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

Okanagan Basin WATER BOARD

OKANAGAN waterwise
One valley. One water.

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Second Edition February 2021

Prepared by: Okanagan Basin Water Board

Adapted with permission from: Resource Conservation District of Santa Cruz County and Sonoma Resource Conservation District

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Copies of this guide can be obtained from:

Okanagan Basin WATER BOARD
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1450 KLO Road, Kelowna, BC
(250) 469-6271

STATEMENT OF PURPOSE

This guide has been developed for educational purposes by the Okanagan Basin Water Board (OBWB) and its Okanagan WaterWise public outreach program. 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. Prior to implementation of ANY practices, seek technical assistance from a licensed professional engineer or landscape architect, and/or certified professionals in erosion and sediment control for specifications for these practices. Site-specific designs that address the needs and constraints of individual sites are essential.

Who We Are

The OBWB was instituted in 1970 through a collaboration between three Okanagan regional districts. The Board's jurisdiction is defined by the borders of the Okanagan watershed, or basin. The basin is almost 200 km long and 8,000 km^2 and stretches from the City of Armstrong in the north to the Town of Osoyoos in the south. It 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.

Acknowledgements

A special thank you to the **Resource Conservation District of Santa Cruz County** and the **Sonoma Resource Conservation Districts** who generously granted permission for us to adapt their Slow It. Spread It. Sink it! guidebooks to address the unique conditions and water challenges of the Okanagan.

Many individuals contributed to the development of this guide. Kellie Garcia, OBWB Policy and Planning Specialist, managed the project and conducted research, writing and editing. Elana Westers of Growing Inspired provided research and writing services for the 2nd edition. The guide was also edited by Corinne Jackson, OBWB Communications Director. Guide design and layout was completed by Blue Heron Design Group (1st edition) and Karen Christensen (2nd edition).

An Advisory Committee reviewed drafts and provided invaluable technical information and photos for the first edition of the guide (published in 2011). Much of the content was carried forward to the 2nd edition. Committee members included:

Gwen Steele	**Kim Stephens**	**Rob Dickinson**
Don Dobson	**Eva Durance**	**Trina Koch**
Chris Johnston	**Jillian Tamblyn**	**Anna Warwick Sears**

Gordon Hiebert, Judie Steeves, Judy Baumbrough, Bill Darnell, Buffy Baumbrough, Jennifer Miles, Bruce Fuller, Zoe Kirk and Gabe Cipes also provided guide content and/or photos. Illustrations were completed by Ritch Waldron, Wildways Illustrated, and Page Gruys unless otherwise noted.

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 **53** *and* **54** *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?

Here are just a few of the ideas you will find in this guide to address rainwater runoff around your home.

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

Cost: LOW
Installation difficulty: EASY
See page **24**

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

Cost: LOW to MODERATE
Installation difficulty: EASY to INTERMEDIATE
See page **27**

Use **PERVIOUS PAVERS** for your patio.

Cost: MODERATE - HIGH
Installation difficulty: INTERMEDIATE
See page **34**

Install a **WATERBAR** on your driveway.

Cost: MODERATE
Installation difficulty: INTERMEDIATE
See page **40**

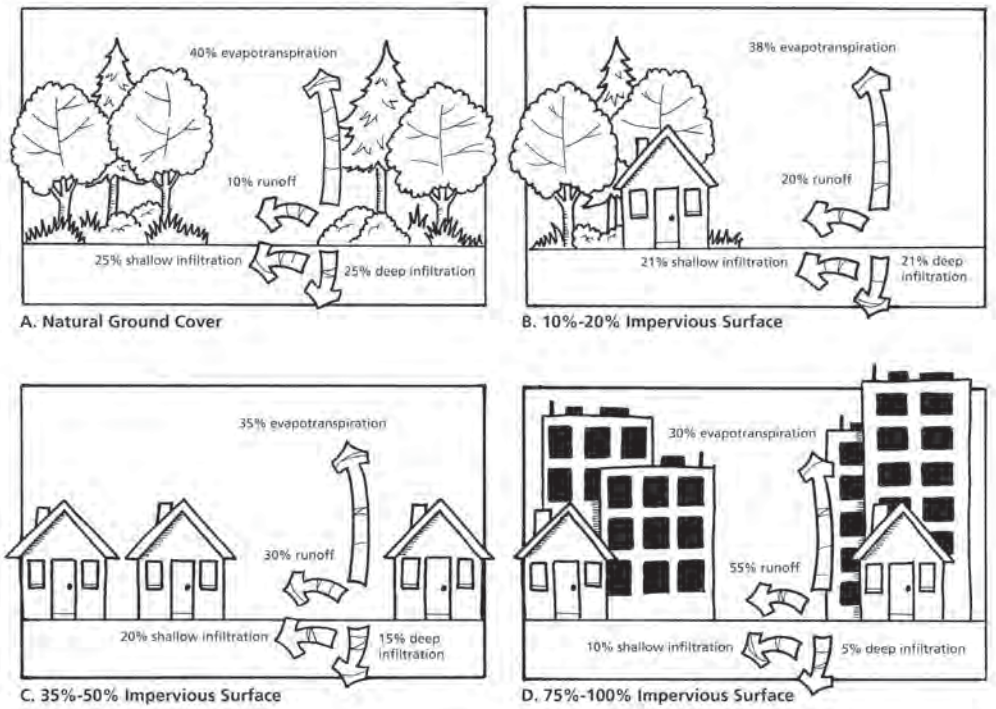
INTRODUCTION

Before the Okanagan's cities, farms, water supply and flood control systems, and highways were built, 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 natu¬ral filters and buffers from major storms.

Under these pre-development conditions as much as 50% of rainwater 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 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. And the stormwater and sewer systems in our cities and towns are often not designed to deal with the high intensity, short duration rainfall events brought on by climate change. 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.



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

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

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
- Clean up our creeks, rivers, and lakes
- Create healthier homes
- 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.

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.

Most 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.

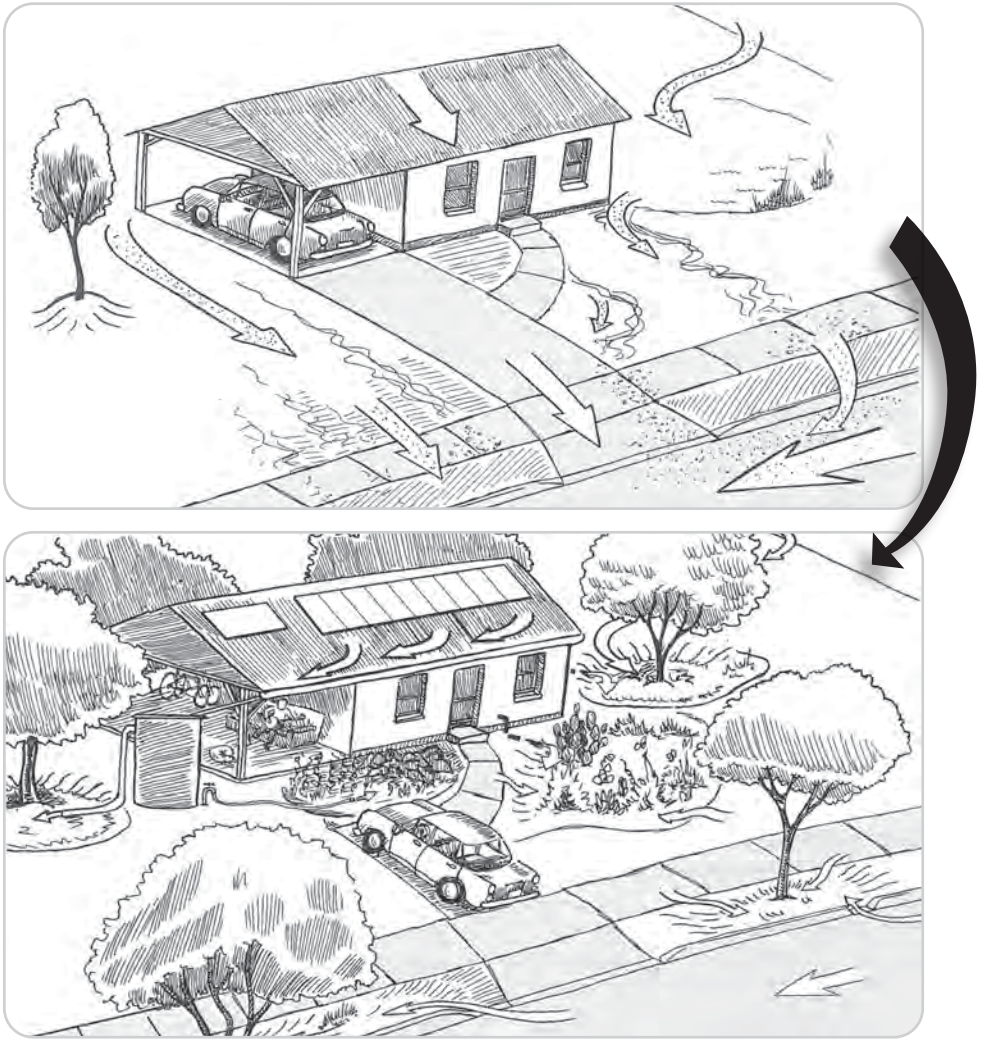
CHAPTER 1

UNDERSTANDING THE RAINWATER HARVESTING POTENTIAL 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.



Illustrations from *Rainwater Harvesting for Drylands and Beyond*, Volumes 1 and 2, 2nd Edition, p4.

ROOFS

Your roof likely generates the most runoff from your home. While most 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 mm 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 mm at Osoyoos to 300 mm at Vernon.

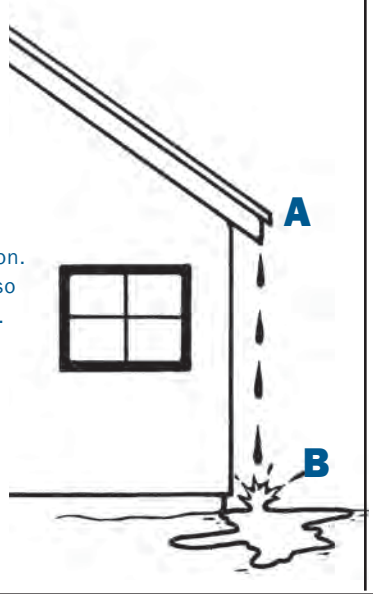
c) In one year, you could collect as much as 28,000 litres of rain from a typical roof in Osoyoos to 42,000 litres in Vernon.

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

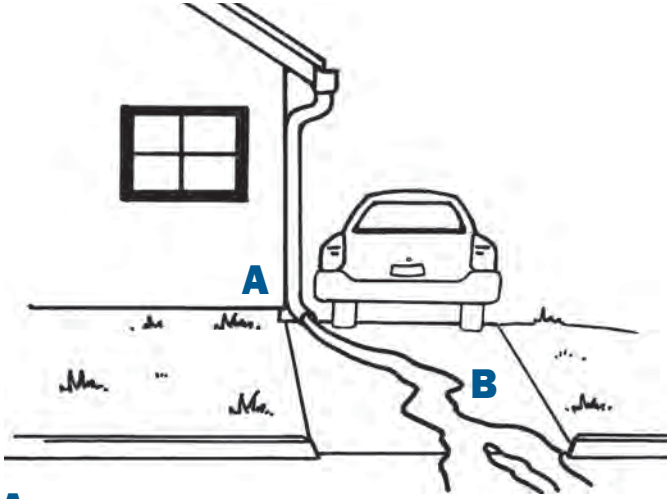
A Adding gutters and downspouts works to direct water to a safe location away from bare soil and buildings (see pages **20 and 21**).

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 **22 and 23**).

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 **24** to **27**).

B See “Driveways and Parking Areas” on 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 (see page **23**).

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 (see page **23**).

C Terracing or retaining walls may be added to sloped areas to keep rock or other mulch in place and protect hillsides (see page **41**).

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);

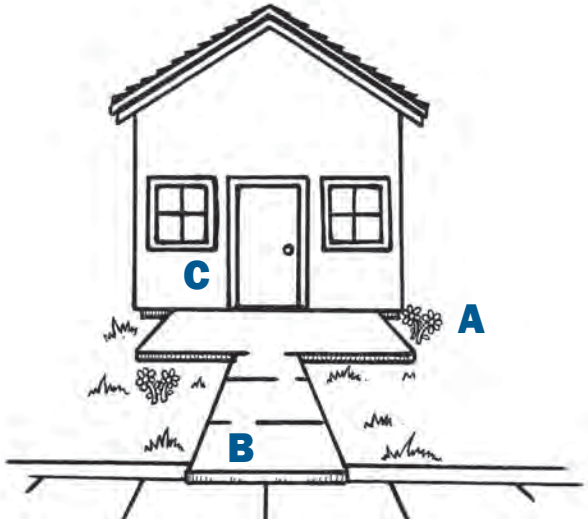
3. Place it in the trash; and

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 (see page **36**). Important: Do not use wood mulches in fire prone areas.

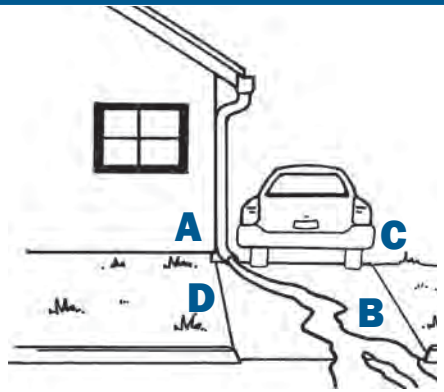
B Turf block works well for allowing water to SINK into the soil in medium-traffic areas or driveways with separate parking areas (see page **35**).

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 (see page **34**).

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. Many alternatives are available to replace impervious concrete and there are 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 (see page **40**).

C Pervious paving (pictured) or other materials such as paver stones or turf block, allow water to SINK into the soil decreasing runoff (see page **34**).

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 (see page **28**).

DID YOU KNOW?

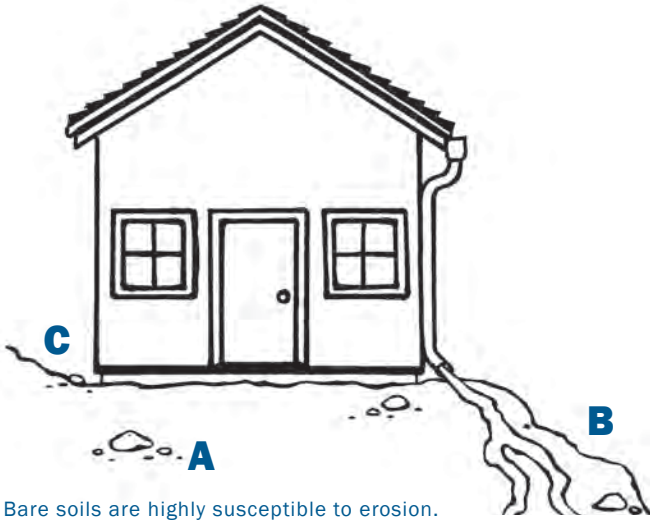
We have all heard that cars contribute to air pollution. But, did you know they can also play a part in water contamination? Soap from car washing, oil and grease from leaking engines, zinc from tires, and copper from brakes can end up in the water that we live beside, play in, and even get our drinking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

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

SOLUTIONS

A Mulch protects soil from direct rain impact and SLOWS runoff across bare soils (page **36**). 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 **41**).

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 **37**).

CHAPTER 2

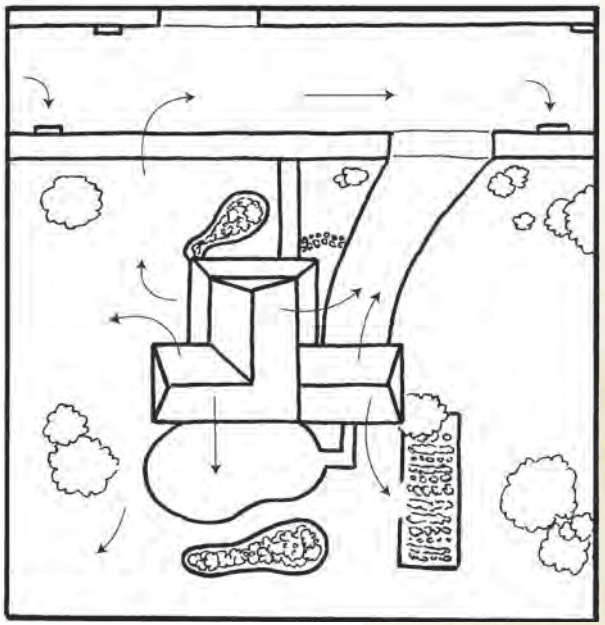
EVALUATING RAINWATER RUNOFF ON YOUR PROPERTY

DO-IT-YOURSELF RAINWATER RUNOFF EVALUATION

To discover where you can use rainwater capture and runoff control techniques that draw on the fundamentals of "slow it, spread it, sink it," we recommend that you do a simple evaluation of your property. The evaluation consists of 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 you might be able to use 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). You can also consult a contour map to help with your sketch. Contour map lines represents 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) OBSERVE 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 mm (1/2 in). 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). 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 barrel, landscape plants, or a rain garden.

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 Express" 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 a critical piece of information. **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.

See next page for instructions on how to complete a mason jar soil test and a soil drainage test.

Precipitation information for your area can be found at 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 traditionally have early, consistent rainfall in April and May 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, accumulated snow in winter can be stored and used as a resource for spring runoff.

5) ASSESS POTENTIAL POLLUTANTS: Determine what your roof is made of and whether there are 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.

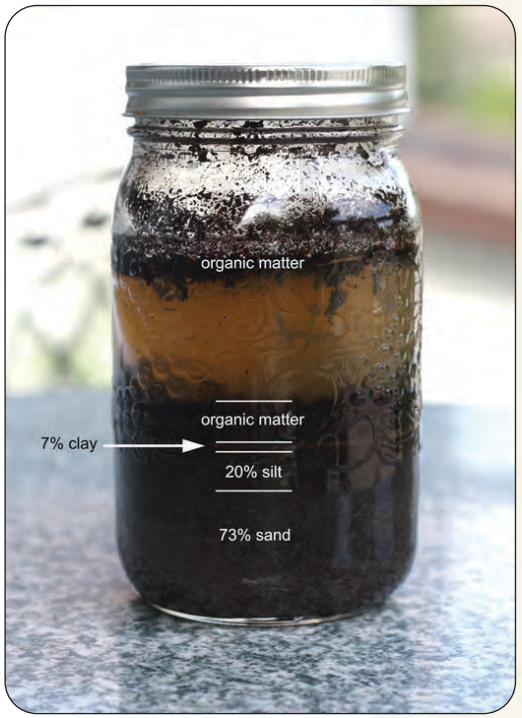
6) LOCATE SEPTIC SYSTEMS AND WELLS, IF APPLICABLE: Determine required local or provincial setbacks from septic tanks, leach fields, interceptor drains and wells. If you have a septic system, be sure to also locate your replacement leach field area, which must remain undeveloped. It is critical that stormwater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

7) EVALUATE YOUR RESULTS. Using your results and the descriptions in Chapter 3, you can determine what practices you might want to adopt to beautify your landscape, protect your property, reduce flooding, and help improve local water quality.

MASON JAR SOIL TEST:

This soil test is a relatively quick way to get a snap-shot look at the percentage of silt, sand and clay in your soil. Because each type of soil has a different particle size, they separate out in the jar into layers, similar to oil and water. Sand has the largest particles and so settles at the bottom, silty or loamy soil is high in organic matter and appears in the middle, and clay has the finest particles so always appears on the surface. Doing several tests from soil in a few different areas will give you a more complete picture of how the soil changes in the space.

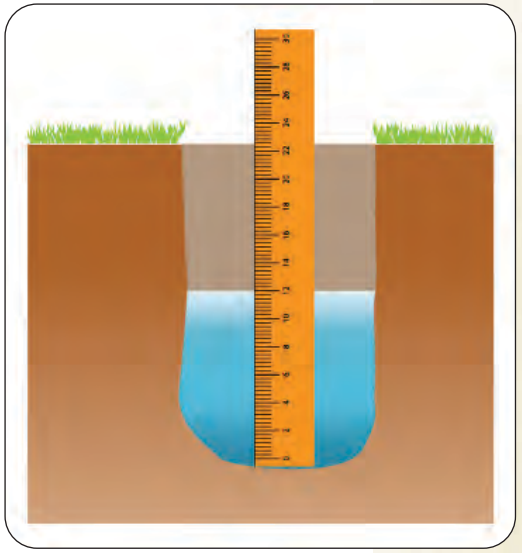
- Find a clear jar with a screw lid (a Mason/canning jar works well for this)
- Use a shovel to dig straight down vertically 20 cm (8 in) into the soil, then use a trowel to get enough soil to fill a jar half way.
- Place the soil in the jar and remove any obvious rocks, roots or debris.
- Pour the same amount of water as soil into the jar and shake for 3 minutes, then place it in a spot where it can sit undisturbed for at least 24 hours.
- Measure the percentages of silt, sand and clay.



SOIL DRAINAGE RATE TEST:

Also known as a percolation or “perc” test, a soil drainage rate test is necessary to inform the design of earthworks on your property. It gives you an understanding of soil characteristics, determines the drainage rate for soil at a certain depth, and also determines whether or not something like a rain garden (for example) is suitable for a particular area. The test is best done in the wetter months, just after the ground defrosts in spring, or in the fall before it freezes, but ideally not in the dry season.

To do a drainage test at home, see the detailed instructions on pages 14-17 of the Okanagan-Similkameen Rain Garden Guide Book which can be found here: https://www.regionaldistrict.com/media/210071/RGGB_RainGardenGuide.pdf.



The test includes three main steps:

Step 1: Dig the hole 60 cm (2 ft) deep and 30 cm to 60 cm (1 ft to 2 ft) in diameter.

Step 2: Evaluate the soil texture.

Step 3: Fill the hole with water and observe the drainage rate over time.

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 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 **12** 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 sinking 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. 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.

Careful planning of upstream terrain development is important to minimize risks to downstream facilities and people.

WATERFRONT DEVELOPMENT

Land modifications for rainwater management need to be done with extra care and attention on shoreline lots. 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.

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 it alone.

For more information, check out "A Resource for Okanagan Lakeshore Living" at okwaterwise.ca/resources/2018/Okanagan_Lakeshore_Living_Guide_web.pdf.

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. To prevent unwanted mosquito breeding, please remember to follow these mosquito-proofing tips for standard rainwater management and water conservation practices.

FOR RAINWATER COLLECTION SYSTEMS

- Use barrels with mosquito-proof screen (fine mesh - 1.5 mm [1/16th of an in]) 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 mm [1/16 of an in]).
- 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.

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

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

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

Regional District Okanagan-Similkameen Mosquito Control Program
250-490-4232
info@rdos.bc.ca
www.rdos.bc.ca

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 cm (18 in) 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.

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 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, including:

- 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 **53 and 54**.

5) CALL BEFORE YOU DIG. Call 1-800-474-6886 for assistance from BC One Call members.

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.bconecall.bc.ca/.

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:

1) 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.

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

3) 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.

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

5) 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.

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

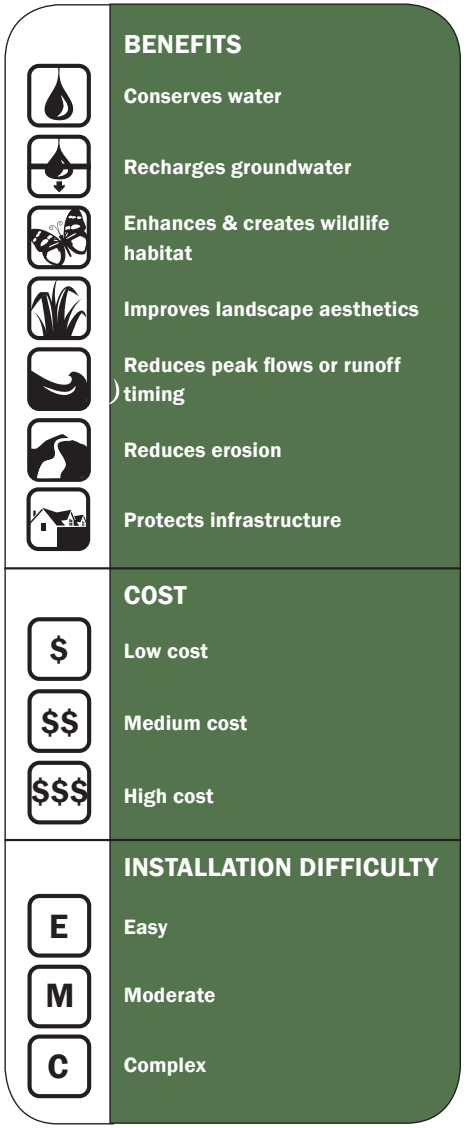
7) Protects infrastructure and increases property value: These practices help reduce runoff that could damage structures, foundations, or public infrastructure such as roads.

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:



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 page **53** 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.

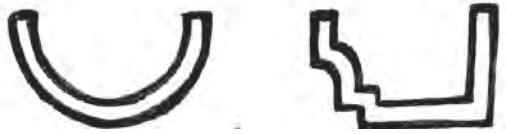
General guidelines for selecting and installing gutters and downspouts or improving capacity are included below.

GUTTERS

Select gutters at least 13 cm (5 in) wide. Use materials made from galvanized steel (29 gauge minimum) or aluminum (0.6 mm [0.025 in] 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 mm (1/16 in) to 3 mm (1/8 in) per 30.5 cm (1 foot) of sectional gutter; or 1.6 mm (1/16 in) to 3 mm (1/8 in) per 3 m (10 ft) of seamless gutters. Tilt the gutter forward keeping the front 13 mm (1/2 in) lower than the back. For straight runs exceeding 12 m (40 ft), use expansion joints at connections. Select elbows with 45, 60, 75 or 90 degree angles, as needed.

Gutters also come in different shapes. The shape of your gutter determines the amount of water it can handle from your roof during a storm. Ogee shaped gutters, for example, can handle more water than rounded gutters. However the ogee gutter's sharp edges and corners can collect sediment and debris.

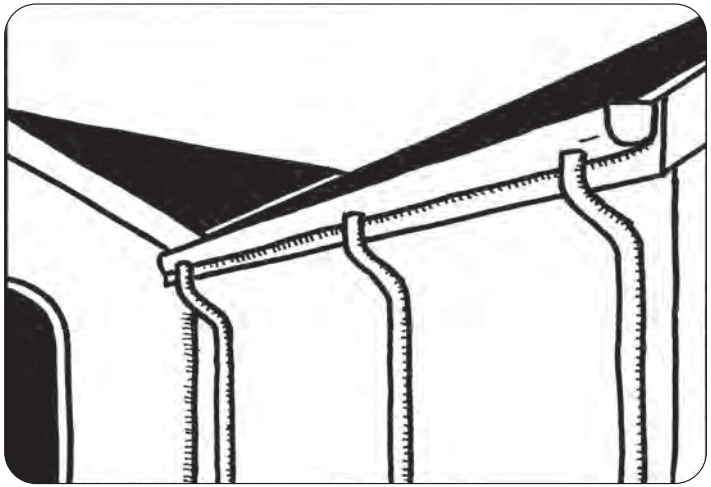
GUTTER PROFILES



Half Round **Ogee**

DOWNSPOUTS

Space downspouts from 6 to 15 m (20 to 50 ft) 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 cm (4 in) 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 **26**. Do not direct downspout outlets to driveways or other impervious surfaces unless there are no safe alternatives. Instead, route them to vegetated areas.



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

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 cm (24 in) clearance zone. Add gutter guards to reduce debris buildup. You can also add a drip line treatment (see page **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. Always check and clean gutters after severe storms.

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.

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.

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 **53** and **54** 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.

Maintenance:

Periodic mowing, pruning, and replacement of plants is needed. Inspect the foundation to ensure water is not saturating or eroding structure or foundation. Keep fertilization to a minimum as it can contribute to excess nutrients in runoff. If you do fertilize, always carefully follow the manufacturer's instructions and never apply in excess or prior to forecasted rain.

DO

- Use Okanagan native and/or drought-tolerant plants.
- Keep plants well-pruned to allow adequate ventilation.
- Keep soil a minimum of 15 cm (6 in) 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 cm (3 in). This treatment must extend 15 cm (6 in) inside the eave and a minimum of 30.5 cm (12 in) beyond the eaves of a single-story roof, 46 cm (18 in) beyond the eaves of a two-story roof, and 61 cm (24 in) beyond the eaves of a three-story roof. This treatment prevents erosion and allows runoff to infiltrate. Pouring washed drain rock 2 to 4 cm (3/4 in to 1-1/2 in) deep 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 m (5 ft).

Deck/stair drip lines: To protect the soil under elevated decks, stairs, and walkways from erosion, install an 8 cm (3 in) layer of drain rock under the entire footprint of the structure and extend 30 cm (one ft) past its edge. If you have structures on your property that are low to the ground and are inaccessible underneath, install an 8 cm (3 in) layer of rock or other mulch approximately 30.5 cm (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 m (5 ft).

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 cm (3/4 in) 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

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 ¼ 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 cm (8 in) 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

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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 in 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 furthermost 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 **54** for contact information). Rain gardens should be located at least 3 m (10 ft) from your house and at least 12 m (40 ft) 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.

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.

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 discouraged (and should be largely unnecessary).

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 **27**) 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 increase the time water spends in the swale, thus aiding the trapping of pollutants and sediments, and infiltration. There are three types of swale systems: vegetated, rock-lined (sometimes called dry creek beds or diversion drains), and contour (also called 'cut and fill' or 'berm and basin' swales).

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.

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.

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 cm [3 in] 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.

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.

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.

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.

Boomerang berms to focus water around trees and contour berms below on hillsides (*Rainwater Harvesting for Drylands and Beyond*, Volume 2, 2nd Edition, p66.)

CONTOUR SWALE ('BERM AND BASIN' OR 'CUT AND FILL' SWALE)

A contour swale (also known as a 'berm and basin' or 'cut and fill' swale), is similar to a vegetated swale in that it is also a trench; however, it is designed to be perfectly level, and follows the natural contours of a slope. A contour is defined as all points on a slope that are at an equal elevation (and therefore level). On a map, the contour lines that are close together represent a steep slope while lines that are further apart depict flatter ground.

A contour swale usually consists of two parts: an excavated basin and a raised berm positioned on the downhill side of the basin. The berm helps to slow the water and can be made of the earth that was excavated to form the basin, however brush or rock can also be used.

By simply working with two of water's natural behaviours (that water always flows downhill and that water will always work to reach a level state), you can design a passive water harvesting method that keeps water on the property for longer.

A contour swale requires no maintenance and can:

- Passively irrigate a landscape by doing the work to capture and effectively distribute water.
- Slow and sink water into the landscape, helping to recharge the groundwater.
- Regenerate and help to reforest sloped land.
- Help to purify water before it reaches streams further downhill.

This type of berm and basin system should only be used on slopes that are less than a 5% grade (less than a 20:1 slope) and should be sized for the maximum stormwater event (for example a 1 in 200-year storm event). For a DIY approach to installing a contour swale, first map out the contour lines by surveying the approximate area where you would like to see your swale. To do this, use a Bunyip water level, which is easy and inexpensive to construct, and only requires two people to use. Essentially, plastic tubing is attached to two long yard sticks and each person holds on to one end. One person stays in the location while the other walks around the landscape, until the same number/level is located.

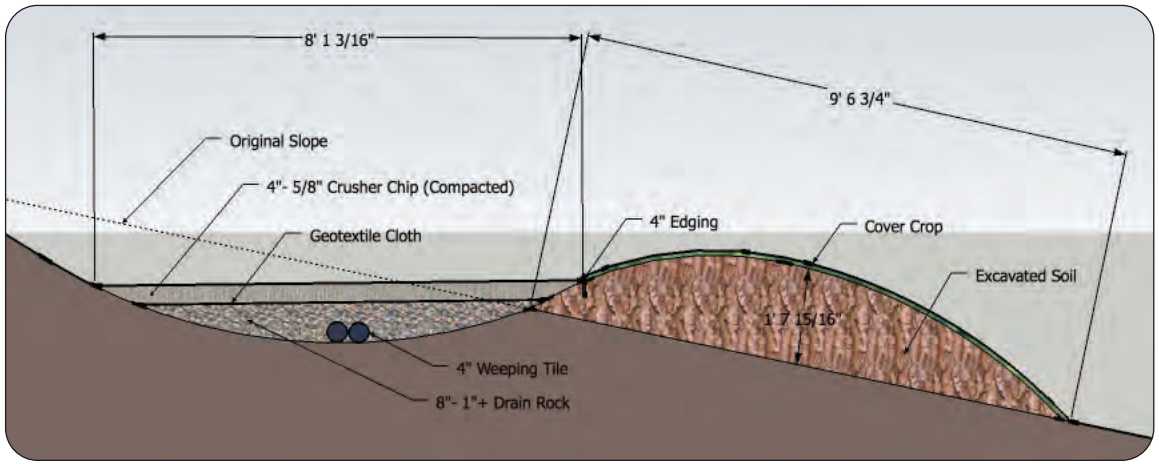

Diagram credit: Gordon Hiebert.

INFILTRATION STRUCTURES

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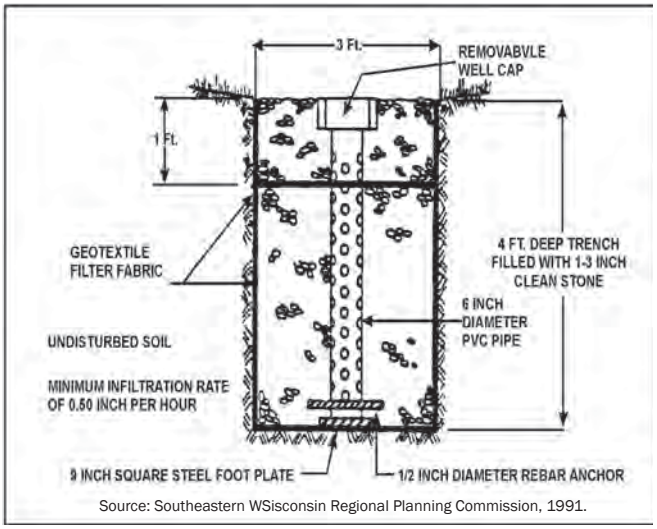
USES: ROOF RUNOFF, WALKWAYS OR OTHER HARDSCAPES, VEGETATED AND/OR UNDEVELOPED AREA RUNOFF, LOW TO MODERATELY SLOPED AREAS

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: rock pit: French drain; 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 because it typically does not have sediment that can clog the structure.



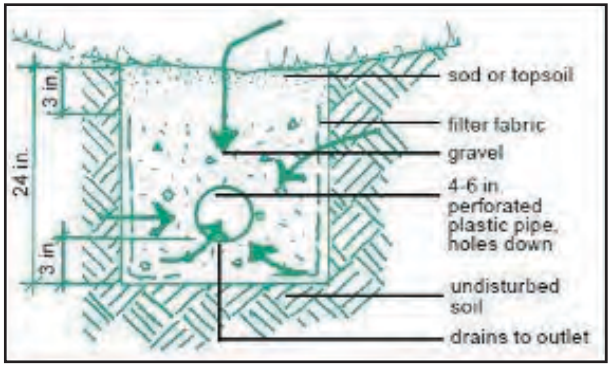
Source: Southeastern WSisconsin Regional Planning Commission, 1991.

TYPICAL DEEP INFILTRATION TRENCH

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 vary 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, including rock pits and French drains, 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 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.



FRENCH DRAIN

INFILTRATION PITS (DRY WELLS)

Infiltration pits, typically referred to as dry wells, 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 the structure is 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 specifically of infiltration pits (dry wells) on a regular basis to ensure it functions properly and to 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 ft) deep.

MULCH BASINS

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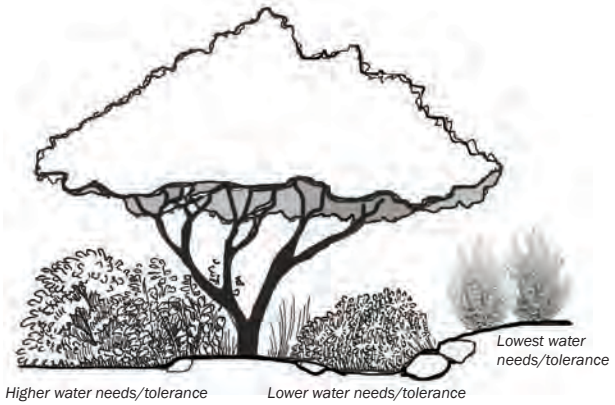
USES: SLOW AND SINK WATER TO SUPPORT GROWTH OF VEGETATION AND A CENTRAL TREE OR SHRUB

A mulch basin, otherwise known as an infiltration basin, is a shallow depression with a level base, dug into the earth. It is designed to help slow and sink water to support the growth of vegetation and a central tree or shrub. The basin technique was inspired through the observation of traditional rainwater harvesting and erosion control techniques developed by the Indigenous A:shiwi (or Zuni) people of New Mexico.

This technique is best used on flat or gradually sloping land. Mulch basins use the leaves that fall within it to reduce evaporation, increase water infiltration and improve soil fertility. Rainwater from downspouts, along with runoff water from hard surfaces such as driveways, sidewalks or curb-less streets, can be directed to one or more mulch basins, as long as the basin is positioned lower than the hard surfaces and downspouts.

A mulch basin garden can reduce the water needs of a landscape by up to 50% compared to a raised bed garden, which is more suitable for releasing water and increasing drainage in areas with greater rainfall. When a mulch basin is designed correctly, it can act as the sole irrigation source for the plants it supplies, once the plants are established.

Mulch basins are easy and quick to install, requiring only a shovel, the strength to use it, and some pipe if you are using water from downspouts. For the mulch basin to be effective, the diameter should be slightly wider than the mature width of the tree canopy. Plants with higher water needs can be placed within the basin while plants with lower water needs are best placed around the outside.



Planting according to water seeds and tolerance. Note: Cold air pools in low spots so cold-intolerant plants may need to be planted outside of baisins. Illustration from *Rainwater Harvesting for Drylands and Beyond*, Volume 2, 2nd Edition, p131.

DO

- Place plants with lower water need around outside.
- Consult a professional or the Rainwater Harvesting for Drylands and Beyond book before constructing a mulch basin

DON'T

- Use on land with excessive slopes.

Maintenance:

- Check mulch basins after heavy rains– you may need to stabilize basin edges
- Check basin edges periodically that adjoin curved paths where people may have cut corners through the basin.
- Stabilize basin edges with rock, boulders, or bulky vegetation.
- Reapply mulch as it decomposes- do this easily, and for free, by keeping fallen leaves in place and adding cut-up pieces of prunings to the basin.

Infiltration basin with spillway, showing depth measurement. Illustration from *Rainwater Harvesting for Drylands and Beyond*, Volume 2, 2nd Edition, p121 and p127.

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. Permiable 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 areas 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 cm [0.5 to 3 in] 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 m (2 to 5 ft) above the seasonally high groundwater table and at least 30 m (100 ft) 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.

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., spreading Junipers, Sumac, Bearberry/ Kinnickinnick) 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 acts as a protective layer of material that is spread on top of the soil. Mulches can be organic -- such as grass clippings, pine needles, bark chips, and similar materials -- or inorganic -- such as stones, pea gravel, and brick chips. 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:

Keep any organic materials at least 15 cm (6 in) from building siding. Gravel or rock should be raked regularly to prevent the buildup of organic materials.

DO

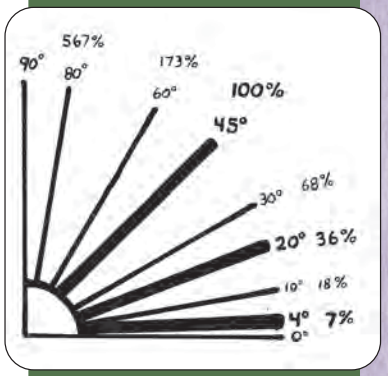
- Use recycled material whenever possible.
- Keep rock free of organic materials.

DON'T

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

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 cm (one foot) horizontally with a 30.5 cm (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.



SLOPE GRADIENT CONVERSION TABLE

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 **53** and **54** for contact information). Refer to Appendix A for a list of plants that are suited to the Okanagan.

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 B.
- 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 contaminate water.

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 **53**) 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 m (2 ft) from the crest, dig a 15 cm (6 in) 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 cm (4 in) and overlap the top and bottom edges of the blankets by at least 8 cm (3 in). The uphill roll should overlie the downhill roll. Stake the blanket, at a minimum, horizontally every 0.6 m (2 ft) and vertically every 1 metre (3 ft). Stake at least every 30.5 cm (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 cm (4 in) 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 70-90% 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.

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.

Before installing a living roof, you will need to know the slope, 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 **54** under Green Roofs.

CROSS DRAINS

$-$$ E-M

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 that is angled down across the road. Waterbars can be constructed by hand, with a backhoe, or with a blade-equipped tractor. Optimal size of an earthen waterbar is 30.5 cm (1 foot) above the road surface and 15 cm (6 in) below the road surface. Asphalt or cement waterbars can be smaller in size (15 cm or 6 in) 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 **26**).

DO

- Install energy dissipators at all outlets (see page **26**).
- 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 cm per 30.5 cm (½ in 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 most water enters the drain and doesn't flow over.
- Install energy dissipators 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

$$-$$$ M-C

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.

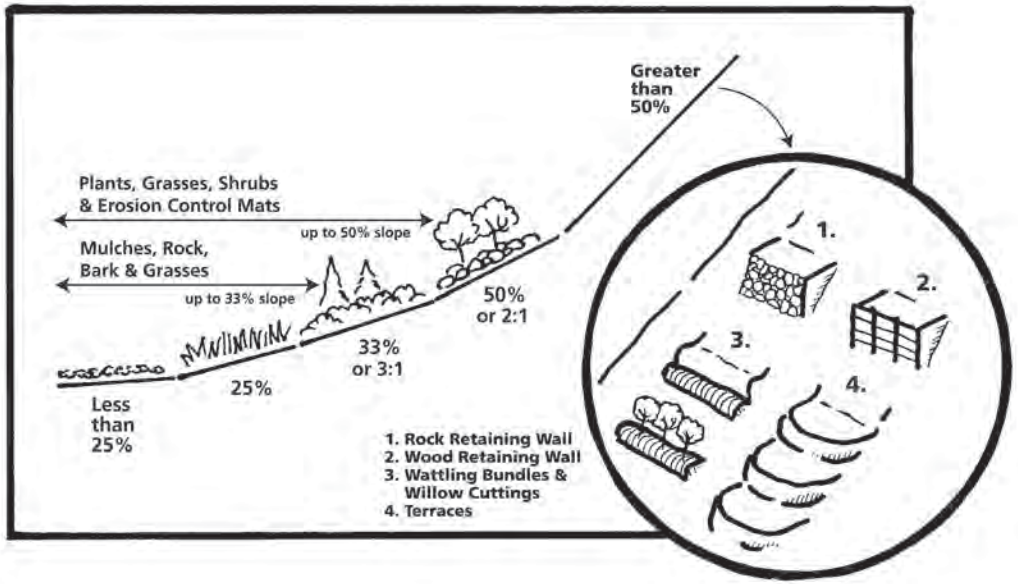
Retaining walls and terraces are used to reduce the gradient or slope and provide level or gently sloping areas for establishing vegetation. Retaining walls and terrace walls are constructed with boulders, treated timber, bricks and/or interlocking concrete blocks. Walls over 4 ft high and overall slopes 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. In addition, 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 **53**.

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 cm (10 in.) to 0.6 m (2 ft.) 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 are usede behind the wall. 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 cm (1 to 2 ft) 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:

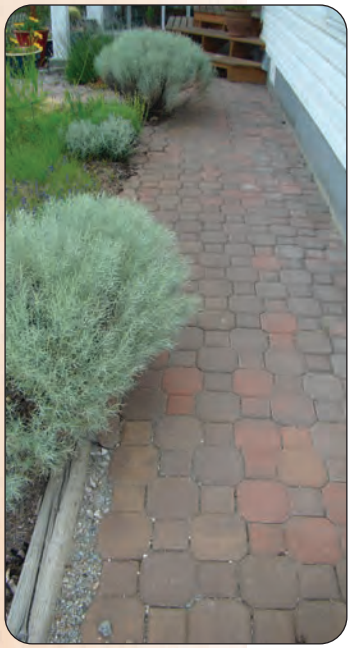
Always check retaining walls to make sure they are not leaning or failing. Ensure there is adequate drainage behind walls and the drains remain functional. Be sure to plant only low water vegetation and use drip irrigation behind retaining walls.

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.



CHAPTER 4

LOCAL PROJECTS

DRIP-LINE PROTECTION - HARDSCAPE

LOCATION: Private Residence, Penticton, B.C.

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, B.C.

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, B.C.

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, B.C.

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

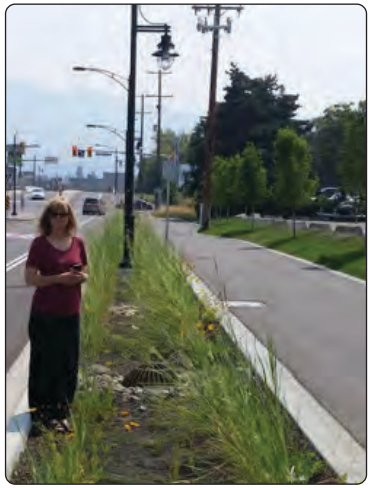
RAIN GARDEN & DRY WELL

LOCATION: Nexus Therapeutics Massage Therapy Clinic, Vernon, B.C.

DESIGNED AND INSTALLED BY: Element Eco-Design

DESCRIPTION: The rain garden and dry well work to manage and keep the stormwater on the property, rehydrating the landscape and reducing irrigation requirements. In the front of the house, the rain garden takes excess flow from the downspout. In the back of the house, a swale is combined with a dry well and engineered to collect and manage all of the stormwater running off the parking lot; the water is directed towards the fence line, to irrigate the Saskatoon trees and drought-tolerant grasses.

PHOTO: Gordon Hiebert



BIOSWALE

LOCATION: Kelowna, B.C.

DESCRIPTION: This bioswale was constructed as part of a multi-use pathway along Lakeshore Road near Mission Creek. The swale consists of salt-tolerant, native and low water-use plants, and incorporates a curb-cut to capture road and pathway runoff. The bioswale protects the nearby lake from runoff, and reduces stormwater volume and pollutant concentrations. Bioswales are also aesthetically pleasing, provide a safe border from the road and help to counter-act urban heat.

PHOTOS: Zoe Kirk

SWALE & DRY CREEK BED

LOCATION: Okanagan College, Vernon, B.C.

DESIGNED AND INSTALLED BY: Element Eco-Design

DESCRIPTION: A partnership project with Trees Canada and Okanagan College to create an incubator farm, food forest and community garden. The contour swales double as walkways and provide water storage while passively irrigating the food forest vegetation planted downslope. A large swale collects stormwater and snowmelt to help irrigate a haskap hedge. Each swale has an overflow that allows excess water to pass to the next swale or disperse on the landscape.

PHOTOS: Gordon Hiebert

DRY CREEK BED (ROCK-LINED SWALE)

LOCATION: Naramata Centre, Naramata, B.C.

DESCRIPTION: Dry creek bed redirects runoff and prevents soil erosion.

PHOTO: Gwen Steele

EROSION CONTROL BLANKETS

LOCATION: Blondeaux Crescent, Kelowna, B.C.

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, Kelowna, B.C.

DESCRIPTION: Large boulders have been used to create terracing to stablize a slope on this property.

PHOTOS: Elana Westers

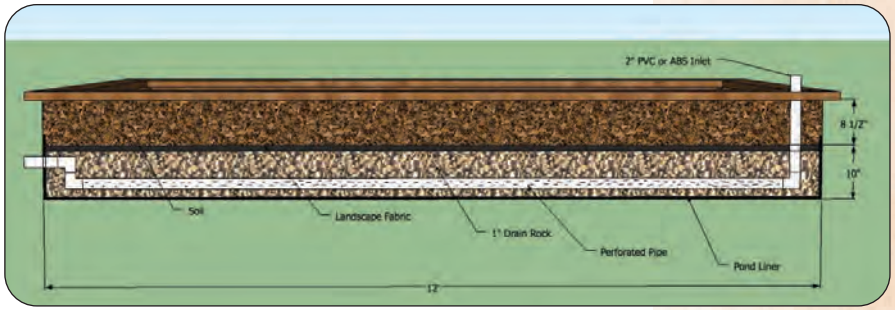
WICKING BEDS

LOCATION: Patchwork Farms, Okanagan College, Vernon, B.C.

DESIGNED AND INSTALLED BY: Element Eco-Design

DESCRIPTION: The community garden wicking beds are self-hydrating beds that only require watering once per week. Wicking beds are best for growing shallow-rooted plants, such as lettuces, squash, melons and peppers to name a few. They can also be connected to downspouts if sized appropriately. The relatively equal proportions of water reservoir to soil, allows for the soil to wick water from the basin below. The overflow pipe placed above the water reservoir, prevents the soil from becoming over-saturated during extreme rain events.

PHOTO: Gordon Hiebert



LIVING ROOF

LOCATION: Private Residence, Vernon, B.C.

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 - approximately 2,000 plants in all. Most 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, B.C.

DESCRIPTION: Sand between paver stones allows rain water to drain through.

PHOTO: Gwen Steele

PERVIOUS PAVING TREATMENT

LOCATION: A lane off 15th Street, Vernon, B.C.

DESCRIPTION: Two paved driving strips with a gravel matrix between them.

PHOTO: Jennifer Miles

GROUND COVER - WOOD AND GRAVEL MULCHES

LOCATION: Private Residence, Penticton, B.C.

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, B.C.

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.

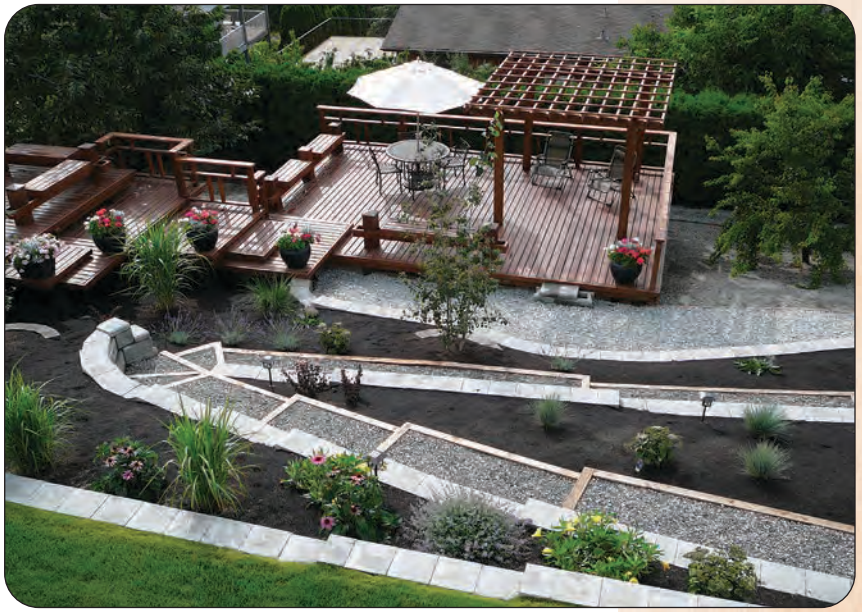
PHOTO: Gwen Steele

RETAINING WALL

LOCATION: Private residence, Kelowna, B.C.

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, B.C.

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, B.C.

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 Species Council of B.C.
250-392-1400
info@bcinvasives.ca
www.bcinvasives.ca

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

Partnership for Water Sustainability in B.C.
www.waterbucket.ca

OKANAGAN LOCAL GOVERNMENT

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

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

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

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

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

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

Okanagan Basin Water Board
1450 KLO Road
Kelowna, B.C.
250.469.6270
www.obwb.ca

Okanagan Falls Irrigation District
1109 Willow Street
Okanagan Falls, B.C. V0H 1R0
250-497-8541
www.okanaganfallsirrigationdistrict.ca

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

Okanagan Nation Alliance
#101-3535 Old Okanagan Hwy
West Kelowna, B.C. V4T 3L7
250-707-0095
www.syilx.org

Oliver, Town of
6150 Main Street, PO Box 638
Oliver, B.C. V0H 1T0
250-485-6200
www.oliver.ca

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

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

Osoyoos Irrigation District
45th Street
Osoyoos, B.C.
250-495-2365

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

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

Penticton Indian Band
841 Westhill Drive, RR#2, S-80, C-19
Penticton, B.C. V2A 6J7
250-493-0048
http://pib.ca

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

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

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

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

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

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

Vernon, City of
3400 30th Street
Vernon, B.C. V1T 5E6
250-545-1361
www.vernon.ca

West Kelowna, City of
2760 Cameron Road
West Kelowna, B.C. V1Z 2T6
778-797-1000
www.westkelownacity.ca

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

PROFESSIONAL ASSOCIATIONS

Association of Professional Biology
www.professionalbiology.com

Engineers and Geoscientists of British Columbia
www.egbc.ca

Irrigation Industry Association of B.C.
www.irrigationbc.com

B.C. Institute of Agrologists
www.bcia.com

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

B.C. Water & Waste Association
www.bcwwa.org

Water Supply Association of B.C.
www.wsabc.ca

SENIOR GOVERNMENT AGENCIES

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

Interior Health
505 Doyle Ave
Kelowna, B.C. V1Y 0C5
250-469-7070
www.interiorhealth.ca

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

Ministry of Environment
102 Industrial Pl
Penticton, B.C. V2A 7C8
250-490-8200

Ministry of Forest, Land and Natural Resources
PO BOX 9049 STN PROV GOVT
Vlictoria, B.C. V8W 9E2
250-387-4809

Ministry of Forests, Lands and Natural Resource
Okanagan Shuswap District
2501 - 14th Avenue
Vernon, B.C., V1T 8Z1
Phone: (250) 558-1700

RESOURCES GUIDE (Cont'd)

CONTRACTORS/DESIGN CONSULTANTS

Gordon Hiebert
Wood & Water Developments
(previously Element Eco-Design)
Vernon, B.C.
250-938-5148
gord@woodwaterdevelopments.com
www.woodwaterdevelopments.com

Joe Ritchie
Top Tier Rock Walls
Kelowna, B.C.
250-859-4493
info@toptierrockwalls.com
www.toptierrockwalls.com

RM Custom Services
Landscape construction and design
Certified Irrigation Specialists
Kelowna, B.C.
250-215-3289
rmcustomservices@shaw.ca
www.rmcustomservices.ca

Elana Westers
Growing Inspired, Ecological Land Design
250-470-2610
www.growinginspired.com

EQUIPMENT, PLANT & SEED SUPPLIERS

Ace Hardware
3223 Woodsdale Road
Lake Country, B.C.
778-480-8030

Andrew Sheret Ltd.
1020 Waddington Drive
Vernon, B.C.
250-545-1381

440 Banks Road
Kelowna, B.C.
250-762-5205

298 Duncan Ave. W.,
Penticton, B.C.
250-493-6754
www.sheret.com

BARR Plastics
(rainwater harvesting equipment)
1-800-665-4499
www.barrplastics.com

Better Earth Gardens & Tropicals
1629 K. L. O. Rd, Kelowna, B.C.
(250) 861-1881
www.betterearthgardens.com

Blue Mountain Nursery Company
1871 Pleasant Valley Rd., Armstrong, B.C.
Phone: 250-546-8181
info@bluemountainnursery.ca
www.bluemountainnursery.ca

Dogwood Nursery
3417A Paynter Road
West Kelowna, B.C.
250-768-3355
dogwood@shawbiz.ca
www.dogwoodnursery.com

Eco Turf Farms
3330 Old Vernon Road
Kelowna B.C.
250-765-9429
info@ecotruffarms.com
www.ecoturffarms.com

GardenWorks Penticton
670 Duncan Ave W.
Penticton, B.C.
250-492-5703
Toll Free: 1-800-667-0765
penticton@gardenworks.ca
www.gardenworks.ca

Nicholas Alexander Landscaping
6325 Hwy 97
Vernon, B.C.
250-542-8881

ProSource Supply
1822 Spall Road
Kelowna, B.C.
250-862-9424

#1 - 1515 Westgate Road
West Kelowna, B.C.
250-454-9424
www.prosourcesupply.ca

Sagebrush Nursery
7556 Island Road
Oliver, B.C.
250-498-8898
orion@sagebrushnursery.com
www.sagebrushnursery.com

Sandhu Greenhouses
9707-128 Ave
Oliver, B.C.
250-489-8898
info@sandhugreenhouses.com
www.sandhugreenhouses.com

Shepherd's Hardware
3525 Mill St
Armstrong, B.C.
250-546-3002
www.shepherdshardware.ca

Swan Lake Nurseryland
7920 Highway 97
Vernon, B.C.
250-542-7614
admin@myswanlake.com
www.myswanlake.com

Xeriscape Endemic Nursery (XEN)
2468 Hayman Rd
West Kelowna, B.C.
778-755-0369
info@xeriscapenursery.ca
www.xeriscapenursery.ca

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

Building Climate Resilience in the Okanagan
(Online PDF)
By Regional District of the Okanagan-Similkameen and the South Okanagan Real Estate Board

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 www.westbenchirrigation.org/manual.pdf

Xeriscape Plant Guide
By Denver Water

Okanagan-Similkameen Rain Garden Guide Book
(Online PDF)
By the Regional District of the Okanagan-Similkameen

Rainwater Harvesting and Reuse
Essential Rainwater Harvesting (E-book)
By Verge Permaculture

Rainwater Harvesting Best Practices Guidebook
(Online PDF)
By the Regional District of Nanaimo

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

Permaculture / Regenerative agriculture
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
A resource for Okanagan Lakeshore Living
By the Okanagan Collaborative Conservation Program

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

RECOMMENDED WEBSITES

www.okwaterwise.ca
www.greenroofs.com
www.commons.bcit.ca/greenroof.com
www.greenroofplants.com
www.waterbucket.ca

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 overflow 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.

Contour: in reference to a 'contour line' used in mapping to join points of equal elevation. In Permaculture/Regenerative design swales are designed "on contour" to keep water level and therefore evenly distributed throughout the landscape.

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 slop 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 LIST

LEGEND:

A Native plant = a plant that is Indigenous to the Okanagan area
Raingarden Zones are taken from the Raingarden plants listed in the Okanagan-Similkameen Rain Garden Guide Book
Visit http://www.okanaganxeriscape.org/db for more information on most of the plants listed below

COMMON NAME	BOTANICAL LATIN NAME	NATIVE PLANT	PERENNIAL/ UNLESS SAYS EVERGREEN	WATER NEEDS (IN FULL SUN)	WHICH ZONE IN A RAIN-GARDEN ((D)RY, (M)OIST OR (W)ET)	LIGHT NEEDS: FULL SUN (FS), PART SUN (PS, SHADE (S)	USED BY BIRDS (B), POLLINATORS (P)	HEIGHT	WIDTH/ SPREAD	SEASON OF INTEREST	EROSION CONTROL (EC), (M)EDICINAL, (E)DIBLE PLANT, (N)ITROGEN-FIXING, (F)RAGRANCE	SPREADS/ SELF-SEEDS
TREES												
Callery Pear (ornamental)	Pyrus calleryana			2		FS	B	25' - 30'	8' - 10'	Spring to Fall		
Choke Cherry	Prunus virginiana	y		1	D	FS	BP	12'	6'	Spring to Fall	E	
Douglas Fir	Pseudotsuga menziesii	y	Evergreen	1		FS,PS	B	60' - 70'	30' - 35'	Year round		
Elderberry- Blue (Shrub/ Tree)	Sambucus caerulea	y		2	M	FS,PS	BP	10' - 12'	10' - 12'	Spring to Fall	E,M	
Golden Rain Tree	Koelreuteria paniculata			1		FS		25' - 30'	25' - 30'	Year round		y
Hawthorne- Black	Crataegus douglasii Lindl.	y			M,D		BP	10' - 20'		Spring to Fall	E	
Hawthorne- Columbian	Crataegus columbianum	y		1		FS	BP	18' - 24'	20'	Spring to Fall	E	
Hawthorne- 'Paul's Scarlet'	Crataegus oxyacantha 'Paul's Scarlet'			2		FS	BP	20' - 30'	15' - 25'	Spring to Fall	E	
Hawthorne- Thornless Cockspur	Crataegus crus-galli inermis			1		FS	BP	20' - 30'	20' - 35'	Spring to Fall	E	
Honey Locust - Thornless	Gleditsia tricanthos var. inermis			2		FS		35' - 60'	35' - 60'	Spring to Fall	N	
Honey Locust -'Twisty Baby' (may spread, not agressive)	Robinia pseudoacacia 'Lace Lady'			2		FS	B	15' - 25'	15' - 25'	Year round	N	y
Ivory Silk Lilac	Syringa reticulata 'Ivory Silk'			2		FS		23'	16'	Spring to Fall	F	
Juniper (Columnar Tree)	Juniperus scopulorum 'Moonglow'		Evergreen	1		FS,PS	B	16' - 20'	5' - 8'	Year round	E	
Juniper- Rocky Mountain	Juniperus scopulorum	y	Evergreen	1	D	FS	B	10' - 30'	10' - 20'	Year round	E,M,F	
Maple- Amur	Acer tataricum subspecies ginnala			3	W	FS,PS	B	15' - 20'	15' - 20'	Spring to Fall	F	
Maple- Douglas/Rocky Mountain Maple (Shrub/ Tree)	Acer glabrum var. douglasii	y		3		FS,PS	B	15'	15'	Year round		
Ponderosa Pine	Pinus ponderosa	y	Evergreen	1		FS	B	50' - 80'	20' - 25'	Year round	M,F	

PLANT LIST (Cont'd)

COMMON NAME	BOTANICAL LATIN NAME	NATIVE PLANT	PERENNIAL/ UNLESS SAYS EVERGREEN	WATER NEEDS (IN FULL SUN)	WHICH ZONE IN A RAIN-GARDEN ((D)RY, (M)OIST OR (W)ET)	LIGHT NEEDS: FULL SUN (FS), PART SUN (PS, SHADE (S)	USED BY BIRDS (B), POLLINATORS (P)	HEIGHT	WIDTH/ SPREAD	SEASON OF INTEREST	EROSION CONTROL (EC), (M)EDICINAL, (E)DIBLE PLANT, (N)ITROGEN-FIXING, (F)RAGRANCE	SPREADS/ SELF-SEEDS
Saskatoon- Autumn Brilliance	Amelanchier x grandiflora 'Autumn Brilliance'			1	D	FS,PS,S	BP	15' - 25'	15' - 25'	Spring to Fall	E	
Trembling Aspen/Quaking Aspen	Populus tremuloides	y		3	W,M	FS		40' - 50'	20' - 30'	Spring to Fall	M	
Wayfaring Tree (Shrub/Tree)	Viburnum lantana			2		FS,PS	BP	10' - 15'	10' - 15'	Year round		
SHRUBS												
Big Sagebrush	Artemesia tridentata	y		only water until established	D	FS	BP	5'	5'	Year round	EC,E,M,F	
Antelope Brush	Purshia tridentata	y		only water until established		FS	P	5' - 7'	4' - 6'	Year round	EC, F	
Ceanothus/Snowbrush	Ceanothus velutinus	y		1	D	FS	P	1' - 2'	3' - 8'	Spring to Fall	F,M	
Caragana- Globe	Caragana frutex 'Globosa'			1		FS/PS	P	3'	2' - 3'	Spring to Fall	N	
Caragana- 'Walker's Weeping' (Shrub/Tree)	Caragana arborescens 'Walker'			1		FS	P	5' - 10'	3' - 4'	Spring to Fall	N	
Currant- Waxy	Ribes cereum	y		1	DM	FS,PS	BP	3' - 5'	3' - 5'	Spring	E,M	
Currants- Red/Black/ Golden	Ribes (rubrum/nigrum/ aureum)			2		FS,PS	B	4' - 8'	4' - 8'	Spring to Fall	E	
Juniper- Common	Juniperus communis	y	Evergreen	1		FS,PS	B	3'	8'	Year round	EC,E,M	
Juniper (nursery shrub cultivars)	Juniperus horizontalis/ sabina/communis		Evergreen	1		FS,PS	B	6" - 4'	3' - 8'	Year round	EC	
Juniper (Columnar Tree)	Juniperus scopulorum 'Moonglow'		Evergreen	1		FS,PS	B	16' - 20'	5' - 8'	Year round	E	
Juniper- Common	Juniperus communis	y	Evergreen	1		FS,PS	B	3'	8'	Year round	EC,E,M	
Juniper (nursery shrub cultivars)	Juniperus horizontalis/ sabina/communis		Evergreen	1		FS,PS	B	6" - 4'	3' - 8'	Year round	EC	
Juniper- Gold Coast	Juniperus chinensis 'Gold Coast'		Evergreen	1		FS		2' - 3'	4' - 6'	Year round		
Lilac- Common	Syringa vulgaris			1		FS	BP	10' - 12'	8' - 12'	Spring to Fall	F	

PLANT LIST (Cont'd)

COMMON NAME	BOTANICAL LATIN NAME	NATIVE PLANT	PERENNIAL/ UNLESS SAYS EVERGREEN	WATER NEEDS (IN FULL SUN)	WHICH ZONE IN A RAIN-GARDEN ((D)RY, (M)OIST OR (W)ET)	LIGHT NEEDS: FULL SUN (FS), PART SUN (PS, SHADE (S)	USED BY BIRDS (B), POLLINATORS (P)	HEIGHT	WIDTH/ SPREAD	SEASON OF INTEREST	EROSION CONTROL (EC), (M)EDICINAL, (E)DIBLE PLANT, (N)ITROGEN-FIXING, (F)RAGRANCE	SPREADS/ SELF-SEEDS
Lilac- 'Miss Kim'	Syringa patula 'Miss Kim'			2		FS	BP	4' - 9'	5' - 7'	Spring to Fall	F	
Ocean Spray	Holodiscus discolor	y		1	D	FS,PS	P	5' - 7'	5' - 10'	Year round	M	
Mugo Pine- 'Slowmound'	Pinus mugo 'Slowmound'		Evergreen	1	D	FS,PS	B	2'	3'	Year round		
Mock Orange	Philadelphus Lewisii	y		1	D	FS,PS	BP	7' - 10'	7'	Spring	F	
Mock Orange- 'Waterton'	Philadelphus Lewisii 'Waterton'			2		FS,PS	BP	7'	6'	Spring	F	
Oregon Grape (tall)	Mahonia aquifolium	y	Evergreen	1	D	FS,PS	BP	1' - 8'	3' - 6'	Year round	E,M,EC,F	y
Shrubby Penstemon	Penstemon fructicosus	y		1	D	FS	P	6"	1' - 18"	Spring to Fall	M	
Potentilla/Shrubby Cinquefoil	Potentilla fruticosa	y		2	M	FS	P	1' - 2'	1' - 2'	Spring to Fall		
Potentilla/Cinquefoil (nursery cultivars)	Potentilla fruticosa (eg cultivars: Abbotswood/ Coronation Triumph/ Goldfinger)			2	M	FS	P	2' - 4'	2' - 4'	Spring to Fall		
Rabbitbrush	Ericameria nauseosa	y		1	D	FS	P	3'	3'	Year round	EC,F	
Red Osier Dogwood	Cornus serica	y		3	WM	PS	B	6'	6'	Spring to Fall		y
Rose - 'Knock Out'	Rosa x RADrazz			2		FS	BP	3' - 6'	3' - 6'	Year round	F,E,M	
Rose - 'Nearly Wild'	Rosa 'Nearly Wild'			2		FS	BP	30"	30"	Year round	F,E,M	
Juniper (nursery shrub cultivars)	Juniperus horizontalis/ sabina/communis		Evergreen	1		FS,PS	B	6" - 4'	3' - 8'	Year round	EC	
Rose - Wild / 'Wood's' (a few varieties are considered to be Indigenous)	Rosa woodsii / acicularis / nutkana / gymnocarpa	y		1	DM	FS,PS	BP	2' - 7'	3' - 5'	Year round	F,E,M (leaves),EC	
Russian Sage (self seeds)	Perovskia atriplicifolia			1	DM	FS,PS	P	3' - 5'	2' - 4'	Summer to Winter	F,EC	y
Saskatoon Berry (Shrub/ Tree)	Amelanchier Alnifolia	y		1	DM	FS,PS	BP	3' - 20'	3' - 8'	Spring to Fall	E,M	
Snowberry (will spread)	Symphoricarpos albus	y		1	D	FS,PS	BP	2' - 3'	3'	Year round	EC	y
Soapberry/Soopalallie/ Skuhshum	Shepherdia canadensis	y		2	MW	FS,PS	P	4' - 6'	3' - 4'	Spring to Fall	E,M,N	
Smooth Sumac (will spread)	Rhus glabra	y		1		FS	B	3' - 10'	3' - 10'	Year round	EC	y

PLANT LIST (Cont'd)

COMMON NAME	BOTANICAL LATIN NAME	NATIVE PLANT	PERENNIAL/ UNLESS SAYS EVERGREEN	WATER NEEDS (IN FULL SUN)	WHICH ZONE IN A RAIN-GARDEN ((D)RY, (M)OIST OR (W)ET)	LIGHT NEEDS: FULL SUN (FS), PART SUN (PS, SHADE (S)	USED BY BIRDS (B), POLLINATORS (P)	HEIGHT	WIDTH/ SPREAD	SEASON OF INTEREST	EROSION CONTROL (EC), (M)EDICINAL, (E)DIBLE PLANT, (N)ITROGEN-FIXING, (F)RAGRANCE	SPREADS/ SELF-SEEDS
Tiger Eyes Sumac (can spread)	Rhus typhina 'Bailtiger' TIGER EYES			1 to 2		FS	B	4' - 6'	4' - 10'	Spring to Fall	EC	y
Globe Blue Spruce	Picea pungens 'Globosa'		Evergreen	3		FS		4'	7'	Year round	E	
Wolf Willow/ Silverberry/ Silverwillow (will sucker- additional shoots need to be cut to the ground)	Elaeagnus commutata	y		1	M	FS,PS	B	4' - 8'	4' - 6'	Spring to Fall	EC,N,F	y
GRASSES												
Blue Oat Grass	Helictotrichon sempervirens			1	D	FS,PS,S		2' - 3'	2'	Year round		
Bluebunch Wheatgrass (self seeds)	Pseudoregneria spicata/ spicatum	y		1	D	FS		2'	18"	Year round	M,EC	y
Feather Reed Grass (nursery cultivars)	Calamagrostis x acutiflora (eg cultivars: Karl Foerster/ Overdam/Avalanche (variegated)			1 to 3	M	FS,PS	B	5'	3'	Year round		
Fescue- Blue Hair Grass	Festuca glauca			1	D	FS		1'	1'	Year round		
Giant Wild Rye	Elymus cinereus	y		2	MW	FS		6'	40"	Year round	M (roots)	
Idaho Fescue (self seeds)	Festuca idahoensis	y		2	D	FS,PS		1'	1'	Year round		y
Junegrass	Koeleria macrantha/ cristata	y		1	D	FS,PS		18"	1'	Year round		y
Switch Grass- Heavy Metal	Panicum virgatum 'Heavy Metal'			2	DM	FS,PS	B	54"	3'	Year round		
Switch Grass- Red	Panicum virgatum 'Rostrahlbusch' or 'Shenandoah', 'Prairie Fire' etc			2	DM	FS,PS	B	3' - 5'	3'	Year round		
PERENNIALS												
Aster- Golden (self seeds)	Heterotheca villosa	y		1		FS,PS	P	8" - 1'	1'	Spring to Fall		y
Aster- Showy (will spread)	Aster conspicuus	y		1		FS,PS	P	2' - 40"	18" - 3'	Spring to Fall	M	y
Aster- Summer or Frikart's Aster	Aster frikartii			2	DM	FS	P	2' - 3'	2' - 3'	Spring to Fall		
Beebalm- Red	Monarda 'Jacob Cline'			2 to 3		FS,PS	PB	3' - 4'	2' - 3'	Spring to Fall		
Bergenia- Heartleaf	Bergenia cordifolia		Evergreen	2		PS,S		1' - 18"	1' - 2'	Year round		

PLANT LIST (Cont'd)

COMMON NAME	BOTANICAL LATIN NAME	NATIVE PLANT	PERENNIAL/ UNLESS SAYS EVERGREEN	WATER NEEDS (IN FULL SUN)	WHICH ZONE IN A RAIN-GARDEN ((D)RY, (M)OIST OR (W)ET)	LIGHT NEEDS: FULL SUN (FS), PART SUN (PS, SHADE (S)	USED BY BIRDS (B), POLLINATORS (P)	HEIGHT	WIDTH/ SPREAD	SEASON OF INTEREST	EROSION CONTROL (EC), (M)EDICINAL, (E)DIBLE PLANT, (N)ITROGEN-FIXING, (F)RAGRANCE	SPREADS/ SELF-SEEDS
Blue Flax (self seeds)	Linum perenne	y		2	D	FS,PS	P	1' - 18"	18" - 2'	Spring to Fall		y
Candytuft - 'Little Gem'	Iberis sempervirens 'Little Gem'		Evergreen	1 to 2		FS,PS	P	1'	2'	Year round		
Chives	Allium schoenoprasum			1 to 2		FS	P	1' - 18"	1'	Spring to Fall	E,F	
Daylily - 'Stella d'Oro'	Hemerocallis 'Stella d'Oro'			2	M	FS,PS	B	18"	2'	Spring to Fall	E	
Daylily (many cultivars)	Hemerocallis (many cultivars available)			2 to 3	M	FS,PS	B	1' - 4'	1' - 30"	Spring to Fall	E	
Echinacea/Coneflower	Echinacea purpurea			2 to 3	M	FS,PS	PB	2' - 30"	18" - 2'	Year round	M	
False Solomon's Seal- (Indigenous)	Smilacina racemosa	y		2	M	PS,S	P	2' - 3'	2' - 3'	Spring to Fall	E,M	
Gaillardia/Blanket Flower/ Brown-eyed Susan	Gaillardia aristata	y		1	D	FS	P	18"	18"	Spring to Fall	M	y
Geranium - Cranesbill (self seeds)	Geranium sanguineum (eg cultivars: Rozanne, Bloody Cranesbill, Cambridge)			1		FS,PS	P	1' - 18"	18" - 2'	Spring to Fall		
Hollyhock	Alcea rosea			1 to 2		FS,PS	PB	5' - 7'	3' - 4'	Spring to Fall		
Hosta (many cultivars)	Hosta (hundreds of cultivars/varieties available)			3	needs part shade	PS,S	P	6" - 4'	6" - 60"	Spring to Fall	E	
Lavender (many cultivars)	Lavandula angustifolia		Evergreen	1		FS,PS	P	1' - 2'	1' - 2'	Year round	E,F	
Milkweed -Showy (self seeds)	Asclepias speciosa			1 to 2		FS	P	3'	2'	Spring to Fall	F	y
Nodding Onion	Allium cernuum	y		1	MD	FS	P	8" - 18"	6" - 1'	Spring to Fall	E,F	
Ostrich Fern	Matteuccia struthiopteris	y		2	needs part shade	PS,S		3' - 4'	2' - 3'	Spring to Fall	E (fiddleheads)	y
Pearly Everlasting (self seeds)	Anaphalis margaritacea	y		2	D	FS,PS	P	1' - 2'	2' - 3'	Spring to Fall	F,M	y
Prairie Crocus or Peace/ Pasque Flower (can self seed)	Pulsatilla vulgaris			2		FS,PS		1'	18" - 2'	Spring		
Rhubarb	Rheum rhabarbarum			1 to 2		FS,PS		16"- 3'	2' - 4'	Spring to Fall	E	

PLANT LIST (Cont'd)

COMMON NAME	BOTANICAL LATIN NAME	NATIVE PLANT	PERENNIAL/ UNLESS SAYS EVERGREEN	WATER NEEDS (IN FULL SUN)	WHICH ZONE IN A RAIN-GARDEN ((D)RY, (M)OIST OR (W)ET)	LIGHT NEEDS: FULL SUN (FS), PART SUN (PS, SHADE (S)	USED BY BIRDS (B), POLLINATORS (P)	HEIGHT	WIDTH/ SPREAD	SEASON OF INTEREST	EROSION CONTROL (EC), (M)EDICINAL, (E)DIBLE PLANT, (N)ITROGEN-FIXING, (F)RAGRANCE	SPREADS/ SELF-SEEDS
Round-leaved Alumroot (sim.to Coral Bells)	Heuchera cylindrical	y	Evergreen	1	DM	FS,PS	P	8" - 18"	6" - 10"	Year round	M	
Russian Sage- Dwarf	Perovskia atriplicifolia 'Little Spire'			1	DM	FS	P	30"	2'	Summer to Winter	F	
Sage- culinary (many cultivars)	Salvia officinalis (many cultivars available)		Evergreen	1		FS	PB	1' - 2'	18" - 30"	Year round	E,F	
Salvia (Perennial)- 'East Friesland' or 'Caradonna'	Salvia nemorosa 'East Friesland' or 'Caradonna'			1 to 2	M	FS	PB	1' - 2'	1' - 2'	Spring to Fall		
Sedum/Stonecrop- 'Autumn Joy' (many cultivars available)	Sedum alboroseum 'Autumn Joy'			1	M	FS,PS	P	18" - 2'	18" - 2'	Summer to Fall		
Lupine- Silky (can spread)	Lupinus sericeus	y		1		FS,PS	PB	1' - 2'	18"	Spring to Fall	N,M	y
Soapweed	Yucca glauca		Evergreen	1		FS		2' - 3'	2' - 3'	Year round		
Zagreb Threadleaf Tickseed	Coreopsis verticillata 'Zagreb'			1 to 2	D	FS	P	1' - 16"	18"	Spring to Fall		
Yarrow- Ornamental	Achillea millefolium 'Terracotta', 'Paprika', 'Strawberry Paprika', etc		Evergreen	2		FS,PS	P	18" - 3'	2'	Year round		
Yarrow (aggressive spreader/lawn alternative)	Achillea millefolium	y	Evergreen	1	M	FS,PS	PB	18" - 3'	18" - 3'	Year round	M	y
Yarrow- 'Moonshine'	Achillea 'Moonshine'		Evergreen	2		FS,PS	P	18"	2'	Year round		
Yucca- 'Golden Sword' (more cultivars available)	Yucca filamentosa 'Golden Sword'		Evergreen	1		FS		2'	2'	Year round		
GROUNDCOVERS												
Sage- culinary (many cultivars)	Salvia officinalis (many cultivars available)		Evergreen	1		FS	PB	1' - 2'	18" - 30"	Year round	E,F	
Hens and Chicks	Sempervivum species		Evergreen	1	D	FS,PS	P	1" - 4"	6" - 2'	Year round		

PLANT LIST (Cont'd)

COMMON NAME	BOTANICAL LATIN NAME	NATIVE PLANT	PERENNIAL/ UNLESS SAYS EVERGREEN	WATER NEEDS (IN FULL SUN)	WHICH ZONE IN A RAIN-GARDEN ((D)RY, (M)OIST OR (W)ET)	LIGHT NEEDS: FULL SUN (FS), PART SUN (PS, SHADE (S)	USED BY BIRDS (B), POLLINATORS (P)	HEIGHT	WIDTH/ SPREAD	SEASON OF INTEREST	EROSION CONTROL (EC), (M)EDICINAL, (E)DIBLE PLANT, (N)ITROGEN-FIXING, (F)RAGRANCE	SPREADS/ SELF-SEEDS
Salvia (Perennial)- 'East Friesland' or 'Caradonna'	Salvia nemorosa 'East Friesland' or 'Caradonna'			1 to 2	M	FS	PB	1' - 2'	1' - 2'	Spring to Fall		
Sedum/Stonecrop- 'Autumn Joy' (many cultivars available)	Sedum alboroseum 'Autumn Joy'			1	M	FS,PS	P	18" - 2'	18" - 2'	Summer to Fall		
Lupine- Silky (can spread)	Lupinus sericeus	y		1		FS,PS	PB	1' - 2'	18"	Spring to Fall	N,M	y
Soapweed	Yucca glauca		Evergreen	1		FS		2' - 3'	2' - 3'	Year round		
Zagreb Threadleaf Tickseed	Coreopsis verticillata 'Zagreb'			1 to 2	D	FS	P	1' - 16"	18"	Spring to Fall		
Yarrow- Ornamental	Achillea millefolium 'Terracotta', 'Paprika', 'Strawberry Paprika', etc		Evergreen	2		FS,PS	P	18" - 3'	2'	Year round		
Yarrow (aggressive spreader/lawn alternative)	Achillea millefolium	y	Evergreen	1	M	FS,PS	PB	18" - 3'	18" - 3'	Year round	M	y
Kinnickinnick/Common Bearberry	Arctostaphylos uva-ursi	y	Evergreen	1	DM	FS,PS,S	BP	4" - 1'	3'	Year round	E,M,EC	
Lamium - 'Beacon Silver', 'White Nancy', 'Chequers'	Lamium			2		FS,PS,S				Summer to Fall		y
Phlox - Spreading	Phlox diffusa	y		1		FS	PB	4" - 6"	4" - 1'	Spring		
Pussytoes - 'Pink' (can spread/self seed)	Antennaria dioica 'Rubra'		Evergreen	1		FS,PS,S	P	2" - 18"	1'	Year round		y
Pussytoes (pink to rose) (can spread/self seed)	Antennaria rosea	y	Evergreen	1		FS,PS,S	P	2" - 18"	1'	Year round	M	y
Wooly Thyme	Thymus pseudolanuginosus		Evergreen	1		FS,PS	P	1"	3'	Year round		
Strawberry- Wild (will spread)	Fragaria virginiana	y		2		FS,PS	PB	6"	18"	Year round	E,M	y
Strawberry (Everbearing/ Day neutral)	Fragaria x 'Tristar'			2		FS,PS	PB	6"	2'	Year round	E	y

APPENDIX B -PLANTS TO AVOID IN ANY OKANAGAN GARDEN

SHRUBS AND TREES

- Russian Olive (Eleagnus angustifolia)
- Scotch Broom (Cytisus scoparius) - It reaches heights of 1-3 (4) m, shading out understorey species. Seeds spread most quickly via water, and along roadways
- Siberian Elm (Ulmus pumila)
- Tamarisk (Tamarix ramosissima) - a huge pest in the U.S Southwest and could become one here with climate change
- Tree-of-Heaven (Ailanthus altissima)
- Black Locust (Robinia pseudoacacia)

VINES

- Silver Lace Vine (Polygonum aubertii) - strangles other plants
- Virginia Creeper (Parthenocissus quinquefolia) - 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
- 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 - often contain invasive species for this area

INVASIVE AQUATIC SPECIES

- Purple Loosestrife (Lythrum salicaria) - it can displace valuable habitat for flora and fauna. Dense infestations have been known to clog canals and ditches impeding water flow.
- Yellow Flag Iris (Iris pseudacorus) - particularly bad for cattails, sedges and rushes that are used by many birds for nesting
- Milfoil (Eurasian Watermilfoil) (Myriophyllum spicatum) - this invasive plant has the ability to outcompete with and replace native plant communities, reducing overall biological diversity and reducing water quality.
- Reed Canary Grass (Phalaris arundinacea) - cultivars brought in from Europe and Asia, for ornamental use and as pasture grasses, hybridize with native populations of the grass, and produce aggressive offspring in the central and western regions of the continent

Okanagan Basin
WATER BOARD

1450 KLO Road | Kelowna, BC V1W 3Z4 | (250) 469-6271

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