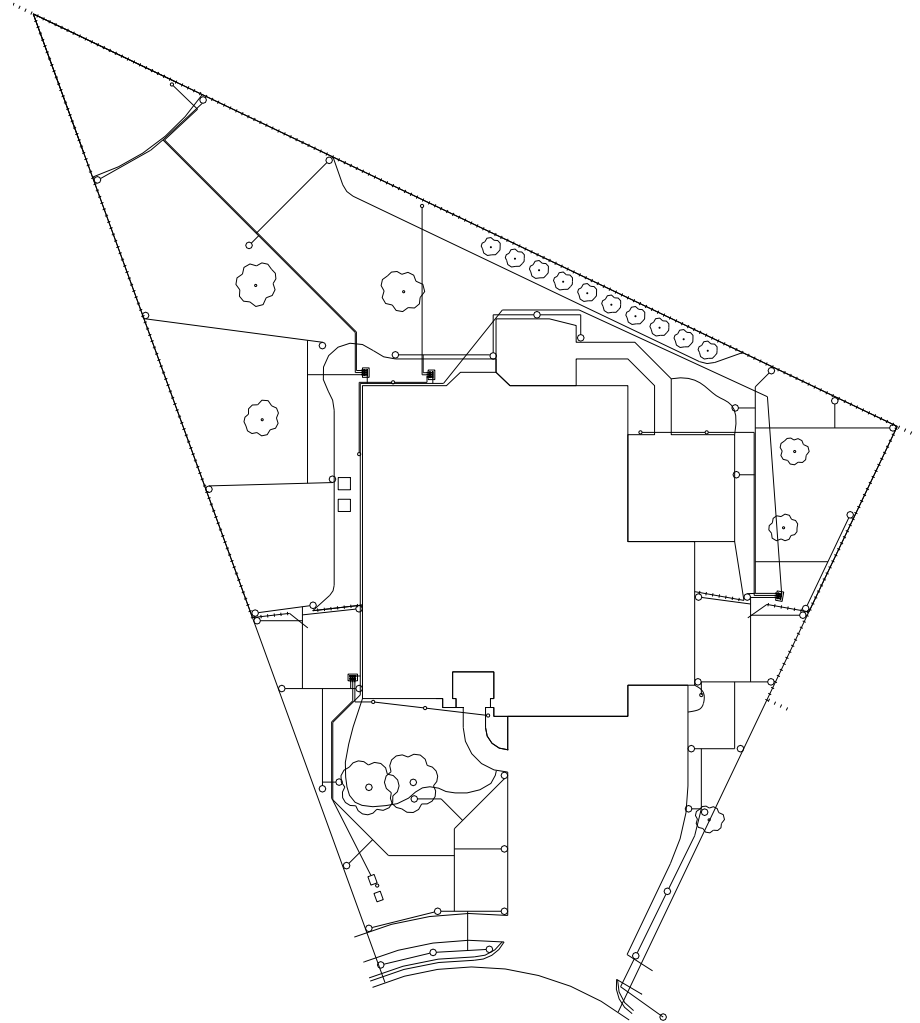
# Underground Utilities

## Irrigation

If you are blessed to have a sprinkler system on your property, irrigation pipes and wires are underground on your property and are subject to the same hazards as the utility lines. In fact, they are probably more subject to damage from digging since there are many pipes, and they may be fairly shallow.

Control valve wires are almost certainly laid in the trench with the pipes, so locating the pipes before digging is the main concern.

A plan or map of the sprinkler layout is the best way to locate pipes underground. Photos of the installation are the next best thing. Apart from that, the only other trick to locate irrigation pipes is to run an electrical fish tape through each sprinkler head into the pipes and use a metal detector to locate it.



# Underground Utilities

## Irrigation

With a sprinkler system there are quite a variety of objects visible above ground. Some of these are shown here:



**Valve Wires in Conduit From Controller**



**Different Sizes and Shapes of Irrigation Boxes**



**Double Check Valve (Backflow Preventer)**



**Manual Shutoff**



**Single and Manifolded Valves**



**Sprayers and Rotors**



# Underground Utilities

## Landscape Lighting

Low-voltage lighting is popular for nighttime path illumination and for highlighting attractive features of your home or landscaping.

The power cable is typically laid very shallow, especially if done by a homeowner who wants to minimize installation effort. This means that landscape lighting cable may be lurking just below the surface.

Cutting the cable with a shovel is unlikely to be hazardous (low-voltage lighting is deliberately safe), but is a real nuisance to repair.

Every effort should be made to locate the wires before digging.