Lifeless waterways tainted hue
Cluttered shorelines obstructing the view
Have you ever stopped and took a moment
To ponder what happens below,
Our streets where water flows?

On the street where vehicles release
Toxic gases at our feet,
Not to mention spills and leaks
Which enter storm drains easily.

Have you ever wondered where runoff travels?
Its destiny, its fate…
Do you know whom to call
When you see grease flowing from an outfall?

When pristine waters are few,
And polluted shorelines obstruct our view
ADOPT AN OUTFALL and you will see,
Our beautiful ecosystem full of integrity.

Marcia Moulton

ADOPT-an-OUTFALL

A program from:

Veins of Life Watershed Society
Box 36057 – 1153 Esquimalt Rd
Victoria, BC V9A 7J5
phone/fax: (250) 383.2086
email: volws3@home.com
website: www.islandnet.com/~volws

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Written by: Donna Ogden, Project Coordinator, Tara Tompkins, Education Assistant, Cathleen Bidese, Education Coordinator
Layout and Design by: Cathleen Bidese, Education Coordinator

To: **Northwest Scientific Supply Ltd**
301-3060 Cedar Hill Road
PO BOX 6100, LCD 1
Victoria, BC
V8P 5L4
Email: service @nwscience.com
Phone: 1-250-592-2438
Fax: 1-250-592-1341

From: _____

Of: _____

_____

_____

RE: order request

I would like to order the following items and pay by _____.

1) 10-5510 LaMotte Dissolved Oxygen Kit @ $58.80 quantity:

2)10-5490 LaMotte Turbidity Test Kit @ $62.55 quantity:

3)10-5612 Investigating Water Problems (handbook) @ $7.25 quantity:

4)17-6062 Thermometer (yellow back, red liquid, single scale, -20-100 C) @ $7.75 quantity:

5) 17-9005A Insta-chek Ph 0-13, standard, 5.5 mm @ $8.75 quantity:

Credit Card #: Expiry Date: Name:

To be delivered to: _____

_____

_____

_____

Thank you.

Photocopy and fill out the order form to fax or mail.

Note: To refill reagents/ individual items in your kits. Refer to the material listings supplied for each kit for the order number.

Additional materials: gloves, safety glasses, garbage bags, water sample bottles, waste container, pencils, storage container, laminated instructions, and monitoring sheets.

Table of Contents

References are stated throughout the manual.

About the Veins of Life Watershed Society

The Veins of Life Watershed Society (VOLWS) is a community based environmental organization operating in the Capital Regional District (CRD). The mission of VOLWS is to work with others to restore and maintain healthy watersheds in which people and natural ecosystems coexist. VOLWS initiates and participates in cleanups, watershed planning, environmental education programs, public outreach, and habitat restoration projects focusing on the Gorge and its component watersheds. The society first got its start when John Roe and his son, Wesley began pulling garbage out of the Gorge Waterway in 1994. The campaign evolved into a non-profit society through partnerships with government, business, academia, environmental groups, volunteers, and the public.

VOLWS vision is for all British Columbians to become watershed citizens.

Our goals are:

- To promote the unique quality of the Gorge Waterway as an extraordinary recreational feature
- To bring back healthy streams and spawning salmon through research and practical on-site restoration
- To educate members of the residential and business community, and visitors about the intrinsic value of natural systems and the stewardship role individuals have as watershed citizens
- To participate in and provide leadership to watershed management planning.

Introduction to the Adopt-an-Outfall Program

This program is a collection of innovative activities and information designed to educate the residents of the CRD about the role that the storm drain system plays in our watersheds and particularly in

our water quality. This program also provides ideas on how to get involved in helping our local waterways. Growing local and international concerns over the gradual deterioration in the quality of our water has brought attention to the nature and sources of pollution that are entering our local water bodies.

The CRD is an urban environment containing natural patches of green spaces and impervious areas across its landscape. Green space provides areas where rain and snowmelt can be absorbed by the natural vegetation and soils. In contrast, the impervious zones (i.e. roads, parking lots, side walks, driveways, buildings, homes, etc) mark the areas which are resistant to water penetration. Where rainwater or snowmelt do not infiltrate into the ground, the excess water runs off the land, picking up and transporting pet wastes, car-washing residues, garbage, pesticides, paints, oil, and other household chemicals. The run off carries the pollutants through the storm drain system. These pollutants are known as non-point source pollution (NPS) because they do not originate from one specific location. Rather this type of pollution accumulates from a number of places that can be hard to pinpoint. Outfalls mark the end point of the storm drain system where storm water enters into local waterways without being treated in any way.

Storm drains act like a stream collecting runoff from the land, but do not contain or create the natural features associated with a stream. With inadequate care of our environment, storm drains carry toxic chemicals to our local water bodies. These pollutants can cause great harm to our fish and wildlife habitat and degrade our recreational and natural legacies.

"In wildness is the preservation of the world."
H D Thoreau

Who Should Use the Adopt-an-Outfall Program?

The goal of the Adopt-an-Outfall program is to stimulate awareness and action to prevent non-point source pollution from entering into our

waterways. **Adopt-an-Outfall is designed as an educational program for all community-based organizations, group leaders, teachers, and other groups who are interested in learning more about protecting our world's most precious resource- water**. By acquiring the knowledge and practical skills to reduce and eliminate pollution from our waterways, individuals can take these practices and use them to educate others in their home, work, school, and recreational environments. When we are aware and take personal responsibility for our actions, the natural environment benefits.

"Tell me, I'll forget.
Show me, I may remember.
But involve me and I'll understand."
Chinese Proverb

How can My Group or Class Adopt an Outfall?

If your group is interested in adopting an outfall or finding out more about the program, contact the education coordinator at the Veins of Life Watershed Society office at (250) 383-2086. The education coordinator will book a presentation or field trip with your group. Once your group has been introduced to the program by VOLWS staff or a group leader, and is ready to begin monitoring the outfall(s), have the group fill out the Adopt-an-Outfall Pledge form (in the appendix) and send/fax it in to the VOLWS office. This is your group's promise to be environmental stewards for the chosen outfall(s). This also ensures that other groups' monitoring does not overlap with your groups' monitoring.

VOLWS is available to introduce you to the program and provide you with additional maps, resources, and support. If you have any questions please do not hesitate to contact our education coordinator.

What is Currently Being Done to Improve Our Storm Water?

Storm water quality is managed by the CRD's "Stormwater Quality Survey" program. One section of this program includes stormwater quality monitoring. This involves sampling the stormwater from selected outfalls for fecal coliform levels and chemical contaminants. These surveys have been successful in highlighting stormwater contaminants and the potential impact to public health (CRD Environmental Services Group, 1999). Some physical improvements have been made to the storm drain system, but reducing non-point source pollution involves educating the public about proper use of our storm drains and reducing our use of hazardous materials.

The government of British Columbia has recognized that the major cause of water pollution is from non-point sources. Non-point source water pollution is subtle, gradual, and cumulative. It is derived from many different and dispersed sources, such as: urbanization, agriculture, and individual homeowners. Storm drains offer a direct avenue for non-point source pollution to concentrate and travel directly to our local water bodies without being treated or filtered in any way.

The Top 10 Causes of River Pollution

Starting with the greatest cause, river pollution is the result of:

1. Sediment (from soil erosion)
2. Excessive nutrients (from fertilizers)
3. Organic enrichment (from sewage)
4. Pathogens (from sewage)
5. Metals (from industrial waste)

6. Salinity
7. Pesticides
8. Suspended solids
9. Habitat modification
10. Flow alteration

Where Does this Pollution Come From?

Starting with the highest contributor, river pollution comes from:

1. Agriculture (farms)
2. Municipal discharges (sewage treatment plants)
3. Habitat modification (construction)
4. Resource extraction (mining)
5. Storm water runoff (storm drains)
6. Industrial discharges (manufacturing plants)
7. Logging
8. Construction
9. Land disposal
10. Combined sewer overflows (older systems that combine sewers and storm drains)

(Dashefsky, H. S. Kids Can Make A Difference! Toronto: Tab Books, 1995)

Through educational programs, such as Adopt-an-Outfall, you can receive authentic and practical learning experiences while helping to improve the quality of our local waterways.

Here in BC, we are lucky to have some of the most pristine water bodies in the world, as well as some of the most productive streams. Given population growth and our increased demand for natural resources, we must act immediately with determination to deal with non-source point pollution. Otherwise we can anticipate a gradual decline in the quality of our waters. This decline will lead to significant future economic and recreational loss and reduced health in our environment.

"The earth we abuse and the living things we kill will, in the end, take their revenge; for in exploiting their presence we are diminishing our future."
Marya Mannes

Non-point source pollution that enters the storm drain is elusive and not easily regulated or enforced. We are all responsible and must all be involved in the solution. This will require cooperation and coordination at all levels: governments, community organizations, and individuals.

Individuals like you can get involved in the Adopt-an-Outfall Program! Individuals and groups can help the Veins of Life Watershed Society move towards protecting and conserving our waterways. Within this resource package, you will find information on how to be an effective watershed citizen. All it takes is a little learning and caring!

Why Should We Care?

Across British Columbia, NPS water pollutants have produced a range of impacts. In the enclosed marine waters of the CRD, NPS water pollution has adversely affected recreational opportunities, degraded aesthetic values, and reduced the abundance and diversity of marine life. The Victoria and Esquimalt harbours remain closed to commercial crab harvesting due to dioxin/furan contamination from boat fuels. Beach closures have been common throughout the CRD, primarily due to fecal matter discharge into storm drain systems. Although much work has been done to locate and eliminate many of these problems, there is still a great deal to be done.

In Saanich Inlet, most bays are closed to shellfish harvesting due to fecal contamination from agricultural runoff, onsite sewage systems, and stormwater runoff. High levels of heavy metals have been measured in sediments near storm drain outfalls. These contaminants can cause lethal toxicity to bottom-dwelling organisms.

Many costs and problems are associated with NPS pollution, including:

- degraded drinking water and potential human risks;
- damage to aquatic ecosystems, including fish, other aquatic organisms, and their habitats;
- economic losses to commercial and recreational fishing and shellfish harvesting and impacts on traditional First Nations food harvesting areas;
- diminished water-based recreation and tourism opportunities;

- reduced aesthetic and market values of lakes, streams and coastal areas;
- costs of remediation (e.g. payments for monitoring, clean-ups and pollution reduction); and,
- reduced real estate values.

"Becoming more aware of possible water contaminants and how they affect our environment can help guide our choices. To contaminate or not to contaminate… the choice is often ours."
Friends of Boundary Bay

An Overview of Our Local Aquatic Ecosystems

✶please note that this is for general background information

An ecosystem can be thought of as a natural unit, for example, Thetis Lake or Colquitz Creek, where there is an exchange of matter and energy between living and non-living parts of the system. Living or organic parts may include: plants, animals, trees, etc. Non-living or inorganic parts may include: soil chemistry, temperature, nutrient supply, etc. Ecosystems vary from place to place due to the variations in climate, terrain, and elevation. Ecosystems contain no boundaries and range in size from as small as a potted plant to as large as the earth! An ecosystem can be a rotting log or a puddle of water beneath a storm drain outfall; or it can be the lakes, estuaries, streams, wetlands, riparian zones, the ocean and its intertidal zones that make up the watershed. These larger ecosystems will be discussed below.

What is a Watershed?

(Stone, Jennifer. "The Water Book" Victoria: Science and Technology Agency, 1998)

A watershed, also known as a drainage basin or catchment area, is the total land area that contributes runoff to a specific body of water, for example, the Gorge waterway. Runoff is the excess water that flows off the land's surface (i.e. when rain exceeds infiltration capacity of the soil or when there is snowmelt).

The elevation and slope of the land determines which way the surface water will flow. A watershed's boundaries are delineated according to the height of land, called the drainage divide, which separates one watershed from another. The watershed is composed of a number of smaller key ecosystems, such as: forests, grasslands, lakes, streams, wetlands, estuaries, etc. The storm drain system is similar to a watershed. Storm drain systems are engineered to work with the slope of the land, collecting the water that runs off the land and transporting water like a stream. Storm drain systems do not contain or create the natural features associated with a stream, for example, vegetation or habitat for fish.

The Gorge receives water from two dominant watersheds: the Craigflower and the Colquitz Creek systems. Storm drain systems are also found in these watersheds and thus contribute water to the Gorge. Within the watershed ecosystem, there are smaller ecosystems such as: lakes, streams, wetlands, riparian zones, estuaries, intertidal zones, and the ocean. These will be discussed below.

Lake Ecosystems

Lake ecosystems such as, Thetis, Beaver, and Swan Lake are considerable bodies of standing inland fresh water. Lakes fulfill a critical part of the environment serving as the collection basin for water that falls in the watershed. The types of species vary according to the light and thermal conditions of the lake. This is a process called stratification. During warmer months, warmer water is found at top layer of the lake while cooler water sinks to the bottom. During cooler months the water begins to freeze. Since the density of water in its liquid form is higher than in its solid form, the freezing progresses down from the water surface. Due to the characteristics of water at its various states, aquatic life can exist in lake ecosystems. The differences in density at different temperatures allow lakes to circulate (increasing oxygen supply and mixing nutrients).

Local species that rely on lake habitat:

Plants: algae, white water-buttercup, watershield, pond-weed, water milfoil, bladder warts
Invertebrates: crayfish, dragonfly, damselfly, waterstrider. freshwater mussels
Fish: cutthroat trout, dolly varden, bull trout, steelhead, rainbow trout, sockeye salmon, pumpkinseed fish, other sunfish
Reptiles: salamanders, tree -frogs, red-legged frogs
Birds: duck (merganser, wood duck, bufflehead, mallard, widgeon), Canada geese, swallows, gulls
Mammals: vole, river otter, raccoon, deer, bear (on Vancouver Island only black bears are found), cougar

Streams Ecosystems

Streams are conduits through which fresh water and sediments move from high to low elevations, and eventually to the ocean. To be defined as a stream, water must be flowing for at least part of the year. The stream receives water within its watershed boundaries through runoff from rain or snowmelt, and from stored groundwater. The morphology of a stream is influenced by a number of factors. These include: its location within a watershed (mouth versus headwaters), geology, precipitation, sediment receiving processes, climate, land use, volume and timing of water flow (i.e. is the water derived from snowmelt in the summer months), and the nature of the riparian vegetation. Depending on the season, a variety of species are found within a stream ecosystem.

Local species that rely on stream habitat:

Invertebrates: crayfish, dragonfly, damselfly, worms, waterstrider, caddisfly, mayfly, stonefly, and hundreds of other insect species who rely on streams for larvae habitat
Fish: salmon (chinook, chum, coho, sockeye, steelhead, and pink), trout (cutthroat and rainbow), stickleback, sunfish, sculpin, char
Reptiles: northwestern garter snakes, tree frogs, red-legged frog
Birds: bald eagle, American dipper, red-tailed hawk
Mammals: vole, river otter, mink, raccoons, white-tailed and black-tailed deer, black bear, cougar

Wetland Ecosystems

Wetlands are ecosystems that have been dominated by water and whose processes and characteristics are largely controlled by water. It is an ecosystem that has been wet for a long time; enough to develop specially adapted vegetation and other organisms. They include areas where water is static or flowing, brackish or salt including marine water (where the depth of low tide does not exceed 6 meters).

Local species that rely on wetland habitat:

Plants: cattail, bullrushes, water smartweed, water plantains, arrowhead, yellow pond-lily
Invertebrates: snail, damselfly, dragonfly, and other insect larvae
Fish: sunfish
Birds: heron, migratory birds (Canada geese), duck (blue-winged teal, scaup, mallard, bufflehead), killdeer, marsh wren, spotted sandpiper, common snipe
Mammals: deer, raccoon, muskrat, beaver, coyote

Riparian Ecosystems

Riparian ecosystems define the linear areas of land that lays adjacent to local water bodies, such as streams, lakes, and wetlands. The riparian zone represents a dynamic interface between aquatic and terrestrial environments. The width of the riparian corridor changes continuously along its length, reflecting the soil moisture and nutrient conditions, vegetation, and slope. Natural disturbances, such as erosion, transportation, and deposition, continuously alter the riparian corridor. With the altering environmental conditions, a complex and diverse vegetation structure develops. Animals are attracted to the wide range of plant species for sources of food, shelter, nesting and resting areas. Organic litter that falls from overhanging vegetation provides nutritional inputs into the aquatic environment. The dense vegetation permits the soil and water temperatures to remain cool during hotter temperatures and their roots provide bank stability and help reduce erosion and silt. Riparian vegetation may become unstable during flooding or windstorms, or when banks become undercut. When this occurs large woody debris (trees, branches, and roots) can fall into the stream, creating and maintaining stream structure, such as pools, gravel bars, and side channels. Woody debris disperses the energy of flowing water (reducing the velocity of the stream), causes the deposition of gravel, and traps other nutrients.

Riparian areas are being lost to development. Removing vegetation in riparian areas eliminates an important source of food for both aquatic and terrestrial organisms. Water quality is also reduced when vegetation is removed. The root systems and microbes associated with riparian

vegetation act as a natural filter, trapping chemical elements from fertilizers, herbicides, pesticides, and other pollutants.

"In British Columbia, 59% of rare, threatened, and endangered species have all or part of their habitat needs met by riparian areas (MOF, p. 5, 1998)."
British Columbia Ministry of Forests. Riparian Areas: Providing Landscape Habitat Diversity, Part 5 of 7. (1998)

Local species that rely on riparian habitat:

Plants: trees (willow, douglas fir, grand fir, red alder), shrubs (red-osier dogwood, Pacific ninebark, snowberry)
Invertebrates: slugs, snails, insects, butterflies,
Fish: all stream species listed previously rely on a healthy riparian zone for their survival
Reptiles: frogs, salamanders
Birds: wrens, swallows, hawks, eagles, sparrows, woodpeckers, flickers, owls, herons, etc
Mammals: deer, cougar, bear, vole, raccoon, people

Estuarine Ecosystems

An estuary is a place where freshwater from a stream mixes with the saltwater from the ocean. This mixing causes fluctuating water levels, temperatures, velocities, salinity, and nutrients in the estuary. These environmental factors determine what type of species will grow in an estuary.

An estuary contains a diverse and rich collection of plants (reeds, sedges, rushes, marine algae) and animals (great blue heron, black brant), are found in the estuary due to the high supply of nutrients created by this unique ecosystem. The freshwater supplies the estuary with nutrients it has acquired on its path through the watershed and as high tide approaches, marine nutrients are also supplied to the estuarine environment. At the end

of the growing season, dead plant material accumulates to form an important base food called detritus. Detritus consists of dead plants combined with a rich assortment of microscopic fungi, bacteria, protozoa, and microorganisms. Small invertebrates such as worms, snails, and crustaceans thrive on this detritus. These invertebrates provide food to fish, birds, and mammals. There are only a few herbivores in the estuary, consisting mostly of waterfowl.

Local species that rely on estuary habitat:

Plants: reeds, sedges, rushes, marine algae, bullrush, saltgrass, arrowgrass, saltbush, cat-tails, eelgrass
Invertebrates: worms, snails, crustaceans, mud shrimp, black dog whelk, ghost shrimp, proboscis worm, lugworm, screw shell, mosquitoes, dragonfly eggs, dungenese crab
Fish: juvenile chum and chinook salmon, starry flounder, Pacific herring
Reptiles: rough-skinned newt
Birds: great blue heron, black brant, red-winged blackbird, curlew, long-billed dowitcher, dunlin, sanderling, black-bellied plover, black turnstone, rough-legged hawk, red-tailed hawk, mallard, American widgeon, northern pintail, bald eagle
Mammals: mole, raccoon, bear, deer, harbor seal,

Intertidal Ecosystems

The intertidal zone is the area of the coastal land that is influenced by the ebb and flow of the tides. Twice each day, the tide falls and rises, leaving the seashore covered with seawater or exposed to air, rain, or the drying effect of the sun. The intertidal zone is composed of four other zones: the spray zone, high tide zone, middle tide zone, and the low tide zone. All are affected differently by the rise and fall of the tide. Therefore the type of species will range in each of the intertidal sub zones.

Local species that rely on intertidal habitat:

Plants: seaweeds (red, brown, green marine algae), lichens, blue-green algae, phytoplankton
Invertebrates: clams, crabs, seastars, barnacles, chitons, sea anemones, calcareous tube worm, sea cumbers, blue mussels, octopus, shrimp, sun stars, limpets, periwinkles, zooplankton, rock louse
Fish: rockfish, sculpins
Birds: western sandpiper, black-bellied plover, black turnstone, black oystercatcher, bald eagle, sea gulls, great blue heron
Mammals: seal, bear, cougar, people

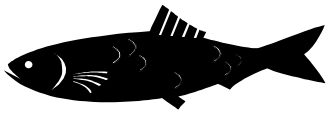
Ocean Ecosystems

The ocean ecosystem is a general name for the large bodies of salt water that cover nearly three fourths of the surface of the globe. The depth of the ocean varies. Its deepest point is over 6000 metres deep. The shallower areas of the ocean are more affected by changes in temperature, salinity, sedimentation, and water movements. Sunlight can influence shallower depths by helping to produce a rich assortment of nutrients, thereby feeding and increasing the number and diversity of animals and plants found in the deeper ocean. The ocean bottom is generally a level or gently rolling plain, covered with fine red or gray clay, or in certain regions, a layer of organic material. The oceans are divided into the Atlantic, Pacific, Indian, Arctic, and Antarctic Oceans. Due to the expanse and depth of the ocean, species vary according to longitude and latitude.

Local species that rely on the Pacific oceanic habitats:

Plants: phytoplankton, macroalgae (seaweeds)
Invertebrates: zooplankton, shellfish (crabs, shrimp, clams)
Fish: salmonids, and a huge variety of others
Birds: pelagic birds (gulls and cormorants), bald eagle, hawks
Mammals: whales, sea lion, seals, porpoises, sea otter, river otter

Water Quality Testing



Note: this activity is typically a good idea to do prior to the Outfall Monitoring Procedure, questions and concerns on water quality testing may be addressed

Objectives:

- To become involved in watershed stewardship, particularly Adopt-an-Outfall
- To define and provide examples of non-point source pollution
- To identify components of the urban watershed
- To be aware of the PEP number and the spill response
- To be familiar with procedures of various water quality tests
- To determine when it is necessary to call PEP
- To infer possible contaminates of water samples and determine their affects on wildlife, plant life, and humans
- To be introduced to VOLWS and its programs

Suggested age group: 12-15 years, adaptable to most ages

Duration: approximately one hour

Setting: indoor, table space required

Materials: Adopt-an-Outfall monitoring kit (see materials in the Outfall Monitoring Procedure), various water samples (suggestions at the end of the activity), Water Quality Testing worksheet, copies of Interpreting Your Results and the Water "SENSE" Wheel

Procedure:

1. Assign participates into groups. Number of groups determined on number of stations.
2. Handout Water Quality Testing worksheets. Read through the worksheet as a group. Answer questions.
3. Safety and appropriate lab behaviour talk: use wafting technique to smell, do not taste, do not touch without bare hands, tie back long hair, take care of loose clothing or jewelry, clean up spills promptly, use materials wisely, etc.
4. Briefly introduce each station. Dissolved Oxygen & Turbidity station requires mature help for pre-adolescents and younger.

Possible Stations (number of kits per station determined on number of participants):

- Turbidity test
- Dissolved Oxygen test
- pH and temperature readings
- observations (colour, odour, other)

*may use the Water "SENSE" Wheel at this station

5. Give each group a hypothetical water sample. The water sample is carried from station to station. All data recorded on the worksheet.
6. Groups come together to share data for others to record. Spokesperson for each group reads out their data.
7. Ask the participants which samples they would alert PEP for. Provide a few minutes for each group to discuss, decide, and defend their choice. Hold a vote for each water sample and pick a group to share their views. Present the votes on the board. Discuss.
8. Ask each group to infer the contaminates in each water sample, if any. Provide a few minutes for each group to discuss, decide, and defend their choice. Spokesperson for each group announces their decision and reason. Verify.
9. Looking at charts and readings (Interpreting Your Results & the Water "SENSE" Wheel): groups list the effects of the unhealthy water on plant life, animal life, and human life. Groups may do their sample and share findings or do all samples.
10. Ask the participants which samples they would alert PEP for. Provide a few minutes for each group to discuss, decide, and defend their choice. Hold a vote for each water sample and pick a group to share their views. Present the votes on the board. Discuss and compare to previous votes.

Hypothetical contaminants for water samples: lemon juice, compost juice, detergent, gasoline

✶ be sure to include one good sample

Water Quality Testing

TEST	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
temperature (° C)					
pH					
dissolved oxygen					
turbidity					
colour					
odour					
Any other observations?					
Which of these water samples would you report to PEP?	☐	☐	☐	☐	☐

Interpreting Your Results:

What do you think is the contaminant for each water sample you deem unhealthy?

Sample 1: _____ Sample 2: _____

Sample 3: _____ Sample 4: _____

Sample 5: _____

How does the contaminant affect wildlife, plant life, and humans?

Sample 1: _____

_____

Sample 2: _____

_____

Sample 3: _____

_____

Sample 4: _____

_____

Sample 5: _____

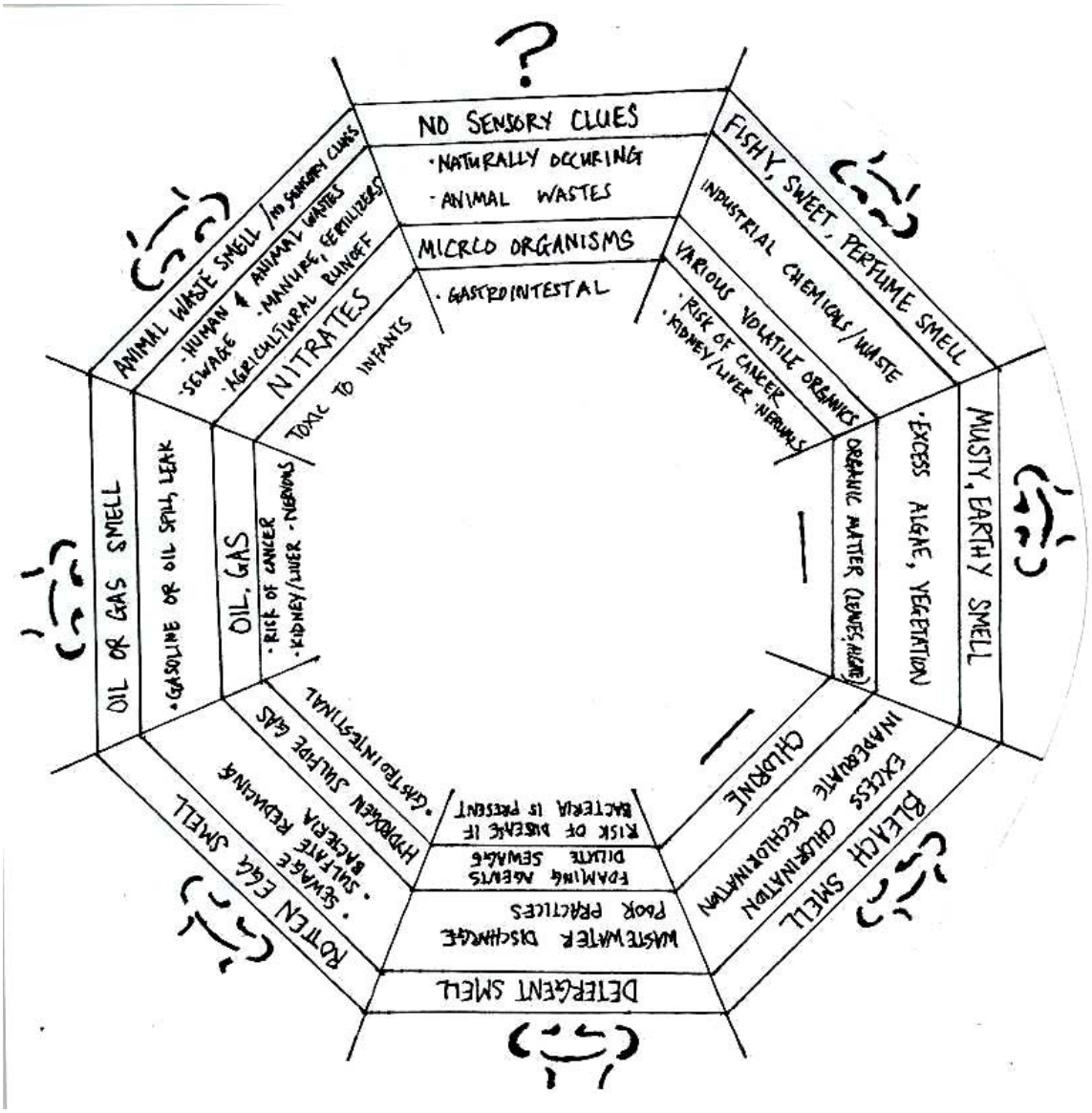
_____

A Second Visit:

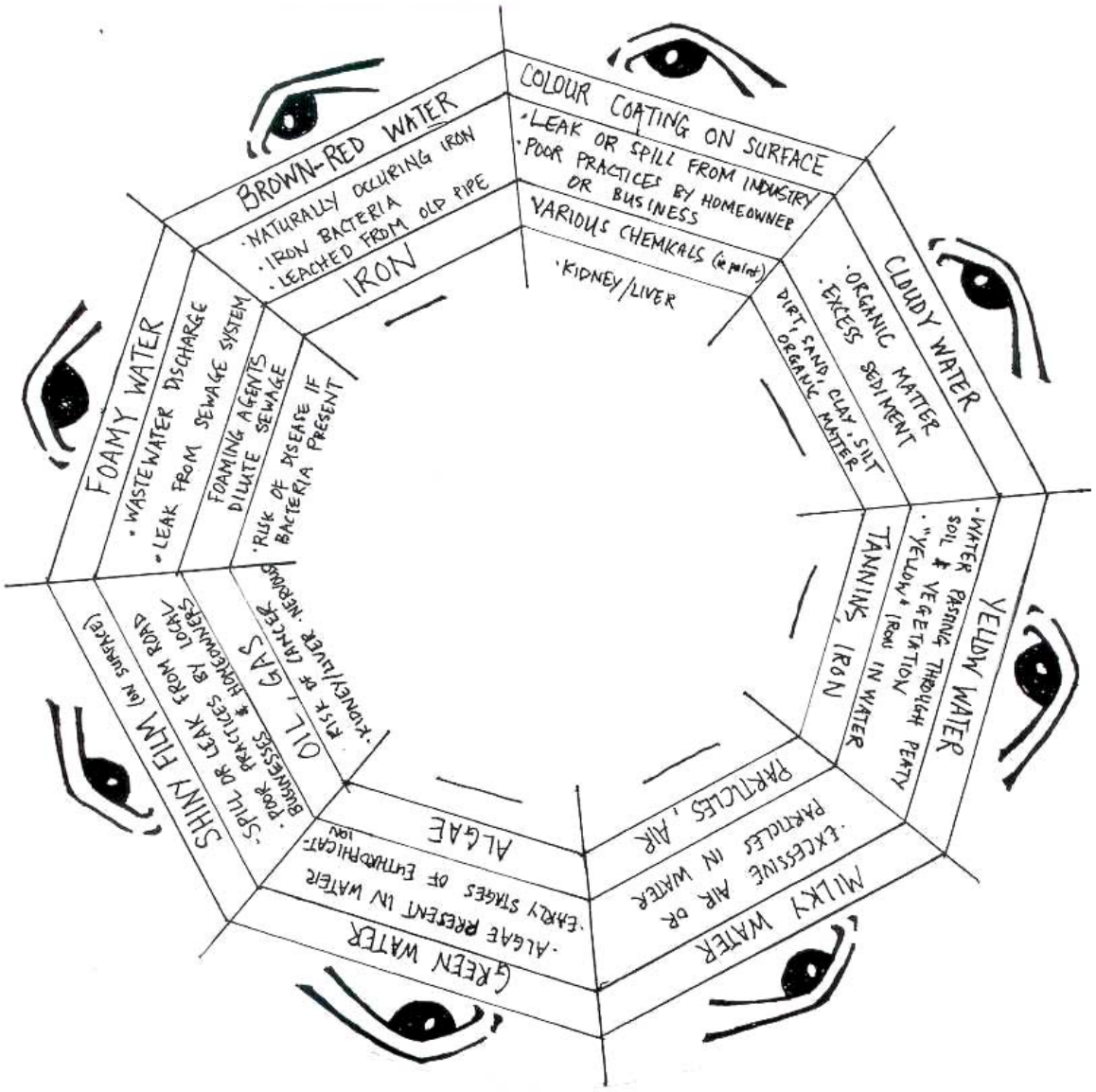
Which of these water samples would you report to PEP?	☐ ☐ ☐ ☐ ☐

The Water "SENSE" Wheel may be used as reference tool for students investigating water quality for the Water Quality Testing or Outfall Monitoring Procedure activities.

Duplicate or cut out both wheels. Glue the blank sides of the sides 1 and 2 together.

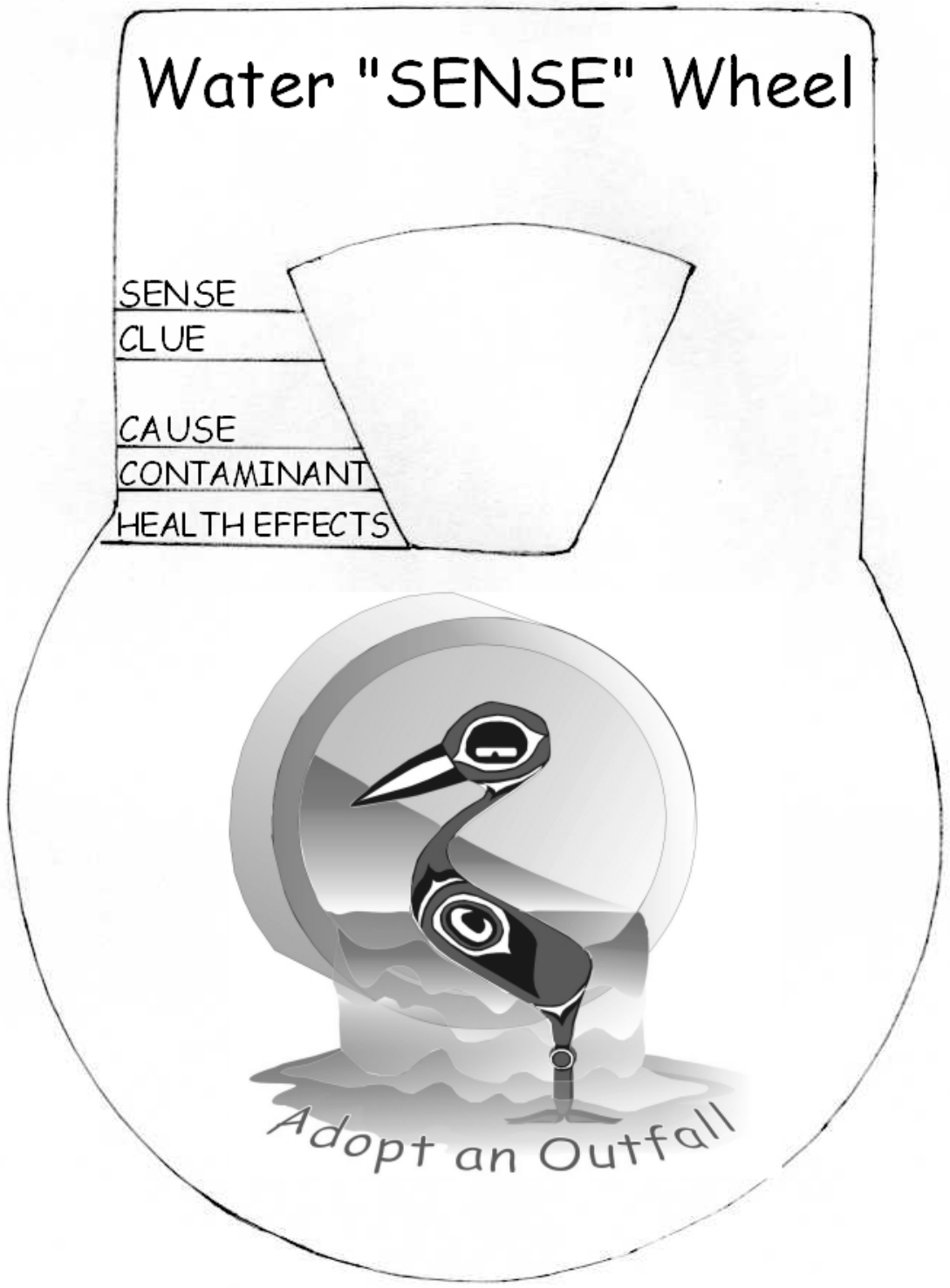


Side 1

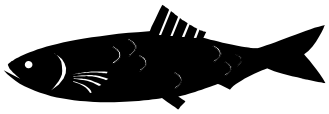

COLOUR COATING ON SURFACE
·LEAK OR SPILL FROM INDUSTRY
·POOR PRACTICES BY HOMEOWNER OR BUSINESS
VARIOUS CHEMICALS (& paint)
·KIDNEY/LIVER
BROWN-RED WATER
·NATURALLY OCCURING IRON
·IRON BACTERIA
·LEACHED FROM OLD PIPE
IRON
CLOUDY WATER
·ORGANIC MATTER
·EXCESS SEDIMENT
DIRT, SAND, CLAY, SILT, ORGANIC MATTER
FOAMY WATER
·WASTEWATER DISCHARGE
·LEAK FROM SEWAGE SYSTEM
FOAMING AGENTS DILUTE SEWAGE
·RISK OF DISEASE IF BACTERIA PRESENT
YELLOW WATER
·WATER PASSING THROUGH PEATY SOIL & VEGETATION
·"YELLOW" IRON IN WATER
TANNINS, IRON
SHINY FILM (on surface)
·SPILL OR LEAK FROM ROAD
·POOR PRACTICES BY HOMEOWNERS & BUSINESSES
OIL / GAS
·KIDNEY/LIVER CANCER
FISH OF CANCER
ALGAE
·EARLY STAGES OF EUTHROPHICATION
PARTICLES, AIR
·EXCESSIVE AIR OR PARTICLES IN WATER
GREEN WATER
·ALGAE PRESENT IN WATER
MILKY WATER

Side 2

Make two copies of the handle. Sandwich the wheel between the two handles. Mark the center of the wheel and fasten the layers together with a paper fastener.



Outfall Monitoring Procedure



Objectives:
After completing this exercise, individuals should be able to:

- Explain the function of a storm drain
- Explain the importance of monitoring
- Describe non point source pollution
- List ways to prevent non point source pollution from entering a waterway
- Monitor storm drain outfalls over a period of time to note changes
- Know when to call the Provincial Emergency Program about water pollutants.

Age Level: upper elementary, middle/ secondary school, adult

Subject Areas: science, environmental studies, chemistry, biology

Materials: Rubber Gloves (many pairs), safety glasses, eyewash bottle, rubber boots, monitoring sheets (sample copy provided), clip boards, pencils, pH kit, dissolved oxygen kit, turbidity test kit, thermometer, closed container for liquid chemical wastes, paper towels or dry cloths for cleaning glassware, drainage maps (obtainable from Veins of Life), tide tables, first aid kit. Camera, plant and animal ID books are optional.

✶ An Adopt-an-Outfall kit is available to borrow or to purchase from the VOLWS office. This kit contains all of the necessary water quality testing equipment.

Background:
Gathering information about water quality helps identify and evaluate problems that are occurring in our local waterways. Water quality surveys provide information about the chemical composition of water. By monitoring the discharge that is coming out of an outfall, we can understand what is going into our local waterways. Long-term monitoring helps detect changes, both good and bad, which then can be used to educate the public, businesses, and motivate government bodies to make changes in laws and land use planning.

The CRD Environmental Services Group currently monitors several storm drain outfalls in the district in order to identify those that are a high environmental or health concern. The results of their monitoring program are published in the **"Stormwater Quality Survey"** each year. These survey reports are a great resource for your group. They can give you more background information on storm water sampling and specific data collected from various outfalls in the Capital Regional District, possibly even one that you are investigating. The CRD website may also be a helpful resource for your group. The address is www.crd.bc.ca.

Safety:

Concern for safety is essential when working outdoors in a water environment, especially around storm drain outfalls.

- When rocks and logs are wet or covered in seaweed they are very slippery and unstable.
- Tide times should be checked to observe high and low tides as some outfalls may not be accessible at higher tide levels.
- Warn children about urban hazards such as syringes, condoms, needles, broken glass, and sharp metal objects. None of these items should be touched unless individuals in the group have gloves and have a separate container to keep these hazardous items in until proper disposal is possible.
- Be aware that dead animals are often found in and around outfalls. Dead animals are potential disease carriers and should be left untouched.
- Carry a first aid kit and local emergency numbers (police, ambulance, poison control center, and provincial emergency program to report any spills) whenever your group visits the outfalls.
- When conducting the chemical tests, it is absolutely imperative that anyone handling the storm water wears safety glasses, rubber/latex gloves, and uses test tube caps or stoppers to cover test tubes during shaking or mixing. When taking gloves off turn them inside out to ensure that the outside rubber or latex does not touch your skin.

- Never smell the storm water sample directly as viruses such as Hepatitis can be transmitted this way. Instead use your hand to waft the odor towards you from a distance.
- Thoroughly rinse test tubes before and after each test. Deposit liquid waste into separate labeled, covered containers and dispose of them safely in the sink when possible.

Procedure:

INTRODUCTION

If your group is new to non-point source pollution and the concept of a watershed, see activities in the Adopt-an-Outfall binder such as: Nasty Non-Point Source Pollution, or Sum of the Parts. These activities will give your group a background on what types of pollution may be entering our waterways via the storm drain and why they are harmful.

If your group is familiar with the above concepts, continue on with this activity.

Ask: *What is a storm drain outfall?* (the end of the storm drain pipe where the storm water "falls out" of the pipe onto the beach or into the stream)

Ask: *Where have you seen outfalls? Describe what they look like.* (they can have a variety of styles in Victoria, including round metal pipes and square concrete blocks) Show photos or drawings of local outfalls if available.

Ask: *Have you ever seen a shiny stream of oil coming out of any outfalls? Or any other pollutants?*

Ask: *Where could the oil have come from?* (homeowner in the area who is changing the oil on their car, local gas station or auto repair shop, parking lot where many cars have leaked oil)

Discuss: *Whose job is it to take care of our waterways and cut down on the pollution that is entering them?* (it is everyone's job)

Discuss: *What does stewardship mean to you?* (taking action to ensure proper management of the environment, etc)

Say: *We are going to become active stewards of our local waterways by monitoring the storm drain outfalls in our watershed. We will take observations and measurements from a number (or just one) of outfalls nearby. We will do this every day/week/month to collect information on the change in the storm water over time, as well as to report spills promptly. We will be especially on the lookout for noticeable pollutants coming out of the outfall.*

Ask: *What would you do if you saw white frothy bubbles on the surface of the water coming out of an outfall?* (call PEP number at 1-800-663-3456 to report it and walk around in the drainage area to discover possible source of pollution)

Ask: *What are some other signs that the water is polluted?* (high temperature, high turbidity, low dissolved oxygen, foul odor, discoloration of water, visible garbage or materials, bubbles, oily sheen on surface, etc.)

Say: *These are all things we will be looking for when we monitor the storm drain outfalls.*

OPTIONAL TOUR OF THE DRAINAGE AREA AND STORM DRAIN SYSTEM:

The Veins of Life Watershed Society offers a free tour of your drainage area to orient you to the storm drain system and maps for your neighborhood. Tours can last up to 2 hours depending on the particular area you live in. Call 383-2086 to schedule a tour.

If you are familiar with the location of the outfalls and using the storm drain maps in your area, it is helpful to take your group on a tour of the drainage area on your own. Start at the storm drain right outside your office, school, or meeting place and follow the slope of the land to the nearest body of water where the outfall is located. Here is an outline of what the tour could look like:

- Starting at the storm drain nearest your building: point out roof gutter systems (eavestroughs) and indicate that they are there to collect and drain rain water from your roof onto the lawn or into the storm drain. Sometimes these are improperly connected to the sewer system and can cause it to overflow. When the sewer system overflows in Victoria, it generally gets directed into the storm drain system. This means that huge amounts of raw sewage are dumped into local creeks and beaches.

- Look into the storm drain: note any debris clogging or surrounding the grates.

- Are there any yellow fish painted by the storm drain? These fish are painted by community groups to remind residents that everything that enters the storm drain leads to fish habitat.

- On your walk down to the outfall, look for any potential sources of pollution such as: gas stations, home businesses, people washing their car on the street or in driveways, people painting their garages, etc.

- Point out the round manhole covers that say storm drain or sanitary sewer on them. They are usually found in the middle of roads or just to the side. This is where city workers can check for problems and monitor the water flow within the two systems. They are not to be lifted! Only authorized individuals can do this with special equipment.

- Once you have reached the water body to which the storm drain leads, search the banks/ shorelines for the outfalls. They are often hidden amongst vegetation, rocks, or logs.

- Maps are very useful to be able to locate specific outfall numbers and to be able to relate a specific drainage area to its respective storm drain outfall. These maps can be ordered from the Veins of Life Watershed Society who receives them courtesy of the various municipal engineers. It is possible to follow the arrows on a map of the storm drain system from a storm drain in your school or group's parking lot directly to the end of the pipe (outfall). See the section on "How to Read Drainage Maps".

AT THE OUTFALL:

- Showing your group the map and how to read it may help them understand exactly where the water they are monitoring comes from.

- Once you have found the outfall(s) that your group is monitoring you can then begin filling in the Monitoring Sheets (provided). Group members can start with sketching what the outfall looks like and noting the surrounding vegetation, animal life, current weather conditions, and date.

- Weather conditions and time of year are very important to your monitoring program. For example: if it is mid-July and it hasn't rained in a month, yet your group sees a steady flow of water coming out of the outfall, it may be an indication of pollution entering the storm drain system. This excess flow could be from someone washing their car on the street or someone over-watering their lawn. Sometimes water enters the storm drain system from natural springs nearby, which is not harmful to our waterways, but could indicate a leaky pipe.

- Next, you can begin performing the tests on the storm water. If there is no water coming out of the storm drain, tests can be done on the surrounding body of water to get an idea of the general water quality, **although it is more meaningful to test the actual storm water to identify pollutants coming in**. A lack of flow is generally a result of dry weather and shows that there is no excess water running in the drainage area.

- It is important to explain what each test can show and how it relates to fish & wildlife. For this information refer to the "Interpreting Your Results" section.

- The tests that are useful to perform on the storm water include: air temperature, water temperature, pH, dissolved oxygen and turbidity. Read all instructions (provided with the kits) carefully for each test. Take the temperature in the air first, and then in the water. Leave the thermometer immersed for at least 2 minutes to get an accurate reading. Tear off a piece of the pH paper, dip it in the storm water for a few seconds, take it out and match the color of the strip to the color chart

on the side of the pH paper roll to find the pH reading. **Remember safety precautions when handling the storm water!**

- Test kits can be costly, however many schools and organizations already have this type of equipment. The Veins of Life does have one "Adopt-an-Outfall" kit that is available on loan to any group for monitoring outfalls. If your organization has the funds, Adopt-an-Outfall kits are available for purchase from Veins of Life at cost. Also, there are some funding programs that offer small grants for groups to purchase equipment relating to environmental education and stewardship (see list of websites in the "Helpful Info" section).

- Observations are the most important part of collecting data on your outfall(s). Visual observations such as water colour and presence of garbage, oil, or bubbles can be very helpful in identifying pollutants in storm water. Odors are very telling of pollution as well.

- Measurements such as the diameter, elevation and slope of the outfall can be taken and recorded on the monitoring sheets.

- Once observations have been recorded and tests performed, be sure to collect everything that you came with. A garbage clean up each time you visit the outfall(s) would be an excellent addition to your stewardship effort.

- Any water left over from testing should be stored in a wastewater container and disposed of properly in the sanitary sewer (sink or toilet).

NOW WHAT?

Now that your group is oriented to the storm drain system and the monitoring procedure, you need to set up a monitoring schedule so that data is collected on a regular basis. This data can be entered on to a database or you can just keep the information in hand-written format.

In order to help stop the pollution from entering the storm drain it is necessary to identify the source. See the guide to "Interpreting Your Results" to help you identify what might be in your storm water.

Once you have a clear idea of what types of pollutants are showing up in the storm water, you have several options as to how to reduce the pollution. The quickest way to find the source of a particular pollutant is to follow the storm drain system backward from the outfall up through the drainage area looking for the point where the pollutants are entering the system. This can best be understood by considering this example: a group is at their adopted outfall taking samples when they notice that the water has turned red and looks thick. They smell a strong chemical odor much like paint. The group decides to consult their storm drain map and follow the pipes up and around the drainage area. As they are walking around they notice a small pool of this red liquid beside the storm drain. The drain happens to be at the end of the entrance to a sign painting shop. The group can then be fairly certain that this shop is the source of the red liquid (most likely paint).

How should you handle the above situation?

Call the Provincial Emergency Program (PEP) number (1-800-663-3456) immediately and tell them at which outfall the pollutants were seen, where you think it is coming from (ie: paint shop), and who you are. The PEP operator will ask you for all the information they need. Once you have reported the spill to PEP, a chain of communication is initiated between local municipalities, Department of Fisheries and Oceans, and Environment Canada. Usually someone goes to the outfall site to investigate, and the incident gets recorded. The fact that you called PEP is an important piece of information to record on your monitoring sheet! Some groups may feel confident in talking with the business manager or homeowners and making them aware of the effects of their actions. If your group plans to do this, remember that you want individuals to be receptive to your ideas. **It is not helpful to make accusations.** Approach them in a non-defensive and informative manner. In many cases people are not aware that their actions are hurting fish habitat or that they may be breaking the law (see "Keeping Our Water Clean is the Law"). However, if your group is not comfortable with this approach, other ways of raising awareness include:

- create a pamphlet about the storm drain system and what should and should not enter it (including best management practices) and distribute it within the drainage area.

Note: There are several brochures already available that may be applicable for your group to use.

- organize an informational booth and display at local community events
- take part in the storm drain marking program (offered by VOLWS) which involves painting yellow fish by storm drains to remind people that they drain to fish habitat

Extension:

- Have your group start a battery collection program to ensure that batteries are disposed of properly in your area. When batteries are disposed of in the landfill, they can leach toxic waste into groundwater and local waterways.

- Have the group create an "inspection" sheet that they can use to search the meeting hall, school, or office for hazardous chemicals and objects that could potentially enter the storm drain. Make recommendations to the administration on ways to reduce their contribution of pollutants to our waterways.

- Start monitoring the beach just below the outfall using the "Shorekeepers Program".

- Start monitoring the stream that the outfall flows into using "The Streamkeeper's Handbook".

Resources:

Dalia Hull and Rob Miller, CRD Environmental Services Group
Stormwater Quality Survey Core Area, 1998 CRD Engineering
Streamkeepers Course, Pacific Federation of Streamkeepers

OUTFALL MONITORING SHEET

NAME	GROUP NAME	OUTFALL #
NAME OF THE BODY OF WATER OUTFALL FLOWS INTO		
DESCRIPTION OF SITE		
SKETCH OF SITE		

DIAMETER OF OUTFALL PIPE	ELEVATION
LATITUDE DEGREE MINUTE NORTH	
LONGITUDE DEGREE MINUTE WEST	
SOURCE OF TOPOGRAPHIC DATA	
DESCRIBE & IDENTIFY PLANT SPECIES YOU SEE	
DESCRIBE & IDENTIFY ANIMAL SPECIES YOU SEE	
WHAT OTHER SPECIES MAY LIVE HERE?	
TYPES OF RECREATIONAL ACTIVITIES OCCURRING	
TYPES OF INDUSTRIAL ACTIVITIES OCCURRING	
SIGNS OF HUMAN INFLUENCE	
OTHER OBSERVATIONS	

CONTINUOUS MONITORING SHEET

NAME	GROUP NAME	OUTFALL #

DATE	Oct.20						
TIME	1:05 pm						
WEATHER CONDITIONS (past few days & today)	rainy – has been for days						
OUTFALL DISCHARGE PRESENT? A lot?	yes, heavy flow						
DISCHARGE COLOUR	grey						
ANY ODD ODORS?	smells like lemon						
WATER TEMPERATURE	15 °C						
AIR TEMPERATURE	10 °C						

GARBAGE PRESENT?	Yes, beer bottles						
TURBIDITY: CLEAR, CLOUDY, PRECIPITATE?	cloudy						
pH	7.5						
DISSOLVED OXYGEN	not done						
ANY OTHER OBSERVATIONS	soapy						
SOURCE OF CONTAMINENT	unknown						
Did you call PEP #?	yes						

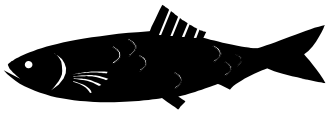
Notes:

Detective work is involved in finding the source of pollutants. Take a walk around the drainage area and see if you can find out where the pollution is coming from. Then call PEP.

The PEP number is 1-800-663-3456.

Caution: Always be careful when near an outfall. Use gloves if you will be touching the water!

Interpreting Your Results



It is important to keep to a monitoring schedule. One set of observations alone is not very useful. Repeated measurements are needed in order to record significant changes in the quality of the water and note the trends that appear in your watershed's storm water. This way you will notice immediately when there is a spill.

Observations

Water Color:

Green Water often means that algae (very small plants) are present in the water. This can signify the early stages of eutrophication. When there are large amounts of algae in the water it makes it difficult for anything else to survive within the stream. When algae dies it uses up oxygen. As a result, large amounts of algae in a stream can cause the suffocation of other life within it.

Muddy-looking water can mean that there is too much dirt entering the water from construction sites, home renovations, or landscaping practices. This makes it hard for fish to breathe and find food. In addition, excess sediment makes it hard for light to reach the plants in the water. Sunlight is necessary for the process of photosynthesis, without it, plants would not survive!

A **shiny film** on the surface of the water can mean that there is oil leaking into the water from residential driveways, parking lots, or poor practices by local businesses and homeowners. Oil is poisonous to organisms. Also, it reflects sunlight off of the surface of the water limiting plant growth.

A **foamy or sudsy** surface on the water is an indication of soap and chemical sources from homes and factories. Unless you know the particular chemical present, the effects are quite variable.

An **orange or red coating** on the water is indicative of an industrial source: such as a factory, or a homeowner that is dumping pollutants into the water.

If there are lots of **fish and bugs** in the water, it indicates a healthy water habitat capable of supporting a wide variety of life forms. It also indicates that there is an abundance of oxygen.

Water Odor: If the water has a rotten egg smell to it, sewage could be leaking into the water from a local pumping station, septic tanks, or due to improper connection of a sewer line to the storm drain. Sewage carries bacteria that can make us very sick, as well as kill aquatic life.

An indicator of a lack of dissolved oxygen in a water source is extremely foul smelling water. Take note of <u>any</u> odor that you notice, as it can be very helpful in identifying some types of pollutants.

Temperature

The temperature of the water is an important factor affecting the health of the aquatic environment. The higher the temperature of the water, the less oxygen it contains. As well, as the temperature increases, animals use oxygen at a faster rate (their metabolic rate increases). Plant growth also increases thereby producing more oxygen. However plant decomposition also increases and ends up using more oxygen than is produced. Organisms in warmer water are more susceptible to disease and other stresses.

See Table 1 for details on optimal stream life at various temperatures. Be sure to compare the storm water temperature to the air temperature and the temperature of the body of water that it is flowing into. This will help identify whether or not pollutants are present.

When the water coming out of an outfall is a high temperature it can indicate an industrial source. When storm water is of a very low temperature, the discharge could contain anti-fouling agents, chlorine from municipal water sources, or effluent from industrial cooling systems. Extremes in temperature should be reported to PEP as with any other source of pollution.

Table 1.

Optimal Stream Life at Various Temperatures
(taken from The Streamkeepers Handbook)

Temperature Range	Types of Stream Life
20 – 25 ° C (warm)	Lots of plant life; high fish disease risk; warm water fish (bass, carp, crappie, catfish, bluegill); caddisflies, dragonflies
13 – 20 ° C (cool)	Plant life; moderate fish disease risk; trout, salmon, sculpins,; stoneflies, mayflies, caddisflies, water beetles, water striders
5 – 13 ° C (cold)	Plant life; low fish disease risk; trout, salmon, sculpins; stoneflies, mayflies,

pH

The pH of storm water can be very helpful to identify the types of chemical pollutants that may be present. It may be very useful to measure the pH of the body of water it is discharging into for comparison.
pH is a measure of the relative acidity or alkalinity of any substance. A pH of 0 indicates a very strong acid while a pH of 14 indicates a very strong base. A neutral pH of 7 is indicative of pure water.

Aquatic organisms can be very sensitive to even the smallest changes in pH and generally prefer a pH of 6.0 to 8.5 **(see Table 2)**.
A low pH reading, indicative of acidic water, can point to the presence of acid rains or industrial effluent. The type of soil and rocks in the watershed also affect the acidity of the water.

Table 2. pH Scale (adapted from The Streamkeepers Handbook)

pH	Examples of solutions with particular pH	Effects of pH on fish and invertebrates
0		
1	battery acid	
2	1.75 – lemon juice	
3	vinegar	3.75 **ALL FISH DEAD!**
4	4.25 - tomatoes	4.50 mayflies and caddisflies dead
5	carrots 5.75 - normal rain	5.50 salmonid eggs & alevin die 5.80 bass & trout begin to die
6	6.50 - milk	6.25 snails & tadpoles begin to die
7	7.50 – human blood	7.5 **Optimum for fish**
8		
9		9.5 **ALL FISH DEAD!**
10		
11	ammonia	
12	bleach	
13	lye	
14		

Turbidity

The turbidity of the storm water is an important indicator of the presence of pollutants in your sample as. Turbidity refers to the cloudiness of the water caused by tiny organisms, sediments, and pollutants. The cloudier the water, the less light that is able to transmit through it. Light is necessary for plant growth and oxygen production. In addition to smothering fish eggs and plant life, sediments in the water can cause breathing problems for fish and other aquatic organisms. Turbid water absorbs more heat thereby increasing the water temperature and in turn decreasing the dissolved oxygen. Possible

sources of high turbidity include heavy rainstorms, erosion from urban development, and point sources such as industry.

Dissolved Oxygen

The measurement of dissolved oxygen in a water sample indicates the amount of oxygen available for use by aquatic organisms. This measurement is dependent on the temperature of the water, as discussed previously, where warmer water contains less dissolved oxygen. Oxygen is necessary to sustain all life within the water and a lack of oxygen is detrimental to the survival of aquatic plants and animals.

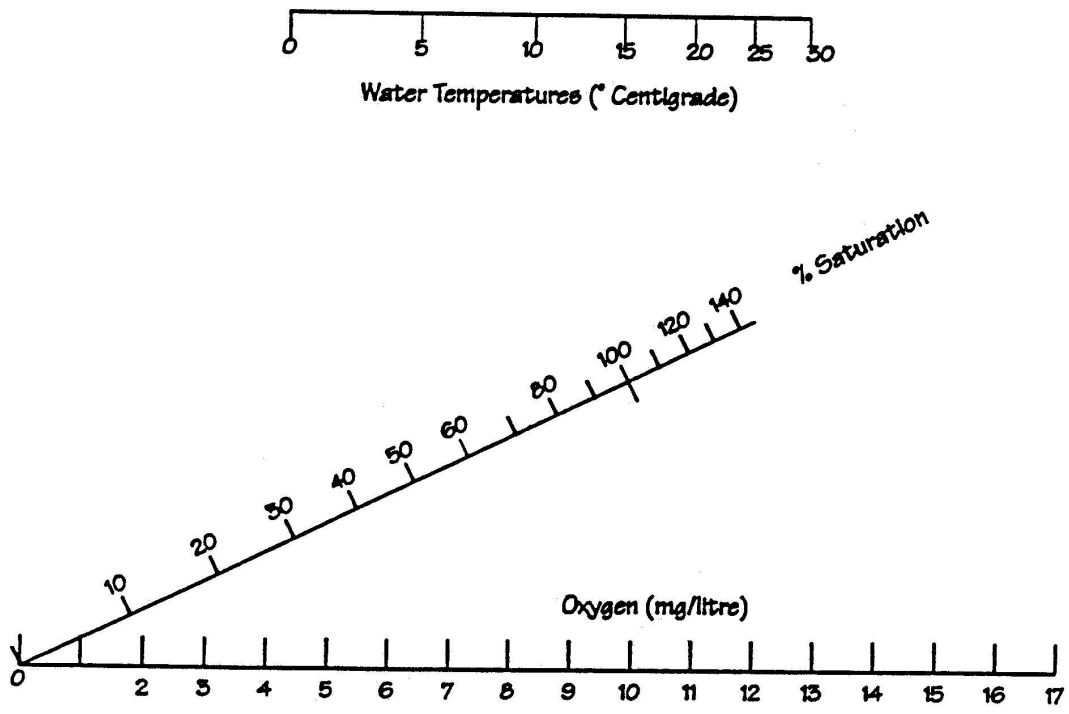
Plants produce oxygen in the presence of sunlight by a process called photosynthesis. At night, this process is reversed. Plants burn the carbon-rich foods that they made during the day in a process called respiration. This process consumes oxygen and results in a decreased D.O. level at night.
A possible reason for a very low D.O. is the presence of organic wastes such as sewage, fertilizers, pesticides, lawn cuttings, dead plants or animals, or discharge from food plants or dairies. These pollutants consume oxygen as they decompose. Another reason that D.O. levels are low is from thermal pollution from an industrial source.

Once you have your oxygen reading in mg/L you need to use it against a temperature chart to find the % saturation **(see Oxygen Saturation Chart below)**. The higher the % saturation with oxygen, the better the water quality is for fish and most invertebrates. 100% saturation is ideal for fish. Anything under 80% could be detrimental to fish & wildlife. Some dissolved oxygen test kits use parts per million (ppm) to measure the amount of oxygen. It is not necessary to convert the results with these kits. Some aquatic species are more sensitive to oxygen depletion than others. Some general guidelines to consider are as follows:

Dissolved Oxygen Level

9+ mg/L	Optimum for most aquatic species
4-9 mg/L	Adequate for most aquatic species
<3 mg/L	Stressful to most aquatic species
<2 mg/L	Fatal to most aquatic species

Oxygen Saturation Chart



Use the temperature and oxygen concentration data to calculate the percent saturation using the figure above. Use a ruler to join up the oxygen and temperature readings. Read the percent saturation value where the ruler crosses the middle line.

(Taccogna, G. and K. Munro (eds). The Streamskeepers Handbook. Vancouver: Salmonid Enhancement Program, DFO, 1995)

Nitrates

Nitrogen is a necessary element in all living things. Certain bacteria found in soil and on some plant roots combine the nitrogen in the air with other elements to make nitrates. Nitrates are important chemicals for plant growth and animal nutrition. An excess of nitrates in a water sample could cause the system to suffocate due to the increased growth and subsequent decay of plant life.

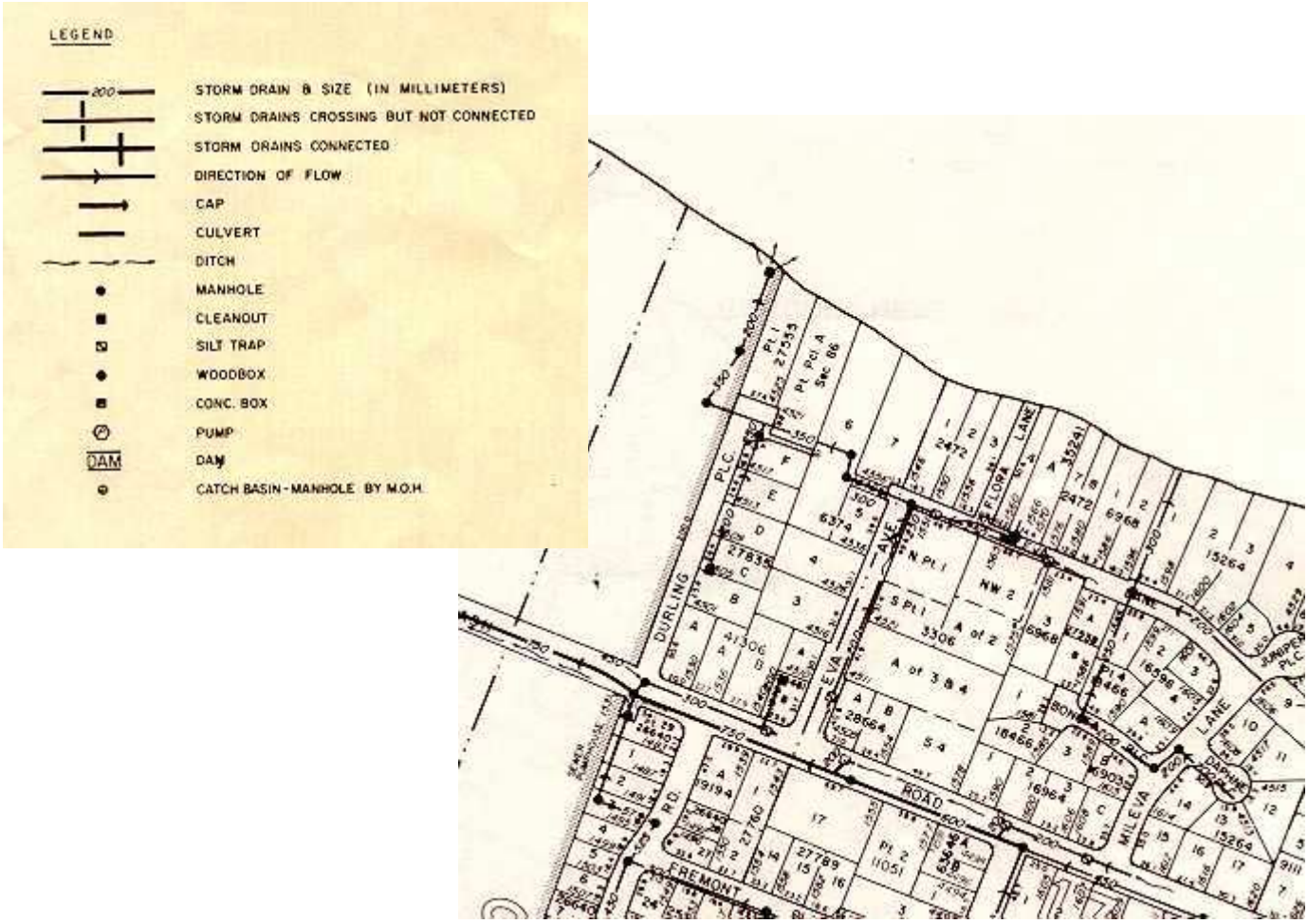
There are test kits that measure the level of nitrates in a water sample (not found in the Adopt-an-Outfall kit). By measuring the amount of nitrates in a sample, you can find out if there is an abundance of lawn, garden, or farm fertilizers; sewage, animal wastes, or car exhaust in the watershed. For the purposes of the Adopt-an-Outfall Program, it is not absolutely necessary to measure nitrates. If your group feels that it is a major problem in the watershed, measuring for this parameter can be useful.

Phosphates

Phosphorus is necessary for plant and animal growth. It is found in phosphates. Phosphates can be found in most fertilizers, some pesticides, cleaning detergents, and human and animal wastes. A high level of phosphates can over-stimulate plant growth, as in the case of nitrates, and end up decreasing the dissolved oxygen in the water. Again, it is not absolutely necessary to measure the phosphates in a water sample for this program, however, if your group has the equipment and the desire to do so, it can be helpful.

How to Read Drainage Maps

Maps are an important tool and an excellent resource for your group while you are monitoring your outfall. The most appropriate maps to use are drainage maps showing the storm drain system and the sanitary sewer system for your neighbourhood. To acquire these maps you should contact the education coordinator at the Veins of Life. Drainage engineers for each municipality will give out copies of maps for local citizens to use. However, they prefer that VOLWS take care of this for the Adopt-an-Outfall Program. The map layout, style, and symbols are different for each municipality. They are all based on the same ideas and can be interpreted quite easily. Having the proper maps will allow you and your group to locate individual outfalls and their respective drainage areas quickly and accurately. This way you can see the exact area that is contributing run-off to each outfall. Drainage maps show the direction that the water flows, as well as street names and house numbers in the area.
Below is a sample map from the District of Saanich:



How to Report a Spill or Water Pollution

If you see a spill or solid waste in the water call: 1-800-663-3456!

Unfortunately in the waters around Victoria, spills are a common occurrence; whether it is an oil slick flowing to a storm drain, a restaurant hosing down their parking lot, or a transportation company power-washing their trucks. Whenever you see anything in the water that should not be there, you should call the Provincial Emergency Program (PEP) at 1-800-663-3456. This number is posted at many outfalls throughout the Victoria area. It is handy to have the number around your home or in your vehicle for emergencies. There is often a three or four digit number posted on outfalls for identification purposes.

When reporting a spill, it is a good idea to note the outfall number and the streets nearest to the outfall location. Many people feel that in order to call PEP, there must be a catastrophic spill. This is not the case. It is the hundreds of small spills that happen on a daily basis that cause the most damage to our waterways. If you see anything except for clean, clear water coming out of the storm drain… call PEP.

When you call PEP, they will ask you everything they need to know to respond immediately. The message is relayed to appropriate personnel, such as local municipalities, Ministry of Environment, Environment Canada, and the Coast Guard (if it is a large spill). Someone will go to the outfall location and decide what measures need to be taken to clean it up at that point.

3330 spills were reported to PEP in BC between April 1, 1999 and March 31, 2000.

Imagine the number of spills that go unreported! As watershed citizens it is our responsibility to ensure that

1) spills do not occur in the first place, and
2) if a spill does occur, it is our responsibility to report it and clean it up if possible.

Keeping Our Water Clean is the Law!

Storm Water Quality Legislation

As stewards of our waterways it is essential to endorse the participation of everyone in the community by not contributing to pollution by depositing harmful substances in the water. This is one of the goals of several regulatory tools for storm water quality control. There is legislation at all three levels of government that are meant to regulate the deposit of substances into the storm sewers, thereby protecting our waterways.

For example, municipalities are given the responsibility of protecting storm water quality under the provincial *Municipal Act.* Under this act, each municipality within the CRD adopts bylaws intended to regulate the deposit of substances into the storm sewers. The CRD Model Storm Sewer Bylaw outlines the protection of storm water protection systems, storm water quality of discharge, and the health of the receiving environment. This model bylaw has been adopted and/or modified by the municipalities throughout the CRD.

Within each of the bylaws, it is generally prohibited to deposit harmful substances into storm drains and/or waterways, unless under a specified level of contamination. Only uncontaminated storm water, or water from natural precipitation, may be discharged to the storm drain system. Uncontaminated water normally includes cooling water, condensed water, water from municipal waterworks, or private water without any contaminants added. Some examples of substances that are not permitted to be released into storm systems and our waterways include: oil and oil-based products, soap, paint, pesticides, pet wastes, human wastes, litter, lawn cuttings, soil, herbicides, fertilizers.

In addition to prohibiting harmful substances from entering waterways, sanitary and storm drain collection systems must be connected to resident homes with a valid plumbing permit and be approved by the appropriate municipality. In some cases where development takes place close to natural waterways or the development is quite extensive, drainage controls and/or filtration provisions may have to be implemented. For example, oil and

grease interceptors capture oil, grease, and silt contained in storm water flows. These interceptors may be useful near a car lot or restaurant.

Managing storm water quality extends beyond what is directly discharged into storm systems to include our natural waterways and human intervention with their functioning. In addition to the flows within the storm drain system, each municipality must have bylaws that address the flow of streams, creeks, waterways, watercourses, and ditches. The obstruction of watercourses is prohibited and no watercourses should be enclosed without permission from the appropriate planning division.

If any municipal bylaws are not being adhered to (including municipalities, businesses, and organizations), provincial and federal legislation will eventually hold the community responsible. Provincially, the *Waste Management Act* oversees the development of management plans that each municipality adopts. The *Water Act, Water Protection Act, Health Act, & Fish Protection Act* are intended to prevent activities, in or around water, from disturbing natural habitats. In effect, solid and toxic wastes are not allowed to enter our waterways.

Federally, the *Fisheries Act* is prominent in protecting our aquatic resources. Any fish-bearing watercourse is not to have deleterious substances discharged into it. Deleterious substances could be considered to be any substances that are harmful to the natural habitat in which they are deposited. Toxic chemicals, detergents, industrial effluents, and other synthetic products are obvious examples of deleterious substances. In the case of a spill, there is legislation to guide the remediation procedures. However the best option is to call the PEP hotline and the appropriate authorities will be recruited.

The goal of storm water quality legislation is to keep our waterways in an undisturbed state as much that is possibly allowed with a growing population. By prohibiting the release of foreign substances into the water via storm drains, the waterways into which outfalls discharge will be protected from significant amounts of pollution. For details on specific municipal bylaws throughout the CRD, municipalities should be contacted separately, or contact the Veins of Life for guidance and further information.

Tips for Watershed Citizens to Help Protect Our Waterways

(To see Tips for Businesses to Help Protect Our Waterways, contact the Veins of Life)

The issue of storm drains and water pollution is one that is not always at the forefront in people's minds. Thus, the "out of site, out of mind" attitude is often adopted without realizing the consequences for the aquatic environment. Once the connection is made between what goes into the storm drain system and what the consequences for fish habitat are, people will become more aware of what management practices should be adopted in or around the home. The following is a list of a few things you can do to prevent harmful substances from entering the storm drain system and the waterways around Victoria.

Washing Your Car

- Bring your car to a car wash where they should be set up to filter the wastewater before releasing it into the storm drain system. It is a good idea to enquire about individual set-ups at the car wash to ensure that harmful detergents will not enter our waterways.
- At home, instead of washing your car in your paved driveway or road on an impermeable surface, wash your car on the grass or gravel to allow the waste water to filter into the ground. Also, using biodegradable cleaning products low in phosphates is more environmentally-friendly and desirable.

Vehicle Maintenance

- Ensure that your car is not leaking oil or other fluids, since these will be carried with rainwater into the storm drains. Drip trays should be used if leaks persist.
- Keeping your car tuned up and in adherence to pollution control standards will reduce the amount of invisible fallout that is picked up by run-off on streets and parking lots.
- Similar to paint, used engine oil from households is accepted at Canadian Tire, Derick's Services, Fountain Tire, Gurton's Garage Ltd, Hartland

Landfill, Mohawk Depot, and Village Service for recycling and disposal (see the CRD Recycling Directory).

- Clean up any leaks or spills with an absorbent material and dispose of in the garbage. Do not attempt to wash spills "away" down the storm drain.

Painting

- Since paints are generally hazardous to fish, it is important to dispose of unused paint appropriately. Alpine Disposal & Recycling, Oak Bay Municipal Depot, Hartland Landfill & Composting Facility, and Sooke Garbage Disposal & Municipal Drop Boxes all have a paint collection and recycling program. In addition, local paint stores often will collect the paint and deliver them to the appropriate facilities to be recycled.
- A toll free BC Recycling Hotline is available province wide if you have any questions: 1-800-667-4321, as well as the CRD Hotline at 360-3030.
- Use a tarp to collect any paint chips or spills outdoors. Clean up any spills with an absorbent material and dispose of in the garbage, do not attempt to wash paint "away" down the driveway or road.

Hot Tubs and Swimming Pools

- Chlorine and other chemicals used in pools and hot tubs are toxic to fish and thus should not be released into storm drains. Drain the water onto the lawn after allowing the water to sit for approximately one week. This wait allows for the chemicals to evaporate. Also, it is acceptable to drain pools and hot tubs into the sanitary system provided that your local municipality has been contacted and approved the process.

Gardening and Lawn Care

- Instead of using potentially harmful fertilizers, pesticides/ herbicides, look into using safe alternatives. The CRD has compiled a list of safe alternatives for common household products. See below for suggestions.
- If these chemicals are used then make sure to read the application, disposal, and handling directions carefully. Avoid spraying areas near or adjacent to waterways and ditches, or during wet weather.
- Use "medicines" for your plants only when necessary. That is, avoid using them if you do not notice pests or diseases present. Healthy plants are

more resistant to pests and disease so maintaining your plants' health will reduce the need for harmful chemicals.

Landscaping

- Vegetation captures and stores significant amounts of precipitation. Keeping existing vegetation and adding more are ways that runoff and erosion can be reduced.
- Bark mulch creates a toxic leachate. Reducing or eliminating the use of this substance will avoid releasing this leachate into the waterways. Be aware of the potential path of the leachate where the mulch is used in the vicinity of watercourses.
- Limit the amount of impervious surfaces such as landscaping plastic or concrete/cement in your yard. Instead, use paving blocks that allow water to infiltrate between the blocks or use porous asphalts, or rocks.
- Plant native vegetation as it is best adapted to the local environment. This will decrease the need to use pesticides and fertilizers. Native plants also require less care and watering.

Gutters

- Direct your roof downspouts into the ground or storm drain system, not the sanitary system. This will decrease the likelihood of sewage overflows in your area. Also, gravel filled trenches could be used to collect the water.

Living Next to a Stream

- Keep animals and livestock away from the shores of a stream to avoid an increase in erosion and siltation. Additionally, the animal wastes will degrade the quality of the stream water.
- Other than naturally occurring downfall from the vegetation in vicinity of the stream, do not place large objects or debris in the stream. This will interfere with the course of the water and affect fish spawning habitat. Dumping garbage can smother plant and animal life. Organic waste (grass clippings, compost, etc.) will make the water eutrophic causing oxygen levels to eventually be depleted.

- Try to keep the riparian area as natural as possible without landscaping and over-beautifying right through to the shore of the stream. This disruption may interfere with natural spawning of fish. Also, the diversion and/or damming of water should not proceed without approved from Fisheries and Oceans Canada and the BC Ministry of the Environment.

Essentially, the guiding principle behind outfall monitoring, stewardship of our waterways, and storm drain maintenance is an increase in our awareness of what substances enter our storm drains and the consequent effect those substances will have on the aquatic environment at the outfall. Remember that there are ways to carry out our current activities in an environmentally conscious way that maintain the integrity of the streams throughout Victoria.

Alternatives to Hazardous Chemicals:
The following is a summary of safe alternatives for common household products compiled by the CRD (for a complete list contact VOLWS or the CRD):

All Purpose Cleaner	1 tsp soap + 1 tsp Borax + squeeze of lemon + 1 quart warm water, for tough grease add ½ cup ammonia
Bleach	Borax
Dish Detergent	Natural liquid soap or phosphate free product, such as VIP
Drain Cleaner	½ cup white vinegar + ½ cup baking soda, cover tightly for 1 minute then flush. Next, add ½ cup salt + ½ cup baking soda + 6 cups boiling water, let sit several hours then flush with water.
Disinfectant	½ cup borax + 1 gallon hot water
Glass Cleaner	White vinegar + water, wipe with old newspaper
Hand Cleaner (paint/grease)	baby oil
Linoleum Floor Cleaner	1 cup white vinegar + 2 gallons water
Oven Cleaner	2 tbsp liquid soap + 2 tsp borax + warm water, for baked on grease: mix paste of baking soda + salt + water

Rug/Carpet Cleaner	2 cups cornmeal + 1 cup borax, sprinkle leave for 1 hour then vacuum.
Scouring Powder	baking soda
Toilet Bowl Cleaner	paste of borax + lemon juice, let stand then scrub
Tub/Tile Cleaner	¼ cup baking soda + ½ cup white vinegar or drop 1000mg Vitamin C, leave overnight then scrub.
Ant Killer	red chili powder at point of entry or mix 1 tbsp sugar + 1 tbsp borax + 2 tbsp water to make syrup, place in flat dish near infestation.
Fertilizer	Compost + vermiculture
Flea Killer (on pets)	Feed animals garlic, tablets of vitamin B or brewers yeast: talk to vet regarding quantity for your pet
Insects on Plants	3 tsp pure soap + 4 liters water – spray on plant leaves and pests
Fly Killer	Well watered pot of basil
Mosquito Repellant	Burn citronella candles or citronella oil
Moth Repellant	Cedar chips enclosed in cotton sachets
Nematodes repellant	Plant Marigolds
Roach repellant	Chopped Bay leaves + cucumber skins or place box of borax in cracks
Slug/Snail repellant	Onion + marigold plants
Deer repellant	Human hair

Glossary

Acidic: a solution with a pH value less than 7.0; when dissolved in water an acidic compound will release hydrogen ions.

Algae: small, rootless plants that live in water; the most simple of green plants that can produce their own food. They may be single-celled, filamentous, or colonial. Algae are of great importance in many aquatic ecosystems because they fill the role of the producers (green plants).

Akaline: solutions with a pH of greater than 7.0; hydroxyl ions are in abundance in alkaline compounds.

Algae Blooms: large concentrations of algae that grow excessively when the water is enriched with nutrients by sewage dumping.

Bioaccumulation: buildup of harmful substances, such as pesticides, in the tissues of animals and plants. These substances can then be passed up to animals and plants higher in the food chain.

Biochemical oxygen demand (BOD): a measure of the oxygen used to meet the needs of microorganisms in water.

Biodegradable: substances that break down naturally in the environment.

Bioremediation: the use of organisms to clean up waste products such as oil spills.

Brackish: slightly salty.

Cadmium: by-product of metal cleaning with caustics, aluminum solders, batteries, paint, oil, tire wear.

Catchment Area: see watershed.

Chlorine: Cl (a halogen); a typical nonmetal; a gaseous element that is not found freely in nature but occurs in combination with certain metals and is also commercially produced by electrolysis of a chloride solution.

Coastal Zone: includes all the water above the continental shelf. This zone begins at the shore and can go out to sea several hundred miles in some areas. It contains some of the most important environments on earth. They are home to many fish, clams, oysters, crabs, sponges, anemones, and jellyfish. In much of the zone, sunlight penetrates to the bottom for many other organisms to use. These zones have a great deal of variety in their types of ecosystems because there are many types of shorelines. Rocky shores have very different ecosystems from sandy shores. The coastal zone has many unique important habitats including estuaries, coastal wetlands, and coral reefs.

Coastal Wetlands: land that is flooded for all or part of the year is called a wetland. If it contains salt water, it is called a coastal wetland. This area includes bays, lagoons, and salt marshes. These wetlands all have grasses as the most common type of vegetation.

Contaminant: a substance that occurs in air, water, or soil that is above background levels.

Crustacean: a class of animals in the Phylum Arthropoda. Most have a shell or exoskeleton; includes crab, lobster, crayfish, and daphnia.

Decomposition: the breakdown or decay of organic matter through the digestive processes of microorganisms, macroinvertebrates, and scavengers.

Deoxygenation: the removal of oxygen from water. It occurs, for example, when large quantities of organic materials, like sewage, are dumped into the ocean. Bacteria, which break down the organic material, use up oxygen that fish and other animals need to survive.

Deleterious Substance: any substance that is harmful to the natural habitat in which it is deposited.

Delineation: drawing or description that outlines an area.

Deposition: the accumulation of a substance such as soil.

Detritus: waste matter produced from the decomposition of organic matter such as leaves.

Erosion: the process by which wind, water, ice, and human development wear away rock and soil.

Estuary: the area on a seacoast where fresh water meets salt water. Since the amount of salt, temperature, and other factors varies with the tides, only certain kinds of organisms with wide tolerance ranges can inhabit this type of ecosystem. Estuaries are among the most productive ecosystems on the earth because the constant flow of water from the river into the estuary provides high concentrations of nutrients which allows these organisms to thrive.

Dissolved Oxygen: oxygen dissolved in water; the amount depends on water temperature, plant photosynthesis, plant and animal respiration, and physical aeration.

Ecosystem: a functional self-supporting system that includes organisms and their environment. The organisms interact with the physical and chemical components of their environment.

Effluent: waste liquid from a house, industry, sewage treatment plant, etc.

Erosion: movement of soil by water and wind.

Eutrophication: the enrichment of a body of water (lake, pond, marsh) with nutrients causing it to become a different community. This change, or succession, may be natural or caused by humans.

Fecal Coliform: Coliform bacteria aid in food digestion in the intestines of cold and warm blooded animals. Coliform bacteria enter the water supply via animal and human wastes.

Fertilizer: a substance added to the soil to supply nutrients required for plant growth. They can be organic or synthetic. Organic fertilizers are natural products that include manure and peat. Synthetic fertilizers are manufactured. Fertilizers supply the three primary plant nutrients (macronutrients): potassium, phosphorus, and nitrogen. They also contain substances required by plants in small amounts (micronutrients): boron and zinc.

Groundwater: water that sinks into the soil and collects over impermeable rock; it flows laterally toward a stream, lake, or ocean.

Habitat: a location where living organisms occur.

Headwaters: un-branched tributaries of a stream.

Herbicide: a chemical designed to kill plants, such as weeds.

Hydrocarbons: petroleum products, caustic de-rusting solutions, solvents, tire wear, exhaust, and erosion of road surfaces.

Infiltration: drainage of water through soil.

Intertidal zone: the area along the coast of the ocean between the high tide mark and the low tide mark. Species that live here are adapted to extreme changes in the physical aspects of their habitat on a daily basis.

Invertebrate: an animal without a backbone or vertebral column, such as insects and shellfish.

Lead: by-product of radiator repair, gas stations, road marking paints.

Metabolic rate: a measure of the rate of chemical change in living organisms.

Morphology: the study of form and structure of an organism.

Microbes: pathogenic organism of a size that can only be observed through a microscope.

Nitrogen: an inactive gaseous element found in free state in the atmosphere; eighty percent is found within the atmosphere. It is essential to plant life except in the form of compounds such as nitrates and nitrites which are naturally and artificially supplied to replenish soils.

Non-point source pollution: when pollution comes from many different sources. It is harder to control because it is more difficult to pinpoint the source.

Organic: any substance that contains carbon; also refers to living things or stemming from living things.

Organism: any living thing of either the plant or animal kingdom, having structural parts operating as a unit to carry out vital functions.

Pathogen: disease-producing agent, especially a micro-organism.

Pelagic: of or inhabiting the portion of the marine environment beyond the edge of the continental shelf, comprising the entire water column but excluding the sea floor.

Pesticide: a name for many types of chemicals/poisons used to destroy and kill pests, such as weeds, fungi, insects, or rodents. Insecticides kill insects, etc.

pH: letters stand for potential hydrogen, used to indicate the degree of acidity or alkalinity of a substance. On a scale from 0 to 14, 7 is neutral, lower numbers indicate an acid substance, and higher numbers indicate an alkaline or basic substance.

Phosphorus: a non-metallic element that occurs only in combined state in such minerals as phosphorite or apatite; salts of phosphorous are fertilizers. It has a vital part in the functioning of all living cells.

Point source pollution: when pollution is produced by a single source such as a power plant smokestack or a leaking oil barge.

Pollutant: a substance that contaminates air, water, or soil that is often harmful; it may foul water or soil and reduce their purity and usefulness.

Riparian area: the border of the stream above its banks; wet soil areas influenced by the water of a stream, lake, or wetland.

Runoff: as rain water washes over the ground.

Salinity: the salt content of that natural water supply.

Sediments: solid matter that will settle out of a liquid or can be removed by filtration; rock or inorganic material transported and deposited by water, ice, or wind.

Sedimentation: is the addition of sediment, beyond a level that can be adequately cycled within the aquatic environment.

Slope: the gradient of a stream and terrain.

Soil erosion: the movement of topsoil from one place to another by water or wind is called soil erosion. Erosion occurs naturally as runoff water flows into streams and rivers. Soil erosion can be reduced and protected by plants that keep the soil in place. Serious erosion occurs when human activities remove most of the plants, exposing the soil.

Species: a classification group in biology; individuals of the same species are similar in appearance and tend to reproduce only with each other, although there are examples of fertile hybrids.

Stewardship: the concept of responsible care taking based on the premise that humans do not own the environment but are part of it.

Storm water: rain that flows off the surface of the land without entering the soil.

Storm drains: a maze of tunnels and pipes that empty storm water into nearby water bodies, for example, the Gorge.

Stratification: arranged in layers or successive beds; usually refers to rocks but also occurs in water where physical characteristics such as temperature, TDS/TSS, and so on, vary.

Streams: conduits through which fresh water and sediments move from high to low elevations, and eventually to the ocean. To be defined as a stream, water must be flowing for at least part of the year.

TDS: total dissolved solids.

Thermal Pollution: the heating of water that causes unnatural temperature changes in the aquatic environment that result in the loss of aquatic plants and animals.

TSS: total suspended solids.

Toxic pollution: any substance found in the environment that causes harm to an organism's normal function.

Turbidity: a measure of the degree to which light penetration is blocked due to cloudy water; measure of sediment suspended in water.

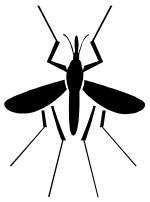
Vertebrate: an animal with a backbone, including reptiles, amphibians, birds, and mammals.

Wastewater: water and water-carried wastes from residential, commercial, industrial, institutional premises, or any other source.

Watershed (also called a drainage basin, or catchment area): the entire region drained by a waterway that flows into a lake or a reservoir; or visually, the topographic dividing line where surface stream water flows in two different directions.

Zinc: by-product of automotive repair (fuel, oil, brake fluid, antifreeze, radiator flush) and automotive exhaust.

Useful Resources and Contacts



ATSDR ToxFAQ's hazardous substance fact sheets	www.atsdr.cdc.gov/toxfaq.html
Aquatic Environments: Canadian site, information about all aquatic habitats, animal, & plants	www.aquatic.uoguelph.ca/
BC Wild Email: comments@bcwild.org	www.multimedia.edu/~bcwild/
Blue Thumb Project Canadian Water and Wastewater Association 45 Rideau Street, Suite 402 Ottawa, Ontario K1N 5W8 Tel: (613) 241-5692 Fax: (613) 241-5193 *great educational resources for students	
Canadian Centre for Pollution Prevention: Information on pollution and businesses	c2p2.sarnia.com/
Canadian Wildlife Canada: For teachers & children	www.wwfcanada.org/wwfkids/index.html
Note: WWF runs four complementary conservation programs: the Endangered Spaces Program, working to complete a comprehensive network of protected areas in Canada; the Endangered Species Program, speeding the recovery of Canadian endangered species and other wildlife at risk; the Wildlife Toxicology Program, protecting Canada's wildlife and wild places from harm caused by toxic chemicals; and the International Program, working to conserve wildlife and natural habitats in Mexico, Latin America, and the Caribbean. Lynn Pady at 1-800-267-2632 (1-800-26-PANDA), or e-mail your postal address to lpady@wwfcanada.org	

Canadian Nature Federation: **Educational links**	www.cnf.ca
Canadian Wildlife Federation Conservation Education Info Canadian Wildlife Federation 2740 Queensview Drive, Ottawa, Ontario K2B 1A2 Tel: 1-800-563-9453 or (613) 721-2286 Fax: (613) 721-2286 Luba Mycio- Mommers, CWF head of education and information at 1-800-563-WILD or email: info@cwf-fcf.org	www.cwf-fcf.org/pages/indexe.htm
Community Learning Network: Educational links	www.cln.org/themes/water.html
CRD: School Teacher's Resource Guide to the Capital Regional District Community Relations Department 524 Yates Street P.O. Box 1000 Victoria, British Columbia V8W 2S6 Tel: (250) 360-3228 Fax: (250) 360-3226	www.crd.bc.ca
Discover Boundary Bay: A Teachers' Resource Guide The Friends of Boundary bay, the Fraser for Life Communications Society, and the Points Roberts Heron Preservation Committee P.O. Box 1441, Stn A Delta, British Columbia V4M 3Y8 Tel/fax: (604) 940-9810	cont'd

Infoline: (604) 940-1540	
Ducks Unlimited: Educational programs, birds and bird habitat	www.ducks.ca
Earthwater Stencils: For non-point source pollution posters and info	www.earthwater-stencils.com
Envirofriendly products hotline: 1-800-968-9355	www.aehf.com/cgi-bin/web-store.cgi
Environment Canada: Information on the environment, (see clean water section) resources and information for teachers: Water is the Lifeblood of Earth	www.ec.gc.ca/envhome.html www.ec.gc.ca/water/index.htm
EPA Environmental Education Center	www.epa.gov/teachers/
Fisheries and Oceans Canada Communications Branch Suite 400, 555 West Hastings Street Vancouver, British Columbia V6B 5G3 Tel: (604) 666-0384 Fax: (604) 666-1847 E-Mail: pacdfocommunications@pac.dfo-mpo.gc.ca	
Green Global Rivers Environmental Network Watershed Education Resources on the Internet: Resource directory	www.igc.apc.org/green/resources.html
The Global Water Sampling Project: Publish your Outfall Monitoring results	k12science.stevens-tech.edu/curriculum/waterproj/
Globe Teacher's Guide: Great Internet site for hydrology and other physical geography subjects	www.globe.gov/
Household Hazardous Wastes: Less Toxic Alternatives	healthdept.co.pierce.wa.us/water/haz/alter.html

Investigating Water Problems: A Water Analysis Manual By: Dr. Charles E. Renn Published by: Educational Products Division La MOTTE Company P.O. Box 329 Chestertown, Maryland, US 21620	
The Living by Water Project P.O. Box 7 Salmon Arm, British Columbia, V1E 4N2 Canada Tel: (250) 832-7405 Fax: (250) 832-6874 Email: Ibywater@jetstream.net *Enviroscape models available for loan	www.livingbywater.ca
OPPT (Office of Pollution Prevention) Chemical Fact Sheets	www.epa.gov/chemfact/
Northwest Scientific Supply 301-3060 Cedar Hill Road P.O. Box 6100, LCD 1 Victoria, British Columbia Tel: (250) 592-2438/ 1-800-663-5890 Fax: (250) 592-1341/ 1-800-797-5773 Email: service@nwscience.com * water quality testing equipment	www.nwscience.com

Project Wet: Water Education for Teachers The Watercourse and Council for Environment Education 201 Culbertson Hall Montana State University Bozeman, Montana, US 59717-0570 Tel: (406) 994-5392 Fax: (406) 994-1919	Project WET Canada Room 300 2365 Albert Street Regina, Saskatchewan S4P 4K1 Tel: (306) 780-8312 Fax: (306) 780-5350 Email: Pauline.nystrom@gc.ca
Project WILD Fisheries, Wildlife and Habitat Protection Department Ministry of Environment, Lands and Parks Victoria, British Columbia, V8V 1X4 Canada Tel: (250) 356-7111	
Riparian and Wetland Research Program: Educational site, riparian glossary	www.rwrp.umt.edu/
Seeds Foundation: 1-800-661-8751	greenschools.ca/seeds
Shorekeepers' Guide for Monitoring Intertidal Habitats of Canada's Pacific Waters Donna Ogden Shorekeepers Coordinator Institute of Ocean Science, Sidney, B.C. 9860 West Saanich Rd PO Box 6000, V8L 4B2 Tel: (250)363-6630 Fax: (250)363-6310	www-sci.pac.dfo-mpo.gc.ca/protocol/shorekeepers/
The Streamkeepers Handbook: A Practical Guide to Stream and Wetland Care The Pacific Streamkeepers Federation	www-heb.pac.dfo-mpo.gc.ca/pskf/home.htm

720 Orwell Street North Vancouver, British Columbia V7J 2G3	
The Water Stewardship: A Guide for Teachers, Students, and Community Groups By: Dr. Milton McClaren, Kim Fulton, and Chris McMahen Ministry of Environment, Lands, and Parks	
Water Words Dictionary	www.state.nv.us/cnr/ndwp/dict-1/waterwds.htm

Adopt an Outfall Pledge

CERTIFICATE OF PARTICIPATION

We, _____
Name of Organization/ School

pledge to monitor outfall(s) number _____ and to promote stewardship of our waterways.

DATE:
SIGNATURES of GROUP:

Complete and fax to: The Veins of Life Watershed Society

383-2086