

A Homeowner's Guide to Drainage

Runoff Behavior and Facts

In this part of Arizona it is not always apparent where the drainage paths are and how deep the water can get. Rainfall is infrequent in this arid and semi-arid climate, but at times can be very intense. Snowfall accumulations can also be significant in the higher elevations. Flooding can take place when there is a rapid snowmelt with or without rainfall or after an intense summer monsoon. Flooding can happen any time of the year, but mid-winter to spring has produced the worst flooding in Coconino County. The most recent major flooding event took place in December 2004 and in February and March of 2005 when there was rapid snowmelt combined with heavy rainfall.

Rainfall is usually discussed in terms of storm frequency and duration (e.g., a 100-year, 6-hour storm). In simple terms, this is the total inches of rainfall that will occur from a storm that lasts 6 hours and has a probability of occurring in any given year of 0.01 or 1 percent. For the Flagstaff area, this is approximately 3.2 inches of rainfall. If such a storm were to occur on frozen ground or during a period of snowmelt, the amount of water generated would be considerably greater.

Questions To Ask Before You Build

Know your lot and all potential runoff sources before finalizing your building plans. Here are some questions to consider.

- Is the building pad lower than the road and/or bowl-shaped?
- Does the lot have a moderate to steep slope and shallow bedrock?
- Will the driveway slope towards the garage and or the house?
- Is the road adjacent to the lot coming down a hill and will it drain onto the lot?
- Are there adjacent hills and do they persist for some distance?
- Are there any natural or man-made drains on the neighboring lot that will discharge onto your lot?
- Are there any road cross culverts that discharge onto your lot?
- Are there any natural or man-made drains running through your lot?
- Are there road drainage ditches and are they maintained?
- Is the lot in a mapped or possibly unmapped floodplain?

Drainage Considerations When Landscaping/Modifying Your Lot

Does water drain away from all sides of my house?

It definitely should. Lots (yards) should be graded to drain water freely away from the house, all walls, foundations and support piers, and even porch and patio slabs. Water ponding or saturating the soil at or beneath structures can be very damaging. Some common symptoms are moisture damage, wood rot/fungus, and soil settlement, upheaval and slippage along planes. If water does not drain freely away from the house it will soak into the soil along the foundation or under it, causing subsidence and settling, and serious and costly cracking of the floors, slabs and

walls of the house. This is a serious and widespread problem as illustrated by numerous websites addressing this issue.

Do I need to address potential drainage issues with my neighbors when placing fill on my lot or moving/constructing a drainage channel?

Refer to Arizona Revised Statutes Sections [48-3615](#) (A), [48-3601](#) (12) and [48-3613](#). They state as follows:

[48-3615](#) Violation; classification; civil penalties; strict liability

A. It is unlawful for a person to engage in any development or to divert, retard or obstruct the flow of waters in a watercourse if it creates a hazard to life or property without securing the written authorization required by section 48-3613. Where the watercourse is a delineated floodplain it is unlawful to engage in any development affecting the flow of waters without securing written authorization required by section 48-3613.

[48-3601](#) subsection 12. "Watercourse" means a lake, river, creek, stream, wash, arroyo, channel or other topographic feature on or over which waters flow at least periodically. Watercourse includes specifically designated areas in which substantial flood damage may occur.

[48-3613](#) Authorization required for development in watercourses; exceptions; enforcement

A. Except as provided in section 48-3625 and in this section, a person shall not engage in any development which will divert, retard or obstruct the flow of waters in any watercourse without securing written authorization from the board of the district in which the watercourse is located. Where the watercourse is a delineated floodplain no development shall take place in the floodplain without written authorization from the board of the district in which the floodplain is located.

B. Written authorization is not required for nor shall the board prohibit:

1. The construction of bridges, culverts, dikes and other structures necessary for the construction of public highways, roads and streets intersecting or crossing a watercourse.
2. The construction of storage dams for watering livestock or wildlife and structures on banks of a watercourse to prevent erosion of or damage to adjoining land if the structure will not divert, retard or obstruct the natural channel of the watercourse or dams for the conservation of floodwaters as permitted by title 45, chapter 6.
3. Construction of tailing dams and waste disposal areas used in connection with mining and metallurgical operations. This paragraph does not exempt those sand and gravel operations which will divert, retard or obstruct the flow of waters in a watercourse from complying with and acquiring authorization from the board pursuant to regulations adopted by the board under this article.
4. Other construction if it is determined by the board that written authorization is unnecessary.
5. Any flood control district, county, city, town or other political subdivision from exercising powers granted to it under this article.
6. The construction of streams, waterways, lakes and other auxiliary facilities in conjunction with development of public parks and recreation facilities by a public agency or political subdivision.
7. The construction and erection of poles, towers, foundations, support structures, guy wires, and other facilities related to power transmission as constructed by any utility whether a public service corporation or a political subdivision.

C. Before any construction authorized by subsection B of this section may begin, the person must

submit plans for the construction to the board for review and comment.

D. In addition to other penalties or remedies otherwise provided by law, this state, a political subdivision or a person who may be damaged or has been damaged as a result of the unauthorized diversion, retardation or obstruction of a watercourse has the right to commence, maintain and prosecute any appropriate action or pursue any remedy to enjoin, abate or otherwise prevent any person from violating or continuing to violate this section or regulations adopted pursuant to this article. If a person is found to be in violation of this section, the court shall require the violator to either comply with this section if authorized by the board or remove the obstruction and restore the watercourse to its original state. The court may also award such monetary damages as are appropriate to the injured parties resulting from the violation, including reasonable costs and attorney fees.

Should roof runoff or outflow from rain gutter downspouts drain will away from my house?

Definitely. Roofs can generate an enormous amount of runoff. When the runoff water is trapped in flat areas up against a wall, footing or stem wall of the house, porch slab or pier, where runoff cannot flow away, water may pond and or percolate (soak into the soil) straight down along the wall, eventually causing settling and cracking of the slab or foundation. Solutions include re-grading, re-landscaping, enlarging wall openings, and or removing obstructions to flow, whatever it takes to allow water to flow away freely from the house as quickly as it comes off the roof. Installing rain gutters on key sections of the roof to collect and convey runoff to a safe location is also a good solution and, in some cases, may be the only practical solution. Again, do not allow gutter downspouts to empty onto flat ground next to a wall or footing. Add a long extension or build a channel to convey it to a point where it will flow away from the house. If emptying onto a steep slope or easily erodible soil, you may need to provide a lined splash pad and channel to convey the water away from the house. Also, do not plumb your roof drain extensions to discharge onto your neighbor's property or towards his/her house. Rather, try to convey it to the road drainage system or to run parallel to your property boundary.

If I install a block wall or fence, are there any things I need to consider related to drainage?

Yes. Block walls and fences built across drainage flow paths or channels have caused the flooding of adjacent homes in the County. An example of the problems associated with doing this occurred in December 2004 in the County. The owner wanted to fence his entire lot for his dogs and at two locations the fence crossed a dry wash. In order to keep the dogs in, the owner ran rebar from the bottom of the fence into the channel bottom. Snow and rainfall runoff froze to the rebar and created an ice dam. Subsequent rainfall on top of the snowfall in late December created a large flow in the channel that jumped the channel at the ice dam and flooded the entire finish floor of an adjacent home.

What if I can't avoid it—what if I have to cross a wash with a block wall or fence?

You will need to submit a drainage plan analysis for the wall or fence to the County Hydrologist and Assistant County Engineer for their approval prior to construction.

What about installing block walls or fences with weep holes or decorative block drains?

If possible, avoid or replace weep holes or decorative block drains with a clear opening. Weep holes and decorative block openings are generally so small they easily catch debris and clog, causing water to pond or divert. This can result in backyards and houses being flooded and walls being undermined and knocked over. Wall openings should drain along lot boundaries to the

road drainage system wherever possible and have the neighbor's approval. We have seen cases in the County where wall openings have created erosion channels in the neighbor's yards extending over to their building foundations. Flow velocities through wall openings can be appreciable, especially if they restrict the flow or pond the flow behind the wall to a higher elevation. In some cases dissipation basins below wall openings may be necessary to insure that downgradient erosion is kept to a minimum.

When lining a channel, swale, wash or roadside ditch do I need to over excavate?

Yes. This is a common mistake. When installing riprap, gravel or decorative rock lining material, you must always over-excavate to the depth of the material you are installing. Otherwise the conveyance capability of the channel can be significantly reduced resulting in channel overflow and backup and flooding of your own or a neighbor's property.

What are my maintenance responsibilities if there is a roadside ditch on my property?

Roadside ditches play an important function in conveying street runoff as well as runoff generated from roofs and other impermeable surfaces to the nearest wash or culvert crossing. Nothing should be filled or placed in these ditches that could retard the flow. Driveways should be dipped or underlain with a culvert of suitable size and placed at the right depth to not impede the ditch flow. Your driveway culvert will need to be cleared of any debris in order for it to function properly.

What should I consider when building a tool shed on my property?

The shed should not be placed in a low spot in the yard, block the natural flow path of a wash, or block the drainage in the yard or the flow of water around or away from your house. Water should be able to flow away from your house and shed.

What types of things should I avoid if I have a wash on my property?

Avoid crossing washes with walls or fences. Stop walls at the edge of the drainage easement or the channel's floodplain and leave the wash area as common open space. Avoid crossing washes with your primary access or the only driveway to your house. Avoid diverting natural washes from their natural flow path. Before ever attempting to divert a wash on your property, you must contact the County Hydrologist and or the Floodplain Administrator. They can determine if the wash is in a FEMA mapped floodplain and recommend the necessary engineering analyses that would need to be run to determine if a wash could be diverted. A wash must not be altered without County approval and certification from a professional engineer that any alterations will not increase flood levels or hazards within, upstream or downstream from the reach that is proposed to be changed. Channel bends greater than 45 degrees should be avoided whenever possible.