

# Homeowners Guide to Runoff



**City and County of Denver**

## **1.0 PRIVATE PROPERTY - RAINFALL, RUNOFF AND GROUNDWATER PROBLEMS**

**1.1 Introduction:** Drainage problems have become one of the most common complaints between property owners. This guide seeks to help property owners to minimize minor drainage problems closer to the root of the problem. One example would be allowing runoff to spread across landscaped areas instead of piping all runoff directly to the street. This reduces street flooding, lessens irrigation demands, reduces stormwater pollution and is a better solution for everyone. This guide, will help homeowners gain a better understanding of minor drainage problems, and simple fixes that may eliminate or minimize these problems. For problems that are not solved with simple fixes, it is recommended that you seek the advice of a professional engineer.

**Rainfall, runoff and groundwater are both a common enemy and ally to each property owner.** This makes it necessary to work together to maximize the benefits and minimize the impacts. Pushing water to the wrong locations can cause private or public nuisance and/or property damage. Never slope your lot or landscaping to push water onto or block water on the neighbor's lot. Any direction that water drains needs to be maintained.

**This is a guide for ideas to correct minor problems.** Drainage is a complicated issue that is dependent on soil conditions, landscaping, slopes, home elevations, adjacent street and property elevations, and rainfall. If the problem is severe, you should hire a Professional Engineer to analyze the problem and recommend the best solution for your property.

## **2.0 STORM WATER DRAINAGE AROUND THE HOME AND FOUNDATION**

**2.1 Introduction:** Water is one of the main problems for foundations, and poor drainage can create problems with wet basements and cracks in the foundation.

**2.1.1 Foundations can convey water into the basement.** Even though most foundations are water-proofed, dirt tends to shrink away from the concrete creating a gap for water to travel down to the bottom of the foundation. Once at the bottom of the foundation water can travel under the foundation wall and onto your basement floor.

**2.1.2** Slope your lot for surface drainage.

Lawns, patios, driveways, and side-yard drainage swales should be slope is 1/4-inch of fall per foot measured horizontally. That means if you hold a two-foot long level flat, the end toward the street or alley should be at least 1/2-inch off the ground. Building Code requires greater than a 5% near the foundation of the home - which is just a little more than 1/2-inch per foot. So, landscape areas near the home should show more than 1-inches of fall on a 2-foot level.



**2.1.3** Prevent rot of siding and fences. Never fill dirt against the homes siding or nearby fences.

Landscape mulch should not be placed against the home, and should be limited to a thickness of one inch against the base of a fence. Foundations are required to be built with at least 6" of concrete foundation above the soil line. In older homes this is rarely the case and it may be better to use landscape plastic with mulch or rock to control the water rather than try to raise the slopes. Even stucco and aluminum siding have wood behind them, and any fill dirt that is placed against stucco or siding can create rot or encourage insects.

**2.1.4** Landscaping within four-feet of the home. One of the best approaches is to use heavy landscape

plastic in all areas within 4-feet of the home with your choice of mulch over the top. Beyond four-feet the use of a porous landscape fabric where there isn't grass will allow some water to soak in and help feed the plants in the area as well as reduce weed growth.

**2.1.5** Use irrigation sparingly near the home. Drip emitters for smaller plants should be limited to 1 liter

(half gallon) twice per week. The drip emitters are usually labeled with the flow rate per minute they can be used to set the irrigation timer. i.e. 0.5 liter per minute emitters should only run two minutes twice per week. All emitters should be checked every spring to be sure none have been knocked off or damaged, which can result in dumping gallons of water where you don't want it. Never use spray irrigation head near the home.

**2.1.6** Small depressions need to be filled in. It is not uncommon to have a small amount of settling near

the foundation or window wells. These areas should be repaired by pulling all the landscape material back to expose bare dirt, and filling the hole flush with dirt. The same landscape material can be placed back, but if the landscape plastic or fabric is torn, then new material more effective at preventing weed growth.

**2.1.7** Caulk concrete against your homes foundation. Sidewalks and patios need to be constructed at a

flatter slope in order to make a comfortable walking surface. These will also tend to pull away from

you foundation due to expansion and contraction of the concrete. This gap must be caulked to prevent minor pooling water from running down along the foundation. Any caulk will tend to crack over about 5 years, and it will periodically need to be replaced. The old caulk can be stripped away with a razor blade and screw driver to get a good bond and seal with the concrete.



**2.1.8** Downspouts must be directed away from foundations. Concrete splash blocks are the recommended solution. They are the most durable and require no maintenance. Tip outs or down spout extenders made from down spout material can also be used, but they can be a maintenance nuisance. The tip out should always be kept in the down position because a rain while they are up can create small settlements near the foundation. All these must be properly positioned to direct water away from the home and not onto the adjacent property.

**2.1.9** Underground drainage collection systems. Underground pipes seem to be the latest trend in Denver. Many landscapers and builders will try to up-sell homeowners into this system which requires much more maintenance and care. In addition these systems need to be permitted by Denver Public works and properly constructed to reduce the problems in the future. Piping must be solid wall PVC that “daylights” properly at least 10-feet from front property lines. “Daylight” means that the piping is properly sloped to drain downhill without restrictions, so that debris is more naturally flushed from the lines. A licensed plumber or drain layer is required to complete this work and call in for inspections. Pop ups and draining to pits can cause water to backup along the outside of the pipe and down into your basement.

**2.1.10** Watch for Plugged Gutters and Downspouts. There are three places that downspouts can become clogged and cause additional water to



come down near your home. Periodically walk around your home during or just after a rainstorm. A clog in the gutter itself may cause runoff to overtop the gutter in even relatively minor rainfalls. During heavy rain events overtopping of downspouts should be expected. Gutters should be cleaned yearly especially in areas with taller trees. Sometimes the clog can occur in the downspouts. Visually inspect the gutter for clogs by tapping the downspout with a screwdriver. A sound more like a “thunk” will indicate water is trapped inside the pipe. The third place for a clog is in the underground piping system. During hard rains water may even shoot up where the downspout connects to the underground pipes. This is the one of the worst places for water since it can be a large portion of the roof coming out next to the foundation.

### **3.0 GROUNDWATER, SUMP PITS, AND THEIR DISCHARGE**

**3.1 Never connect to the sanitary sewer.** Connecting to the sanitary sewer can create backups or sewer odors especially if multiple homes on one block are pumping to the sewer system. The sanitary sewer system is not sized large enough for additional groundwater flows. Metro Wastewater charges the citizens of Denver to treat even the clean water that might be dumped to the sewer system.

**3.2 Nuisance in the public Right-of-Way** Sidewalks are the primary pedestrian area and the adjacent property owner’s responsibility. If the sidewalk becomes slippery it is a risk to the pedestrian on the sidewalk. Alleys and curb and gutters are less of a concern, because they are design to carry water and are not solely a pedestrian area. The Department of Health may deem standing or continuous flow a health nuisance based on DRMC 37-12

**3.2.1** Sidewalks may be protected creating a small depression on private property to encourage more water to soak into the ground prior to reaching the sidewalk.

**3.2.2** Sidewalk Chases are NOT a good solution. Sidewalk chases are sometimes used to transfer rain and snow runoff under the sidewalk and into the gutter. Sidewalk chases don’t work for transferring groundwater because chases just transfer the water to gutter where it becomes a nuisance.

**3.3 Discharge from pumps that run occasionally** The most a sump pump can run and not create a nuisance is very dependent on the property. A large flat front yard with good soil drainage could handle a discharge every hour, and a site with poor soils and the flow concentrated into a single swale pumping once a day may create a nuisance. Occasional discharge is only acceptable if it doesn’t create a nuisance in the public right-of-way or adjacent properties.

**3.3.1 Occasional sump pump discharge solution** A two inch diameter pipe out the side of the house to a splash block near the front of the house that drains toward the street without crossing other people’s

property. This allows the maximum amount of water to be absorbed by the landscaping.

- 3.3.2** Don't extend the 1 ½ or 2-inch pipes more than five-feet. These pipes can freeze and build up ice until they are clogged. Especially small flow rates are subject to freezing, and this can burn out the sump pump.

### **3.4 Continuous Discharge Problems**

**3.4.1 The primary cause is a high groundwater table and a sump pit in the basement that is well below**

- 3.4.2** Rising groundwater levels can be caused by over irrigation both on the affected property and the neighborhood as a whole. Denver Water has some watering recommendations: <http://saver.denverwater.org/start.asp>, and the entire neighborhood needs to follow these recommendation.

- 3.4.3** Large rain fall or snow events might be the cause of the rising groundwater. These events typically take 5 days to peak and the cumulative effect of many storms can be much worse than one large storm, since more water soaks into the ground. Typically these types of problems don't become a long-term nuisance in the Right-of-way, since they should dry up after a few weeks of dry weather.

- 3.4.4** Wet basements the same day of a storm are usually related to site drainage problems, and all the measures recommended under section 2 should be reviewed.

- 3.4.5 Solution to Continuous Groundwater Discharge Problems.** It is the homeowner's responsibility to find a solution that doesn't transfer the problem to neighbors, public sidewalks, streets or alleys. The best place to discharge on most lots is 5' from the building in the front, so the water has the greatest opportunity to travel over landscape areas and soak back into the ground.

- 3.4.5.1 First** All of Section 2 of this document should be reviewed to be sure the lot has proper drainage and no other problems

- 3.4.5.2 Raise the sump pump.** Sometimes the simplest solution is to raise your sump pump a few inches by putting a brick underneath. The pipes that drain into the sump should still be at least ½ exposed at the waters highest level. Slowing the waters flow rate should actually protect the foundation from soil washing away. A soils engineer should be consulted before making these changes because expansive soils cannot be exposed to any additional moisture.

- 3.4.5.3 Pipe to a storm sewer.** A landscape inlet must be placed where the piping changes from the 2" sump pump pipe to a 4" gravity drained pipe. The 4" gravity should connect to the nearest storm sewer inlet, storm sewer manhole, or storm sewer pipe. Not all streets have storm sewer, so some research is required. See the attached detail #1 for recommended installation guidelines. This will

require permits from the State Department of Health for groundwater discharge and a Sewer Use and Drainage Permit through Denver Wastewater.

**3.4.5.4 Infiltration Pits.** Gravel infiltration pits can be used in areas with free draining soils, but still too much water to soak it into landscaping. See the attached detail #2 for the recommended installation guidelines. Infiltration pits need to be sized by an engineer to discharge periodically only during the peak event. Homeowners that choose to approximate on sizes may be forced to upsize the pit or take additional measures to correct the problem. This will require a Sewer Use and Drainage Permit through Denver Wastewater.

**3.4.5.5 Injection Wells.** Injection wells may be used in circumstances where the infiltration pit will not handle the flows. This installation will require soil borings and a geotechnical engineer to find a porous layer that can take the flows without having an impact to the surrounding structures. This will require permits from the State Department of Health for an injection well and a Sewer Use and Drainage Permit through Denver Wastewater.

**3.4.5.6 Cistern to temporary store the water.** A cistern can be pumped dry at 3am preventing a nuisance from forming during the day. This is the only system that has a sidewalk chase for groundwater discharge. The chase is required if the discharge is crossing a sidewalk. This should meet the requirements of drainage law as long as the cistern only holds the water temporarily and is pumped out every day. This will require permits from Public Works if there is a sidewalk chase, the State Department of Health for groundwater discharge and a cistern and a Sewer Use and Drainage Permit through Denver Wastewater.

**Groundwater Connection to Storm: Splashblock**

Connect directly to Storm when available

To Existing Storm Using Insertable Gasket Connector

Sidewalk

Sidewalk

6" curb will be required if pumped water runs onto the neighbors property

Minimum Side Yard Grading Deviation Will Require A Plot

- Plan With Grading Including Adjacent Property Drainage Pattern

Single

m11y...

**Groundwater Pipe in the Street**

**Bedding Requirements**

Patch Per Std. Dwg. No 12

**1:2**

2 - 0"

1:2

N

**1:1**

Flow Fi11/Flash Fill

4" Schedule

40 @ 1%

Minimum

3/4" Class B Bedding

**Groundwater Connection to Storm Underground Option**

As Above

To Existing Storm Using Insertable Gasket Connector

Sidewalk

**Landscape Drain**

ADS or approved equal

8" P.V.C. 2" Minimum

**1:1**

Clean

Periodically

12 Min. sump when connected to downspouts

Landscape Drain

4" (Min.)

Schedule 40

Single Family Home

1.11" Schedule 40 PVC

PUBLIC WORKS

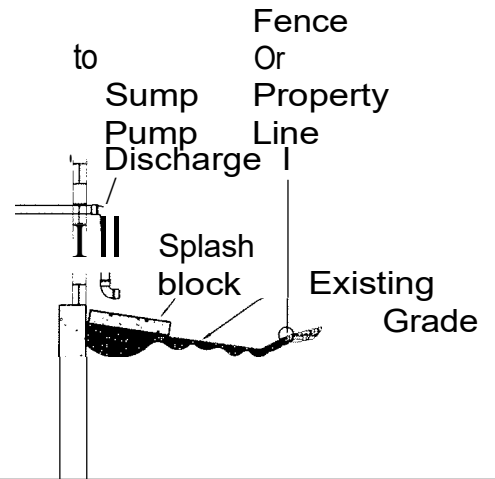
**Residential Drainage**

**1**



Preferred Option: Splashblock

Sump Pump Discharge Detail



Infiltration Pit:  
Engineer and Place on down gradient side

6" Curb Required if swale is than 4" deep

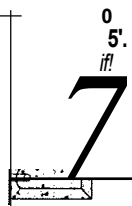
Minimum Side Yard Grading Deviation Will Require A Plot Plan With Grading Including Adjacent Property Drainage Pattern

Sidewalk

3/4" Clean rock wrapped on all sides with landscape fabric  
Maximize

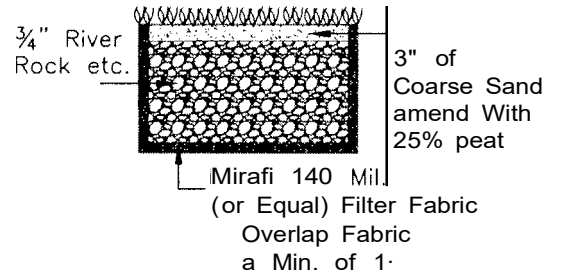


Single Family Home



Note: drainage may go to the rear when an alley is present

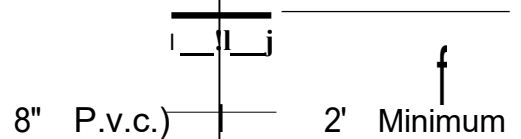
Infiltration Pit (sized by Engineer)



Underground Option

Landscape Drain

ADS or approved equal



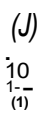
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Periodically

12" Min. sump when connected to downspouts

Infiltration pit:  
Engineer and Place on down gradient side

3/4" Clean rock wrapped on all sides with landscape fabric



4"(Min.)  
Schedule 40  
Single Family Home

Landscape Drain

2" Schedule 40

Note: Drainage may go to the rear when an alley is present

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Residential Drainage



2

3" Min. Per. I.R.C.

1" Min. Per. I.R.C.

Compacted Native Soil

6" Min. Per. I.R.C.

10:1 slope Minimum

Window well drain a min. of 6" above compacted earth

Note: No hardscape window well can be connected to the perimeter drain

Fence or Property Lin

Minimum Side Yard Grading  
Deviation Will Require A Plot Plan With Grading  
Including Adjacent Property Drainage Pattern

Window well must be  
3" Above Highest Grade

A min. of 1" clearance is required below the  
fence line from the adjoining property and  
4" min. depth to the bottom of the swale



Grade  
13% / 8:1 Minimum  
33% / 3:1 Maximum

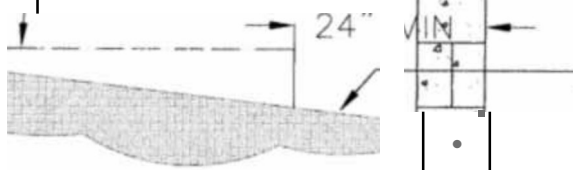
During Construction Perimeter Control Is  
Required. Recommend  
6" Straw Waddle  
Buried 2" Below  
Shored Lot Line.

Fence or Property Lin

Minimum side yard grading  
when adjacent property is higher  
than development site

Window well must be  
3" above highest  
grade

A Min. of 1" clearance is  
required below the fence line  
from the adjoining property  
and 4" min. depth to the  
bottom of the swale



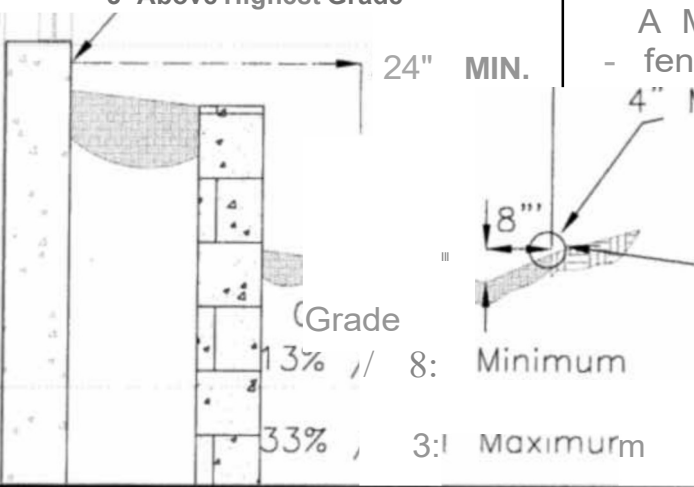
Grade  
13% / 8:1 Minimum  
33% / 3:1 Maximum

Fence or Property Lin

Minimum side yard grading  
when adjacent property is lower  
than development site

Window well must be  
3" Above Highest Grade

A Min. of 1" clearance is required below the  
fence line from the adjoining property and  
4" min. depth to the bottom of the swale



Grade  
13% / 8:1 Minimum  
33% / 3:1 Maximum

During Construction Perimeter Control Is  
Required. Recommend 6" Straw Waddle  
Buried 2" Below Shored Lot Line.