Kids! Educators! Communities! Here's a way to help reduce pollution in your community and have fun too...

A do-it-yourself guide for building an interactive pollution model

WORKING TOGETHER FOR THE GEORGIA BASIN
AU TRAVAIL POUR LE BASSIN DE GEORGIA

A Georgia Basin Ecosystem Initiative

Learn where pollution comes from,
some of its effects, and where it ends up.

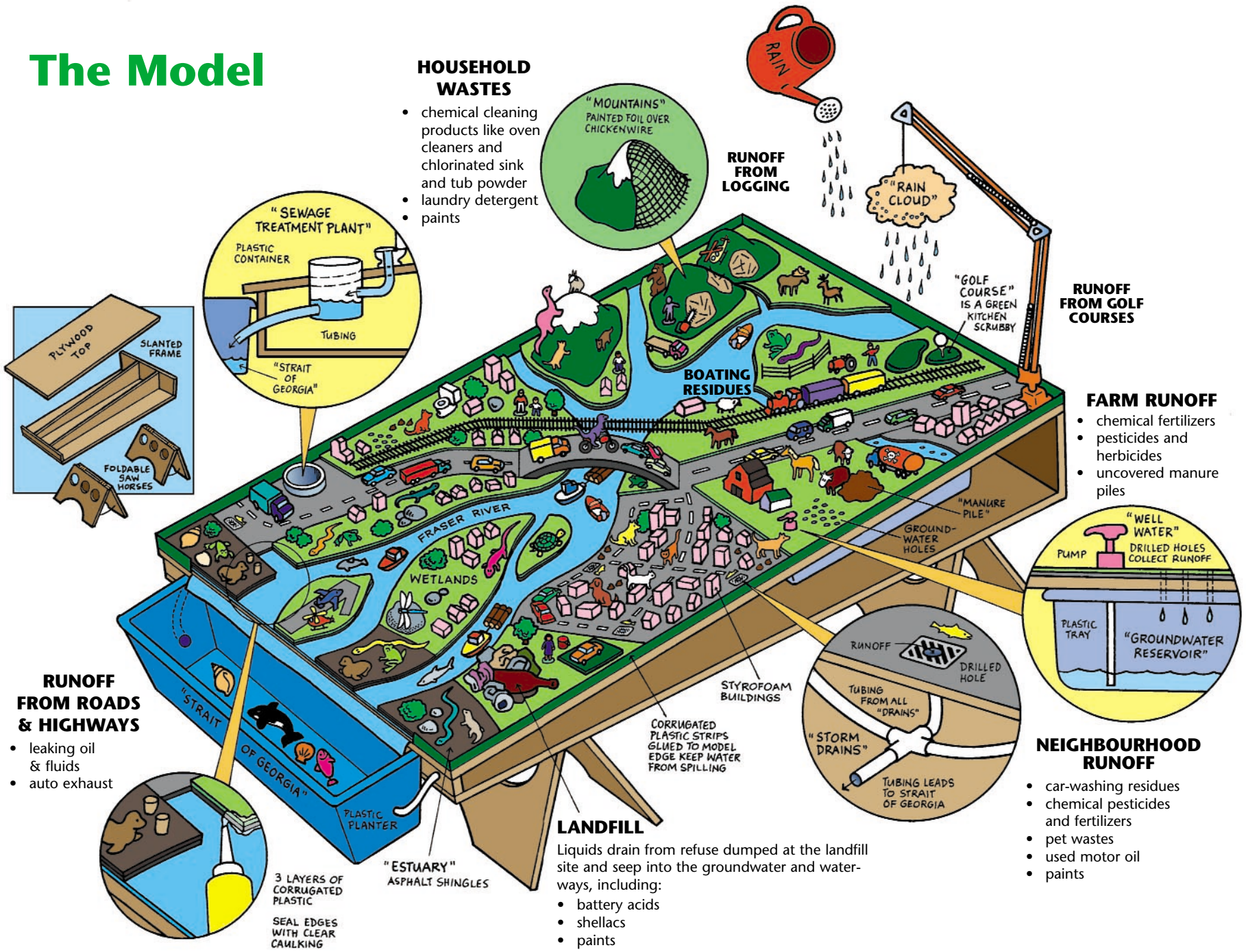
Get the message out to your friends and neighbours...

"It all adds up" and
"Every little bit helps"

Imagine if every community in B.C. cleaned up all the little bits.

Environment Canada Environnement Canada

The Model


HOUSEHOLD WASTES
• chemical cleaning products like oven cleaners and chlorinated sink and tub powder
• laundry detergent
• paints
"MOUNTAINS" PAINTED FOIL OVER CHICKENWIRE
RUNOFF FROM LOGGING
RAIN
"RAIN CLOUD"
"GOLF COURSE" IS A GREEN KITCHEN SCRUBBY
RUNOFF FROM GOLF COURSES
"SEWAGE TREATMENT PLANT"
PLASTIC CONTAINER
TUBING
"STRAIT OF GEORGIA"
PLYWOOD TOP
SLANTED FRAME
FOLDABLE SAW HORSES
BOATING RESIDUES
FARM RUNOFF
• chemical fertilizers
• pesticides and herbicides
• uncovered manure piles
"MANURE PILE"
GROUND-WATER HOLES
FRASER RIVER
WETLANDS
"WELL WATER"
PUMP
DRILLED HOLES COLLECT RUNOFF
PLASTIC TRAY
"GROUNDWATER RESERVOIR"
RUNOFF
DRILLED HOLE
TUBING FROM ALL "DRAINS"
"STORM DRAINS"
TUBING LEADS TO STRAIT OF GEORGIA
STYROFOAM BUILDINGS
CORRUGATED PLASTIC STRIPS GLUED TO MODEL EDGE KEEP WATER FROM SPILLING
NEIGHBOURHOOD RUNOFF
• car-washing residues
• chemical pesticides and fertilizers
• pet wastes
• used motor oil
• paints
RUNOFF FROM ROADS & HIGHWAYS
• leaking oil & fluids
• auto exhaust
"STRAIT OF GEORGIA"
PLASTIC PLANTER
3 LAYERS OF CORRUGATED PLASTIC
SEAL EDGES WITH CLEAR CAULKING
"ESTUARY"
ASPHALT SHINGLES
LANDFILL
Liquids drain from refuse dumped at the landfill site and seep into the groundwater and waterways, including:
• battery acids
• shellacs
• paints

Pinpointing nonpoint source pollution

It's pretty easy for us to understand the pollution that comes from a particular place like a pulp mill or a sewage system. We can see it... and sometimes smell it! Because the pollution is coming from a single source, it also means that we can measure it and find ways to reduce it. Scientists call this kind of pollution **point source pollution** because the source of the pollution is at a particular point. You could think of it as **pollution where you can point to the source**.

Scientists from Environment Canada, working with the Fraser River Action Plan, have been studying pollution in the Fraser River watershed for several years. During the time they have been measuring water quality in the watershed, they have seen many improvements in places like pulp mills and sewage plants where point source pollution has been monitored and the pollution controlled. But the scientists knew they had another less obvious but equally important pollution problem. They could still measure pollution in the water, but they couldn't point to the source. You see there were as many sources as there were people, cars, buildings and developments. This is called **nonpoint source pollution** because—you guessed it—**you can't point to the source**. It comes from **everywhere!**

Nonpoint source pollution sneaks up on you. You think that a few drops of oil leaking from the motor of your car or a little weed-killer on your lawn won't be harmful. Or that if your dog poops in the woods or the park, Nature will take care of it. Well, Nature could if it were just you—but there are almost four million of us living in British Columbia with our cars and lawns and dogs. It all adds up.

It's hard for us to understand how the little bit of pollution each of us produces makes a difference in a whole big watershed. If we don't understand it we probably won't work to fix it. So the Environment Canada scientists had to figure out a way to show us just how nonpoint source pollution affects the quality of our water, our air, and the plants and animals that live here.

First they built a model of the Lower Fraser River watershed on a sheet of plywood, complete with hills, mountains, streams and rivers. Then they populated this world with toy buildings, animals and vehicles. They took their model to schools and festivals and teacher conferences. Kids, parents and teachers sprinkled and squirted colourful substances on the model. These substances represented pollutants. For example, cocoa powder represented car exhaust; fruit drink crystals represented pesticides, paints and other household chemicals; and chocolate syrup represented motor oil. They then rained on this miniature world with water from small watering cans. The rain created streams which flowed down the hills and waterways. Participants could see for themselves how pollutants moved through the system. Once they understood just how the system worked, they could talk about ways each of us in our daily lives can help reduce pollution.

A bird's-eye view of the Lower Fraser River

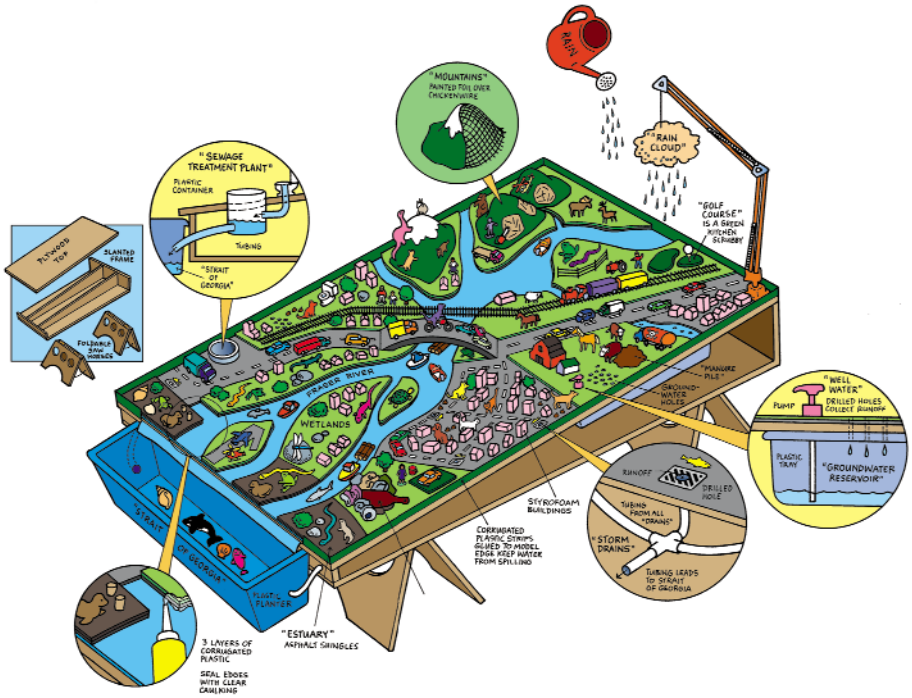
The Lower Fraser River model, shown here, represents one option. The Environment Canada team has also built a smaller, folding version, with an inset plastic collection container to represent the Georgia Basin. Sometimes they use the miniature model shown on the other side of this poster for interactive demonstrations. Customize your model to your own needs, and use your imagination!

The model shown below is the size of a sheet of plywood, four feet wide and eight feet long (122 x 244 cm). It is big enough for 15 to 20 people to participate and get a good view of all the action. The model loosely represents the Lower Fraser Valley, Greater Vancouver, the Fraser River Estuary, and the Strait of Georgia (which is part of the Pacific Ocean.)

This model even has underground water systems that work. Groundwater seeps through holes in a field, is caught in a plastic container, and can be pumped up to demonstrate drinking-well water. Sewage treatment is represented by a container with tubing that carries treated waste into the Strait of Georgia. A big sponge suspended from a desk lamp frame represents a rain cloud.

Building materials recommended here

You may come up with materials more appropriate for your own situation, or the ones recommended here may not be available in your community. The physical features of the model can be created with materials other than corrugated plastic—but if they are not waterproof, everything will have to be coated; and if the material is very hard, you'll need a special saw to cut natural shapes. Sheets of corrugated plastic can be found at large stores selling home/building supplies or art/architects' supplies; or a local sign-making company may be able to order some for you.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SEAL EDGES WITH CLEAR CAULKING

The Model

How the Lower Fraser model was built

The model built by the Environment Canada team can be carried by two people but needs a pickup size truck to transport it.

Frame. The base of the model is two sheets of 4' x 8' plywood joined by dimension lumber and supported by two folding sawhorse-style supports. The plywood top slants so that water runs from the top of the model to the bottom. Strips were cut from sheets of corrugated plastic* and glued around the edges to extend above the model. The strips form a barrier that prevents water from spilling over the edges of the model.

* *Corrugated plastic is sold as a product called "Coroplast" in many lumber stores.*

Rivers, urban areas, green areas. These were formed by stacking three large sheets of coloured corrugated plastic: blue on bottom, black in the middle, green on top. Outlines of rivers and streams, urban areas and natural areas were drawn on the green layer using markers and paint. Locations of rivers and tributaries were shown by cutting through both the green and black layers, leaving only the blue. Urban areas were shown by cutting through only the green layer, thus exposing the black. This cutting allowed runoff water to flow from green areas onto urban areas, then finally into the rivers. All the cut plastic edges were sealed with clear caulking.

Asphalt shingle pieces were used for the **estuary.** The **Strait of Georgia** was represented by a plastic planter box supported by a metal frame hooked onto the plywood frame to catch water.

Mountains and hills were created by covering chicken wire with aluminum foil and then painting them. **Bridges** were also constructed with chicken wire.

Buildings were cut from pink Styrofoam (the kind used for insulating). **Golf courses** were made from green scouring pads, with real golf tees and plastic balls stuck into the greens.

For **groundwater,** holes were drilled through the top so water could collect in a plastic container attached with metal brackets underneath. A hand lotion pump set into the top represented a well where water could be pumped up from the plastic "reservoir" or "aquifer" to represent **drinking water**.

Clouds were created by attaching a large, porous sponge to a desk lamp frame. The sponge was kept wet then squeezed for rain.

They visited lots of loonie stores and garage sales to collect **cars, trucks, trains, farms, animals, dinosaurs** and **people.**

Sponges were used for **wetlands** and decorated with frogs, ducks and plants.

All pieces were caulked to the plastic model top so they could not be removed.

Build your community in miniature—and show what happens when you rain on it

Your own model could be large or small, and you can have fun choosing which details of your community you want to represent.

The main thing to remember is that there has to be a water source nearby so you can fill the watering cans, and there will probably be drips and drops and a bit of mess. Consider doing demonstrations outdoors, or use a large tarp under the model if you are indoors.

When deciding on size and building details, think about the audience you are trying to reach. Does the model have to be small and light enough to transport to various places, or can you keep it in one place and bring the audience to the model?

A high-school science project

Grade 9 students Emily Shemko and Sophia Philion live in the Squamish River watershed at the north end of Howe Sound, where water drains from the Squamish Valley, Whistler Mountain and other steep mountains, and ends up in the Squamish Estuary.

They heard about the Lower Fraser River model and decided to build a model of their own community as a science project.

Emily and Sophia gathered information about pollution sources from posters and pamphlets. Then to find out what was going on locally they phoned the two local sewage treatment plants, a local radio station, the dump and the municipal hall.

To build the model they got help from Emily's dad. They included details like a hiker with his feet sticking out of a little tent on the side of Mount Garibaldi, a car crash on Highway 99 and an airplane suspended on a wire above the model with an eagle chasing it. They had a bucket on the floor at the bottom of their model to catch the water. They learned one lesson the hard way, after their plaster mountains got soggy in the first demonstration. As Emily puts it, "You have to remember to shellac everything because all of it will be getting wet".

They ran demonstrations with their science class, with a group working on watershed restoration, and at their local Rivers Day community event.

Sophia reports that "what really interests kids, or anyone, is when you let them interact with the model. That really motivates them to ask questions". She says kids always noticed the "dog poo" (chocolate chips) first, and that the colour of the water mixed with pollutants (represented by cocoa powder and fruit drink crystals) always got a reaction.

Stream Team students ready for a demonstration of the Colquitz River model

A school-district/ community project

Teachers Lenny Ross and Angus Stewart have been conducting watershed stewardship activities with hundreds of elementary students living on southern Vancouver Island. At one of these events a demonstration of the Lower Fraser River model was such a success they wanted to build a model of a local stream in their own community.

Angus worked with local Streamkeepers coordinator Jennifer Sutherst to build a model that would be demonstrated by high school students to teach elementary students and community groups about nonpoint source pollution in local streams.

The Stream Team, a local high school action group trained as Streamkeepers, took on the project. The students constructed a 4' x 8' plywood model of the Colquitz watershed, from its source at Beaver Lake to the Colquitz Estuary and Portage Inlet on the Gorge Waterway in Victoria. It is a working model with farms, wetlands, highways, malls, storm drains, groundwater and subdivisions.

The Stream Team has conducted demonstrations at a local shopping mall and is available for bookings by schools throughout southern Vancouver Island. They found they needed at least four people working at once to help with the pollution and water, to answer questions and to keep everyone occupied.

An introductory brochure includes some key advice: "The model should be located outside the school whenever possible. Model facilitators will need easy access to water and a sink or storm drain close to where the model is located. Participants are in groups of 15 and can range in age from kindergarten to adult."

Passers-by at the shopping mall look on as kids learn about nonpoint source pollution

Kids learn by getting fully involved

Here's a plan for a 20-minute demonstration that allows 15-20 kids and adults to interact with a model the size of the Lower Fraser River model.

If you are running several demonstrations one after the other, remember to leave enough time between sessions to clean up the model, dispose of the dirty water and refill pollution containers and watering cans.

It's a good idea to have a number of presenters and helpers for everything from handing out the pollution to helping keep everyone on task.

A model with lots of details is guaranteed to attract kids. They'll learn best if they get physically involved in polluting or raining and if they can share their ideas with the group.Here's a plan for a 20-minute demonstration that allows 15-20 kids and adults to interact with a model the size of the Lower Fraser River model.

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Skits, humour and fun are helpful!

The team from Environ-ment Canada developed a series of skits and characters to get across concepts and involve kids in thinking about pollution.

One skit began with one of the presenters (named Suzie) taking a walk with her dog (with plastic bag in hand) to the creek. Suzie noticed a neighbour washing his car on the driveway and that the soap suds, mud and grease were being washed down the street into a nearby storm drain, the one marked with a painted fish (presenter demonstrates with soap suds, cocoa syrup, etc. running onto street and into the storm drain). As she continued walking along the creek she noticed soap suds were floating down the creek. The next day on her favorite walk to the creek she noticed some dead fish along the bank of the creek. The presenter then asked the kids what may have killed the fish and how they could raise awareness in their neighbourhoods about problems with things flowing down and being dumped in storm drains, and about using environmentally safe cleaning products.

Another skit began with a presenter asking the kids around the model, “Who wants to build big, strong biceps?” (making a fist and showing her bulging biceps to everyone).

The presenter then held up a tin of baking soda and demonstrated how you can build up muscles by using safer cleaners such as baking soda. Scrubbing the tub with toxic chemicals may be easier but they contaminate our water supply.

Presenters got their ideas from reading pamphlets and brainstorming. They had as much fun as the kids as the skits evolved from demonstration to demonstration.

Step by Step

1. Show real photograph or map

Have participants identify physical features and landmarks on a photo or map of the area represented by the model. Point out wetlands and other homes for plants and animals, including any that have been lost to urban or industrial development. Note the location of the river, which way it flows and its tributaries.

Important note! *It's best to start with this activity before you invite everyone to gather around the model. The messages can be lost if the kids get excited too soon.*

2. Point out landmarks on the model

Invite the group to gather around the model. Make sure everyone can see and point out major landmarks and physical features. Have kids see if they can locate their school and their home.

3. Discuss pollution sources shown on the model

Have participants point to as many pollution sources on the model as they can find. Emphasize nonpoint source pollution to which we all contribute. Show that waste from urban household toilets and drains is treated in the sewage treatment plant before being released into waterways. But also point out that many harmful substances we pour down household drains, such as laundry detergents, household cleaners and paint, still get into the waterways.

Pour a toxic substance such as antifreeze (strawberry syrup) down a storm drain and show how rain washes the toxic substance directly into waterways where it can harm fish and other aquatic life. Point out other pollution sources such as uncovered manure piles, auto exhaust and residues from boat operation. Point out the cloud and show how airborne contaminants gather in clouds and rain back down on the land.

4. Separate participants into Polluters, Rainers and Rivermakers

5. Polluters sprinkle and squirt substances onto the model

At your signal, polluters are encouraged to sprinkle and squirt anywhere on the model. Make sure there is enough pollution to make a visible "blob" when the pollution is mixed with water.

6. Rainers and Rivermakers apply water

Have Rainers rain down everywhere on the model, showing how rain plays an important part in moving nonpoint source pollution into waterways. Rivermakers add water to the rivers.

7. The Blob flows from everywhere and ends up in the ocean

The water mixed with the pollutants flows from everywhere—including farms, forests, cities, the air, home gardens, urban streets and highways—and ends up in streams, groundwater, the Fraser River and finally in the Strait of Georgia.

Participants see dramatic evidence of how our everyday activities contribute to pollution.

8. Debriefing: Pollution and you—What can you do?

Be sure to ask participants what each of us can do to help reduce pollution in our own community.

Tips for debriefing: what can you do?

Have participants suggest ways to reduce pollution. Make sure the main points come up, such as:

- Reduce car exhaust: take transit, ride a bike, skateboard or walk.
- Clean up after your dog and cat.
- Don't pour motor oil, paints, gasoline, antifreeze or other chemicals down household drains, toilets or storm drains.
- Use recycled or re-refined motor oil in your car and recycle your old oil and antifreeze.

  Recycling Hotline: (604) 732-9253 or 1-800-607-4321
- Wash your car on the lawn instead of the driveway, or take it to a car wash facility that treats waste water.
- Adopt a wetland! Preserving wetlands not only provides homes for wild plants and animals but it also helps to keep our water clean by filtering and removing harmful pollutants.
- Try a safe insecticide in your garden: add 30 ml (2 tablespoons) of biodegradable soap to one litre of water and apply with a watering can—instead of pesticides and other harmful chemicals for spraying pests in your garden.
- Build a compost pile for a chemical-free source of fertilizer.
- Replace laundry detergent with pure soap flakes; add 1 tablespoon of vinegar to the rinse to keep colours bright.
- Use baking soda or diluted vinegar instead of harmful household cleaners.
- Help spread the word in your community: we can reduce nonpoint source pollution if we all work together!

Be Imaginative!

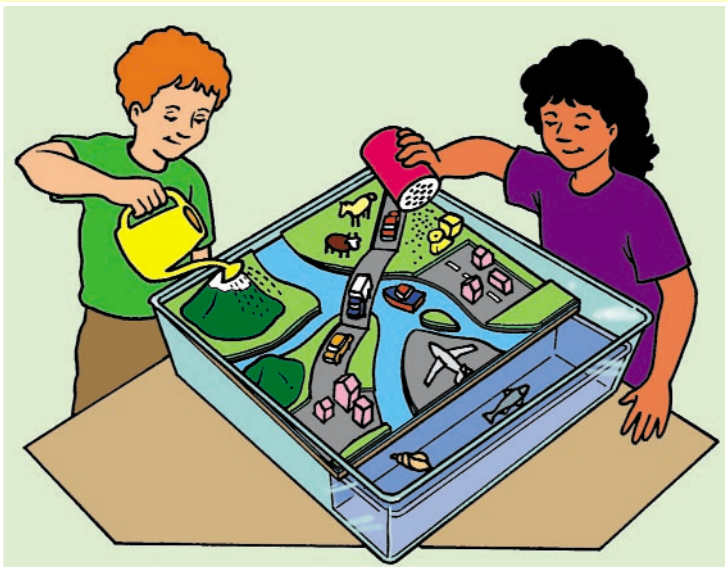
Use your creativity and have fun designing your own model. You learn by experimenting. For instance, when Environment Canada built their second large model, they designed it to fold in two for easier transportation; and they inset the Georgia Strait right into the frame to make it neater and more waterproof.

Preparing the pollution

Use non-toxic substances, for example:

- chocolate or strawberry syrup for motor oil (mix syrup with water in medium-sized, red plastic oil cans and squeeze from bottom of can to make it work);
- cocoa powder for car exhaust and manure:
- chocolate chips for dog and cat poo; and
- fruit drink crystals (unsweetened) for paints, pesticides and other chemicals.

A small model that is easy to build and store



The scientists at Environment Canada also built a small model of the Lower Fraser River that is about 60 x 60 cm and uses a transparent plastic container as its frame.

This simplified version can be quite effective for demonstrating the basic concepts of nonpoint source pollution. It may not be as detailed or as exciting as the large model—and there's only room for a handful of participants at once—but it can be built quite quickly and the cost of materials is much lower.

Sheets of coloured corrugated plastic are cut to make green areas, urban areas and waterways—just like in the large model—but the plastic base is rigid enough to act as the main support.

A plastic bin with a ridge on the inside is used to hold the plastic base in place. The "up-river" section has to be wedged or supported so the water runs from the top to the bottom of the model. A space is left at the bottom of the bin and a smaller tray is put in place to represent the Strait of Georgia.

The model and the shallow tray can be removed from the plastic container to be rinsed off in a sink. This is a handy way to remove leftover "pollution" after each demonstration.

One way of using the plastic container method is to have kids working individually or in groups to create their own model on a separate removable plastic base. They could take turns using the large container for their demonstrations.

Curriculum Connections

Teachers, parents and community groups who are thinking of developing a local pollution-model project will find numerous opportunities for elementary and high school student activities at the various project phases, including:

- Researching pollution in your local community;
- Researching and mapping key landscape, water and ecological features of your neighbourhood;
- Identifying both point and nonpoint sources of pollution in your community;
- Building a model;
- Communicating findings and ideas by conducting demonstrations of the model at school and in the community; and
- Conducting follow-up studies.

Here are a few examples from the current British Columbia *Instructional Resources Packages*:

Science

Four Major Processes
Kindergarten to Grade 12—

Students develop the knowledge, skills, and attitudes necessary for scientific literacy through:
- Working scientifically
- Communicating scientifically
- Using science
- Acting responsibly

Life Science

Grades 2 & 3— Plants and animals in the environment
Grade 4— Adaptations of organisms
Grade 5— B.C.'s living resources
Grade 7— Ecology
Grade 8— Social issues: resources, pollution, global ecosystems

Physical Science

Grade 7— Environmental chemistry

Earth and Space Science

Grade 4— Water
Grade 5— B.C.'s non-living resources

Environmental Education

Cross-curricular integration

("Appendix C" in Science and all other IRP documents)

Kindergarten to Grade 12—
- Environment theme
- Sustainability theme

Science & Technology 11

- Resource management and environmental planning
- Pollution
- Energy and environmental trade-offs

Earth Science 11

Resources and environment

Social Studies

Applications of Social Studies

Kindergarten to Grade 12—
- Identify a problem or issue
- Gather information
- Interpret information
- Analyse information
- Present information
- Practice active citizenship

Politics and Law

Grades 2 & 3— Roles, rights, and responsibilities in the community

Grade 6— Global citizenship

Economy and Technology

Grades 2 & 3—Natural resources and related occupations

Grade 5— Communities and their relationships to population, resources, transportation, and technology

Environment

Grade 4— Interactions of people with their environments, past and present

Grade 5— Natural resources in Canada; sustainability and stewardship; effect of lifestyles and industry on the environment

Grade 7— Impact of human-induced changes on communities

Career and Personal Planning

Kindergarten to Grade 12—

- Career and career skills awareness
- Career exploration
- Career preparation

Resources

Environment Canada has produced a number of publications on non-point source pollution and what we can do about it. Call the Inquiry Centre at 1-800-668-6767 or visit **www.ec.gc.ca** and click on the Publications button.

The B.C. Ministry of Water, Land and Air Protection has made a number of their publications available at their website. One series of fact sheets, **"Clean water, it starts with you"**, offers succinct background information on nonpoint source pollution, and tips for reducing or preventing it. Go to **http://wlapwww.gov.bc.ca/wat/wq/NPS_web_page/General_Info/NPS_Resources.htm#Ed** and click on the Water Quality Section button to send an email to ask for information or order materials.

You can buy posters of **satellite images** (the Georgia Basin, the Fraser Valley, Victoria area, Greater Vancouver, and others) from a map store. Check the *Telus Yellow Pages* under Maps.

BC Eco Education is an environmental education provider initiated by the B.C. Ministry of Environment, Lands and Parks. They offer full-day and interactive workshops across B.C. for students in grades 4-6, independent learning resources, and an educational website—**www.bccf.com/ecoed** For more information, call their office in Vancouver at 604-683-0127.

You'll find curriculum-based activities in the B.C. Ministry of Environment's Eco Education Program **Household Hazardous Products** binder which was distributed to elementary schools throughout B.C. Activities include "Polluted radish seeds", "Make greener cleaners" and "Community hazardous products".

A number of excellent publications on stream stewardship are available free of charge from Fisheries and Oceans Canada. Contact the Information Coordinator, Habitat and Enhancement Branch, 555 West Hastings Street, Vancouver, B.C., V6B 5G3; phone 604-666-6614. Publications include the **Lost Streams of the Lower Fraser River** map which shows the many streams and wildlife habitat areas that have been lost to urban development. The Information Coordinator also has books and brochures on the **Storm Drain Marking Program**. Storm drain marking materials are available from your local Salmonid Enhancement Program Community Advisor or Education Coordinator.

Several **curriculum-based publications** on water and pollution are available, free of charge, from the Greater Vancouver Regional District (GVRD) Communications and Education Department. Phone 604-432-6339 in Burnaby. Check out the GVRD web site for more information: **http://www.gvrd.bc.ca**

Another website to visit for nonpoint source pollution information is: **www.epa.gov/owow/nps**

Contacts

If you have any questions or would like to learn more about what Environment Canada is doing in the Pacific & Yukon Region, please contact 604-664-9100. Website: www.pyr.ec.gc.ca

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