

Slow it. Spread it. Sink it!

An Okanagan Homeowner's Guide to Using Rain as a Resource

Practical and Eco-Friendly
Ways to Protect Your Property
and the Environment from the
Effects of Rainwater Runoff





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Prepared by: Okanagan Basin Water Board and
Insight Environmental Consulting Ltd.

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WATER BOARD

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STATEMENT OF PURPOSE

This guide has been developed for educational purposes by the Okanagan Basin Water Board (OBWB). It was adapted with permission from the Resource Conservation District of Santa Cruz County. The rainfall capture and runoff control practices included in this guide are to be used as general guidelines and are not to be used as professional engineered specifications. It is recommended that technical assistance be sought from a licensed professional engineer, landscape architect, or geologist, and/or certified professionals in erosion and sediment control before implementing more complicated practices or if you have constraints such as steep slopes or geological hazards on your site. Site-specific designs that address the needs and constraints of each individual site are essential to ensuring the practices do not have unintended outcomes.

WHO WE ARE

The Okanagan Basin Water Board (OBWB) was instituted in 1970 through collaboration between three Okanagan regional districts. The Board's jurisdiction is defined by the borders of the Okanagan watershed, or basin, rather than by political boundaries. The basin is almost 200 km long and 8,000 km² in area. It is a narrow strip stretching from the City of Armstrong to the U.S. border and includes Okanagan, Kalamalka, Wood, Skaha, Vaseux and Osoyoos lakes, their tributaries, and the surrounding mountains.

The overall objective of the OBWB is to undertake strategic projects and programs on a valley-wide scale that ensure a sustainable water supply for the citizens of the Okanagan while supporting member jurisdictions to meet their water management goals. Programs are supported through tax assessments on lands within the Okanagan watershed.

The Board of Directors includes representatives from the three Okanagan regional districts, the Okanagan Nation Alliance, the Water Supply Association of BC and the Okanagan Water Stewardship Council – a multi-stakeholder group established by the Board to provide independent science-based advice on water issues.

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We would especially like to thank the RCD of Santa Cruz County who generously granted the use of their guidebook to be adapted to address the unique conditions and water challenges of the Okanagan. The RCD of Southern Sonoma County guide was also used as a resource. Lastly, we would like to thank Brock Dolman of the Occidental Arts & Ecology Center's Water Institute for use of the phrase "Slow it. Spread it. Sink it!" in this guide.

IMPORTANT NOTE: National, provincial, and local regulations pertain to many of the subjects presented in this guide. Regulations change, as do the technical methods and standards for environmental protection. Be sure to follow applicable regulations covering private land maintenance and related activities for your area. See the Resources Guide on pages 58 and 59 for a list of contacts that you may need to consult when implementing rainfall capture and runoff control practices.

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DID YOU KNOW?

Something as simple as water from a downspout can contribute to a number of unwanted consequences. Roofs and other impervious surfaces alter natural hydrology and increase the volume of stormwater runoff.

This can have a variety of impacts, including streambank erosion and degraded wildlife habitat. Other unintended outcomes associated with accelerated stormwater runoff are potholes, damage to structures, beach closures, and in severe cases, land and mud slides.

Fortunately there are simple low-cost things that we all can do to help decrease the volume of, and minimize the pollutants in, the runoff leaving our properties. And many practices have the added benefit of beautifying our landscapes. Read on to find out what you can do.

DID YOU KNOW THAT THIS...



CAN CONTRIBUTE TO THIS?



SO WHY NOT TRY ONE OF THESE?

Collect your roof water in a **RAINWATER COLLECTION SYSTEM**.



Cost: LOW
Installation difficulty: EASY
See page 23

Plant a **RAIN GARDEN** on your property.



Cost: LOW to MODERATE
Installation difficulty: EASY to INTERMEDIATE
See page 26

Install a **WATERBAR** on your driveway.



Cost: MODERATE
Installation difficulty: INTERMEDIATE
See page 37

Use **PERVIOUS PAVERS** for your patio.



Cost: MODERATE - HIGH
Installation difficulty: INTERMEDIATE
See page 31

INTRODUCTION

Before the Okanagan's cities, farms, water supply and flood control systems, and highways were developed, the diverse collection of ponderosa pine forests, woodlands, native grasslands, riparian areas, wetlands, and cliffs and slopes were virtually undisturbed. Rivers and streams, capturing and moving rainwater, flowed from the mountains to the valley lakes and into the Okanagan River. Wetlands and oxbows functioned as natural filters and buffers from major storms.

Under these pre-development conditions as much as 50% of rainwater **infiltrated** (soaked into) the soil, replenishing groundwater supplies, contributing to year-round stream flows, and sustaining plants. Another 40% was released into the atmosphere through **evapotranspiration** (evaporation of surface and ground water, plus water loss from plants). Only about 10% contributed to **runoff** (rainwater that flows over land).

A high percentage of our urban centres and rural neighbourhoods are now made of **impervious surfaces** (hardened surfaces that do not allow water to pass through) such as roofs, streets, and parking areas. When rain falls on these surfaces, it flows faster and in greater amounts than it would have under

pre-development conditions, significantly increasing runoff and decreasing infiltration and evapotranspiration. Furthermore, runoff is typically carried away by pipes, driveways, streets, and storm drains to creeks and rivers, where it can cause flooding, road damage, stream erosion, and landslides.

Runoff also carries sediments and other pollutants to beaches and rivers, contributing to unsafe conditions for recreation and wildlife. Though rainwater starts out as being relatively clean, runoff collects pollutants as it flows over the landscape. For example, excess lawn fertilizers, pesticides, pet waste, soap from car washing, and oil and grease from leaking engines are just some contaminants that have been found in runoff. It is important to note that nearly ALL storm drains in the Okanagan empty into local waterways **UNTREATED**.

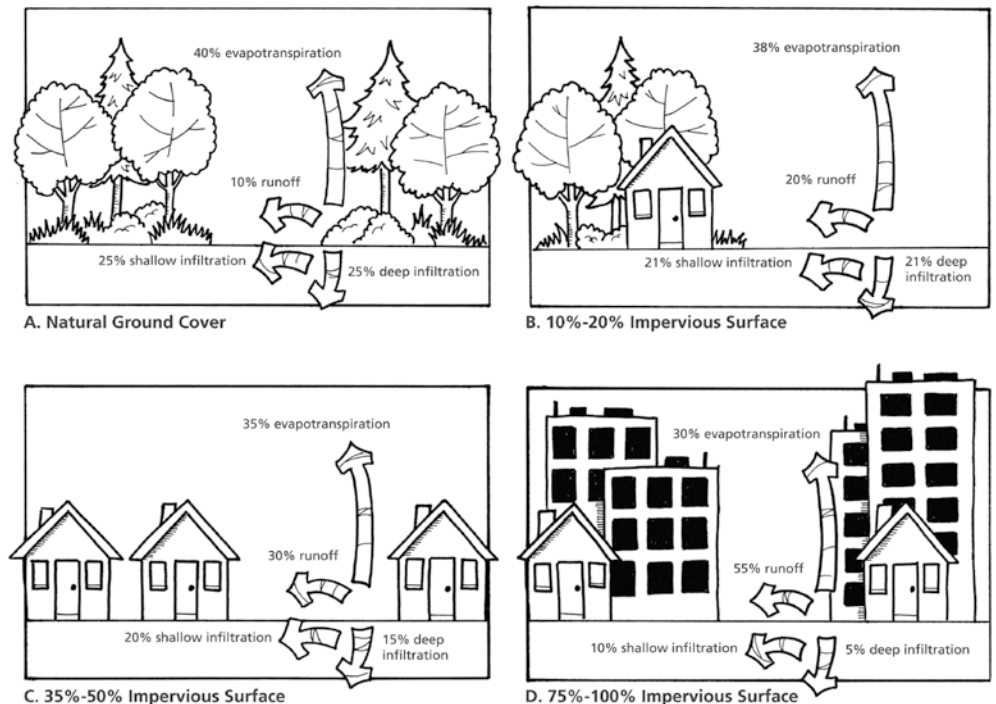


FIGURE 1: PERCENTAGE RUNOFF GENERATED FROM IMPERVIOUS SURFACES, ADAPTED FROM FISRWG 1998'



RUNOFF FROM THE SURROUNDING HOMES AND STREETS FLOWS THROUGH STORM DRAINS...



...AND CONTINUES DIRECTLY INTO LOCAL CREEKS AND RIVERS.



DID YOU KNOW?

Just as a city and our personal properties have boundaries, so does a watershed. A watershed is the land that contributes water to a given area.

Brandts Creek, for example, is a small watershed in Kelowna. The creek is approximately 14 km long with its headwaters in the east Glenmore area and its mouth at Okanagan Lake near Knox Mountain.

The majority of the stream channel has been impacted by urban development. However, there are still wetlands and riparian areas of high value along the creek. Urban watersheds similar to Brandts Creek occur throughout the Okanagan. Restoring the runoff from rainfall to more natural patterns by using the practices outlined in this guide will benefit these watersheds.

One way to help reduce the negative impacts of runoff is by changing the way we approach new construction. But, since much of the Okanagan Valley is already built up, great benefits can be seen from addressing runoff from our existing homes. Through good planning and design we can accomplish the following:

- Conserve our natural resources
- Create healthier homes
- Clean up our creeks, rivers, and lakes
- Protect infrastructure and reduce flooding

This guide provides techniques to capture rainfall and control runoff that you can do at home. The techniques are not complicated. An example is slowing runoff by temporarily storing it in a rain barrel or other containment system where it can be used to water plants. Another example is allowing runoff to sink into the ground by directing it to landscape vegetation where sediment can be filtered out and contaminants reduced. The practices are geared toward residential homes or small developments and the underlying concepts behind them follow a simple mantra: **Slow it. Spread it. Sink it!**

- SLOW the runoff down,
- SPREAD it out in planters, gardens, or over other pervious surfaces (do not confine runoff to pipes), and
- SINK it back into the ground.

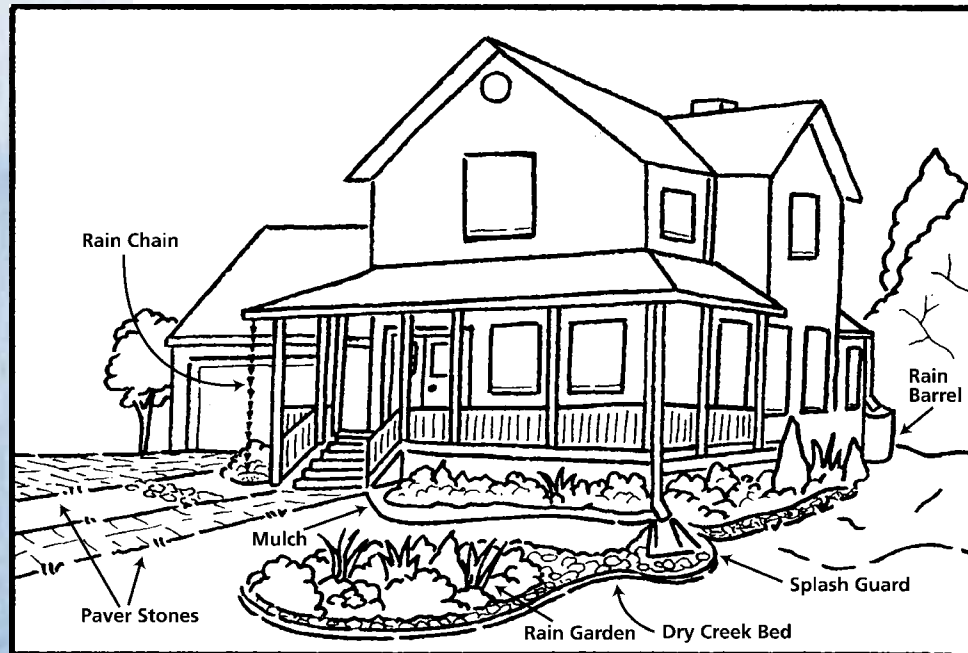
CHAPTER 1

UNDERSTANDING THE RAINWATER RUNOFF ZONES OF YOUR PROPERTY

This chapter divides your property into five major areas or “zones” that can contribute to runoff. It examines each zone for common problems related to runoff and suggests potential solutions. Each solution is covered in detail in Chapter 3.

The five runoff zones discussed in this chapter are:

- 1) roofs,
- 2) elevated structures,
- 3) walkways and patios,
- 4) driveways and parking areas, and
- 5) bare soils and landscapes.





ROOFS

Your roof likely generates the most runoff from your home. While the majority of roofs are outfitted with gutters and downspouts, some are not, so protection measures for either possibility are discussed in this guide. Regardless of which system you use, all eaves and downspouts should be routed away from sensitive areas such as septic system leachfields, hillsides, and building foundations.

ROOFS WITHOUT GUTTERS

If it is not possible to install gutters because of cost or other issues, you will need to protect the ground below the eaves, which is referred to as the drip line. Runoff from eaves can cause significant erosion, damage foundations, and cause unhealthy mold to develop.

WHAT IS YOUR ROOF MADE OF?

Metal and tile roofs are preferred catchment surfaces if you want to irrigate edible garden crops with roof runoff. Composite roofs (made from a mix of asphalt or asbestos shingles, tar paper roofing, shake, slate, laminate, wood, plastics and/or other materials) may require the installation of a downspout diverter to filter the asphalt and contaminants out.

DID YOU KNOW?

a) It only takes 25 millimetres of rain falling on a typical 140-square-metre roof to generate approximately 3,500 litres of runoff.

b) Annual rainfall in the Okanagan typically ranges from 200 millimetres at Osoyoos to 300 millimetres at Vernon.

c) In one year, you could collect as much as 28,000 litres of rain from a typical roof in Osoyoos to 42,000 litres in Vernon.

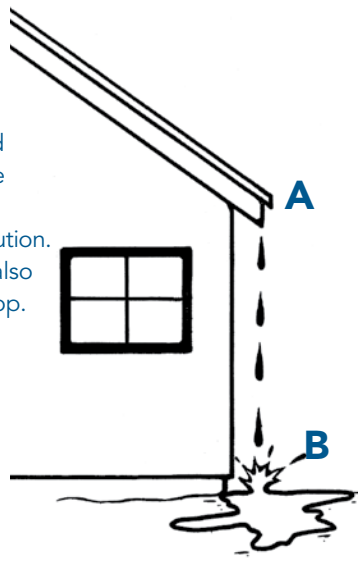
POTENTIAL PROBLEMS

A Non-guttered roofs can cause problems along the drip line of your home.

B Water from a non-guttered roof can cause erosion, damage structures and foundations, and contribute to downstream pollution. Ponding near foundations can also cause unhealthy mold to develop.



Repairing mold and water damage



SOLUTIONS



A Adding gutters and downspouts works to direct water to a safe location away from bare soil and buildings (see pages 19 and 20).

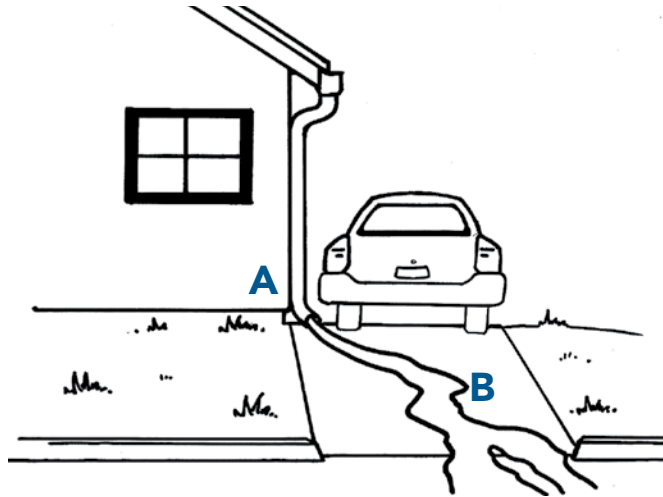


B Vegetated or rock drip-line protection SLOWS runoff thus reducing erosion and promoting infiltration. It is also designed so that the ground slopes away from the home's foundation (see pages 21 and 22).

GUTTERED ROOFS

Gutters and downspouts are an excellent choice for handling roof runoff but they must be properly sized, managed, and maintained to prevent damage to property and the environment. Undersized gutters clog and overflow more frequently, which can damage foundations. Directing downspout runoff toward impervious surfaces like driveways is common but can contribute to downstream flooding, surface water pollution, potholes and other issues. ALWAYS avoid sending runoff towards hillsides, septic system leachfields, and buildings where it can cause significant damage to your property.

POTENTIAL PROBLEMS



A The downspout is directed toward an impervious (concrete) driveway that drains to the street. The runoff can damage roads, exacerbate downstream flooding, and carry pollutants to nearby waterways.

B This driveway is constructed of impervious materials (concrete), and all of the runoff is directed toward the street. The runoff can damage roads, exacerbate downstream flooding, and carry pollutants to nearby waterways.

SOLUTIONS

A Rain barrels, rain gardens, and downspout diverters are all potential solutions for treating downspout runoff by SLOWING water down and SPREADING it out (pages 23 to 26).

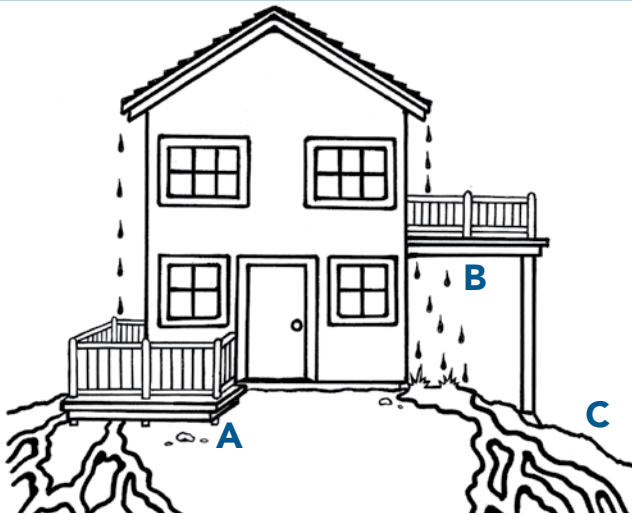


B See Driveways and Parking Areas (page 8).

ELEVATED STRUCTURES

The area under decks, outdoor stairs, and other elevated structures, where water impacts the ground, is called the drip line. Significant soil loss, damage to supporting structures, or worse, can occur if this area is not adequately protected. Locations with more than a 50% slope are particularly vulnerable and may require treatments designed and installed by a qualified professional.

POTENTIAL PROBLEMS



A Low decks may prohibit the addition of protective ground cover, leaving bare soil to erode.

B The runoff from high decks impacts the soil with greater force than low decks. It can cause structural damage to supports and contribute to sediment and other pollutants entering nearby storm drains and streams.



Visible erosion under a deck is common.

C Runoff on steep slopes with bare soils can cause significant erosion and even landslides. Ground covers such as rock and mulch are hard to keep in place and can easily wash away.

SOLUTIONS



A Adding drain rock or vegetation to the perimeter SLOWS and SPREADS water, limiting the movement of sediment (pages 21 and 22).



B Adding drain rock SLOWS runoff and safeguards the drip line area under elevated surfaces. Mulch around the perimeter adds extra protection to the surrounding bare soil (pages 21 and 22).



C Terracing or retaining walls may be added to sloped areas to keep rock or other mulch in place and protect hillsides (pages 38 and 39).

DID YOU KNOW?

It's important to scoop your dog's feces. Roundworms, E. coli, and Giardia are just a few of the many harmful germs that can be transmitted from pet waste to humans. Some can last in your yard for as long as four years if not cleaned up. Children who play outside and adults who garden are at greatest risk of infection.

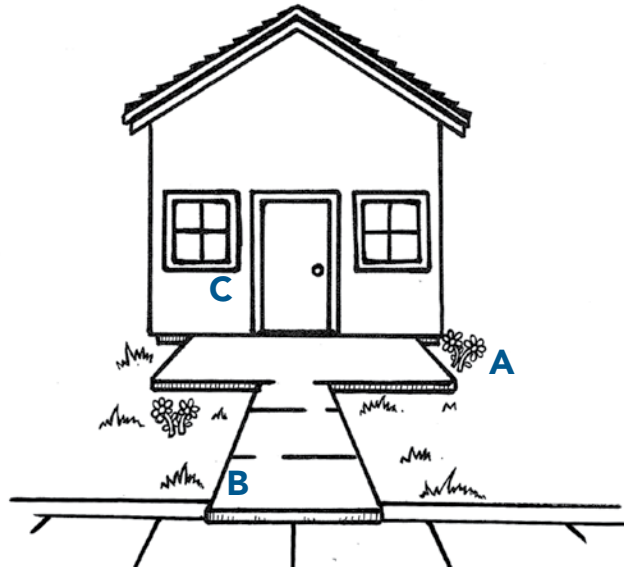
Pet waste is also one of the causes of bacterial contamination of creeks in the Okanagan. For example, a water quality study conducted by the BC Ministry of Environment showed high levels of bacteria and nitrates in Coldstream Creek. The study showed that 20% came from domestic dog feces. Coldstream Creek runs through the suburbs of Vernon with three dog walking parks located along the creek.

The solution is safe and easy:

1. Scoop the feces;
2. Put it in a bag (recycled or biodegradable bags are the best option);
3. Place it in the trash; and
4. Wash your hands.

**WALKWAYS AND PATIOS**

Walkways and patio areas often become conduits for runoff. For existing paved paths or patios, look for areas of standing water or visible signs of erosion where the path or patio surface meets the soil. Does your walkway drain to the street or toward your house? When constructing a new walkway or patio always consider where it will drain. Angle it toward a vegetated area or try one of the new porous products available that will reduce runoff and promote infiltration.

POTENTIAL PROBLEMS

A Foot traffic, even in low use areas, can inhibit plant growth and leave bare soil to erode.

B Walkways or other hard surfaces that drain to the street increase runoff and cause problems downstream.

C Hard durable surfaces such as patios are often constructed of concrete or other impervious materials that don't allow runoff to infiltrate.



Residential runoff that drains to the street contributes to localized flooding.

SOLUTIONS

A Mulch, gravel, or wood chips work well in low-traffic areas and allow for runoff to SINK into the ground (page 33). Important: Do not use wood mulches in fire prone areas.



B Turf block works well for allowing water to SINK into the soil in medium-traffic areas or driveways with separate parking areas (page 32).



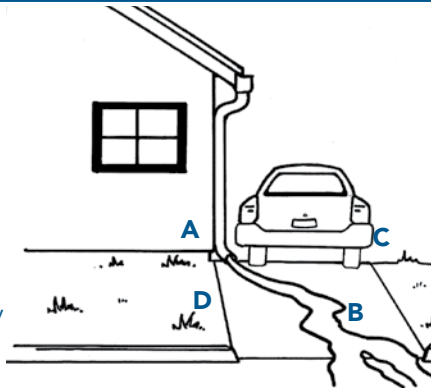
C Use paver stones for high-traffic areas and patios. For areas with excess runoff, use plant borders to allow more water to SINK into the ground (pages 31 and 32).

DRIVEWAYS AND PARKING AREAS

Traditionally, driveways have been constructed to divert runoff directly to the street. That runoff can carry a variety of pollutants, such as oil and grease, soap from car washing, leaked antifreeze, and more. Your driveway also acts as a conduit for large volumes of roof runoff. Allowing large volumes of water to drain to the street increases the chances of potholes, flooding, and erosion. Check to see where your driveway runoff goes and locate the nearest storm drain. There are now many alternatives available to replace impervious concrete and a variety of solutions for addressing runoff on your driveway or parking areas.

POTENTIAL PROBLEMS

A The downspout is directed toward an impervious (concrete) driveway that drains to the street. The resultant runoff may damage roads, exacerbate downstream flooding, or carry pollutants to nearby waterways.



B This driveway slopes toward the street and creates runoff potentially contributing to flooding, erosion, and pollutants in nearby storm drains and streams.

C This driveway is constructed of impervious materials (concrete) and directs all of the runoff toward the street. The runoff may damage roads, increase downstream flooding, or carry pollutants to nearby waterways.



D Driveways that do direct water runoff away from the street can still contribute to erosion if the area collecting the runoff is not properly protected or maintained.

Driveways can act as conduits for excess amounts of runoff that can damage roads.

SOLUTIONS

A See Guttered Roofs on page 5.



B An asphalt berm (like a small speed bump) known as a waterbar can be added to existing driveways to SLOW and SPREAD runoff to vegetated or rocked infiltration areas (page 39).



C Pervious paving (pictured) or other materials such as paver stones or turf block, allow water to SINK into the soil decreasing runoff (page 33).



D A rocked or vegetated swale lining the edge of a road or driveway reduces erosion potential by SLOWING runoff and then SINKING it back into the soil or directing it to a safer outlet (pages 27 and 28).

DID YOU KNOW?

We have all heard that cars contribute to air pollution. But, did you know they can also play a part in water contamination? Soap from car washing, oil and grease from leaking engines, zinc from tires, and copper from brakes can end up in the water that we live beside, play in, and even get our drinking water from.

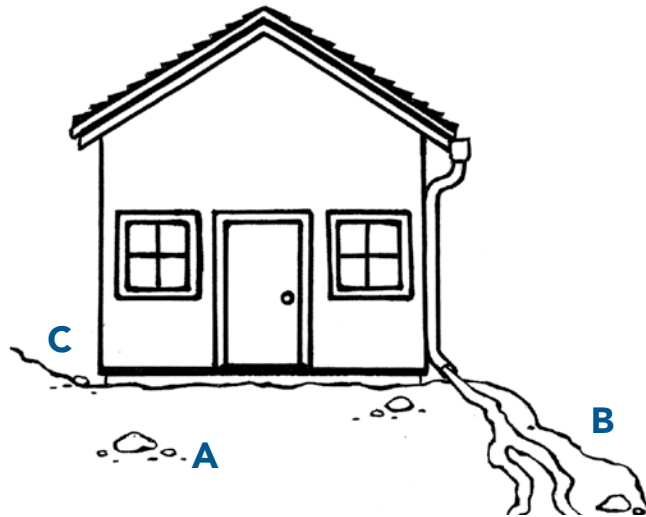
We can help keep our water clean by: keeping cars properly maintained; washing vehicles on lawns or gravel areas, or better yet, using commercial car washes; and recycling oil, antifreeze and used batteries.



BARE SOILS AND LANDSCAPES

In any landscape, bare soils and sloped areas are vulnerable to the impacts of runoff. Without a protective cover of vegetation, decaying leaves and needles, or mulch (wood chips, etc.), these areas erode and increase runoff. Erosion reduces soil fertility, can compromise support structures for decks and buildings, and in extreme cases leads to catastrophic events such as landslides. Erosion on bare soils can be identified by uneven soil surfaces, depressions in the soils that create small gullies, and any sign of soil loss. If water is flowing across bare soil anywhere on your property, at least some soil is being carried away (eroding). Since vegetation plays an important role in preventing soil loss, it is important to use plants adapted to your site. Some plants such as certain kinds of ivy or ice plant can actually hinder the stability of sloped areas due to poor root structure or added weight.

POTENTIAL PROBLEMS



A Bare soils are highly susceptible to erosion.

B In steeply sloped or hilly areas soil erosion is not only harmful to the environment, but can also cause bodily harm if land movement occurs (e.g., landslide).

C Moderately sloped areas are also prone to erosion and can cause damage to surrounding structures if they become unstable.



Bare soils are susceptible to erosion and increase runoff that delivers sediments and other pollutants to streets and storm drains and eventually to local waterways.

SOLUTIONS



A Mulch protects soil from direct rain impact and SLOWS runoff across bare soils (page 33). Important: Do not use wood mulch if you are in a fire prone area.



B Retaining walls help hold sloped areas in place and SLOW runoff. They also add beauty to a landscape and can double as benches and planter boxes (page 38).



C Using carefully chosen vegetation such as smooth sumac (pictured here) can help SLOW and SPREAD runoff in order to prevent soil erosion on hillsides (page 34).

CHAPTER 2

EVALUATING RAINWATER RUNOFF ON YOUR PROPERTY

DO-IT-YOURSELF RAINWATER RUNOFF EVALUATION

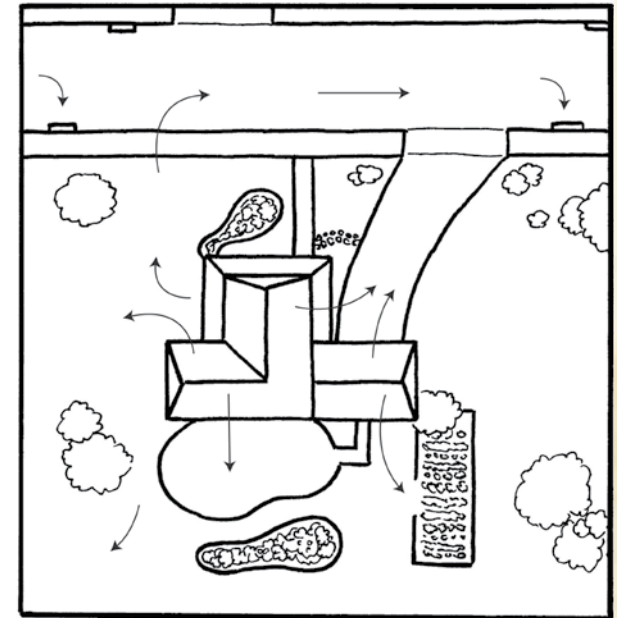
To discover where you can implement rainwater capture and runoff control techniques that draw on the fundamentals of “slow it, spread it, sink it,” we recommend that you conduct a simple do-it-yourself evaluation of your property. The evaluation consists of some background research and a walk around your property on a rainy day to record observations of the 5 zones (see pages 3 to 9). Your observations should include how runoff is currently handled, where runoff is going, and where there might be potential for using rainfall capture and runoff control practices. Make it fun - the kids can don their rubber boots and join you!

1) GATHER YOUR TOOLS. Below is a list of items you will need:

- rain gear
- a notepad
- a simple sketch of your property
- a pencil (ink may run if it gets wet)
- an umbrella (to keep the paper dry)
- a camera

2) SKETCH YOUR PROPERTY. Your sketch will be used to record observations about where the runoff comes from and flows to. The sketch can be very simple. It should include property boundaries, an outline of your house and foundation, outbuildings, driveways, areas of bare soil and any major vegetation (trees, lawns, etc.). Also note how close you are to the nearest stream, storm drain, or ditch that carries water away from your property. If you aren't sure, see if you can find it on your walk (step 3). Be sure to also consult a contour map to help with your sketch. Contour map lines represent level lines across the landscape. Lines that are close together represent a steep slope while lines that are further apart depict level ground. Also, lines pointing towards a higher elevation represent a ridge while lines that make a point towards a lower elevation represent a valley. Remember that water: flows perpendicular to contour, concentrates in valleys, disperses on ridges, speeds up on slope, and de-energizes and infiltrates when level.

3) WALK YOUR PROPERTY. Once you've gathered all of the tools and completed an initial property sketch, head outside on a rainy day for the stormwater evaluation walk. For the most accurate results, do not choose the first storm of the season or go out during the first few minutes of rain. Wait until there have been at least one or two good rain events, more than 12.5 millimetres (1/2 inch). Go out during a subsequent storm once you see water flowing on your property. During the walk, you can record stormwater runoff observations by drawing arrows that follow the direction of water movement on your property (see sample drawing). It is a good idea to take several photographs while on your walk. You can also record potential locations where you might apply the techniques listed in Chapter 3. For example, if you have a downspout that currently drains to a driveway, look around and note locations where you might direct the runoff to a rain garden or hook up a rain barrel.



DID YOU KNOW?

There is a computer model that homeowners can use to compare multiple scenarios of rainwater management solutions for different land use, soil, and climate conditions.

The “Water Balance Model for the Site” is especially relevant to homeowners interested in exploring conservation and environmentally appropriate solutions they can apply on their own lots. It is a handy web-tool that allows you to examine many of the rainwater capture and runoff control practices listed in this guide to see which is the most appropriate for your property.

See www.waterbalance.ca for more information.

4) KNOW YOUR SOILS AND RAINFALL RATES. This is one of the most critical pieces of information you need. **Soils with poor infiltration rates are not recommended for most of the rainfall capture and runoff control techniques described in this guide.** A simple test can be completed on a dry day to determine the general properties of your soil, but you should consult a professional for a more detailed analysis or if you think your soils may have poor infiltration rates. The test includes the following steps:

- a. Moisten a small amount of the soil you want to test. Take a handful, squeeze it gently, and then open up your hand.
 - If the soil feels very gritty and falls apart immediately, it is high in sand/mineral content and will drain very quickly;
 - If the soil feels somewhat gritty, but holds together in a loose ball, it has a reasonable amount of organic matter in it and is considered a loamy soil that drains well and evenly, but will hold water for a good period of time;
 - If the soil feels smooth and slippery and is a tight ball, the soil is high in clay, which is rather impermeable, can take a long time to drain, and becomes very hard when it dries out.
- b. Put about 1/2-3/4 cup of the soil to be tested in a clear container such as a water glass. Pour about the same amount of water into the glass and time how long it takes for the water to percolate to the bottom of the glass.
 - If the soil is high in sand, the water will reach the bottom in 2-3 minutes depending on the proportion of sand to other material;
 - If the soil is loamy (i.e., has a good amount of organic matter in it) the water will take 5-10 minutes to reach the bottom, depending on the amount of organic matter and what other material is in the soil: if sand, more quickly, if clay, more slowly;
 - If the soil has a high proportion of clay, the water can take up to an hour or longer to reach the bottom.

Precipitation information for your area can be found at <http://atlas.nrcan.gc.ca/site/english/maps/environment/climate/precipitation/precip> and http://climate.weatheroffice.gc.ca/climateData/canada_e.html.

It is important to plan for extremes. Rainwater capture and runoff control techniques should be designed to endure extreme events by considering exit points or overflows for excess water in the design. Seasonal cycles must also come into effect. In the Okanagan, we have early, consistent rainfall in April and May (traditionally) and late rainfall in October and November. In the summer months, rainfall comes down in large rain events that can cause floods so water harvesting features must be built to handle those. Also, in winter accumulated snow can be stored and used as a resource for spring runoff.

5) ASSESS POTENTIAL POLLUTANTS: Determine what your roof is made of and determine if there are any potential pollutants associated with the material. Do your automobiles leak oil and/or antifreeze onto your driveway? Both are highly toxic to pets and the environment. Identify these potential sources of pollution, mitigate wherever possible and then determine areas that need to be protected from pollutants and erosion.

6) LOCATE SEPTIC SYSTEMS AND WELL, IF APPLICABLE: Determine required local or provincial setbacks from septic tanks, leach fields, interceptor drains and wells. If you have a septic system, be sure to also locate your replacement leach field area, which must remain undeveloped. It is critical that stormwater projects be designed so that water is not diverted to, or intercepted from, an existing septic system.

DIFFICULT SITES AND SITE CONSTRAINTS

While this guide presents great ideas, it is critical to recognize when and where they are NOT appropriate. Some site conditions make it difficult or impossible to do certain drainage techniques on your property. For example, properties that have poor infiltration rates, are on steep slopes, have pre-existing erosion issues, or are prone to flooding or landslides can be problematic. Waterfront properties also require special consideration when implementing rainwater management practices. Below is a description of primary site constraints that you should consider when evaluating drainage practices for your property. If your property falls into one of the categories discussed in this section, or you are unsure, do not infiltrate your water into the soil without consulting a professional geotechnical engineer. Further, your local municipality may also have specific bylaws concerning rainwater practices near geologically hazardous sites.

SOIL CONDITIONS

There are a wide variety of soil types found in the Okanagan. When attempting to implement any practice that increases the infiltration of water into the soil, it is critical that the soils on your property have the capacity to handle the amount of water being directed to them. Before choosing a technique for your property, perform the simple test outlined on page 11 and/or consult a qualified professional. Also make sure to look for areas of shallow parent material or infiltration limiting layers such as hardpans. The more you know about your soils the more successful you will be at managing runoff.



STEEP SLOPES

The steepness of the slope plays a significant role in determining practices that can be installed on the site. Avoid installations on slopes greater than 50% without professional consultation and use caution on any steep slopes. By directing and infiltrating runoff to these sites you run the risk of saturating soils and causing slumping and conditions that promote landslides (see information under geologically hazardous sites on the next page).



PRE-EXISTING EROSION ISSUES

In some cases, pre-existing erosion problems may complicate the site and preclude the implementation of drainage practices. It is important to be aware of your current erosion issues and be sure that drainage practices you implement will not make your erosion issues worse. Of particular importance is ensuring that you do not exacerbate current conditions by diverting flows into areas that can not handle them. If your home has existing erosion issues, please consult an expert before considering home drainage projects.



GEOLOGICALLY HAZARDOUS SITES

Geologic hazards are natural processes that can be damaging to property, structures and/or human life. Landslides, sinkholes and floods are examples of geologic hazards in the Okanagan Valley. The following information is from “Okanagan Geology British Columbia”, edited by Murray Roed and John Greenough (2004).



LANDSLIDES ZONES

Landslide is a general term used to describe the down-slope movement of soil, rock and organic materials, wet or dry, and the landform that results. Landslides can be caused by undercutting of a slope by a river, addition of water to soil from prolonged rainfall, melting snow or groundwater seepage, and unintentional or accidental release of excess irrigation water on steep slopes.

The glacio-lacustrine soils with high silt content (>80%) that occur throughout the bench lands of the Okanagan, especially in the Penticton area, are a source of many landslides and subsidence events. The soils are highly susceptible to surface and subsurface erosion and slumping, often triggered by groundwater loading.

Consultation with a qualified geotechnical professional prior to development will help to limit activities that result in the undercutting of slopes, eliminate the placement of fill on steep slopes, emphasize the necessity of proper drainage, and prevent building construction near unstable slope crests.

SINKHOLES ZONES

Sinkholes in the Okanagan occur when water seeping along vertical and/or horizontal fractures in silty soil interacts with the tiny sediment particles, collapsing the structure holding the silt particles together. The silt particles become mobilized by water along a thin tubular channel where the fracture originally occurred. With time, the channel enlarges, caving occurs and the ground collapses due to the extrusion of silt.

Sinkholes are especially well-developed in the Sage Mesa area near Penticton. If construction is on or near a former sinkhole, the addition of extra water may cause the foundation material to fail. The hazard can be considerably increased by uncontrolled irrigation or backyard watering. Another issue arises when land owners attempt to reclaim sinkholes by filling them with material, which eventually disappears down the hole.



AREAS PRONE TO FLOODING

All streams entering the valley have alluvial fans or deltas associated with them. These areas may be at risk from flooding, particularly during an extreme climate event. Flooding can also be caused by inadequately designed or maintained storm drainage systems.

WATERFRONT DEVELOPMENT

Waterfront development is common in the Okanagan. Six large lakes form a chain along the valley bottom providing prime real estate opportunities. We also have many creeks and streams flowing from the hillsides and the Okanagan River on our valley floor.

Shorelines are more fragile than regular upland city lots. Any land modifications for rainwater management need to be done with extra care and attention. Waterfront properties, due to their close proximity and direct connection to surface water bodies, can play an especially important role both in the creation but also the control and reduction of harmful rainwater runoff and erosion.

You need to consider that shorelines often slope, are on the receiving end of drainage and seepage from uphill, and usually have wetter soils that are more easily compacted and damaged than upland soils. Shoreline banks and bluffs have a tendency to erode. Shoreline properties often experience microclimates such as temperature inversions or unusual frost patterns and can also be more susceptible to the effects of storms and flooding. Shorelines support many kinds of wildlife, including species at risk, and provide protection for aquatic habitat. Last, but definitely not least, shorelines are governed by a large variety of laws and regulations and special approvals are often needed to conduct work on the property.

Having a “buffer zone” – an area of natural vegetation that runs along the length of your shoreline, also known as a riparian zone – is one of the most important things you can do to maintain the quality of your water and protect your land. Vegetated buffers purify water by filtering toxic substances out of runoff before they reach water bodies. The roots of buffer plants reinforce soil and sand and help prevent erosion. Vegetation, logs and rocks along the shoreline slow down flood waters and increase the soil’s ability to absorb water, reducing damage to your property. If you have an undisturbed, natural shoreline, the best thing you can do is to leave as much of it alone as you can.





RAINFALL CAPTURE AND MOSQUITO CONTROL

Mosquitos need standing water to reproduce. When open water is left to stagnate, mosquito populations can soar. In addition to the nuisance of an itchy bite, mosquitos also have the ability to transmit disease. While we strive to conserve, protect, and diversify our water supplies, it is also our responsibility to maintain a healthy environment that does not harm or affect the health of those around us. To prevent unwanted mosquito breeding, please remember to follow these mosquito-proofing tips for standard rainwater management.

FOR RAINWATER COLLECTION SYSTEMS

- Use barrels with mosquito-proof screen (fine mesh - 1.5 millimetres [1/16th of an inch]) under the lid and covering the overflow hole.
- Keep your rain barrel lid and all connectors in the system sealed.
- If possible, place your barrel on a surface that will soak up or promptly drain water that has overflowed.
- Keep your barrel free of organic materials such as leaves and debris.
- Remove water that may have pooled on the top of the barrel at least 1 to 2 times a week, or use a barrel with a self-draining lid.
- Use a downspout diverter to direct water into the barrel.
- Inspect the system on a regular basis to be sure there are no cracks or leaks and that all seals and fittings remain intact.
- Keep gutters and downspouts clean and free of debris.

FOR LARGE WATER TANKS/CISTERNS

- Cisterns (above and below ground) should be completely enclosed with no openings to the outside environment.
- Tightly seal cistern lids and connections.
- Cover all inlets, outlets, and vents with mosquito-proof screening (fine mesh - 1.5 millimetres [1/16 of an inch]).
- Inspect on a regular basis to ensure there are no cracks or leaks and that all seals and fittings remain intact.
- The area surrounding the cistern should be designed to either divert or absorb excess water from overflow.
- The inside of the cistern must be accessible for periodic maintenance as well as inspection by mosquito control personnel.

MOSQUITO CONTROL IN SWALES, RAIN GARDENS, AND INFILTRATION SYSTEMS

Stormwater treatment, storage, and infiltration structures and systems must be designed and maintained properly. Correct design and maintenance minimizes the potential for mosquito production, the need for repeated mosquito control, mosquito-borne disease transmission, and other public health issues. Stormwater treatment features such as rock-lined swales, rain gardens and retention basins should not contain standing water in excess of 48-72 hours.

The following list provides examples of how to minimize mosquito production while using rainfall capture and runoff control techniques.

PLANNING:

- Select and maintain proper grade for moving water (e.g., swales, retention features, cross drains).
- Systems should completely drain within 72 hours to prevent mosquito breeding.
- Avoid loose-fitting rock or rip rap that may trap water, creating an ideal environment for mosquito production.
- Systems should be easily accessible.
- Use caution when installing any type of catchment system that holds 46 centimetres (18 inches) or more of water as this poses a potential drowning hazard to children.

VEGETATION:

- Choose appropriate vegetation for the specific project.
- Native, low-growing vegetation is preferred to minimize the potential for mosquito production in stormwater treatment systems and allow for efficient mosquito control, if necessary.
- Do not plant cattails or other aquatic plant species that can become invasive such as yellow flag iris and purple loosestrife.
- Do not surround rain gardens, swales, or retention features with dense vegetation that could hinder access.

MAINTENANCE:

- Develop and adhere to a maintenance plan and schedule.
- Periodic sediment removal may be necessary to minimize mosquito habitat (e.g., swales, retention features, cross drains) and maintain proper function.
- Aggressively manage unwanted vegetation.
- Mow or thin out vegetation regularly to avoid overgrowth, ensure proper system function, and facilitate access.
- Keep inlets and outlets serviceable and free of debris.



*If you are experiencing a mosquito problem or would like more information about controlling mosquitoes, contact:

Interior Health Authority
1-866-300-0520
www.interiorhealth.ca

**Regional District North Okanagan
West Nile Virus Program**
250-550-3700
info@rdno.ca
www.rdno.ca

**Regional District Central Okanagan
Regional Nuisance Mosquito Control Program**
250-763-4918
info@cord.bc.ca
www.regionaldistrict.com

**Regional District Okanagan-Similkameen
West Nile Prevention Program**
250-490-4232
info@rdos.bc.ca
www.rdos.bc.ca

CALL BEFORE YOU DIG

BC One Call is a FREE service available to anyone planning a project that entails digging. A phone call to BC One Call at 1-800-474-6886 is the best way to find out what is buried on your dig site and which areas you must avoid when digging. It is simple and easy to use. Within three days of your call, the members of BC One Call will send you a site plan showing the exact locations of their buried facilities or a technician will visit your site and provide physical markings. For more detailed information, visit www.bconeacall.bc.ca/.

CHAPTER 3

TECHNIQUES FOR RAINFALL CAPTURE AND RUNOFF CONTROL AROUND YOUR HOME

Disclaimer: The techniques described in this guide are provided exclusively for general educational and information purposes. The guide is intended to help landowners consider their current runoff practices and to identify concerns and potential solutions. Consultation with an experienced professional who can address specific site conditions may be required for some techniques and/or sites.

Managing rainwater on residential properties is not a new idea. Most homes were constructed using the runoff methods of the era in which they were built. For the past 50 years, that approach has been to direct runoff away from the property as quickly as possible using pipes and pavement. While largely effective, we now recognize that this approach only shifts problems downstream. We are now experiencing the consequences in a variety of ways including increased potential for flooding, damage to public and private property, stress on our water supplies, and degradation of our local waterways and habitats.

The **techniques** recommended in this guide move away from the old “pipe it and pave it” model and toward the SLOW it, SPREAD it, SINK it approach: slow the water down, spread the water out, and sink the water into the land. That notion is at the heart of these practices and is a simple mantra you can use to address the runoff on your own property. The following chapter includes information on a variety of techniques that are practical and cost effective. Find the one that best fits your needs, your pocketbook, and your unique site conditions.

Before embarking on any new project, please remember:

1. In many cases a simple **change in management** of your current system may be all that is needed to minimize negative impacts of stormwater runoff. It is important to recognize that each technique described in this guide requires ongoing maintenance to remain effective. Be sure to factor this maintenance into your plans. If you already use one of the listed techniques, please review the maintenance section for tips on getting the most out of your existing features. Observe your system frequently and obtain feedback to ensure everything is operating as efficiently as possible.
2. **Vegetation** plays several important roles in rainwater capture and runoff control, which may include:
 - slowing down water and physically removing sediments,
 - helping to stabilize slopes through their root structure and reduction of rain impact on the soil,
 - biological removal of nutrients and other pollutants (bioremediation), and
 - improving soil infiltration.
3. **Structural practices** are usually more expensive to install and maintain and place a greater strain on resources and the environment. Structural practices should only be used when management changes or vegetation is not an option.
4. **ALWAYS check with applicable regulatory agencies to determine if a permit is necessary for any project.** Examples of projects for which a permit may be required include building a retaining wall, installing a large cistern, sending runoff to a creek or stream, and directing water to a neighbouring property. For a list of resource agency contacts see pages 51 and 52.

The **techniques** described in this chapter include general information on the benefits of each, an estimated cost range from low to high, and a level of difficulty for installation by the homeowner. It is noted when using a qualified licensed professional is highly recommended.

BENEFITS OF RAINWATER MANAGEMENT

Potential benefits of the techniques outlined in this chapter include the following:

Conserves water: Water can be conserved through capturing rainwater, using plants with low water needs OR directing runoff water to areas where it can be stored in the soil for use later by plants.

Promotes groundwater recharge: Allowing more water to sink into the soil helps protect our aquifers by enhancing recharge.

Enhances and creates wildlife habitat: When installing runoff control techniques that use vegetation, choosing appropriate plants can create habitat for local wildlife and act as natural pest control.

Improves landscape aesthetics: Many of the techniques in this guide can beautify your landscape.

Reduces peak flows or facilitates runoff timing: Peak flows occur when runoff reaches its greatest volume. By changing the timing of our residential runoff, we can reduce peak flows and mitigate flooding potential.

Reduces erosion: Practices that reduce erosion limit the loss of top soil and reduce the amount of sediment entering local streams.














Protects infrastructure and increases property value: These practices help reduce runoff that could damage structures, foundations, or public infrastructure such as roads.

RETROFIT VERSUS NEW DEVELOPMENT

The scope of this guide is to provide rainfall capture and runoff control techniques that can be used for existing homes and properties. That said, many of the techniques presented in this guide are also suitable for new developments.

Typically, during retrofit development (i.e., renovating your existing lot), it is difficult to control the grading of the soil around your house. As a result, it is very important to know where the water is going during a large storm. Many existing lots may be lower than surrounding road systems or have neighbouring lots in the pathway of runoff water. New development areas are typically graded such that rainfall from large storms drain safely to road systems or interceptor ditches and away from buildings. When in a retrofit development situation, you need to provide an overflow connection to the existing storm sewer system for larger storms. Do not disconnect the storm service completely. For new development, where grading should not be an issue, surfaces can be disconnected provided they can run overland to a safe location during large storms.

Look for these symbols to help you choose the best options for your property:

BENEFITS	
	Conserves water
	Recharges groundwater
	Enhances & creates wildlife habitat
	Improves landscape aesthetics
	Reduces peak flows or runoff timing
	Reduces erosion
	Protects infrastructure
COST	
	Low cost
	Medium cost
	High cost
INSTALLATION DIFFICULTY	
	Easy
	Moderate
	Complex

Gutters and Downspouts

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USES: ROOF RUNOFF

Your regional district or municipality may have specific requirements for installing gutters and downspouts. Since requirements often change, we have provided general guidelines, but you should contact your respective planning/building department for more detailed information. See pages 51 and 52 for contact information.

NEW INSTALLATIONS OR RETROFITS

Properly sized gutters and downspouts are crucial for proper performance. While installation is fairly simple, calculating the correct size system for your roof can prove more difficult. You will need to know your roof area and pitch or slope and your location's annual rainfall. We recommend contacting a local qualified professional to assist with calculating correct gutter and downspout sizes.

Also consider where your downspouts drain. Where possible and safe, divert downspouts AWAY from impervious surfaces such as concrete driveways, walkways, or compacted soils. Instead, direct them to well vegetated areas of your property, allowing runoff to SINK into the soil. This decreases water volume on streets and in storm drains and reduces the potential for downstream flooding.

General guidelines for selecting and installing gutters and downspouts or improving capacity are included below.

GUTTERS

Select gutters at least 13 centimetres (5 inches) wide. Use materials made from galvanized steel (29 gauge minimum) or aluminum (0.6 millimetres [0.025 inches] minimum). (Note: galvanized gutters should be painted to reduce the potential impacts of zinc.) To enhance flow, slope gutters according to the manufacturer's recommendations commonly 1.6 millimetres (1/16 inch) to 3 millimetres (1/8 inch) per 30.5 centimetres (1 foot) of sectional gutter; or 1.6 millimetres (1/16 inch) to 3 millimetres (1/8 inch) per 3 metres (10 feet) of seamless gutters. Tilt the gutter forward keeping the front 13 millimetres (1/2 inch) lower than the back. For straight runs exceeding 12 metres (40 feet), use expansion joints at connections. Select elbows with 45, 60, 75 or 90 degree angles, as needed.



GUTTER PROFILES



Half Round



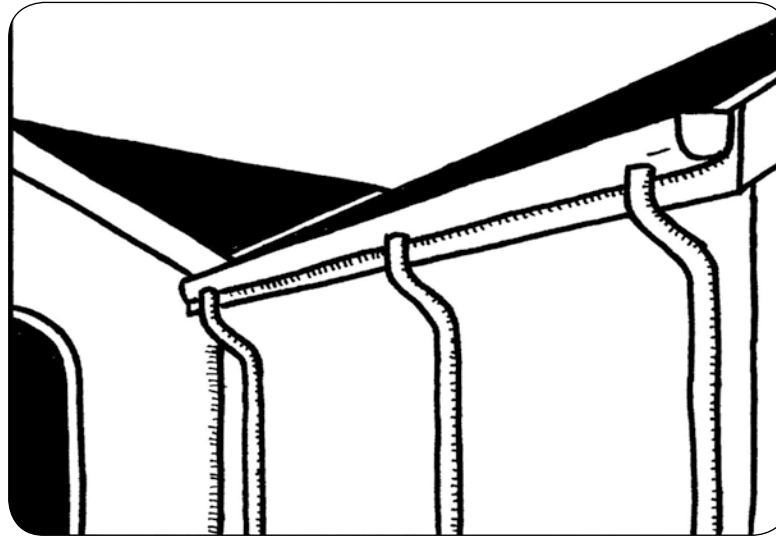
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DOWNSPOUTS

Space downspouts from 6 to 15 metres (20 to 50 feet) apart. Adding additional downspouts can increase capacity where necessary and help SLOW water down and SPREAD it out. Do not exceed 45 degree angle bends. Where needed, use 10 centimetre (4 inch) diameter extensions (flexible or rigid) to convey water to infiltration areas such as rain gardens and swales or to other safe outlets away from structures and steep slopes. All downspouts and pipes that outlet onto surfaces without substantial vegetation cover should use one of the outlet protection practices described on page 25. Do not direct downspout outlets to driveways or other impervious surfaces unless there are no safe alternatives. Instead, route them to vegetated areas.

MAINTENANCE:

Setting up a maintenance schedule is one of the easiest and most cost-effective solutions to many roof runoff issues. The vegetation on your property will impact your maintenance schedule. Gutters on homes surrounded by deciduous trees will need to be cleaned in late fall after the leaves have been shed. Gutters on homes surrounded by evergreen trees will need cleaning in the spring. In areas with dense trees or vegetation, trim trees and vines away from gutters to maintain a minimum 61 centimetre (24 inch) clearance zone. Add gutter guards to reduce debris buildup. You can also add a drip line treatment (pages 21 and 22) below gutters that clog often. Check your system for leaks, damaged parts, rust, and evidence of past erosion. Make sure to check hidden outlets under decks or staircases that might be forgotten.



Adding an additional downspout helps reduce the volume and velocity of runoff at any given point reducing the potential for erosion.

DID YOU KNOW?

A RAIN CHAIN can be used instead of a downspout. Rain chains ('kusari dio' in Japanese) have been used for hundreds of years in Japan. Not only are they visually appealing, they also provide some runoff reduction through evaporation and spillage.

When installing rain chains, make sure to take the same precautions for outlet protections as you would with standard downspouts. For more information visit a local retailer or www.rainchains.com.



DO

- Direct runoff to a rain garden or swale.
- Collect runoff in a rain barrel or cistern.
- Check and clean gutters after severe storms.

DON'T

- Release water onto bare soil.
- Direct runoff to steep slopes or foundations.
- Send runoff onto a neighbour's property.

Drip-Line Protection



USES: BELOW ROOF EAVES, UNDER DECKS OR OTHER ELEVATED STRUCTURES

A drip line is the area below any elevated surface that receives runoff. For roofs it is the ground below eaves that do not have gutters installed. For decks and other elevated surfaces it is the area underneath where water drips through (e.g., the area between and below the deck boards). The drip-line techniques described in this section are intended to create a barrier to protect exposed soil and reduce erosion. The protective cover also SLOWS runoff and allows it to SINK back into the soil. This is critical in areas where runoff-induced erosion could reduce the effectiveness of support structures and footings. Drip-line protection is also a great addition where gutters frequently overflow due to large amounts of debris.



VEGETATION PROTECTION FOR DRIP LINES

Roof drip lines: Homeowners can plant and maintain mature vegetation below their roof drip lines. If there is existing vegetation (such as turf or a bordered planter bed), simply maintain these areas. Examples of adequate drip line vegetation include the following:

- healthy grass or turf that has been established directly up to the foundation of your home, and
- plants, shrubs, or flower beds that are completely bordered by wood, rock, or turf with mulch between vegetation covering any bare soil.

See Appendix A for a list of plants well-adapted to the Okanagan. You may also contact native plant nurseries, the Okanagan Xeriscape Association, or a landscaping professional for further information (see pages 51 and 52 for contact information).

Deck/stair drip lines: Where adequate sunlight is available, planting hardy ground cover, grasses, or other low growing vegetation is a good low-cost option for protecting soil from erosion beneath decks and stairs. Use drought tolerant plants that do not require supplemental watering once established to prevent additional runoff or water near a structure. If you have structures on your property that are low to the ground and are inaccessible underneath, try planting around the perimeter.

DO

- Use Okanagan natives and/or drought tolerant plants.
- Keep plants well-pruned to allow adequate ventilation.
- Keep soil a minimum of 15 centimetres (6 inches) below siding.
- Minimize fertilization to prevent water contamination.
- Try organic fertilizers and pest controls.

DON'T

- Plant invasive species such as Goutweed.
- Plant highly flammable vegetation.
- Allow irrigation water to drain to your driveway, the street, or onto bare soil.

HARDSCAPE PROTECTION FOR DRIP LINES

Roof drip lines: Wood chips, mulch, or gravel can be used to protect soil from erosion and promote infiltration into soils with high permeability (sandy soils). Install gravel or mulch under the drip line at a minimum depth of 8 centimetres (3 inches). This treatment must extend 15 centimetres (6 inches) inside the eave and a minimum of 30.5 centimetres (12 inches) beyond the eaves of a single-story roof, 46 centimetres (18 inches) beyond the eaves of a two-story roof, and 61 centimetres (24 inches) beyond the eaves of a three-story roof. This treatment prevents erosion and allows runoff to infiltrate. Two centimetre to 4 centimetre (3/4 inch to 1-1/2 inch) washed drain rock is an adequate size to prevent the rock from being moved by rainfall. However, you can use any kind of rock you like to achieve desired aesthetic effects on your property. Installing non-woven geotextile fabric beneath the rock and then bordering the rock with wood or other material will reduce maintenance and increase effectiveness. You also need to ensure that the ground slopes slightly (1-2%) AWAY from the structure for a minimum of 1.5 metres (5 feet).



Deck/stair drip lines: To protect the soil under elevated decks, stairs, and walkways from erosion, install an 8 centimetre (3 inch) layer of drain rock under the entire footprint of the structure and extend 30 centimetres (one foot) past its edge. If you have structures on your property that are low to the ground and are inaccessible underneath, install an 8 centimetre (3 inch) layer of rock or other mulch approximately 30.5 centimetres (1 foot) wide around the outside perimeter of the structures. This treatment will slow runoff and reduce erosion potential. It is only necessary to install drain rock under and around these structures if there is not adequate vegetation established. Installing non-woven geotextile fabric beneath the rock and then bordering the rock with wood or other material will reduce maintenance, help control weeds, and increase effectiveness. You also want to ensure that the ground slopes slightly (1-2%) AWAY from the structure for a minimum of 1.5 metres (5 feet).



MAINTENANCE:

Periodic replacement of gravel or mulch may be needed. Weeds should be pulled when small and before they go to seed. Remove fallen leaves from mulch. Inspect your home frequently to ensure that water is not saturating or eroding either the structure or the foundation.

DO

- Use existing rock or mulch from your property.
- Use rock from a local quarry.
- Make sure rock is washed.

DON'T

- Use rock under 2 centimetres (3/4 inch) in size.
- Allow runoff to flow TOWARD the house or structure.

DID YOU KNOW?

Sediment and debris that collect in the corners and edges of gutters support the growth of bacteria and other organisms that could contaminate rainwater.

Because rounded gutter systems have fewer edges than their square-cornered counterparts, they provide cleaner water for rainwater catchment systems.

Rainwater Collection Systems

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**USES: COLLECT AND STORE WATER FROM ROOFS**

Rainwater collection is an excellent opportunity to SLOW water down by temporarily storing it. Captured water can be reused for irrigation or other non-potable options or drained off slowly after storm events to allow for infiltration and reduced flooding.

RAIN BARRELS

Rain barrels are small-to medium-sized containers placed outside buildings and connected to roof downspouts to collect runoff for later use in non-potable applications. Rain barrels have many advantages in urban settings. They take up very little space, are inexpensive, and are easy to install. Rain barrels conserve water and reduce the volume of runoff moving off-site.

MAINTENANCE:

Rain barrels require regular draining after rainstorms and removal of leaves and debris collected on screens. Ensure that there is an overflow outlet near the top of the rainbarrel with an attached hose or pipe to take excess water away. Always check that the overflow is clear and directed away from the foundation to an appropriate location (e.g., nearby vegetation or a runoff swale). Be sure to divert water and drain the barrel for winter because expansion and freezing of water may crack it.

**DO**

- Use rainwater regularly (e.g., water indoor plants).
- Use gravity to your advantage.
- Use multiple barrels where possible.
- Keep covered to prevent debris build up and mosquito breeding.

DON'T

- Allow access for mosquitos, rodents, children, pets, or debris.
- Use for drinking.
- Capture water from roofs with excessive debris (e.g., leaves, pine needles, or bird droppings).



WATER TANKS (CISTERNS)

Water tanks (cisterns) are manufactured water storage containers for non-potable use in residential, commercial, or industrial applications. Water tanks can be installed both above and below ground. Some tanks come as sectional pieces that can be put together to fit different space constraints. Tanks can be used with most guttered roofs to collect runoff and reduce runoff volume. Both water tanks and rain barrels can be used without pumping devices, instead relying on gravity flow. However, depending on the desired use for the water, a pump may be necessary for best performance.

Larger tanks can be designed to also function as privacy screens, fences, or small retaining walls. Tanks can also be hidden under decks or serve as the foundation for play structures or other landscape features. Get creative!

An underground tank is an excellent option for areas with limited space. However, do not install underground systems beneath the path of vehicles or heavy machinery traffic unless they have been engineered for that purpose. Extra precautions may be needed when placing tanks in locations with high water tables or saturated clay soils. Contact an experienced licensed professional for tank installations under these conditions.

Basic components of a rainwater collection system are:

- Catchment surface: this is normally a roof, but there are other options.
- Gutters and downspouts: round gutters are recommended because they are less likely to collect sediment in corners and edges. This sediment can support bacteria growth.
- Mesh screens on tanks or barrels and downspout openings.
- First-flush device: recommended but optional.
- Water tanks: There are various options including manufacturing on-site.
- Water tank vent.
- Overflow device: this should be equal to, or larger in diameter than, the inflow pipe to avoid backup.
- Faucet and valve.
- Filters and pumps (optional).

MAINTENANCE:

Remove accumulated sediment and debris annually and inspect all components regularly. The inside of the tank must also be inspected. Look for leaks and cracks. Check all connections and hoses for wear and all screens or mesh for debris accumulation and holes. Make sure overflow is clear and directed to an appropriate location. Inspect all seams for leaks. Follow all manufacturers' recommended maintenance for any storage device.

DO

- Check with your local municipality or regional district to see if you require a permit.
- Secure tanks with straps for protection from earthquakes and other movement.
- Use gravity to your advantage wherever possible.
- Keep underground tanks a minimum of $\frac{1}{4}$ full at all times to prevent collapsing of certain tank types.

DON'T

- Place tanks on steep hillsides.
- Place water tanks below ground unless they are approved for this use.
- Collect water from cedar or highly degraded roofs.
- Collect roof water from areas prone to large amounts of debris (leaf litter, etc.).



Outlet Protection

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USES: DOWNSPOUT, PIPE, OR CULVERT OUTLETS

One of the most overlooked parts of a drainage system is the outlet of downspouts and pipes. Outlets should not release water onto bare soil or to an area prone to erosion. On the other hand, discharging water onto hardened impervious surface eliminates infiltration and increases the velocity of water that is directed to streets and streams creating a new set of challenges. All outlets that drain onto soils or other erodible surfaces should have some type of outlet protection. The techniques below work to SLOW water down and/or SPREAD it out so it can SINK back into the soil.



SPLASH GUARDS are simple devices that reduce the initial force of the water at the outlets and allow it to SPREAD out into an area of vegetation or an appropriate infiltration area and SINK back in to the soil.

A HOSE ADAPTER is a great option (Drought Buster East Connect is pictured at upper left) that allows a standard garden hose to connect directly to a downspout. The hose can then be moved to different locations of your yard when it rains. It is perfect for watering trees or keeping any one area from becoming too saturated by allowing the water to SPREAD out through the landscape.



ROCK DISSIPATORS (lower left photo) are placed at outlets to SLOW runoff by reducing the initial impact of concentrated, high velocity runoff. For downspout outlets there are several easy creative options like filling a large plant container (it must have drain holes) with pebbles or placing rock on the ground surrounded by a wood border (similar to a rock drip line). Large containers (1/2 wine barrels are an inexpensive option) with established plants and a thick layer of mulch (wood chips or gravel) also work well. Make sure that the drainage from under the pots flows away from your foundation.

For culverts or outlets with drain pipes over 20 centimetres (8 inches) in diameter, rock must be properly sized to prevent movement and placed with filter fabric underneath. Angular rock is typically recommended for high velocity flows because it locks in place and has a greater capacity to slow the water than rounded rock or broken concrete which tends to have some smooth edges. Rock should be carefully laid by hand forming an evenly lined depression or basin with no spaces between the rocks. It is highly advisable to contact a qualified professional for design assistance. Work done at any outlets that drain directly into a waterway will need a permit.

DO

- Direct downspouts to vegetated areas or rock dissipators.
- Protect ALL outlets on your property.

DON'T

- Allow water to pond near foundations.
- Direct water to driveways or other impervious surfaces that drain directly to the street.

Rain Gardens



USES: ROOF, WALKWAY, DRIVEWAY, OR PARKING AREA RUNOFF

A **rain garden** is a specialized landscape design that captures stormwater runoff from roofs, driveways, or other impervious surfaces and allows water to SINK back into the ground. In the Okanagan, rain gardens can also be used to capture snow during the winter and retain and slow runoff during the spring melt. Rain gardens also use plants to filter the water, removing pollutants before they enter storm drains and waterways. Rain gardens are a beautiful way to reduce erosion on your property and protect the water quality of local creeks. They can enhance the aesthetic value of a site; be used on small parcels of land, easements, and right-of-ways; and are easily incorporated into existing landscapes or open space.

In the Okanagan, your rain garden will most often be dry for most of the summer (except in the unusual situation of being on a marsh). Vegetation needs to be chosen with this in mind. Proper soil selection is also a very important consideration when designing a rain garden. A rain garden needs soil that has a high sand content (60% or higher if the on-site soil is heavy clay), 20% compost and 20% soil.

The required size, shape, and depth of the garden depends on how much water you are trying to capture, the slope of the land, and the type of soil on your property, among other factors. For large amounts of runoff or areas with insufficient infiltration, there are a full spectrum of engineered features, such as specialized soil mixtures, an aggregate base, and subsurface drains that can be added.

Plant the centre of the garden with species that tolerate wetter conditions, such as native sedges and rushes. Around these, put plants suited to occasional standing water that may occur during major storms (see Appendix A for suggested plants). At the furthest edges, you may want to plant a variety of native evergreen and deciduous shrubs that prefer drier soil. If you are putting in only a small rain garden, you may not have room for shrubs. Also, from a design perspective, ringing the garden with shrubs could make it difficult to see smaller perennials in the centre of the garden. Contact your local nursery knowledgeable in native and drought tolerant species for advice on what plants to use (see page 52 for contact information). Rain gardens should be located at least 3 metres (10 feet) from your house and at least 12 metres (40 feet) from a septic system or steep slope. They should also be designed to drain within 48 hours to reduce the risk of standing water and mosquito breeding.

MAINTENANCE:

Routine upkeep is required and can be performed as part of the regular yard maintenance. Weeding and irrigation are essential until plants become established (can be up to two years or even longer if hot, dry weather persists). Annual pruning and mulching are recommended. Additional irrigation may be necessary during hot and dry months and weeding needs to be included in ongoing maintenance. The use of native, site-appropriate vegetation and proper soil reduces the need for excessive water and overall maintenance. Fertilizers and pesticides of any kind are actively discouraged (and should be largely unnecessary).

DO

- Use Okanagan native or drought tolerant plants as appropriate.
- Minimize fertilization to prevent water contamination and try organic options.

DON'T

- Use a rain garden in soils with high water tables or clay soils without an overflow device.
- Use fertilizers or pesticides of any kind.
- Place the rain garden too close to your home's foundation.

Swales





USES: ROOF, WALKWAY, DRIVEWAY, OR PARKING AREA RUNOFF; LOW TO MODERATELY SLOPED HILLSIDES

Swales are shallow channels designed to SLOW water down, SPREAD it out and allow it to SINK into the soil during low flows. Once saturated, swales convey water to a safe outlet such as a rain garden (page 26) or other infiltration area. They can be formed to fit almost all site conditions and landowner objectives. Depending on the landscape and available space, swales can have a meandering or nearly straight alignment. An advantage to a meandering swale is that its twists and turns increases the time water spends in the swale thus aiding the trapping of pollutants and sediments, and infiltration. There are two types of swale systems: vegetated or rock-lined (sometimes called dry creek beds or diversion drains).

VEGETATED SWALES

Vegetated swales are planted with native perennial grasses along the bottom and sides of the channel. The vegetation in the channel slows runoff, allows sediments to filter out, and can help remove excess nutrients that can cause excessive plant growth in waterbodies (eutrophication).

Bioswales are vegetated swales that use engineered materials (usually a designed soil mix consisting of sand, loam soil and hardwood mulch) beneath the swale to improve water quality, reduce runoff volume, and control peak runoff rates. Although their functions are similar to vegetated swales, bioswales have a greater capacity for water retention, nutrient removal, and pollutant removal. Adding gravel or other permeable material below the soil mixture further enhances infiltration. Installing a bioswale is more difficult than constructing a simple vegetated swale so assistance from a professional is recommended.

When installing a vegetated swale, use a minimum 2% slope from beginning to end (longitudinal slope) to convey water away from any structures and to a desired destination. Vegetation in the swale should be established before the first winter storms, so roots can withstand the movement of water. Once the soil beneath them is saturated, swales function as small, temporary streams carrying runoff to a rain garden, wetland, infiltration area, or other safe location. Swales are not recommended for areas that receive large amounts of sediment that can fill the swale and stop it from functioning.

MAINTENANCE:

Regular maintenance of vegetated swales is required. Before the plants in a swale are well established, it is extremely vulnerable to erosion and must be protected with straw matting or other erosion control materials. The vegetation will need careful watering to get it established. Maintenance consists of mowing in the late spring and late september (to 8 centimetres [3 inches] or higher), weed control, reseeding bare areas, and clearing debris and accumulated sediment. Do not irrigate once the swale is established. The swales should be regularly inspected for pools of water, formation of gullies, and for uniformity in width and slope. When the uniformity is compromised it should be corrected quickly to ensure the swale is not breaking down by sloughing in or meandering.



DO

- Use Okanagan native plants or drought tolerant plants.
- Consult a professional before installing a bioswale.

DON'T

- Walk or drive machinery directly in the swale as this will cause soil compaction.
- Place too close to your home's foundation.
- Use fertilizers or pesticides unless absolutely necessary.

ROCK-LINED SWALE (DRY CREEK BED OR DIVERSION DRAIN)

A rock-lined swale (also known as a dry creek bed or diversion drain) uses rock instead of grass or other vegetation to safely infiltrate and convey runoff. Most are designed with rounded rock for an aesthetically pleasing landscape feature that mimics a creek bed.

Rock-lined swales are better for cleaner roof runoff rather than driveway runoff because the rock is easily plugged with sediment. Eventually, the sediment will travel straight through and little infiltration will be achieved. For driveways and other surfaces with higher sediment content consider replacing the rock with vegetation. The vegetation will capture the sediment, and re-generate the bed's infiltration ability.

When installing a swale use a minimum 2% slope from beginning to end (longitudinal slope) to ensure that water is conveyed away from any structures and to a desired destination. It is important to use non-woven geotextile fabric underneath the rock. The steeper the swale, the larger the rocks that will be needed to prevent movement and erosion.

MAINTENANCE:

Periodically remove leaves and replace rocks moved by surface flow. Remove weeds when small and before they go to seed. A vinegar/salt/dish detergent spray can be used on a hot sunny day to control weeds.



BOOMERANGS

Similar to swales, boomerangs are small semi-circle water harvesting mound and ditch systems. They are dispersed throughout a slope so the overflow from one boomerang flows into two other boomerangs. This system is also known as a net and pan system. Trees are planted upslope of the boomerang and filled with mulch to create a mulch basin that will act to preserve rainwater. Ditches and diversion drains can be directed to boomerangs to provide adequate water so trees do not require constant irrigation.

DO

- Use existing rock from your property if available.
- Use washed rock from a local quarry.
- Make sure the outlet does not cause erosion or clog.
- Use non-woven geotextile fabric beneath the rock.

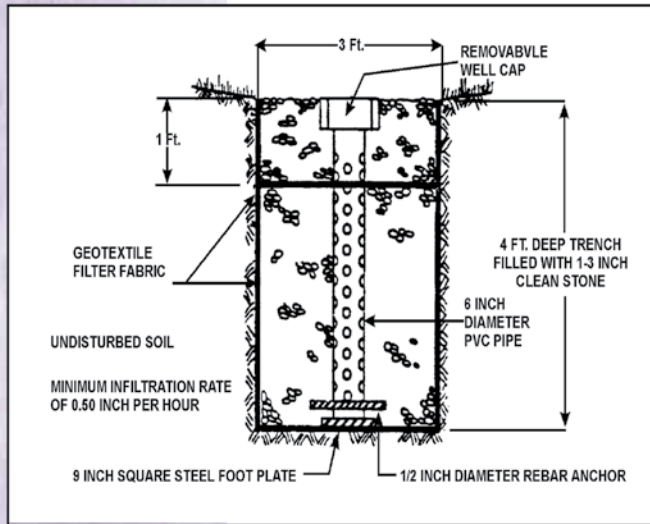
DON'T

- Install in soils with high water tables or saturated clay soils without an overflow device.
- Place too close to your home's foundation.
- Use where there will be a lot of debris from leaves or seeds from nearby vegetation.
- Allow leaf litter to accumulate or weeds to grow.

Infiltration Structures



USES: ROOF RUNOFF, WALKWAYS OR OTHER HARDSCAPES, VEGETATED AND/OR UNDEVELOPED AREA RUNOFF, LOW TO MODERATELY SLOPED AREAS



Source: Southeastern Wisconsin Regional Planning Commission, 1991.

FIGURE 1 TYPICAL INFILTRATION TRENCH

Infiltration structures are typically underground storage chambers designed to collect stormwater and allow it to infiltrate into the surrounding soil for groundwater recharge. They go by many names including; infiltration gallery, seepage pit, drainage well, and dry well. In addition to recharging groundwater, they can also help to enhance base flows in nearby creeks, reduce runoff volume, and improve water quality by removing sediment and pollutants. Downspout water is often the best source for an infiltration structure as it typically does not have sediment that can clog the structure. Infiltration structures should only be undertaken with sufficient planning and professional assistance.

Groundwater protection: A discussion of infiltration structures would be incomplete without a word on groundwater protection. In some areas, the water table may be shallow (“perched”) or vary depending on the season. Soil types and ground disturbance also varies by site location. Success relies on proper design, appropriate soil types and a minimum depth of underlying soil (above the water table) to filter pollutants before stormwater reaches the aquifer to avoid groundwater contamination. Therefore, extreme care must be taken to ensure the infiltration structure is properly sited, designed, constructed, and maintained.

INFILTRATION TRENCHES

Infiltration trenches are fabric-lined, rock filled trenches or shallow rock-filled pits that receive and infiltrate stormwater runoff. They are designed to capture runoff and SINK it into the soil, restoring infiltration function, replenishing groundwater supplies and restoring base flows in nearby creeks. Infiltration trenches also help to filter runoff pollutants and alleviate the negative environmental impacts of peak storm flows such as erosion. The potential property and environmental benefits of installing an infiltration trench are considerable, but the design and installation of an infiltration trench should only be undertaken in consultation with a qualified professional. Proper site conditions are critical to avoid groundwater contamination and possible failure of the trench. In addition, infiltration trenches often need to be used in conjunction with other techniques that pre-treat the stormwater. Pretreatment is important because it removes suspended solids before they enter the trench to prevent clogging and possible failure.

INFILTRATION PITS

Infiltration pits are nearly identical in principal and design to a trench but are typically smaller and vertical (a “pit”). Like a trench, they have similar design, pre-construction site evaluation and analysis requirements. The advantage is that they can be installed with minimal space requirements. Note that infiltration pits also have setback and site requirements that must be considered.

SITE AND DESIGN REQUIREMENTS: Consideration of an infiltration trench or pit must start with a thorough, professionally performed site analysis. The site analysis should carefully examine if soil types, percolation rates, required setbacks from roads, wells and septic systems, and depth to groundwater table are appropriate. **Infiltration structures are not for all sites and only a professionally performed site analysis can determine if your property is suitable.** The analysis should also consider runoff water quality, quantity and whether or not pre-treatment will be required to remove suspended solids. If the analysis indicates that the site is appropriate, the trench should be designed and installed by a qualified professional. You should also be sure to notify the appropriate building or planning agency before the site analysis to determine if there are any special permitting requirements, site limitations, or restrictions.

MAINTENANCE:

Regular maintenance is required for the proper operation of an infiltration structure but maintenance requirements are reasonable if properly designed and constructed. Future planning should also take into account maintenance requirements for any associated techniques that pre-treat the stormwater and include a specific inspection and maintenance schedule as well as acceptable performance guidelines. General guidelines recommend that in the first year, the infiltration structure should be inspected during and after several major precipitation events to confirm that it is functioning properly. After the first year, it should be inspected at least twice a year. Garbage and plant debris should be removed from the surface on a regular basis to ensure it functions properly and prevent clogging. A properly functioning infiltration structure should drain within 72 hours. Even a partially clogged trench can lead to standing water that favours mosquito breeding. If inspection indicates that the infiltration structure is partially or completely clogged, consult a professional immediately to identify the problem and repair requirements. The probability of failure for an improperly sited, designed or maintained infiltration trench or pit is nearly 100%.



DO

- Consult a professional before considering installation.
- Perform a thorough site analysis before building.
- Have the infiltration structure professionally designed and constructed.
- Plan on regular maintenance.
- Determine if any permitting requirements, site limitations or restrictions apply to your project before you begin.

DON'T

- Attempt to install without a site analysis.
- Build an infiltration structure in an area with high sediment input or excessive slopes.
- Install a trench or pit that is greater than one metre (3 feet) deep.

Pervious Hardscapes

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USES: WALKWAYS, PATIOS, PARKING AREAS AND DRIVEWAYS

Pervious materials are path, patio or driveway surfacing materials that allow runoff to pass through and SINK back into the soil. Some popular choices are paver stones, turf block and permeable asphalts and pavements. There are now pervious options for almost any application. Since the variety of options is growing rapidly, we will only discuss them generally. For specifics on installation and use, contact your local retailer or product manufacturer.

PAVER STONES/FLAG STONES

Paver stones are normally made of pre-cast brick, concrete, stone or other material and installed over a sand base. They come in various shapes and normally interlock and can form different shapes and patterns. Paver stones are designed to allow more runoff to SINK into the ground than traditional pavers. Each paver has a spacer that ensures the ideal distance between placed stones for maximum infiltration. Each piece is placed with gaps between to allow the infiltration of water. Flag stones are larger and may be placed directly on the soil. A low-growing ground cover may be planted between flag stones to allow for greater infiltration. Pavers can be used in high use area such as parking lots, patios and walkways.

MAINTENANCE:

Keep the area clear of sediment to prevent clogging. Annual sweeping with a shop vac or a hard bristle broom helps maintain permeability.

The gaps between pavers may require occasional weeding and sand or gravel replenishment. Because pervious pavers are easily lifted and reset, they are easy to repair or replace.

DO

- Use only in gravelly sand, loamy sand or other pervious native soils.
- Plant vegetation in between or around pavers.

DON'T

- Use in areas with high sediment loads that can clog porous areas.



TURF BLOCK

Turf block (concrete blocks with holes) and similar products can be filled with sand or planted. They provide soil stability for driveways and walkways. Sometimes the pores are filled with gravel or cobble. They are not ideal for everyday parking, because of irrigation and maintenance demands and, if they are planted, long term parking inhibits sunlight required for plant growth.

MAINTENANCE:

Planted turf block may require regular mowing (depending on plant choices) as well as irrigation, fertilization and weeding.

DO

- Choose low water grasses such as Enviro-turf or Eco-lawn.
- Use only in gravelly sand, loamy sand or other pervious soils.

DON'T

- Use in high traffic areas or parking areas where the sunlight will be impaired for most of the day (unless you are planting drought-tolerant grasses).
- Aerate.



PERVIOUS PAVEMENT/ASPHALT

Pervious pavements contain pore spaces that allow infiltration of runoff. The water seeps through the material to a rock base layer underneath and pollutants are naturally filtered through the underlying soil. There are different types of pervious (or porous) pavements including porous asphalt and pervious concrete. The underlying soil must be permeable (between 1.3 to 8 centimetres [0.5 to 3 inches] per hour) to be considered for pervious concrete installations. The bottom of the rock base/reservoir should be completely flat so that runoff will be able to infiltrate through the entire surface. Pervious pavement should be located a minimum of 0.6 to 1.5 metres (2 to 5 feet) above the seasonally high groundwater table and at least 30 metres (100 feet) away from drinking water wells. Ideal uses include walkways, residential parking areas, and driveways.

Although installation is becoming easier and pervious pavers are a cost-effective alternative to traditional paving, appropriate construction techniques are necessary to ensure the effective performance of pervious pavements. Hiring a licensed contractor experienced in these materials is highly recommended and may even be required in some jurisdictions.

MAINTENANCE:

Keep clear of soil, rocks, leaves, and other debris. Vacuuming annually, using a shop vac or specialized vacuum for larger areas, may be necessary to remove debris from the surface of the pavements. Other cleaning options may include power blowing and pressure washing. Always follow the manufacturer's maintenance recommendations.

DO

- Consult a professional to recommend a design customized to your site.
- Treat surrounding bare soil areas by planting or mulching.

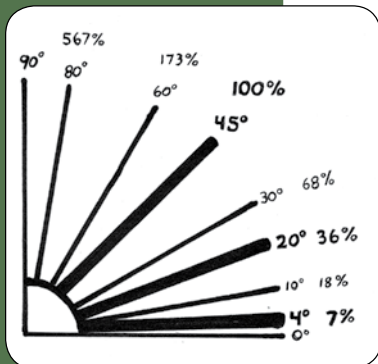
DON'T

- Use in areas where there is a possibility of sand drifts.
- Seal or repave with non-porous materials.



DID YOU KNOW?

There is much confusion when referring to the “steepness” of slope. We sometimes find a slope measured in degrees and other times as a percentage (e.g., a 20% slope). To figure out the percentage slope, you would use the rise over run formula. For instance a distance of 30.5 centimetres (one foot) horizontally with a 30.5 centimetres (one foot) rise over that distance would give you the formula 1/1 or 100% slope. The equivalent angle or degree would be a 45° angle. The chart below is an easy conversion table to calculate the equivalent % grade to degree of slope.



Ground Covers



USES: TEMPORARY AND PERMANENT SOIL COVER, LOW USE WALKWAYS, AND SLOPE PROTECTION

Using vegetation and/or wood chips, gravel or other mulches to cover bare soil is key to SLOWING down runoff and thus preserving valuable top soil, preventing sediment from being carried downstream, and reducing erosion. Mulches are a good choice for areas with LESS THAN a 33% slope. Certain types of vegetation (e.g., prostrate Junipers, Sumac, Bearberry) can be used on slopes of LESS THAN 50%, but in many cases terracing should also be used.

MULCH (ROCK, WOOD CHIPS, OR OTHER MATERIALS)

Mulching is a simple and beneficial conservation practice you can use in your yard. Mulch is simply a protective layer of material that is spread on top of the soil. Mulches can be organic -- such as grass clippings, straw, bark chips, and similar materials -- or inorganic -- such as stones, brick chips, and recycled glass. Mulching has many benefits such as protecting soil from erosion, reducing compaction from the impact of heavy rains, conserving soil moisture, maintaining an even soil temperature, and preventing weed growth. It is also useful as temporary ground cover until supplemental vegetation becomes established.

MAINTENANCE:

Organic mulch should be inspected annually. Be sure to check for fungus and other unwanted pests or diseases. Keep any organic materials at least 15 centimetres (6 inches) from building siding. Gravel or rock should be raked regularly to prevent the buildup of organic materials.



**SLOPE
GRADIENT
CONVERSION
TABLE**

DO

- Use recycled material whenever possible.
- Keep rock free of organic materials.

DON'T

- Use wood chips from diseased trees.
- Use straw mulch near stream channels.
- Use wood mulch in fire prone areas.

VEGETATION/PLANTING

Plants cover and protect the soil. Once established, plants provide excellent long-term erosion control. Their roots knit together to hold the soil in place. Their leaves, needles and twigs reduce the impact of rain, and the organic matter they add to the soil improves water infiltration. A drip irrigation system provides slow delivery of water to plants, so water infiltrates with little or no runoff.

When selecting plants for a landscape, it is important to understand the site conditions. While most property owners select plant materials for their form and color, it is essential to know their solar, soil, and moisture requirements. Plants that do well in specific microclimates on a site are termed “site appropriate.” For the purpose of improving stormwater runoff, choose plants that improve infiltration, decrease runoff, filter pollutants, and help stabilize slopes. Contact the Okanagan Xeriscape Association or a local plant nursery knowledgeable in native and drought tolerant species best suited for these functions. (see page 52 for contact information).

Native plants (plants that are indigenous, or naturalized, to the particular region you live in) are a great choice. They are beautiful, they attract and assist native wildlife (birds, insects, butterflies, etc.), many of which help keep your garden healthy, and they are adapted to the soil, climate and amount of moisture in this area. Native plants also combine well with a wide range of non-native plants with similar cultural requirements.

In choosing non-native plants, be careful not to plant any that may spread from your garden (see Appendix A for examples). Instead, select plants that have cultural requirements similar to the native species you plant. Native plant nurseries usually also stock non-native ornamental plants that work in xeriscape gardens and with native plant species.

MAINTENANCE:

Routine maintenance is needed for any plantings. The first season is most critical when plants are getting established. Even drought-tolerant plants should not be allowed to dry out completely. Drip irrigation and mulching will help prevent this and reduce watering needs greatly to approximately once every 5-7 days for about 1 hour depending on soil type.

The use of native and non-native drought-tolerant and site-appropriate plantings greatly reduces the need for fertilizer, water, and overall maintenance. Use of pesticides is not recommended as they can kill or disrupt native insects, birds, and other beneficial organisms in your garden and these chemicals are unnecessary in a well-maintained xeriscape garden.

DO

- Use Okanagan native species or drought tolerant plants that can endure periods of saturation (see Appendix A for examples).
- Keep plants located near foundations and siding well-pruned to allow adequate ventilation.
- Use a mulch of organic matter such as compost to supply a natural slow release of nutrients to the plants.

DON'T

- Plant invasive species such as those listed in the “Plants to Avoid” list in Appendix A.
- Plant highly flammable vegetation near buildings.
- Allow irrigation water to drain to your driveway, the street, or bare soils.
- Use chemical fertilizers or pesticides; they can cause water contamination.



Erosion Control Blankets (ECBs)

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USES: BARE SOIL COVER AND SLOPE PROTECTION WHILE ESTABLISHING VEGETATION

Erosion control blankets (ECBs) are a good tool to improve the success rate of new plantings and can quickly add a layer of protection to bare soils. Some of the benefits of ECBs are reducing seed and soil loss, decreasing runoff volume and speed, reducing top soil disturbance and loss, encouraging plant root development, and suppressing weeds. In this section, we discuss permanent installations of ECBs. Temporary ECBs are usually synthetic and are used to stabilise excavated slopes or piles during construction.

It's important to choose the correct ECB for the site conditions (slope, runoff velocity, and purpose). Ask your local retailer (see page 52) for help. We have included basic installation instructions, but ALWAYS follow the manufacturer's recommendations.



Permanent ECBs can be synthetic or coconut matting. They are permeable and allow shoots from vegetation to grow through from the soil beneath or are hydroseeded from above and the roots grow through the medium into the ground. For larger vegetation like bushes or trees, the ECB is cut and a hole dug to bury the root ball.

Before laying the ECB, prepare the soil surface making sure it is smooth to maximize soil-blanket contact. At the top of the slope, at least 0.6 metres (2 feet) from the crest, dig a 15 centimetre (6 inch) minimum ditch (called an anchor ditch). Line the ditch with the top of the ECB leaving enough to roll back over once the ditch is filled. Now fill the ditch back in over the ECB and wrap the extra over the top and secure with staples. Next, carefully roll the ECB vertically down the slope in the same direction as the water flows. Overlap the side edges of the contiguous blankets used by at least 10 centimetres (4 inches) and overlap the top and bottom edges of the blankets by at least 8 centimetres (3 inches). The uphill roll should overlie the downhill roll. Stake the blanket, at a minimum, horizontally every 0.6 metres (2 feet) and vertically every 1 metre (3 feet). Stake at least every 30.5 centimetres (1 foot) where an uphill and downhill blanket overlap.

If the ground is soft, staples can be used to hold the blanket down. Otherwise, 10 centimetre (4 inch) nails and a washer should be used.

MAINTENANCE:

Monitor for erosion until vegetation becomes established. Check for proper placement that could be disturbed by animals or a large storm event. Ensure that overlaps remain in place and correct as necessary.

DO

- Make sure to choose the appropriate erosion control blanket for the desired use and conditions.
- Use decomposable netting.

DON'T

- Walk on the erosion control blanket after it is in place.
- Allow gaps between the blanket and the soil.
- Let concentrated runoff flow onto the erosion control blanket from above.

Living Roofs



USES: ROOF RUNOFF

Living roofs, also known as green roofs, are intentionally vegetated roof surfaces. The layers of a contemporary green roof system, from the top down, include:

- the plants, often specially selected for particular applications,
- an engineered growing medium,
- a landscape or filter cloth to contain the roots and the growing medium, while allowing for water penetration,
- a specialized drainage layer, sometimes with built-in water reservoirs,
- the waterproofing / roofing membrane, with an integral root repellent, and
- the roof structure, with traditional insulation either above or below.

Living roofs offer several stormwater management benefits:

- They store water in their growing medium that is then absorbed by the plants and returned to the atmosphere through evapotranspiration.
- They retain 70 to 90% of the precipitation that falls on the roof in the summer; and 25-40% in the winter.
- They moderate the temperature of the rainwater and act as natural filters for any water that runs off.
- They reduce the amount of stormwater runoff and slow it down, resulting in decreased stress on sewer systems during peak flows.

Before installing a living roof, you will need to know the slope, the structural loading capacity, and existing materials of your roof, as well as the nature of any drainage systems, waterproofing, and electrical and water supply in place. You should also consider who will have access to the roof, who will do maintenance, and what kind of sun and wind exposure the roof gets. Plant selection depends on climate, type and depth of growing material, loading capacity, height and slope of the roof, maintenance expectations, and the presence or absence of an irrigation system. The cost of a green roof varies considerably depending on how it is built. It is necessary to seek expert advice from relevant professionals such as structural engineers, landscape architects, green roof manufacturers, and roofing contractors and suppliers when planning and designing a green roof.

MAINTENANCE:

The amount of care required by a living roof depends on the roof's exposure, the types of plants, the growing medium and the weather in your area. Most green roofs will require some irrigation to get established. This is especially important when the weather is hot and dry since the plants may not be acclimated to the higher stresses associated with roof living. Other maintenance activities include inspecting for damage, roots penetrating the membrane, blown-in debris, weed growth, dead and dying plants, disease and pests, fertilizing needs and uncontrolled over-growth. Some plants may have to be replaced especially during the establishment phase.

For more information on living roofs, please see the resources listed on page 52.



DO

- Carefully select your growing medium and plants to suit your climate, growing material, loading capacity, etc.
- Check with your local government to see what permit(s) you require before you begin construction.

DON'T

- Construct a green roof without seeking advice from professionals such as structural engineers, landscape architects, green roof manufacturers, and roofing contractors and suppliers.

Cross Drains

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USES: DRIVEWAYS, PRIVATE ROADS

Cross drains are used to SLOW water down by breaking up the impervious surface area into smaller sections. Smaller sections help divert the water to a point where it can SINK into the ground to help combat the effects of driveway and road runoff. The techniques described here can be installed on existing driveways and roads, both paved and unpaved. If you are constructing or reconstructing a road, other techniques such as outsloping can be used but are beyond the scope of this guide.

WATERBARS

A waterbar is essentially a speed bump that is used for slowing down and/or redirecting runoff. They are used to break up runoff into small units so that it does not have enough energy to erode soils. They also divert water away from streets and allow it to infiltrate. On unpaved roads, an earthen waterbar, also known as a water break, consists of a shallow trench with a parallel berm or ridge on the downslope side which is angled down across the road. They can be constructed by hand, with a backhoe, or with a blade-equipped tractor. Optimal size of an earthen waterbar is 30.5 centimetres (1 foot) above the road surface and 15 centimetres (6 inches) below the road surface. Asphalt or cement waterbars can be smaller in size (15 centimetres or 6 inches) and thereby provide greater ease of access. Waterbars should be

installed at a 30 to 45 degree angle and, in most cases, the outlet of waterbars should be protected with rock dissipaters (see page 25).

DO

- Install energy dissipaters at all outlets (see page 25).
- Install at 30 to 45 degree angles.

DON'T

- Direct runoff to erodible surfaces.
- Outlet water onto steep slopes.
- Direct water to a neighbour's property.

MAINTENANCE:

Keep the outlets clear of debris and sediment so water drains freely. Inspect annually and make necessary repairs to earthen berms that break down over time and ensure there is no erosion.



SLOTTED CHANNEL DRAIN

A slotted drain installed across the width of your driveway is another option to handle surface runoff. It consists of a metal-grated pipe-like structure that transports water to a safe location. Decorative varieties are available. Slotted channel drains are installed flush with the driveway surface, making them more appealing for aesthetic reasons. The drain should be sloped no less than 1.3 centimetres per 30.5 centimetres (½ inch per foot) of length to prevent clogging from sediment and debris. It should also be angled at 30 to 45 degrees.

Although slotted channel drains may be installed on any driveway, they are recommended for driveways with slopes greater than five percent.

DO

- Ensure the drain is large enough so that the majority of water enters the drain and doesn't flow over.
- Install energy dissipaters at all outlets.
- Install at 30 to 45 degree angles.

DON'T

- Install channel drains in areas with large amounts of leaf debris.
- Outlet water onto steep slopes.
- Direct water to a neighbour's property.

MAINTENANCE:

Ensure that the grate is open before and during storm events (not covered by leaf litter). Check that the outlet is protected, non-eroding, and clear of debris and sediment so water drains freely.

Retaining Walls and Terracing

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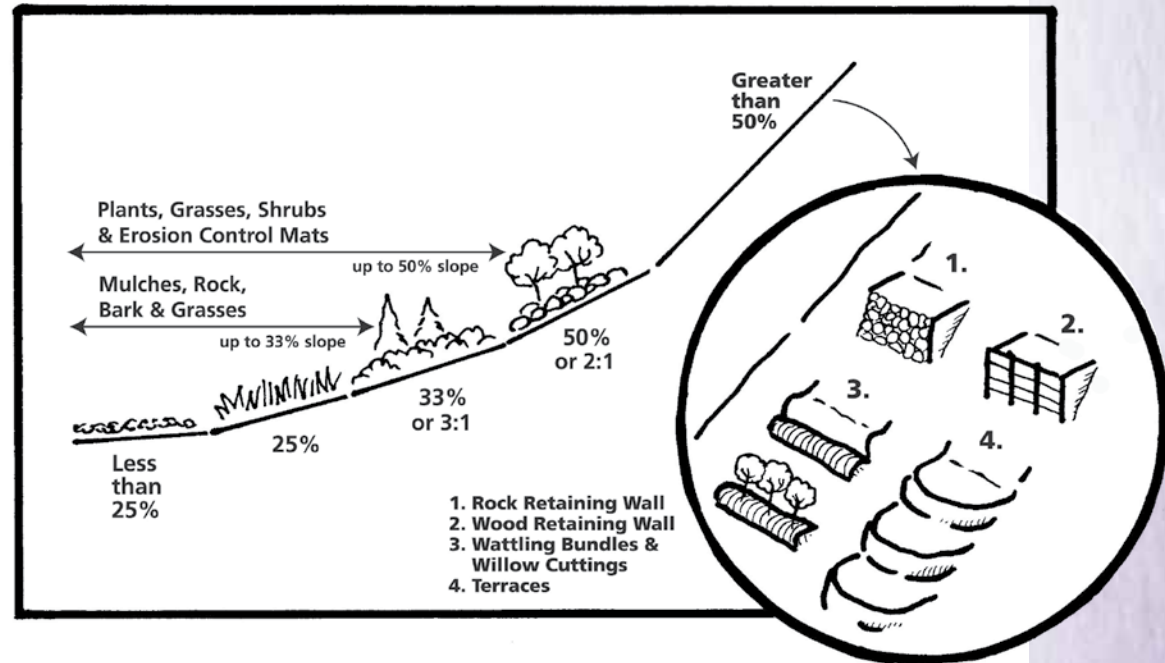
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USES: SLOPED AREAS

Protecting steep slopes is very serious. Improperly installed systems can pose a serious threat to life and property. We recommend that ALL retaining wall and terraced areas be designed and installed by a qualified professional.

Retaining walls and terraces are used to reduce the gradient or slope and provide level or gently sloping areas for establishing vegetation. Retaining walls and terrace walls are constructed with boulders, treated timber, bricks and/or interlocking concrete blocks. Walls over 4 feet high and overall slopes steeper than 1.5:1 must be designed by an engineer. There are MANY different types of retaining walls, each with a different purpose, so always check with a qualified professional before embarking on any wall project for soil retention. A building permit and engineering expertise are required to build many retaining walls. Always check with your local planning department to determine if a permit is necessary for your project. Contact information can be found on page 51.



RETAINING WALLS

We discuss two types of retaining walls in this guide: rock and wood.

Rock retaining walls are often used next to a roadway or drainage way. They are freestanding walls built from rock 25 centimetres (10 inches) to 0.6 metres (2 feet) in diameter. A footing trench is dug along the toe of the slope, and the largest boulders are placed in the trench. Subsequent rocks are laid with at least three bearing points on previously laid rocks. The external face of the wall should incline slightly uphill, though the wall itself is freestanding and does not lean. As the wall is built, fill material is placed around and behind the rocks and packed in. Since the finished slope behind the wall will be flatter than before treatment, possibly a level terrace, it should be easier to establish all-important perennial plants on and above the wall.



Wood retaining walls can be used on slopes steeper than 50 percent and are often located between the base of a slope and an adjacent road, driveway or drainage way. Lumber and posts should be treated with an approved wood preservative (not creosote). Ensure proper drainage methods behind the wall are used. As always, vegetation should be established on the slope above and below the wall.

WILLOW CUTTINGS

Willow cuttings are used under very specific site conditions and are normally recommended only through the guidance of a qualified professional.

TERRACES

Many materials are available for building terraces. Treated wood (do not use creosote-treated) is easy to work with, blends well with plants, and is often less expensive than other materials. Interlocking concrete blocks are made specifically for walls and terraces and are more easily installed by a homeowner than other materials, such as fieldstone and brick. The steepness of the slope dictates wall height. Make the terraces in your yard high enough so the land between them is close to level. This soil surface should be carefully revegetated. Be sure the terrace material is strong and anchored well to stay in place through cycles of freezing, thawing, and heavy rainstorms. Large terraces should be tied back into the slope and properly drained. This takes expertise and equipment, so you may want to restrict the terraces you build to 30.5 to 61 centimetres (1 to 2 feet) in height. Get help from a professional to make sure higher walls stand up to the forces of gravity and water pressure in the soil.



MAINTENANCE:

Always check retaining walls to make sure they are not leaning or failing. Ensure there is adequate drainage behind walls and the drains remain functional. Be sure to plant only low water vegetation and use drip irrigation behind retaining walls.

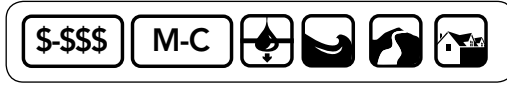
DO

- Provide adequate drainage behind retaining walls.
- Use a qualified professional to design your wall.

DON'T

- Install without checking on permit requirements.
- Use creosote-treated wood.

Check Dams



USES: IN ROCK-LINED DRAINAGE CHANNELS, VEGETATED DITCHES AND SWALES, LOW TO MODERATE SLOPED AREAS

A check dam is a small structure constructed of rock, gravel bags, logs or sandbags generally used in vegetated swales, constructed channels or drainage ditches to lower the speed of stormwater flows. They reduce flow velocity by temporarily ponding water and decreasing the effective slope. Stormwater enters a swale or rock-lined channel and is ponded behind the check dam, which allows sediment and other pollutants to settle out. Check dams can help to SLOW and SINK stormwater by reducing peak flows and runoff timing. In certain situations, they provide other benefits such as erosion control and partial removal of other pollutants in addition to sediment. They are relatively inexpensive and easy to install depending on the site conditions.

Multiple check dams are often used in succession to further reduce velocity and increase effectiveness. They can also be useful for establishing vegetation and preventing erosion in newly constructed swales. It is important to note that check dams must not be used in creeks, streams, or any other type of natural watercourse or wetland. Consult with a professional (see page 52) during the planning stages to ensure proper design and the suitability of your site.

GENERAL INFORMATION: Proper site selection, maintenance and installation of a check dam is crucial. Size of the drainage area, construction materials, spacing, and water quality are some of the important issues that must be addressed prior to installation. Check dams should only be used in small open channels in areas that drain less than 4 hectares (10 acres). They must not be installed or substantially alter flows in a natural watercourse. When installing check dams in drainage channels or swales with established vegetation, it is important to prevent erosion if vegetated areas are disturbed during installation. Conversely, small check dams are particularly useful when installed at the same time as a vegetated swale, to help establish vegetation. They are carefully removed once the vegetation is established. They may also be useful in rock-lined drainage channels for slowing water down to manage peak flows. Erosion control blankets are typically installed under and around a check dam to prevent erosion. A professional can assist you with site analysis, design, possible permitting requirements and installation.

DESIGN: The size and structure of a check dam will depend on the site but should be no greater than 61 centimetres (two feet) in height and extend across the entire water conveyance channel. The centre of the check dam must be at least 15 centimetres (6 inches) lower than the outer edges. Grass linings in channels may be killed if water stays high or sediment load is excessive.

MAINTENANCE:

Be prepared for regular maintenance and repairs for the life of the check dam. Check dams should be inspected after rainfall events, and repairs made immediately. Accumulated sediment and debris must also be removed when it reaches one half the original height of the structure. If this material is left in place, it can become re-suspended and released in a subsequent storm event – sometimes known as “fill and spill.” Erosion around the edges of a check dam is a serious potential problem and must be avoided.

DO

- Consult a professional before considering installation.
- Plan on regular maintenance for the life of the check dam.
- Consider other options when channel stabilization is the primary objective.

DON'T

- Install in drainage areas with excessive erosion or sediment input.
- Use a check dam in a natural watercourse or wetland or alter flows in natural drainages and watercourses.

CHAPTER 4

LOCAL PROJECTS



DRIP-LINE PROTECTION - HARDSCAPE

LOCATION: Private Residence, Penticton, BC

DESCRIPTION:

Small block pavers and interlocking pavers were used along the drip lines of this house to allow water to soak into the ground rather than running off, as would happen with a concrete or other uniform hard surface.

PHOTOS: Eva Durance



DRIP-LINE PROTECTION - VEGETATION

LOCATION: Private Residence, Penticton, BC

DESCRIPTION:

Plants were used along this drip line to slowly sink and absorb water from the roof. For plants along a drip line, choose ones with sturdy leaves and stems that will not be damaged by water dripping on them and with fibrous roots to absorb water. In this garden, grasses, iris, and the native Bearberry/Kinnikinnick have these characteristics and the chopped wood mulch increases the absorbing capabilities.

PHOTO: Eva Durance

RAIN COLLECTION SYSTEM

LOCATION: Xerendipity Garden, Vernon, BC

DESIGNED AND INSTALLED BY: Element Eco-Design

DESCRIPTION:

This system uses two used wine tanks from a local vineyard that hold 1,000 litres each. A gravel rainwater harvesting trench next to the fence takes the overflow from the cubes to water the lower flower beds.

PHOTO: Gordon Hiebert



RAIN BARREL SYSTEM

LOCATION: Private Residence, Vernon, BC

DESCRIPTION:

This four barrel manifold system was installed at a private residence in Vernon. The downspout was re-routed to allow access to the gate below and drain water in the barrel system. The system has a tap and an overflow, which is routed to fruit trees downslope.

PHOTOS: Gordon Hiebert





RAIN GARDEN

LOCATION: Vernon, BC

DESIGNED AND INSTALLED BY: Dusty Shovel Gardens and David and Gale Woodhouse

DESCRIPTION:

A buried system of perforated PVC pipe directs water from the roof of the nearby house into the garden. The 275 square foot garden is comprised of a variety of specially selected perennials, including native species, which have been planted in a 60:20:20 sand:soil:compost mix.

PHOTOS: Buffy Baumbrough



BIOSWALE

LOCATION: Peachland, BC

DESCRIPTION:

This bioswale was recently constructed as part of the Centennial Way, a 1.2 kilometre walkway along a scenic stretch of Okanagan Lake in Peachland. The swale is 1.5 to 2 metres wide and consists of native low water use plants. It borders the walkway to protect the lake from road runoff and offers the added benefit of a pleasant, aesthetically pleasing, and safe border from the road.

PHOTOS: Corinne Jackson

SWALE

LOCATION: Sawdon Residence, Vernon, BC
DESIGNED AND INSTALLED BY: Element Eco-Design

DESCRIPTION:

This swale has been installed on contour to collect the water from downspouts and neighbouring properties and disperse it through the landscape.

PHOTOS: Gordon Hiebert



SWALE

LOCATION: Grasslands Nursery, Summerland, BC
DESIGNED AND INSTALLED BY: Element Eco-Design

DESCRIPTION:

A multi-tiered swale system that collects runoff from the road and distributes it through a food forest. Vegetation is planted downslope of the swale / contour ditch to provide water storage and irrigation. Each swale has an overflow that allows excess water to pass to the next swale or disperse on the landscape.

PHOTO: Gordon Hiebert





DRY STREAM BED (ROCK-LINED SWALE)

LOCATION: Naramata Centre, Naramata, BC

DESCRIPTION:

Dry stream bed redirects runoff and prevents soil erosion.

PHOTO: Gwen Steele



EROSION CONTROL BLANKETS

LOCATION: Blondeaux Crescent, Kelowna, BC

DESIGNED AND INSTALLED BY: Mike Kamann, ILR Nursery

DESCRIPTION:

Use of erosion control products during the restoration of a section of riparian zone of Brandt's Creek in a residential area.

PHOTOS: Gwen Steele



TERRACING

LOCATION: Private Residence, Penticton, BC

DESCRIPTION:

Large boulders have been used to create terracing to stabilize a slope on this property.

PHOTO: Eva Durance

LIVING ROOF

LOCATION: Rustico Winery, Oliver, BC

DESCRIPTION:

This unique roof was constructed in 1964 by John Tokias. He cut sod strips from the adjacent mountainside and created a complete sod-roof covering for the building. On the roof, he placed numerous wild animal bones, antlers and skulls. Not only was this his unique creative expression but they served to help the sod pieces to knit together to form a very practical roofing solution. The roof attracted a wide variety of birdlife, some species rare to the area. Today, the sod roof also displays a number of cacti and flowering desert plants and its insulation abilities allow the log structure to remain cool in the heat of the desert summer and with a minimal amount of heat generated from recycled wood pellets, comfortable in the freezing temperatures of winter. The official scientific name for this unique roof is cryptobiotic crust. Note: This construction technique would not be used today.

PHOTOS: Bruce Fuller



LIVING ROOF

LOCATION: Private Residence, Vernon, BC

DESCRIPTION:

In 2005, Bill Darnell and his wife began constructing a new house with a green roof. First, they had the trusses for the 1,000 square foot roof designed to carry the extra load, in this case 50 pounds per square foot. Next, they applied a "torch on" roof membrane with a top cap so that they had a continuous waterproof roof. Then, they laid down a heavy landscape cloth to stop roots from getting into the roof with a plastic mesh attached to allow water to drain. Finally, they put on the growing medium. They used "crusher chip" because it is nutrient poor and unwanted plants wouldn't be able to take root on the roof. They planted several varieties of sedums and semper vivums from Dusty Shovel, a local nursery - approximately 2,000 plants in all. Most have survived the harsh climate on the south facing roof. Maintenance includes watering the plants once a week in the summer and applying Okanagan Gold fertilizer as needed.

PHOTOS: Bill Darnell





PERMEABLE PATIO

LOCATION: Private residence, Kelowna, BC

DESCRIPTION:

Sand between paver stones allows rain water to drain through.

PHOTO: Gwen Steele



PERVIOUS PAVING TREATMENT

LOCATION: A lane off 15th Street, Vernon, BC

DESCRIPTION:

Two paved driving strips with a gravel matrix between them.

PHOTO: Jennifer Miles



GROUND COVER - WOOD AND GRAVEL MULCHES

LOCATION: Private Residence, Penticton, BC

DESCRIPTION:

Mulches are critical parts of both rain gardens and xeriscape gardens as they absorb AND retain water/moisture. Chopped wood of various sizes (often called bark mulch) and other organic materials work best at both of these functions; however, inorganic materials such as gravel or rock mulches are also attractive and useful in preventing runoff. Organic and inorganic mulches are combined in the garden shown in this picture.

PHOTO: Eva Durance

GROUND COVER - VEGETATION

LOCATION: Private residence, Kelowna, BC

DESCRIPTION:

Plants can provide an excellent rainwater absorbing surface in gardens, effectively acting as a living mulch. This easy care, low water garden has prostrate Juniper and Cotoneaster species as a ground cover. Creeping Thyme species are low water ground covers that can stand up to some foot traffic.

PHOTO: Gwen Steele



RETAINING WALL

LOCATION: Private residence in Toovey Heights, Kelowna, BC

DESCRIPTION:

Using Allen block walls and wood framed gravel stairs, a water-wise garden was created on a very steep hillside.

PHOTO: Gwen Steele





RAIN BARRELS, WETLAND, SWALES, MULCH

LOCATION: Summerhill Pyramid Winery, Kelowna, BC

DESCRIPTION:

Summerhill Pyramid Winery uses several biodynamic and permaculture features at its farm. Rain barrels are used to collect water for compost tea and for large scale biodynamic foliar sprays. A natural Okanagan wetland flood plain is located on the property and purifies the runoff before it enters the lake. Swales are used to capture water in the event of torrential rain or snow and passively irrigate the field by spreading the water underground. The farm also uses mulches, drip irrigation, and companion planting to reduce water use and evaporation.

PHOTOS: Gabe Cipes



RIPARIAN RESTORATION

LOCATION: Creekside Park, Coldstream, BC

DESCRIPTION:

This riparian restoration project, funded by Environment Canada, the District of Coldstream and EBA, A Tetra Tech Company, involved planting over 300 trees and shrubs along Coldstream Creek. Eleven residences located along the creek participated in the project. The project included a riparian planting hands-on demonstration and presentations that discussed permits required for development in riparian areas.

PHOTOS: Trina Koch



RESOURCES GUIDE

NON-PROFIT ORGANIZATIONS

Native Plant Society of British Columbia
www.npsbc.org/nativeplants.html

Invasive Plant Council of BC
#140-197 North Second Avenue
Williams Lake, BC V2G 1Z5
250-392-1400
info@invasiveplantcouncilbc.ca
www.invasiveplantcouncilbc.ca

Okanagan Xeriscape Association
info@okanaganxeriscape.org
www.okanaganxeriscape.org

Partnership for Water Sustainability in BC
<http://watersustainabilitybc.blogspot.com>

MUNICIPALITIES, REGIONAL DISTRICTS, INDIAN BANDS & WATER UTILITIES

Armstrong, City of
3570 Bridge Street, PO Box 40
Armstrong, BC V0E 1B0
250-546-3023
www.cityoffarmstrong.bc.ca

Black Mountain Irrigation District
285 Gray Road
Kelowna, BC V1X 1W8
250-765-5169
www.bmid.ca

Glenmore Ellison Improvement District
445 Glenmore Road
Kelowna, BC V1V 1Z6
250-763-6506
www.glenmoreellison.com

Kaleden Irrigation District
119 Ponderosa Road, Box 107
Kaleden, BC V0H 1K0
250-497-5407
www.kaledenirrigation.com

Kelowna, City of
1435 Water Street
Kelowna, BC V1Y 1J4
250-469-8500
www.kelowna.ca

Lake Country, District of
10150 Bottom Lake Road
Lake Country, BC V4V 2M1
250-766-5650
www.lakecountry.bc.ca

Okanagan Falls Irrigation District
1109 Willow Street
Okanagan Falls, BC V0H 1R0
250-497-8541

Okanagan Indian Band
12420 Westside Road
Vernon, BC V1H 2A4
250-542-4328
www.okib.ca

Okanagan Nation Alliance
#106-3500 Carrington Road
West Kelowna, BC V4T 3C1
250-707-0095
www.syilx.org

Oliver, Town of
35016 - 97th Street, PO Box 638
Oliver, BC V0H 1T0
250-485-6200
www.oliver.ca

Osoyoos, Town of
8707 Main Street, PO Box 3010
Osoyoos, BC V0H 1V0
250-495-6515
www.osoyoos.ca

Osoyoos Indian Band
105 Harmony Cres, RR#3, S-25, C-1
Osoyoos, BC V0H 1T0
250-498-3444
www.oib.ca

Osoyoos Irrigation District
45th Street
Osoyoos, BC
250-495-2365

Peachland, District of
5806 Beach Avenue
Peachland, BC V0H 1X7
250-767-2647
www.peachland.ca

Penticton, City of
171 main Street
Penticton, BC V2A 5A9
250-490-2400
www.penticton.ca

Penticton Indian Band
200 Westhill Drive, RR#2, S-80, C-19
Penticton, BC V2A 6J7
250-493-0048
<http://web.pib.ca>

Regional District of Central Okanagan
1450 KLO Road
Kelowna, BC V1W 3Z4
250-763-4918
www.regionaldistrict.com

Regional District of North Okanagan
9848 Aberdeen Road
Coldstream, BC V1B 2K9
250-550-3700
www.rdno.ca

Regional District of Okanagan-Similkameen
101 Martin Street
Penticton, BC V2A 5J9
250-492-0237
www.rdos.bc.ca

Rutland Waterworks
106-200 Dougall Road N.
Kelowna, BC V1X 3K5
250-765-5218
www.rutlandwaterworks.com

South East Kelowna Irrigation District
PO Box 28064, RPO
East Kelowna, BC V1W 4A6
250-717-8871
www.sekid.ca

Spallumcheen, Township of
4144 Spallumcheen Way
Spallumcheen, BC V0E 1B6
250-546-3013
www.spallumcheentwp.bc.ca

Summerland, District of
13211 Henry Avenue, Box 159
Summerland, BC V0H 1Z0
250-494-6451
www.summerland.ca

Vernon, City of
3400 30th Street
Vernon, BC V1T 5E6
Phone: 250-545-1361
Fax: 250-545-7876

West Kelowna, District of
2760 Cameron Road
West Kelowna, BC V1Z 2T6
778-797-1000
www.districtofwestkelowna.ca

Westbank First Nation
301-515 Hwy 97 South
Kelowna, BC V1Z 3J2
250-769-4999
www.wfn.ca

PROFESSIONAL ASSOCIATIONS

Association of Professional Biology
www.apbbc.bc.ca

Association of Professional Engineers and Geoscientists of BC
www.apegbc.ca
Irrigation Industry Association of BC
www.irrigationbc.com

BC Water & Waste Association
www.bcwwa.org

BC Landscape & Nursery Association
604-574-7772
www.bclna.com

REGULATORY AGENCIES

Fisheries and Oceans Canada
200 Kent Street
13th Floor, Station 13E228
Ottawa, Ontario K1A 0E6
1-800-465-7735

Interior Health
2220-1815 Kirschner Road
Kelowna, BC V1Y 4N7
250-862-4200
www.interiorhealth.ca

RESOURCES GUIDE (CONT.)

Ministry of Environment
PO BOX 9339 STN PROV GOVT
Victoria, BC V8W 9M1
250-387-1161
www.envmail@gov.bc.ca

Ministry of Forest, Land and Natural Resources
PO BOX 9049 STN PROV GOVT
Victoria, BC V8W 9E2
250-387-4809

CONTRACTORS/DESIGN CONSULTANTS

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dustyshovel@gmail.com

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Element Eco-Design
250-938-5148
info@elementecodesign.com
www.elementecodesign.com

Mike Kamann
ILR Nursery
250-863-2223
info@ilrnursery.com

TRL Landscapes
250-859-4493

Lisa Masini
Waterwise Landscape Design
250-862-1931
lisa@waterwisedesign.ca
www.waterwisedesign.ca/index.html

EQUIPMENT, PLANT & SEED SUPPLIERS

BARR Plastics
(rainwater harvesting equipment)
1-800-665-4499
http://barrplastics.com

Bluestem Nursery
(mail-order nursery)
16 Kingsley Road
Christina Lake, BC
250-447-6363
www.bluestem.ca

Clement Turf Farms
3330 Old Vernon Road
Kelowna BC, V1X 6P3
250-765-9429
1-866-923-8873 (TURF)
www.clementturf.com/index.html

Dogwood Nursery
3417A Paynter Road
West Kelowna, BC
250-768-3355
www.dogwoodnursery.com

iDUS Controls Ltd.
(products for home water conservation)
2215 McGarrille Road
Nanaimo, BC
250-758-9995
www.iduscontrols.com

Gardens North
(seedhouse)
PO Box 370
Annapolis Royal, NS
seed@gardensnorth.com
http://gardensnorth.com

Grasslands Nursery
3615 Gartrell Road
Summerland, BC
250-494-4617
info@grasslandsnursery.com
www.grasslandsnursery.com

I.L.R. Nursery
9071 Shanks Road
Lake Country, BC
250-863-2223
info@ilrnursery.com
http://ilrnursery.com

Sagebrush Nursery
38084 Island Road
Oliver, BC
250-498-8898
orion@sagebrushnursery.com
www.sagebrushnursery.com

RECOMMENDED BOOKS

XERISCAPE, NATURESCAPE & RELATED REFERENCE BOOKS

Atlas of South Okanagan and Similkameen (available from the Penticton Library - no longer available to buy)

Beth Chatto's Gravel Garden
Drought Resistant Planting Through the Year
By Beth Chatto

Building Within Nature
By Andy and Sally Wasowski

Creating the Prairie Xeriscape
By Sara Williams

Cultivating the Wild - Gardening with Native Plants of British Columbia's Southern Interior and Eastern Washington
By Eva Durance

How to Get Your Lawn off Grass
By Carole Rubin

Landscaping for Wildlife in the Pacific Northwest
By Russell Link

Naturescape British Columbia, Caring for Wildlife Habitat at Home (Southern Interior edition)
call 1-800-387-9835 to order program and books

Plants of Southern Interior British Columbia and the Inland Northwest
by Parish, Coupe, and Lloyd

Taylor's Guide to Water Saving Gardening
By Houghton Mifflin Co.

The Landscaping Revolution
By Andy and Sally Wasowski

The Xeriscape Flower Gardener, a Water-wise Guide for the Rocky Mountain Region
Jim Knopf

Trees, Shrubs & Flowers to Know in British Columbia and Washington
By Lyons and Merilees

Xeriscape Design Concepts for Large Lots: Solutions to the Challenges of Landscaping on the West Bench.
By Boot and Parchomchuck
Available at <http://westbenchirrigation.org/manual.pdf>

Xeriscape Handbook: a how-to guide to natural, resource-wise gardening
By Gayle Weinstein

Xeriscape Plant Guide
By Denver Water

RAINWATER HARVESTING AND REUSE

Rainwater Harvesting for Drylands & Beyond Volume 1 and 2
By Brad Lancaster
www.harvestingrainwater.com

Create an Oasis with Greywater
By Art Ludwig
www.oasisdesign.net

PERMACULTURE

Gaia's Garden
By Toby Hemenway

Permaculture: A Designer's Manual
By Bill Mollison and Reny Mia Slay

GREEN ROOFS

Design Guidelines for Green Roof
by Steven Peck and Monica Kuhn
www.cmhc.ca/en/inpr/bude/himu/coedar/loader.cfm?url=/commonspot/security/getfile.cfm&PageID=70146

Green Roof Plants: A Resource and Planting Guide
By Edmund Snodgrass

Planting Green Roofs and Living Walls
by Nigel Dunnett

WATERFRONT LIVING

On the Living Edge: Your Handbook for Waterfront Living
By Kipp and Callaway

RECOMMENDED WEBSITES

www.greenroofs.com
<http://commons.bcit.ca/greenroof.com>
www.greenroofplants.com
www.waterbucket.ca

FOOTNOTES: 1. FISRWG (1998). Stream Corridor Restoration: Principles, Processes, and Practices. By the Federal Interagency Stream Restoration Working Group (FISRWG)(15 Federal agencies of the US gov't). GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN 3/PT.653. ISBN-0-934213-59-3. Also available online at: http://www.usda.gov/stream_restoration/

GLOSSARY

Biodynamic agriculture: a method of organic farming that treats farms as unified and individual organisms, emphasizing balancing the holistic development and interrelationship of the soil, plants and animals as a self-nourishing system without external inputs insofar as this is possible given the loss of nutrients due to the export of food.

Bioswale: engineered material (usually a designed soil mix consisting of sand, loam soil and hardwood mulch) that is sunken in at the edge of a property or driveway to improve water quality, reduce runoff volume, and control peak runoff rates.

Boomerang: similar to a swale, small semi-circle water harvesting mound and ditch system dispersed throughout a slope so the over-flow from one boomerang flows into two other boomerangs.

Check dam: a small structure constructed of rock, gravel bags, logs or sandbags generally used in vegetated swales, constructed channels or drainage ditches to lower the speed of stormwater flows by temporarily ponding water and decreasing the effective slope.

Cistern: manufactured water storage container for non-potable use in residential, commercial, or industrial applications. Can be installed both above and below ground.
Contaminant: biological, chemical, physical, or radiological substance (normally absent in the environment) which, in sufficient concentration, can adversely affect living organisms through air, water, soil, and/or food.

Downspout diverter: a device that fits on a downspout to direct water away from foundation.

Drip line: the area below the eaves of a house and underneath decks, outdoor stairs, and other elevated structures where runoff drips to the ground.

Dry creek bed (diversion drain): a swale that uses rock instead of vegetation to safely infiltrate and convey runoff away from a structure or to a retention area.

Energy dissipator: rocks, concrete, brick or other non-erosive product placed at outlets of downspouts to slow runoff by reducing the initial impact of concentrated, high velocity runoff.

Erosion: a natural process by which material is loosened from the earth's surface at one location and moved to another. Water, wind, ice, and waves are the agents of erosion that wear away at the surface of the earth. Human land use can have an effect on erosion, especially industrial agriculture, deforestation and urban sprawl.

Erosion control blanket: permeable synthetic or coconut matting that is used to protect bare soils while vegetation grows.

Eutrophication: excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life.

Evapotranspiration: evaporation of surface and groundwater plus water loss from plants.

Groundwater: water located beneath the ground surface in soil pore spaces and in the fractures of rock formations.

Hardpan: a general term for a dense layer of soil, usually found below the uppermost topsoil layer.

Impervious surfaces: hard surfaces that do not allow water to pass through, including roofs, streets and parking areas.

Infiltration: the process by which water on the ground surface enters the soil.

Infiltration structure: typically underground storage chambers designed to collect stormwater and allow it to infiltrate into the surrounding soil for groundwater recharge.

Leach field: typically an arrangement of trenches containing perforated pipes and porous material covered by a layer of soil that is used to remove contaminants and impurities from the liquid that emerges from the septic tank. Also called septic drain fields or leach drains.

Living roof: an intentionally vegetated roof surface that typically consists of the roof structure, a waterproofing/roofing membrane, specialized drainage layer, landscape or filter cloth, growing medium and plants. Also known as a "green roof".

Mulch: a protective layer of material that is spread on top of the soil. Can be organic, such as grass clippings, straw, and bark chips, or inorganic, such as stones, brick chips, and recycled glass.

Native plant: plant that occurs naturally in a particular region, ecosystem or habitat.

Non-potable water: water that is not of drinking water quality, but which may still be used for many other purposes, depending on its quality.

Percolation rate: the rate, usually expressed as a velocity, at which water moves through saturated granular material. A soil with a greater percolation rate can usually absorb more water.

Permaculture: a design-science that aims to create sustainable human habitations that provide food, shelter, energy and economic stability for its occupants. Permaculture principles apply a "systems based" approach to incorporate seemingly unrelated functions into a closely integrated system that focuses on the efficient use of resources, energy capture, water and waste management. Simply put, Permaculture looks at all existing elements that are in a home system and links them together to get the most efficiency/effectiveness out of them.

Pervious material: materials such as paver stones, turf block and permeable asphalts and pavements that allow runoff to pass through and sink back into the soil.

Pollutant: a waste material that pollutes air, water or soil, and is the cause of pollution.

Potable water: water that is pure enough to be consumed or used with low risk of immediate or long term harm.

Rain barrel: small-to-medium sized containers placed outside buildings and connected to roof downspouts to collect runoff for later use in non-potable applications.

Rain garden: specialized landscape design that captures rainwater runoff from roofs, driveways, or other impervious surfaces and allows water to sink back into the ground.

Retaining wall: boulders, treated timber, bricks, and/or interlocking concrete blocks used to reduce the gradient or slope and provide level or gently sloping areas for establishing vegetation.

Riparian area: the areas, or zones, bordering on streams, lakes, and wetlands that link water to land.

Runoff: the water flow that occurs when soil is infiltrated to full capacity or the surface is impervious and excess water from rain, meltwater, or other sources flows over the land.

Slotted channel drain: metal-grated pipe-like structure that transport water from a driveway to a safe location.

Splash guards: simple devices that reduce the initial force of water at an outlet of a downspout allowing it to spread out and sink back into the soil.

Swale: an uncompacted water harvesting ditch on contour that works to disperse runoff water along the landscape.
Water footprint: the total volume of freshwater used to produce the goods and services consumed by the individual or community or produced by the business.

Waterbar: essentially a speed bump that is used for slowing down and/or redirecting runoff.

Watershed: an area where all surface water drains into the same body of water (river, lake, or ocean).

Xeriscaping: landscaping and gardening in ways that reduce or eliminate the need for supplemental water from irrigation.

APPENDIX A PLANT LISTS

NATIVE PLANTS SUITABLE FOR OKANAGAN GARDENS

Symbols used to describe trees, shrubs and vines:

showy flowers or foliage – sf

fruit, berries, seeds - fru

fragrant – fr

fall and/or winter interest (colour, textures, shape) – w

erosion control capabilities – ec

Symbols for herbaceous plants, flower colour:

yellow – y, orange – or, blue – bl, purple – pu, red – r, pink – p, rose –ro, white –

wh, bronze – br, greenish - gr

TREES, SHRUBS AND SUB-SHRUBS

Pinus ponderosa (Ponderosa pine) – fru, w

Juniperus scopulorum (Rocky Mountain juniper) – fr, fru w, ec

Acer glabrum (Douglas maple) - w

Amelanchier alnifolia (Saskatoon berry) – sf, fru

Artemisia tridentata (Big sage) – fr, w, ec

Purshia tridentata (Antelope-brush) - fr, sf, w, ec

Chrysothamnus nauseosus (Rabbitbrush) – sf, w, ec

Ribes cereum (wax currant) – fru

Philadelphus lewisii (mockorange) – sf, fr

Rhus glabrum (smooth sumac) – sf, fru, w, ec

Juniperus communis (common juniper) – fr, fru, w, ec

Mahonia aquifolium (Oregon grape) – sf, fr, fru, w, ec

Eriogonum heracleoides (parsnip-flowered buckwheat) - sf

Penstemon fruticosus (shrubby penstemon) – sf, w

Salix scouleriana. (Scouler's willow: most drought tolerant sp.) – ec, fru

Cornus stolonifera (red-osier dogwood) – fru, w: for shady areas

Symphoricarpos albus (common snowberry) – fru, w

Holodiscus discolor (ocean spray) – sf, w

Rosa woodsii (Wood's rose) – sf, fr, fru, w

Sambucus caerulea (blue elderberry) – fru, sf

Crataegus columbianum (Columbian hawthorn) – sf, fru

Arctostaphylos uva-ursi (kinnikinnick/bearberry) – fru, w

GRASSES

Pseudoregneria spicata (bluebunch wheatgrass) – sf, w

Festuca idahoensis (Idaho fescue) – sf, w

Koeleria macrantha (junegrass) - w

Aristida longiseta (red three-awn) – sf, w

Sporobolus cryptandrus (sand dropseed) - ec

Elymus cinereus (giant wildrye) – sf, w

HERBACEOUS PLANTS

Achillea millefolium (common yarrow) – wh

Gaillardia aristata (blanket flower/brown-eyed Susan) - y

Ipomopsis aggregata (scarlet gilia)- r

Balsamorhiza sagittata (arrowleaf balsamroot/Okanagan sunflower) - y

Lewisia rediviva (bitterroot/rock rose) - p

Artemisia frigida (pasture sage) - gr

Artemisia ludoviciana (western wormwood) - gr

Antennaria dimorpha (sagebrush pussytoes) - wh

Aster ericoides ssp. *Pansus* (white tufted prairie aster) – wh

Linum perenne (blue flax) - bl

Erigeron sp. (fleabane) – wh, p, pu, y

Heuchera cylindrical (roundleaf alumroot) – y (cream)

Allium cernuum (nodding onion) - p

Arenaria capillaris (threadleaf sandwort) – wh

Penstemon confertus (yellow penstemon) y (cream)

Penstemon procerus (little penstemon) – bl-pu

Sedum lanceolatum (stonecrop) – y

Lupinus sereus (Silky lupin) – bl-pu

Eriogonum niveum (snow buckwheat) - wh

Phlox longifolia (long-leafed phlox) – p-b

Mahonia alnifolia (tall Oregon grape) - y

Aster conspicuus and *ciliolatus* (Showy and Lindley's aster) – pu-bl

Monarda didyma (beebalm) - p

VINES

Clematis ligusticifolia (virgin's bower/white clematis): excellent cover for fences and steep banks, or as a climber or privacy screen on trellis – w, sf

Clematis columbianum (blue clematis): for shady thickets where it can clamber, hard to obtain – bl, sf

APPENDIX (CONTINUED)

NON-NATIVE PLANTS SUITABLE FOR DRYLAND GARDENS IN THE OKANAGAN

Refer to www.okanaganxeriscape.org for a searchable plant database of over 400 suitable plant species.

SHRUBS AND TREES

NOTE: Eleagnus angustifolia (Russian olive) has become a serious pest in the Southern Interior of BC. It is able to out-compete native species under almost all conditions and muscle them out. While it does have some wildlife value (nectar for insects and winter food for a few birds), it is less valuable in the overall ecology than the native species and should not be deliberately planted. It is also seeds profusely and is very spiny and as it matures the limbs spread and become difficult to keep in check.

Koelreuteria (Golden Rain Tree)
Acer x freemanii 'Jeffersred' (Autumn Blaze Maple)
Gleditsia triacanthos 'Suncole' (Sunburst Honeylocust)
Tilia cordata 'Greenspire' (Greenspire Linden)
Rugosa roses especially, but all roses can be acclimated to less water than they usually are given
Juniper (all cv, species, and var.)
Red, black and golden currants
Spirea
Potentilla
Cotoneaster (vary in drought tolerance, but most okay)
Lilac
Mock orange (native, but cvs available)
Yucca
Buddleia (butterfly bush)
Various Viburnum (deciduous only as evergreen species generally require acid soil)
Pyracantha (Firethorn)
Apricot, plum (especially Italian)
Mugo pine

ORNAMENTAL GRASSES

Blue fescues
Blue Oatgrass
Some Miscanthus sinensis (Maiden Grass) and Calamagrostis Karl Foester (Feather Reedgrass) sp. & var.
Switchgrass, Perennial Fountain Grasses, Blue Moor Grass
Blue Grama

HERBACEOUS PERENNIAL FLOWERING PLANTS, BULBS, HERBS

Note: Euphoria myrsinites (Burrotail) is spreading into the grasslands and should not be planted in gardens anywhere close to natural areas.

Purple coneflower
Black-eyed Susan
Gloriosa daisy
Sedum spectabile 'Autumn Joy' and other cvs.
Numerous other sedums
Daylilies
Bearded iris (hybrids and species, all sizes)
Perennial allysum
Non-native penstemon sp. from western USA
German statice
Sea lavender
Thyme species and var.
Salvia species (including culinary Artemesia sp. and var.)
Most spring bulbs (Narcissus, crocus, etc.)
Santolina (Lavender cotton)
Lavender
Poppies
Coreopsis (half-hardy perennials, but usually survive winter in the lower elevations here)
Ornamental yarrows
Russian sage
Perennial flax
Hens-and-chickens (Sempervivums)

ANNUALS

California poppy
Mexican poppy
Cosmos
Zinnias
Globe amaranth and Love-lies-bleeding
Lavatera
Portulaca
Clary sage
Nasturtiums
Osteospermum
Marigolds
Sunflowers
Dusty Miller

APPENDIX (CONTINUED)

NATIVE AND NON-NATIVE PLANTS SUITABLE FOR OKANAGAN RAIN GARDENS

Choose plants that can tolerate occasional wet conditions as well as dry. Plant the driest loving plants at the higher edges of the garden.

NATIVE PLANTS

Giant Wildrye (*Elymus cinereus*) - for large areas
Idaho or Rough Fescue
Junegrass
Native sedges or rushes (Baltic, for eg.)
Common Yarrow
Bearberry
Gaillardia
Blue Flax
Showy or Lindley's Aster
Native fleabanes (*Erigeron*)
Solomon's Seal (*Smilacina stellata* or *Smilacina racemosa*)
Ostrich Fern

NON-NATIVE PLANTS

Ornamental grasses, sedges, and rushes
Bergenia (needs shade and may require supplemental watering)
Yarrow cv (can be invasive - use only in large gardens and remove spent bloom)
Vervain/Veronica/Speedwell
Daisy cv/sp.
Sweet Woodruff (needs part shade and may require supplemental watering)
Pachysandra (needs part shade and may require supplemental watering)
Lady's Mantle (needs part shade)
Ornamental Mulleins
Hosta (needs part shade and may require supplemental watering)
Gaillardia
Coralbells (*Heuchera sanguinea* species - NOT the fancy cultivars)
Echinacea
Aquilegia
Threadleaf Coreopsis
Daylilies
Phlox stolonifera
Monarda
Amsonia

PLANTS TO **AVOID** IN ANY OKANAGAN GARDEN

SHRUBS AND TREES

Russian Olive (*Eleagnus angustifolia*)
Siberian Elm (*Ulmus pumila*)
Tamarisk - a huge pest in the US Southwest and could become one here with climate change
Tree-of-Heaven (*Ailanthus altissima*)
Black Locust (*Robinia pseudoacacia*)

VINES

Silver Lace Vine - strangles other plants
Virginia Creeper - white fly and can take over huge areas if allowed to spread
English Ivy - much more of a problem on the Coast, but can get out of hand here too

PERENNIALS

Donkeytail (*Euphorbia myrsinites*) – has already spread into grasslands; latex in stems toxic and can cause rashes to humans
Euphorbia in general
Perennial ryegrass (*Lolium perenne*) – seeds extensively and spreads into grasslands
Scotch Broom
Vetches, especially American Vetch
English violet (*Viola odorata*) – toxic to native butterfly that feeds on violets
Baby's Breath (*Gypsophyla paniculata*)
Wildflower mixes in general - usually mostly grasses and often contain invasive species of this area

INVASIVE AQUATIC SPECIES

Purple Loosestrife (*Lythrum salicaria*)
Yellow Flag Iris
Milfoil
Reed Canary Grass



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