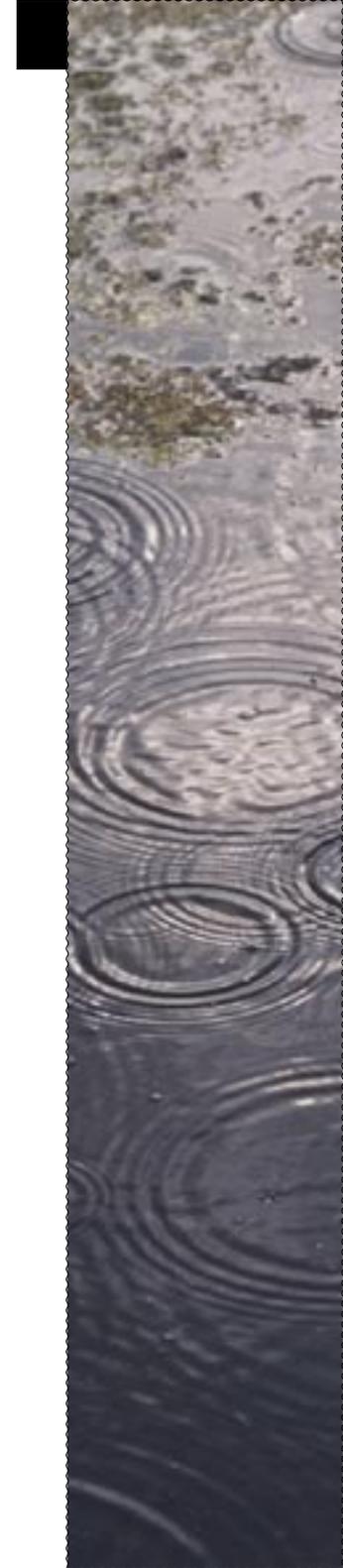


Solving Drainage Problems Around Your Home





What's the Problem?

Basically, home drainage problems are caused by too much water or by water that's misdirected. Left uncorrected, these problems can cause significant damage to both your home and property.

Damp or wet basements and crawl spaces

invite silverfish, rodents and other pests into your home. Dampness also rots wood. It promotes the growth of mold and mildew. And standing water can freeze and thaw, cracking and weakening the concrete foundation of your home.

Puddles or pools on your property

can be harmful to trees, shrubs and other plants. Most garden plants cannot survive if their roots stay drenched for long periods. Puddles or pools are unsightly and may become stagnant, causing unpleasant odors and attracting insects.

Soil erosion and slides

can literally carry land away, damaging property and homes. How much damage is caused will depend on the amount of water, how fast it is flowing and the size and kind of material over which the water flows. Sandy soils erode very easily. Large gravel and rocks are not easily eroded, because of their weight. Clay and silt have cohesive properties that can hinder erosion, even though particle sizes are very small.

Your drainage problems are everyone's.

Water running off your home and property can carry litter, oil, gas, fertilizer, pesticides and anything else that can float, dissolve or be swept along. These pollutants flow directly into lakes, rivers and streams. The oil that drips onto your driveway, the excess fertilizer

or pesticide used in your yard, even the soap and dirt washed off your car—these can affect the health of our waters, and they can contaminate the fish and shellfish we eat.

For these reasons, it's important to properly manage the drainage around your home. The City of Redmond's storm drain system is not directly connected to a water treatment plant.

So even if your drains are connected to the City system, they still carry water directly to area lakes and streams. It is good to think of the catch basin near your house as the start of the stream.

On your property, you are responsible for needed drainage work. The City may be of assistance where drains need to be extended onto City-owned property; the only locations where the City's crews are authorized to work.

If you already have drainage problems on your property or around your house, please read on!

Warning: Slide Area

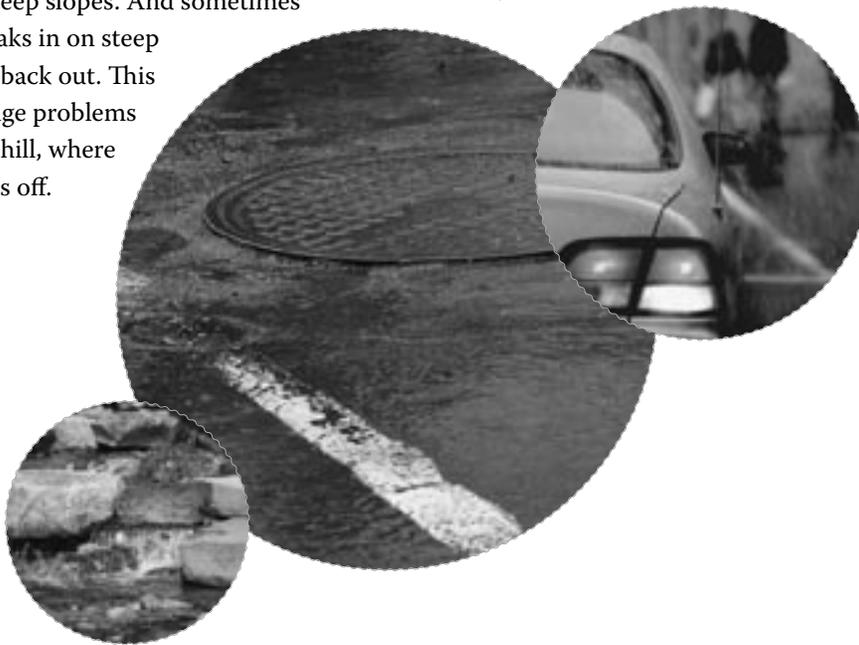
When large amounts of soil move, either quickly or slowly, it is called a landslide or mudslide. The potential for these slides increases when it rains. Rainfall causes slopes to erode, making them steeper. The soil also becomes saturated, making it heavier. Saturation also weakens the soil by acting as a lubricant between particles. The heavier, slippery soils can actually flow downhill—causing considerable damage to homes and property.

Why Is This Happening To Me?

What causes drainage problems in Redmond? Several things do. First is the rainfall that our area receives—typically 40 inches each year. Next are compacted soils, which can make it difficult for rainwater to filter into the ground.

The lay of the land is another source of trouble—especially in parts of Redmond where slopes can be fairly steep. Rather than soak into the ground, rainwater tends to run off of these steep slopes. And sometimes water that soaks in on steep slopes, seeps back out. This causes drainage problems further downhill, where the land levels off.

There is also the growth rate. Redmond's population has grown from just 1,426 in 1960 to 46,391 in 2003. Rapid development has covered the land with impervious surfaces like buildings, streets and parking lots, limiting the area that's available for water to soak into the ground. Instead, it stays at the surface and quickly runs off into streams, storm drains and ditches. Or it flows onto your property and into your home!



Growing Pains

Stormwater management plans are required with all new development. If you think that a proposed development near your house could cause drainage problems for you, then call or write to **Development Services** at 425-556-2760 or **Development Services, MS:2SPW, P.O. Box 97010, Redmond, WA 98073**, or e-mail pwgen@redmond.gov.

What's There?

There are dozens of ways to attack drainage problems. Of course, it's unlikely that you'll need all of them to protect your home or property. But when finding the solution to your particular home drainage problem, it's best to know your options.

1 Foundation drains

carry stormwater away from your building's foundation. The pipes of these drains are perforated and usually surrounded by gravel. The gravel may be wrapped with a layer of plastic mesh called filter fabric, which holds the soil back but lets water through, preventing the gravel and drain from clogging.

2 Roof drains

unlike foundation drains, are not perforated. They should be connected to an underground system that drains to the City's storm drain system, directly to a water body or to a drywell (See item 9). There's a good reason why roof drains should never be connected to the foundation drain system: if foundation drains become clogged with sticks, leaves and other debris from roof gutters, then water could seep out of their perforations and into your home!

3 Gutters

collect runoff from your home's roof and feed it through downspouts to roof drains.

4 Storm drain pipes

carry rainwater away from your property and into the City system. These pipes are made from a variety of materials, including concrete, aluminum and polyvinyl chloride (PVC). Depending on the material used, these pipes can last as long as 100 years in the ground. Note that many private drain pipes are single-walled corrugated HDPE pipe. This type of pipe has been a problem due to clogging and crushing. PVC pipe is a superior alternative.

5 Catch basins

are basically concrete boxes with grated tops or throat openings. Connected to storm drain pipes, they're designed to catch small rocks, gravel, soil and other debris that might otherwise clog the pipes. Captured debris settles at the bottom of the basin (called a sump), where it can be removed. Because the City has thousands of these basins to maintain, years may pass between cleanings. Homeowners can do their part by helping to contain debris, keeping it out of the basins.

6 Yard inlets

are like catch basins but much smaller and without a sump. You can buy ones made of metal or plastic at hardware stores or make your own out of poured concrete. Remember, anything that enters the inlet goes straight into your drain system and into a stream.

7 Trench drains

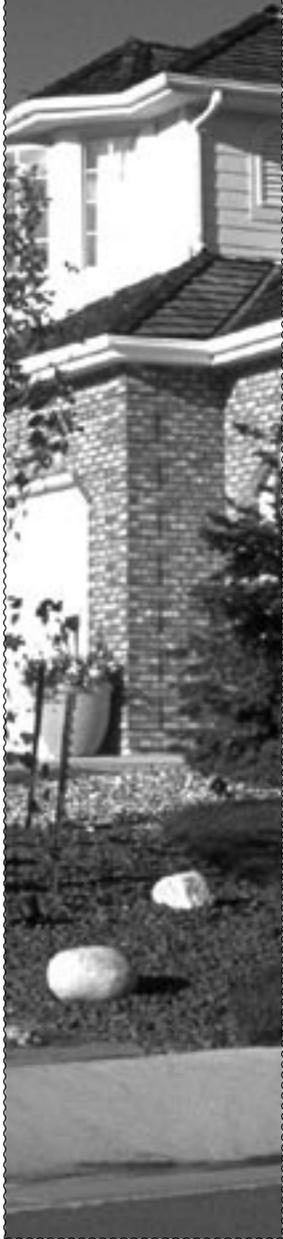
are placed wherever stormwater is spread over a wide width such as a driveway. Inside the drain, water flows to one end or the other. Then it flows out through a pipe to the City's storm drain system or some other destination. Like yard inlets, they typically lack a sump.

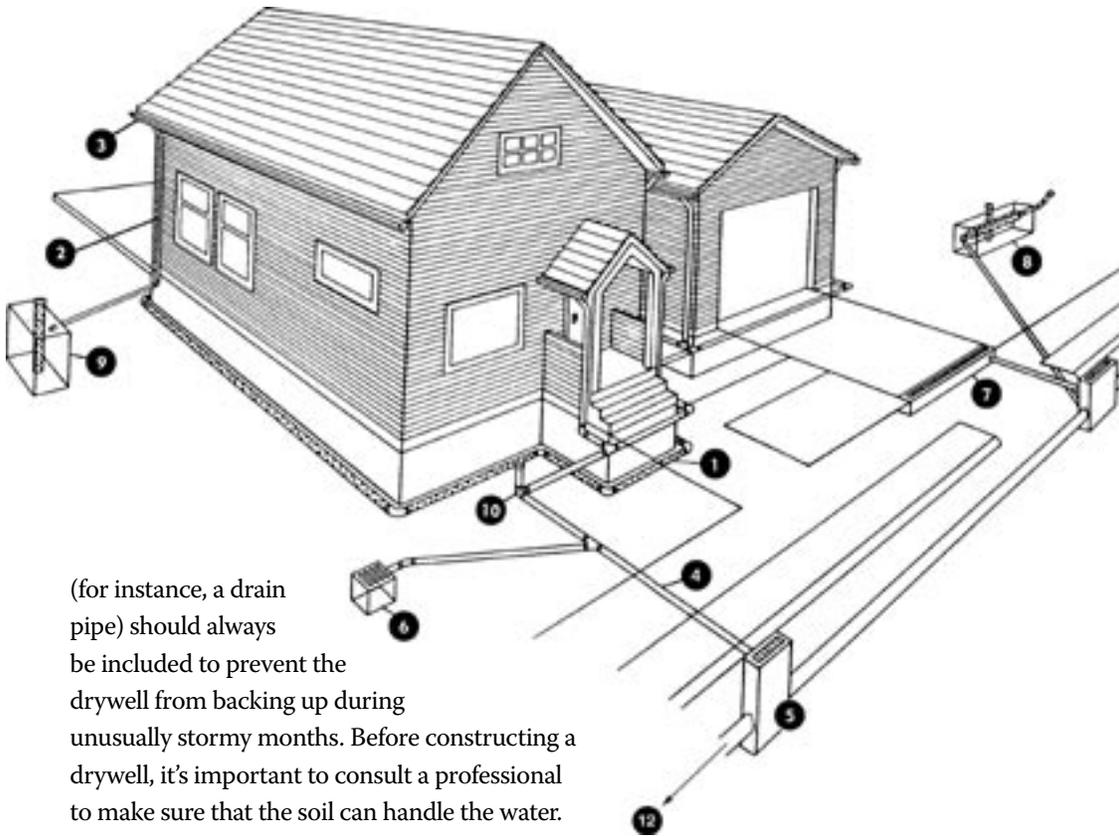
8 French drains

are perforated pipes surrounded by gravel and filter fabric and connected to a drain system. They can be installed anywhere you need to capture water, not just from around your building's foundation.

9 Drywells

are pits lined with gravel (which is also surrounded by filter fabric). They fill with water, then gradually release it into the ground. Placed at least ten feet away and downhill from the house, drywells are especially useful where connections cannot be made to a drainage system. Some other means of releasing water





(for instance, a drain pipe) should always be included to prevent the drywell from backing up during unusually stormy months. Before constructing a drywell, it's important to consult a professional to make sure that the soil can handle the water. Remember: saturating the soil can cause slides. You also need to consider whether the water being released will cause a problem for your neighbors downhill. **Remember that this water goes into your groundwater. Dump no waste!**

10 Cleanouts

are placed at critical points in a drainage system—a pipe's elbow, for example—where debris can collect and clog the drain. By removing an end piece, you can reach down through the cleanout and take out any debris.

11 Sump pumps (not shown)

are devices that are put in a hole, or sump, in a basement or crawl space. The pump turns on when the sump starts to fill with water, usually from underground sources. The water is then pumped into the storm drain pipes away from the house. Sump pumps should be used as backup systems or when all other practices will not work. These pumps are limited in that they need electricity to run. So, if the power goes out and the water rises you will get wet.

12 Drains to stream, lake, or groundwater

Remember that whatever you put on the ground or into any of these types of drainage structures will get to a stream, lake or into our groundwater. Washing cars in your driveway releases dirt and soaps into our streams. Parking cars with oil leaks in the street is like parking on the lake. Washing paint rollers outside or dumping radiator fluid in the drain releases contaminants into the ground, from which we pump much of our drinking water.

Please, no contaminants in the water!

Note: Splash Blocks

Splash blocks don't protect your home, because they keep rainwater too near its foundation and can cause surface erosion. For this reason, they're not a good idea. Their use is not permitted for any new construction in Redmond.

So Much Water, So Many Pipes

Drainage pipes vary greatly in size and materials. Here are some of the more popular types currently used in Redmond:

Concrete pipes

last longer—up to 100 years—and can handle more loading (weight from above) than any other pipe. But they're very heavy, making them difficult to install, so they're seldom used by home builders today.

Ductile Iron/Schedule 40 Steel

are very strong pipe materials that can be used in shallow applications subject to heavy loading.

Flexible, single-walled Corrugated Polyethylene Pipe (CPEP)

was, in the past, perhaps the most commonly used drainage pipe in the Northwest—even though it often fails to protect homes. The corrugations on the inside of CPEP pipe can catch and hold debris, which eventually leads to clogging. CPEP pipe collapses under heavy loads, particularly if installed on or under large rocks. This pipe is also difficult to clean and is easily punctured.

Smooth interior double-walled CPEP

doesn't have inside corrugations, so it doesn't catch debris. It is also stronger than single-walled pipe. Gasketed connections are recommended.

Corrugated Metal Pipes (CMP)

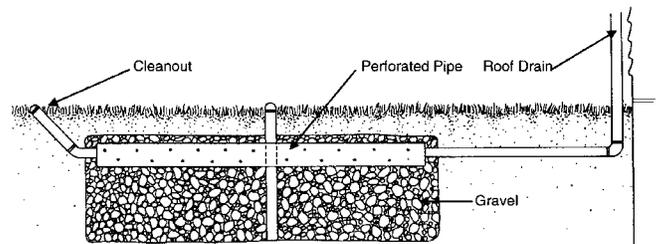
are steel or aluminum pipes that are corrugated for strength and sometimes coated inside with asphalt to increase the capacity

and design life—ordinarily about 20 years. They're lightweight and come in smaller sizes than concrete pipes. Redmond's drainage system is made primarily of corrugated metal pipes.

Polyvinyl Chloride (PVC) pipes

are not as strong as aluminum or concrete, but they're much easier to handle and come in a wide range of sizes. And they last longer than aluminum, because they don't rust or decay. PVC is now being used for most new stormwater piping in Redmond.

Any of these pipe types can be purchased with perforations for use in dry wells or French drains.



Typical French Drain

Redmond has five shallow groundwater wells that provide a significant supply of its daily drinking water. These wells, located in the heart of Redmond's downtown, are protected through the Wellhead Protection Program.

Businesses and residents are asked to ensure safe use and storage of hazardous materials in order to protect the valuable groundwater resource. If you have questions about protecting the groundwater, contact the **Wellhead Protection Lead** at 425-556-2756 or groundwater@redmond.gov.

Please, never allow hazardous materials or other contaminants to enter drains or percolate into the ground.

Let The Land Work For You

Now you've met all the main options—except one. The way water behaves on your property and that of your neighbor will affect how your home drainage system performs. For this reason, the contour of the land (in particular, the degree of slope) and the percent of the land that's covered by **impervious surfaces** are considered the final elements of a home drainage system.

A moderate degree of slope will allow rainwater to flow gently, reducing the chances for troublesome puddles and ponds and erosion.

That's why the ground around your home should slope gradually away from the foundation for a distance of at least five—and preferably ten—feet. This will keep water away from your home, where it might otherwise get into its crawl space or come up through the floor. A good slope should drop down at least three inches for every five linear feet.

Along (parallel to) your home, the ground should drop down at least three inches for every ten linear feet. And where the land slopes toward a building, a way must be found to redirect the flow around the house.

Swales are gently sloping depressions in the land's surface. By creating swales, water can be moved away from your home and onto another part of your property. Then French drains, drywells or other constructed drainage systems can eliminate the problem altogether.

Of course it's important to make your swales large enough to carry the volume of water that will drain into it. The larger the swale, the more water will be redirected away. Grass or other plants that grow in the swale will help keep soil and the nutrients it contains from being carried away. A series of smaller ridges, called berms, can be used to direct water into and through the swale.

When constructing berms and swales, let common sense be your guide. Avoid directing the water to a place where it wouldn't flow naturally. Don't redirect the flow in a way that causes problems for somebody else. And never create new ponds without drainage outlets on your property.

To fill in low areas during grading, use the most free-draining soils available. Save the topsoil and spread it over the newly filled and graded areas to help establish plantings.

Impervious surfaces include streets, sidewalks, driveways and roofs and anything else that prevents rainwater from seeping into the ground. As a general rule, the volume of water that flows off an impervious surface is four times greater than the volume that flows off your lawn.

There are many materials that are as durable as concrete but can let rain water through. When planning any new patios, paths or driveways, think about using *gravel*, *paving blocks*, *porous asphalt* or other water-friendly materials instead of concrete.

Wait! We Want That Clean Water

Why is it important for some water to seep into the ground? Why can't it just flow away? Simple. Replenishing underground sources of water (called groundwater) is important.

Many streams are sustained by groundwater—especially during seasons when surface water is in short supply. If their groundwater sources are depleted, the streams will dry up.

The City and some residents also depend on groundwater from wells for drinking, so problems could arise if water is prevented from seeping into the ground. The wells of individual property owners could run dry.





Map Out a Solution

Having plenty of drains, pipes and swales won't automatically solve your problems. That's because a good home drainage system is more than the sum of its parts. Make sure that your system works well by carefully sizing, installing and maintaining all of its elements. Any signs of drainage problems may hamper the sale of your home, so the work that you do now will more than pay for itself later.

First, take a look at the conditions that are affecting your home and property. Where does the water that drains to your lot come from? On what parts of your property does it collect? Then where does it go? How much of your property is covered by impervious surfaces? The answers to these questions will help you determine what steps should be taken to solve your home drainage problems.

Taking a good look means making a map of your property.

To create your map, take your house location survey, which is often available from the City or perhaps from your title company, and trace or photocopy it onto white paper. Check with the Building Department, which may already have plans of your house's roof and foundation drains on file. The Public Works Department may also have plans of the City's storm drain system, which you can use to determine how your system drains and to plan for new installations of pipe. Pencil this information onto your copy of the house location survey.

Now add more information—the location of all buried storm drainage pipes, their approximate depth, size (diameter) and type (plastic, corrugated metal, etc.). Include the dimensions to known surface points, such as the corner of your house or the tree in your backyard. And indicate any landscape features that might affect the way water flows or collects on your property.

Even if you come up empty-handed at the Public Works or Building departments, there's still plenty to do. You can peer into street catch basins to determine where your pipes tie in.

Or simply run a hose into your downspouts and watch where the water drains out. Don't forget to talk with your neighbors, who may have found the answers to many of the same drainage questions already.

Now compare your map with the problem areas you identified at the start of your project. You should be able to see where new drainage elements are needed, old elements need to be replaced or repaired, or the slope and other features of the land altered to help water drain and flow.

Use Your Drainage Map To:

- ▶ Locate drainage system elements for maintenance or future system expansion.
- ▶ Help prevent the weight of parked mobile homes, delivery trucks, or construction equipment from damaging your existing drainage system elements.
- ▶ Avoid damaging drainage system elements during repair or construction of pools or installation of onsite sewage disposal systems and power lines.
- ▶ Plan for landscaping.

Do It Yourself... Or Hire A Contractor?

Don't give up if you're unsure about what to do next or concerned that your drainage problems are too big for you to correct. Professional help is available. Contractors that specialize in drainage problems are listed in the yellow pages or can be searched on the internet under *Drainage Contractors*, *Pipe Waterproofing Contractors* and *Waterproof Materials*. These helpers will sometimes provide free or low-cost opinions and cost estimates.

Architectural/engineering services can also address home drainage problems. Such firms offer one-stop shopping. That is, they can provide a soils engineer for determining drainage capacities and stability, a civil engineer to design your drainage system and an architect to oversee the project and to recommend contractors who will actually perform the work. Check the yellow pages under *Engineers-Drainage*.

Remember: whether you or someone else solves your drainage problems, it's still important to start with a good map.

Small improvements or minor adjustments to your home drainage system can often be made by you. Depending on your budget and the amount of available time, a home owner may choose to undertake still larger jobs—for example, the installation of French drains or infiltration drains—without seeking outside help. But for many homeowners, hiring a reputable, licensed contractor is a way to ensure that even the largest drainage repairs and installations are done right. For particularly large or complex jobs, you may again choose to contact an architectural/engineering service.

What Else Will I Need?

In some circumstances, the City of Redmond requires homeowners to obtain building or grading permits before any drainage projects are begun. Permits are required if the project meets any of these thresholds:

- ▶ Clearing of 7,000 square feet of land area or more.
- ▶ Earthwork of 50 cubic yards or more.
- ▶ Changing existing grades by four feet or more.
- ▶ Any clearing or grading within sensitive areas like a steep slope, stream, wetland, or work within the buffer of a sensitive area.
- ▶ Work within the City Right-of-Way or other City property.
- ▶ Removal of trees 6 inches or greater in diameter (measured 4.5 feet above ground).

To find out about permit requirements, contact **Development Services** at **425-556-2760**, e-mail pwgen@redmond.gov, or write to **Development Services, MS: 2SPW, P.O. Box 97010, Redmond, WA 98073**.



Do It Right

The best way to solve a drainage problem is to correct it at the source. For instance, if water is flowing off your driveway and into the planter next to your house, you'd be wise to install a new yard inlet or add some other drainage system element to catch the water before it creates the problem.

Unfortunately, it's not always possible to get to the problem's source. Or trouble may stem from an uncontrollable source, such as an underground spring on your property. In either case, don't despair: City staff may be able to offer advice, and there are many private engineers and contractors who can help you find answers.

Here are a few final tips for saving yourself from home drainage problems:

Protect your trees.

Remember that the lot where your house stands was likely forested at one time. Those trees intercepted rain water and used it, thus preventing most drainage problems. With the building of homes and streets, that natural system was eliminated, thus creating many of the problems we face today. Think twice before cutting down trees on your lot, and consider adding some.

Careful placement of trees or large shrubs

can save lots of trouble. That's because the roots of these plantings can grow down into underground pipes and eventually destroy them. If the pipes need to be dug up and replaced, your trees or shrubs could be destroyed in the process.

By sweeping your driveway instead of hosing it off, you can keep dirt out of your system—and save water.

Avoid using wood chip mulch around yard inlets or swales in landscaped areas.

Wood floats, so it's easily carried away by runoff.

Always leave yourself an out, an independent backup system, just in case the City's storm drain system should fail.

Put cages or screens on all gutters

to prevent debris from entering downspouts. These are inexpensive and easy to obtain from hardware stores and home centers, but remember, you need to clean them.

Put a removable connection between downspouts and roof drains.

When cleaning your roof, disconnect all downspouts from the roof drains. This will keep debris from being washed into and clogging your underground system.



Keep It Going

Chalk it up to human nature: the most common cause of drainage problems is inadequate system maintenance. So inspect all drainage structures around your house and remove any debris regularly. Hard-to-get drains and inlets are often ignored during maintenance, so make sure that all parts of your home drainage system have cleanouts that are ample and accessible.



Roof gutters should be cleaned at least twice a year. If trees overhang your home or are close enough for leaves, needles and branches to be blown onto your roof, then gutters should be cleaned more often—especially in the fall. Remember, it’s much easier to remove debris from gutters than it is to clean underground pipes.

If you’re still unclear about what to do about rainwater on your property, then phone the **City of Redmond’s Public Works Department** at 425-556-2825 or email nr@redmond.gov, or write to **MS: 2NPW, P.O. Box 97010, Redmond, WA 98073**.

Working with your map and any other information that you can supply, the Department’s stormwater engineers may be able to give you ideas to help you identify the best solutions to your particular home drainage problem.



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