Environment Canada Environnement Canada

Urban Issues

FRASER RIVER
ACTION PLAN

Canada

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FRASER RIVER BASIN

Urban Issues

CITIES AND THE ENVIRONMENT

Urban areas intrude into and interact with the natural environment in innumerable ways. The Fraser River Action Plan (FRAP) focuses on interactions which are critical to the fish and wildlife of the Fraser River watershed.

For a few fish and wildlife species an important interaction with urban residents has been hunting and fishing for recreation or commerce. However, the focus of FRAP's attention has been other subtle and dangerous byproducts of urban activity. These are of two kinds:

- elimination of natural habitat: land use and watercourse alterations reduce and eliminate diverse natural forms of space, shelter, and food for fish and wildlife.
- pollution: contaminants are discharged into the water and air, which carry them into harmful contact with fish and wildlife.

FRAP programs have investigated the issues and taken action in both these areas.

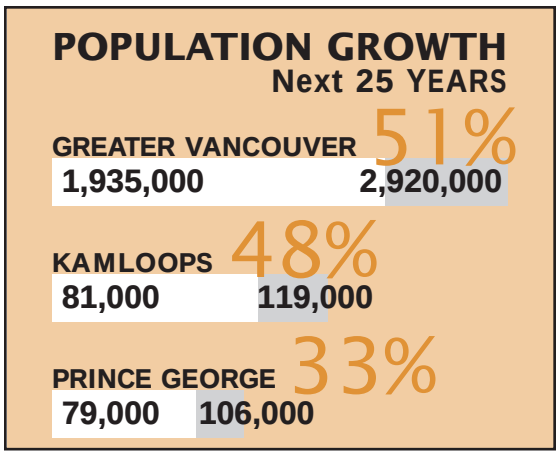
EC AQUATICS SECTION

Streams in cities are under increasing environmental pressure: Brunette River, Burnaby.

habitat

ELIMINATION OF NATURAL HABITAT

Cities often grow in locations rich in diverse natural habitat. The shorelines and river banks that appealed to pioneers and later settlers in British Columbia are also favoured by wild animals and birds. As settlements grew into towns and then into sprawling cities, wildlife has been progressively excluded from some of its best habitat. Housing, industrial developments, and transportation corridors squeeze and divide natural populations. River docks and shoreline structures



push into the backwaters and shallows that make prime fish habitat. Of 30 creeks historically recorded in the city of Vancouver, only one still runs freely. There has been little in past urban design to encourage human cohabitation with fish and wildlife.

Human encroachment may accelerate. In the next 25 years, city populations in the Fraser Basin are expected to grow dramatically.

In the next 25 years, city populations in the Fraser Basin are expected to grow dramatically

For example Greater Vancouver is projected to grow by 51 per cent, Kamloops by 48 per cent, and Prince George by 33 per cent. New residents and businesses will intensify the pressures on the landscape.

As will be seen, FRAP's initiatives have included conservation and rehabilitation of surviving riparian (waterside) habitat and wetlands. In the Fraser delta alone these areas remain vital to migration staging, breeding, and overwintering of more than 1 million shorebirds and about 250,000 waterfowl annually.

riparian

POLLUTION

Cities and towns expose fish and wildlife to waterborne pollution in a variety of ways:

- Effluent: Water is used by residents and industries and then discharged, with varying degrees of treatment, into watercourses as "effluent." Effluent discharges from municipal sewage treatment plants and from industrial outlets are "point sources" which are licensed, monitored, and subjected to regulations for effluent quality. Municipal sewage contains chemicals, not only from residential products such as household cleaners, solvents, and laundry detergent but also from the smaller industrial firms that do not have their own effluent treatment, but rather are connected to the municipal sewer system.

- Runoff: The rooftops and paved surfaces of urban areas act as a vast collection system for precipitation. Unlike the countryside, which holds precipitation in vegetation or allows it to percolate slowly through the soil, these hard urban surfaces channel it immediately into storm sewers, which carry it directly into watercourses. When rain follows a dry spell, the first pulse of runoff lifts the load of dust, oil, litter, and chemicals

which has accumulated in gutters and streets and washes it into the river. Some storm sewers share a discharge system with sanitary sewers. During wet weather, heavy runoff can overload the combined sewer system and impair sewage treatment. When this happens, in an event known as a combined sewer overflow, or CSO, untreated sewage may join the quantities of stormwater flowing into the receiving waters. The origins of runoff pollution, such as leakages of oil from cars and trucks or airborne contaminants caught in the rain, often called "non-point sources," are too numerous to identify and control individually.

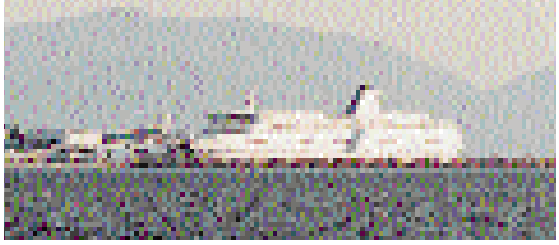
• Contaminated sites: A location where a polluting activity was once carried on, such as certain abandoned industrial sites, may be underlain by a residue or plume of toxic chemicals. With the movement of groundwater, these chemicals may slowly drain into surface waters. More than 1600 such sites have been identified throughout the Fraser Basin, and not only in urban areas. There is no reason to believe that all have been found.

The relative importance of these categories is not entirely clear. Point source effluents are comparatively well known. Much less is known about runoff pollutant quantities and hazards. And contaminated sites are only slowly being evaluated.

How do these sources compare in the Fraser Basin? In waste water volume (leaving aside questions of relative toxicity), runoff is approximately equal to all effluent point sources, and the latter are about equally divided between municipal sewage treatment and industrial discharges. No estimate is available for contaminated sites, but their volume will probably be much smaller even though surface runoff is sometimes involved as well as groundwater seepage.

FRAP's tasks have been to estimate the quantities and effects of such pollution in the Fraser River system and take steps to help reduce them.

Contaminants washed from streets pollute watercourses. CHRIS LAUSTRUP



SIGNS OF URBAN STRESS

CHANGES IN THE DELTA

Except in its upper reaches, the Fraser River is a silty brown colour. From aloft near Vancouver, the brown plume can be seen pushing out into and across the Strait of Georgia. The colour is not from pollution. It is the natural colour of the suspended sediment being carried by the water. Over many thousands of years, a portion of these sediments have been deposited where the river encounters tidal action, creating the Fraser delta. The continuing deposition of silt, especially in annual flooding, interacting with tidal currents, has given the estuary its shape.

The intertidal flats of Roberts and Sturgeon Banks show signs of sediment depletion

But this natural maintenance process is no longer occurring, FRAP studies show. Dikes, training walls, and dredging have channelled the arms of the Fraser and redirected flows and sediment transport. Only at tiny Canoe Passage, a channel too small to have been altered, can natural deltaic processes be seen. The intertidal flats of Roberts and Sturgeon Banks show signs of sediment depletion. Evidence of erosion in the vicinity of the Westshore terminal at Roberts Bank and the Tsawwassen ferry terminal warns of possible threats to those structures. The studies therefore signal the loss of delta habitat.

In the Fraser estuary, not all sediment transport goes downstream. Scientists have observed upstream movement of sediments in some channels carried by flooding tides. A net flow of sediment up the Pitt River has produced a reverse delta at the mouth of Pitt Lake. In some areas that have been

A jetty keeps tidal flats from being naturally replenished with sediment.

SATELLITE IMAGE - ADVANCED SATELLITE PRODUCTIONS INC. KELOWNA, B.C., CANADA

Greater Vancouver is gradually phasing out obsolete storm drain technology.

dredged (eg Queen's Reach near New Westminster and Main Arm by Steveston Cut and Steveston Jetty), some scientists suggest there are signs of an upriver return of sediment quantities removed by dredging. This would support the general observation that sediment configurations on river bottoms are developed into a state of equilibrium over time and tend to re-establish themselves when disturbed. Some observers argue that the use of sandy dredged sediment for construction may be effectively starving the delta of sand.

URBAN POLLUTION IN SILT AND FISH

Certain pollutants are signs of human activity:

- Fecal coliform bacteria levels in the estuary are very high in winter months. These have two origins, both urban: releases from the sewage treatment plants in the estuary during periods when chlorination is not used, and runoff from city streets and other locations where animal droppings are washed away.

- Polycyclic aromatic hydrocarbons (PAHs), produced by fossil fuel combustion, and polychlorinated biphenyls (PCBs), used in electrical equipment, have been found at elevated levels in sediment and fish in the Lower Fraser river and estuary and in the Kamloops area in the Thompson.

These findings show that urban pollution is finding its way into natural systems and, as populations grow, will do so increasingly unless something is done.

EFFECTS IN ESTUARY FISH

Scientific data indicate that in fish tissue concentrations of a number of contaminants of historic concern, reductions have occurred where action has been taken. These include certain organochlorines (PCBs, chlorophenols, pesticides, dioxins, and furans) and at least

EC AQUATICS SECTION

Measuring the health of the river

two metals (lead and arsenic). Yet developing pharmacological and ecological understanding continually raises new concerns about chemicals whose effects, individually or in combination, have not been well studied. The past gives no reason to be complacent about the future.

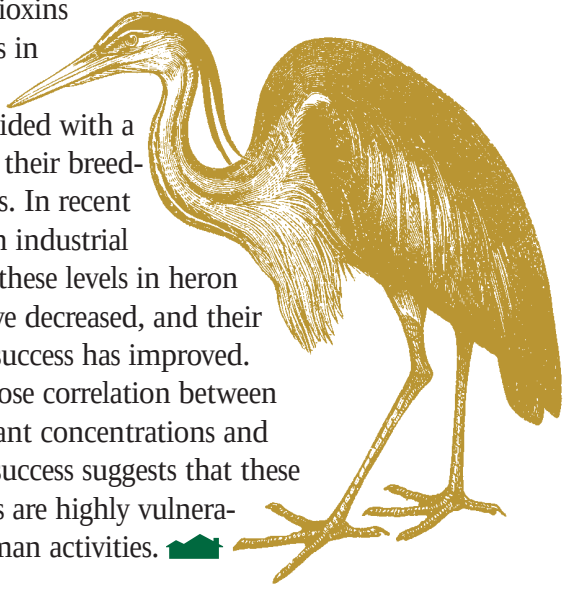
Scientists are not yet sure of all the pollutants involved and where they may come from

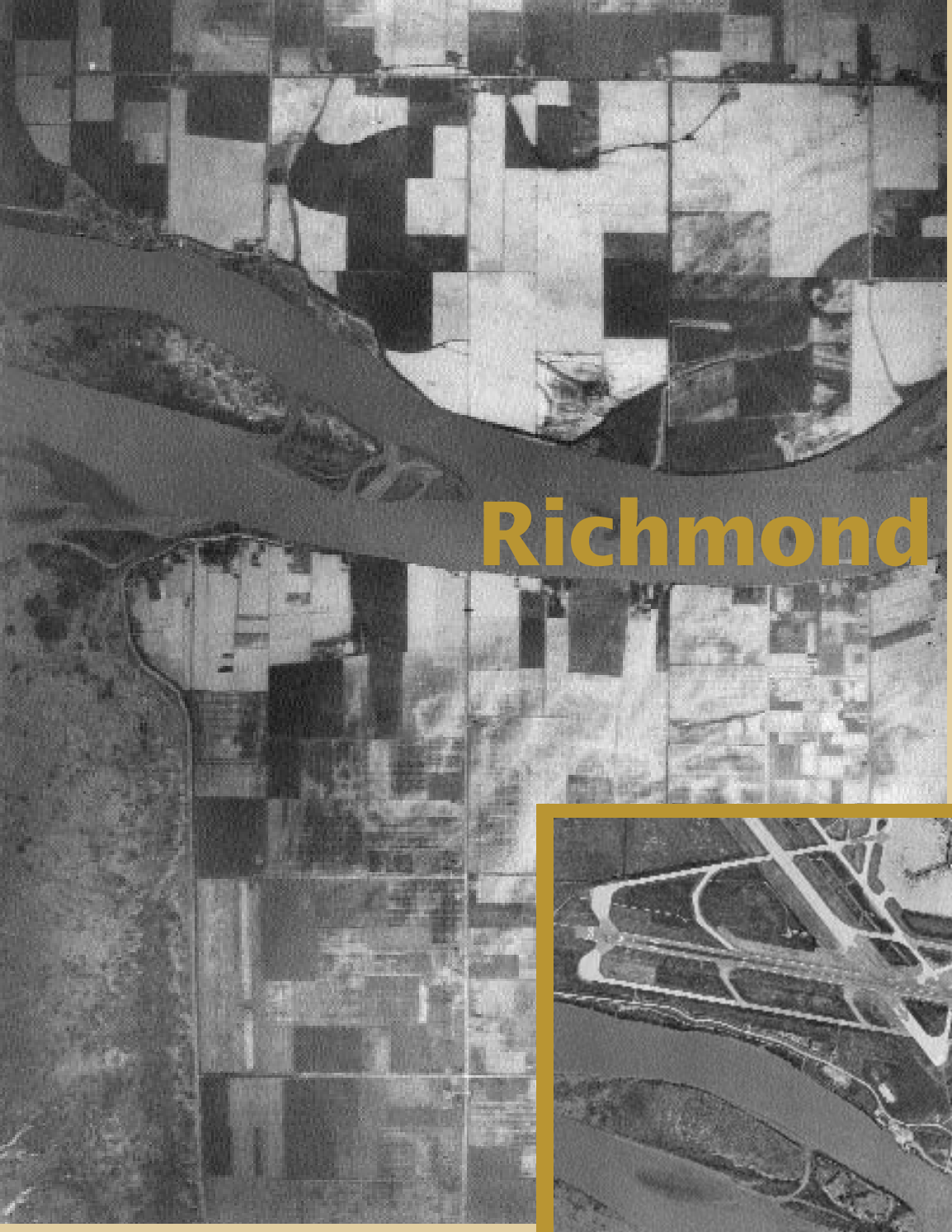
For example, fish in the Fraser estuary are reacting to contamination. Samples of two resident fish species, peamouth chub and starry flounder, showed mixed function oxidase (MFO) activity in their livers. MFOs are enzymes produced by the liver to eliminate some toxic organic chemicals. They therefore reveal the fish's exposure to those chemicals, unlike other health indicators, which usually reflect the cumulative effects of all stressors, not just certain contaminants. Scientists are not yet sure of all the pollutants involved and where they may come from (though vehicle emissions are among the suspects), but the results indicate that MFO induction can serve as a first warning of contaminant exposure in the environment.

stressors

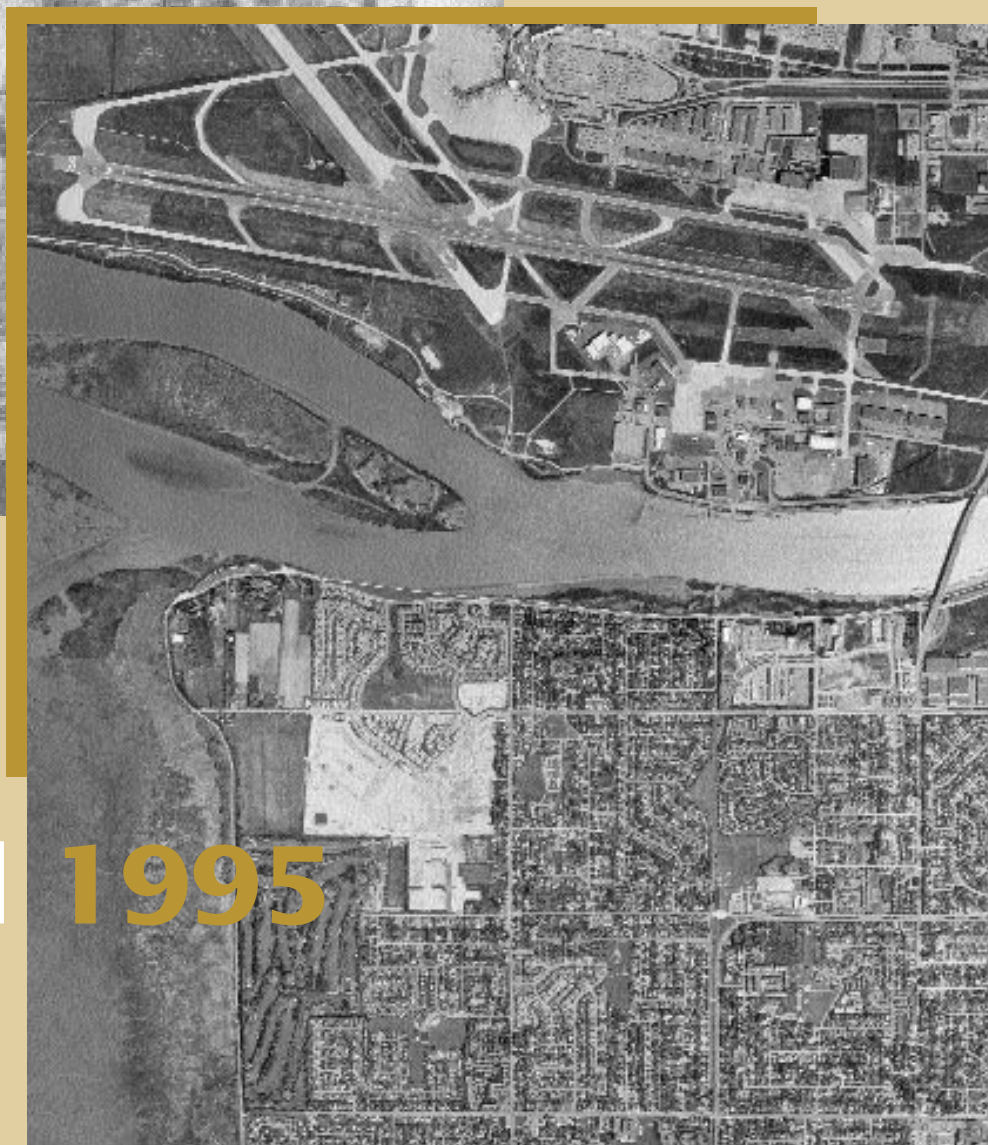
HERON BREEDING

The Great Blue Heron, which often symbolizes a tranquil and healthy environment, is under increasing stress around urban areas. Its nesting areas are being consumed by urban sprawl and are more and more disturbed by human activities. Industrial, agricultural, and residential contaminants are found in heron eggs. In the 1980s, scientists found that high levels of dioxins and furans in heron tissues coincided with a decline in their breeding success. In recent years, with industrial cleanups, these levels in heron tissues have decreased, and their breeding success has improved. But the close correlation between contaminant concentrations and breeding success suggests that these great birds are highly vulnerable to human activities.





Richmond 1930



Richmond 1995

EC AQUATICS SECTION

RISING IMPORTANCE OF URBAN RUNOFF

In total volume, urban runoff amounts to as much as all other effluent point sources combined, that is, municipal sewage treatment plants and industrial outfalls together. In harmfulness, urban runoff has in the past been less important, but that is changing. There are two reasons for this:

- The point sources have radically improved the quality of their effluent. The forest products industry has been making great strides in pollutant reduction, and the sewage treatment plants in the Lower Fraser are completing some significant upgrades.

Research is tending to attribute pollution increasingly to runoff sources

- Urban growth, and especially the increase in motor vehicle traffic, tends to increase the amount of urban runoff and the variety of contaminants it contains.

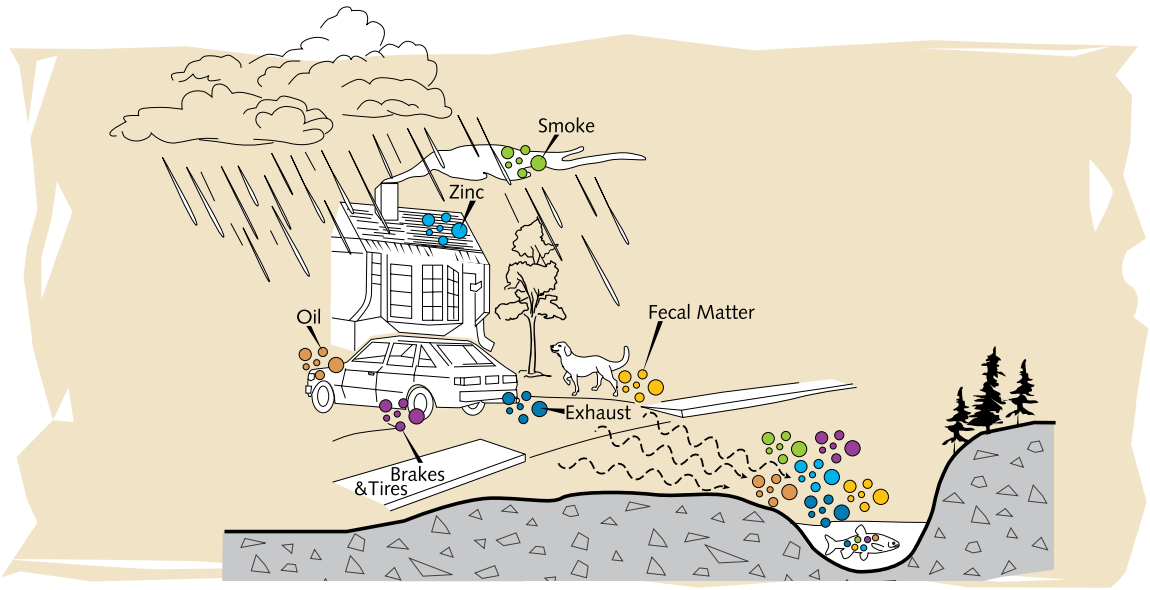
These changes can be seen in two traditional general indicators for comparing pollution levels. Biochemical Oxygen Demand (BOD) indicates the amount of organic material in the water, the decomposition of which depletes oxygen levels and may leave the water uninhabitable by fish and bottom-dwelling organisms. Total Suspended Solids (TSS) indicates the amount of particulate material being carried in the water, and pollutants often stick to, or themselves are, small particles.

These measures can give an idea of the relative polluting effect of industrial discharges, municipal sewage treatment plants, and urban runoff. In the Upper Fraser (above Prince George) and the Middle Fraser (Prince George to Hope), industrial discharges are much more important than runoff or municipal sewage as a source of BOD and TSS. However, in the Lower Fraser (below Hope), the situation is very

CHRIS LAUSTRUP

Left–The changing face of the Fraser Estuary in the 20th century

NATIONAL AIR PHOTO LIBRARY A2238 - 36 (1930); TRIATHLON MAPPING CORPORATION (1995)



different. Once the Vancouver sewage treatment plant upgrades are completed in 1998, urban runoff will be the predominant source both of BOD and (by far) of TSS. Moreover, the overall trend for urban runoff is upwards, while those for industry and municipal sewage are downwards.

Indeed, research is tending to attribute pollution increasingly to runoff sources. When elevated pollutant concentrations were found in the Thompson River near Kamloops and in Kamloops Lake, early suspicions implicated the Weyerhauser Pulp and Paper Mill. However, further research with improved methods showed that the mill was in compliance with regulations on all contaminants. The culprits turned out to be a number of storm sewer outlets into the Thompson River. The highest oil and heavy metal contamination was found in a storm sewer draining a residential area and another draining a highly industrialized area. Increasingly, reducing pollution is the responsibility of everybody in the community.

THE BRUNETTE WATERSHED: A CASE STUDY

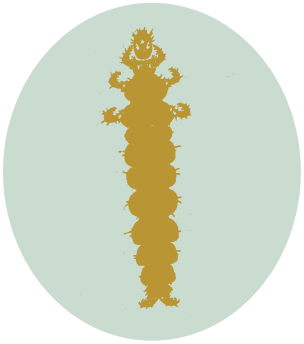
The effects of urban runoff can be seen in the Brunette watershed, a chain of small lakes and streams within the developed core of Greater Vancouver. The area is highly prized for outdoor recreation and as a green refuge for people and wildlife. The Brunette River, which flows through Burnaby and

forms the border between New Westminster and Coquitlam, is a small tributary in the Lower Fraser Valley. In such streams, two-thirds of Fraser River coho try to spawn. The watershed is also divided by the Trans-Canada Highway and surrounded by residential, commercial, and industrial sites. The Brunette watershed therefore presents a classic instance of vulnerability to urban development and pollution. Besides the encroachment on wildlife habitat, the watershed has a variety of pollution sources: atmospheric deposition, storm water runoff, spills and dumping, sanitary sewers connected illegally, and fecal matter from pets and urban wildlife. Pollutants from all these sources are channelled by runoff into the Brunette ecosystem.

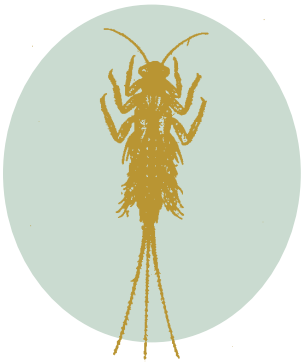
Pollutants are channelled by runoff into the Brunette ecosystem

With urban development, more than one-quarter of the surface area of the watershed is now impermeable to water. Rain falling on these surfaces gathers airborne pollutants from exhausts, chimneys, and industrial activity, as well as oils, chemicals, and other substances on the ground and carries them through dozens of storm drains into the lakes and streams of the watershed. The long history of development in the Brunette watershed, from forestry, to agriculture, to residential, commercial, and industrial, has had a series of effects on its waters which have been recorded in the sediments of Burnaby Lake.

FRAP studies show the lakes and streams of the Brunette watershed have an abundance of the contaminants typical of runoff: fecal coliforms, high concentrations of metals (copper, zinc, lead, and manganese), PAHs, and hydrocarbons (oil derivatives), and low oxygen. Furthermore, these levels rise sharply during and after rainfall. During storms, measurements show very high levels of dioxins, furans, PAHs, and metals both in water and in sediment suspended in the water. The rain itself often contains concentrations of many of these contaminants, having caught them in its descent and deposited them in or near the surface water.



As sediment is deposited on lake bottoms, the resulting layers provide a permanent record of runoff contamination at successive periods. Scientists take vertical core samples of the sediment to study these layers. FRAP studies of sediment cores from Burnaby Lake show how contaminants have changed. For example, lead concentrations reached a peak in 1973 and have declined since then, in part because of the gradual adoption



Storm sewers have made the Brunette system a sink for pollutants.

of unleaded gasoline. The cores also show the signature of a local metal plating facility with increases in copper, zinc, lead, and mercury in the early 1970s, followed by some declines. PCB and DDT concentrations have declined since the 1950s and 1960s.

What would these concentrations have meant for Brunette's water creatures? Some glimpses may be available from a FRAP experiment using the mesocosm device for observing and measuring the reactions of organisms to water pollution. Tests were conducted of metals at guideline concentrations (which are often much lower than those in the Brunette system). Some macroinvertebrate species (such as mayfly larvae) were more affected than others (such as caddisfly larvae). Scientists then sampled the same species in the Brunette system. They found that, indeed, there was a shortage of the more sensitive species, compared to the less sensitive species.

WAYNE BELZER

Burnaby Lake

Left–The tranquillity of the Brunette River belies the contamination below the surface.

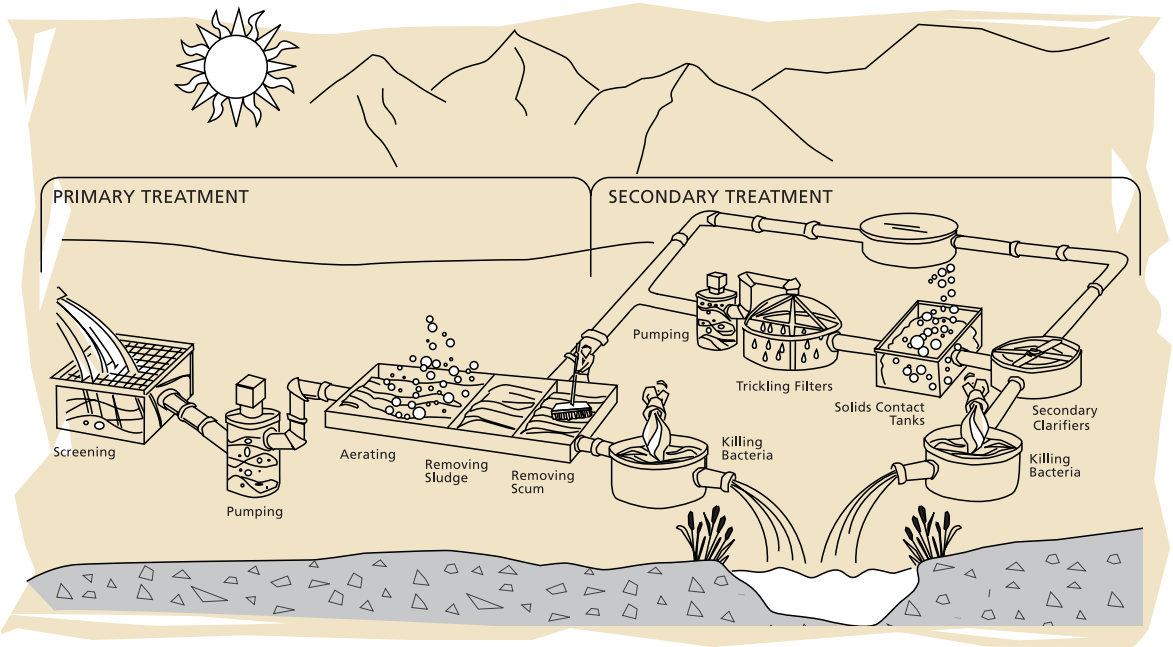
EC AQUATICS SECTION

The recovering tidal flats at Iona Island

SEWAGE TREATMENT

There are 90 municipal sewage treatment plants in the Fraser Basin. Of these, 87 are upstream of Surrey and account for only 13 per cent of the total volume of sewage discharged into the Fraser system. The three massive plants in the Fraser estuary – Annacis Island, Lulu Island, and Iona Island – account for nearly nine-tenths of the total volume.

In the 1980s, the three big plants in the estuary often did not have the treatment capability to meet their effluent quality permit levels and in one case had a poorly located discharge outfall. The effects were visible in the estuary. All life was eliminated in the vicinity of the Iona Island discharge point. The estuary was very vulnerable. The mixing of salt and fresh water makes it a highly productive habitat for birds and marine life. With water moving more slowly through the estuary than the main channel upstream, the backwaters of the estuary were prime habitat for fish. Because of tidal currents, pollution would frequently back up the arms of the Fraser as far as New Westminster. Long before FRAP, the insufficiency of these facilities was well known, and contaminant reduction targets had been established for sewage and for combined sewer overflows (CSOs) But there were many delays.



Primary and secondary sewage treatment

ADAPTED FROM G.V.R.D

Improved sewage treatment

Environment Canada was among the many advocates of treatment plant upgrades, which finally got under way when the various levels of government came to agreement on responsibilities and funding. The upgrades involve full secondary treatment at Annacis and Lulu (and at the Lansdowne plant in Prince George).

The Iona extension allowed the re-establishment of benthic communities on Sturgeon Bank

Projects cosponsored by FRAP included development of new technologies, design guidelines, and education programs for sewage treatment and disposal. For example, a study was carried out at Prince George to determine the source of toxic discharges to the sewer system resulting in treatment plant upsets and to find ways to reduce the frequency and duration of the upsets. A study at the District of Hope identified measures to get the most out of the current treatment plant and recommended upgrades. A design manual was also developed for technologies especially effective in cold and temperate climates.

The results are dramatic. Total Fraser Basin municipal sewage output will be reduced by 84 per cent for BOD and by 68 per cent for TSS. The upgraded plants, which were sometimes unable to meet the old standards for BOD (130 parts per million at Annacis and 169 at Lulu) and for TSS (100 ppm at Annacis and 128 at Lulu), are now designed to achieve output concentrations of 15 ppm for each. The Annacis and Lulu upgrades are also expected to reduce their output of metals and organic pollutants by 54 per cent and 66 per cent, respectively.

CHRIS LAUSTRUP

Iona outfall extension

The 1988 extension of the Iona outfall diffuser beyond the estuary into the Strait of Georgia eliminated the old discharge point on Sturgeon Bank. This allowed scientists, with FRAP's help, to study the re-establishment of benthic communities on the bank. They demonstrated many positive trends. Levels of all metals have decreased or stabilized. Concentrations of copper, mercury, and zinc in the Macoma clam have declined,

LAUREN ROSS

Collecting samples on the mud flats

as have those of copper, mercury, lead, silver, and cadmium in sediments. Oxygen in the water above the sediments has recovered from the low levels experienced when the outflow was on the bank. Yet nitrate and ammonia are still being released vigorously from the intertidal sediments, as a result of the high organic carbon levels still present there.

The vicinity of the former discharge is no longer barren of life. Macoma clam densities are now similar to those in other estuaries, while the amphipod, Corophium, has recovered to normal levels. The formerly dominant blue-green and green algae indicative of pollution have given way to diatoms, as in other areas of the banks. More improvement can be expected when combined sewer overflows have been eliminated at the plant.

Water conservation

As populations grow, so do the benefits of conserving water. Using less water in urban areas reduces the cost of increasing sewer system capacity and lowers the risk of combined sewer overflow.

However, with water, as with energy or raw materials, conservation initiatives often encounter inertia or even resistance. Though the predicted benefits may be substantial overall, they tend to be widely distributed and gradually accumulated. The costs, on the other hand, tend to be concentrated and up front. For example, local politicians may object to the initial cost of installing water meters and discount the longer-term benefits of reduced supply costs and delayed capital expenditures on facility expansions. Like prevention, conservation requires thoughtful planning.

A number of water conservation programs aimed at municipalities, industries, institutions, and households had been proposed before FRAP but few had funding to proceed. They included economic instruments, pilot projects, and public and technical information programs. By providing funds for these activities, FRAP built partnerships, encouraged water conservation, and supported municipal planning in the province.

Using less water in urban areas reduces the cost of increasing sewer system capacity

FRAP helped Simon Fraser University sponsor a demonstration project on water conservation. The project converted boiler room air compressors from water cooling to air cooling. The conversion saved 60,000 cubic metres of water a year, for an annual cost savings to the university of $29,000. At this rate, the project would pay for itself in only three years. The university is now looking for other conservation activities on campus. However, the university faces a barrier in making even highly remunerative investments: its capital budget is separate from its operating budget with no mechanism to pay back capital investments from operating cost savings beyond a single fiscal year. Nevertheless, Simon Fraser University physical plant staff presented details of the pilot project at several GVRD workshops. The university has since been able to undertake at least one water conservation project a year of similar scale and payback period.

FRAP then worked with GVRD on analyses of potential savings from water conservation in several industries and on methods of carrying out water audits at selected establishments to demonstrate possible savings. These analyses were used at later GVRD workshops with industries on water conservation.

Simon Fraser University is demonstrating water-saving technology.

FRAP also helped sponsor an economic analysis of universal water metering in the GVRD. The unanswered question was whether installation costs would outweigh long-term costs for expanding water facilities. The study, published by GVRD, argued that, while indoor metering would be advantageous, outdoor metering would not be, because outdoor meters would cost so much more to install.

NON-POINT SOURCES

As industrial and municipal point sources of emissions and effluents become better identified, regulated, and controlled, the vast array of non-point sources moves to the forefront as a critical problem. We have seen this shift in the increasing importance of urban runoff in polluting the watercourses of the Fraser Basin.

Paved streets collect contaminants.

An aspect of the emerging importance of non-point sources of pollutants is the need for a much wider public involvement. Point sources have managers, with whom authorities can work on technical issues of pollution abatement. But non-point sources involve everyone – small firms, individuals, groups, and institutions – and the many different ways each contributes to pollution. Responses to non-point source pollution will thus require changes in public attitudes and practices and therefore programs of public information and education.

But more than public participation will be required to reduce non-point pollution. A great deal of it occurs because of the physical structure of cities. Urban sprawl, with its reliance on vehicle travel, and therefore on paved corridors, streets, and lots, imposes a degree of non-point pollution no matter what individuals try to do. In this sense, pollution reduction (like energy efficiency and waste materials reduction) will depend in part on planning to reduce urban sprawl and encourage more compact cityscapes, as well as on transportation alternatives to single-occupant vehicles.

Another example is industrial technology and practices. Every sector, from service stations to small manufacturing to materials handling to fish processing, uses equipment and processes that create pollution and environmental stress. Though their individual effects may be minor; their combined effects are significant. Improving management strategies and encouraging employee awareness and stewardship will be crucially important.

ZAHEER MANKI

Some management failures are obvious.

Best management practices

FRAP has sponsored the development of guideline documents on improving environmental performance in 15 industrial sectors, the development of pollution prevention plans at two industrial facilities, and the demonstration of two new industrial processes.

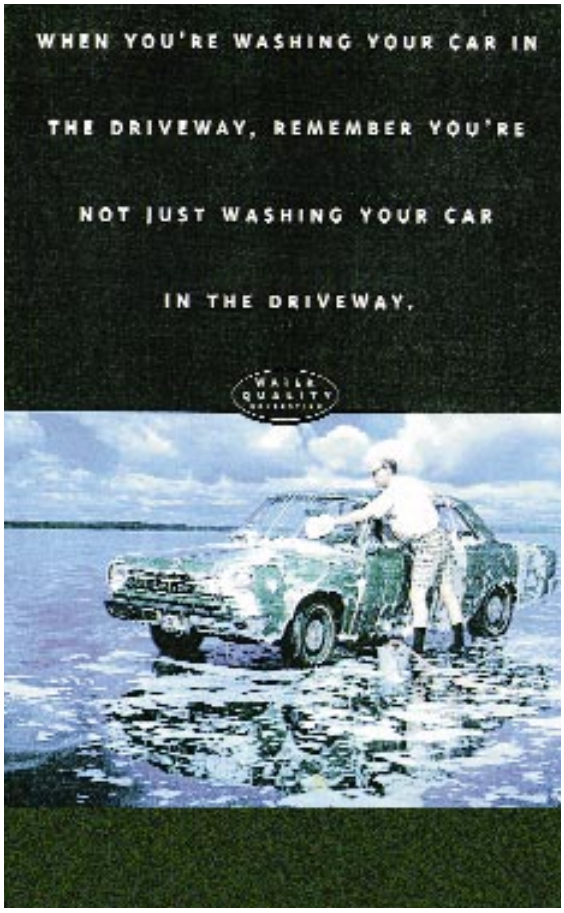
In some cases, the potential for improvement is surprising. For example, British Columbia has 17 dry bulk loading facilities which handle grain, metal ores, coal, and chemicals such as dry sulphur. Of these, 12 are located in the Lower Fraser Basin and Burrard Inlet. When FRAP staff began inspecting compliance with guidelines for grain handling in 1995, the result was a remarkable reduction in BOD discharges by 95 per cent and TSS discharges by 89 per cent. This was due mainly to improvements in the cleaning up of spilled grain.

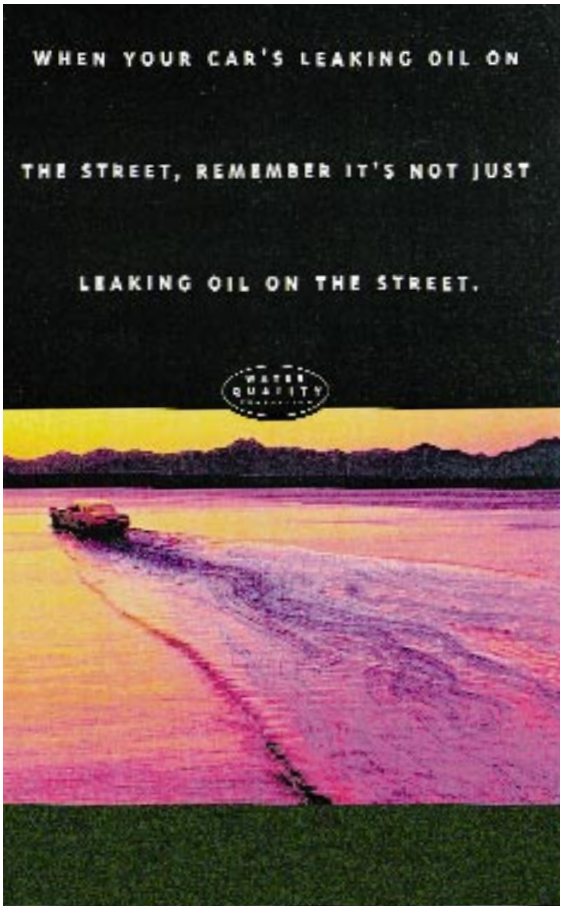
Another example is fish processing. In 1996 FRAP inspectors tested effluents from fish processing facilities in the Fraser Basin that discharge directly into fish-bearing waters. Three effluent streams were found to be out of compliance with the Fisheries Act and to have BOD or TSS levels harmful to fish. The changes recommended in the FRAP-sponsored Guide for Best Management Practices for Fish Processing Plants have been shown by experience elsewhere to cut fish processing organic pollution by up to half.

By 1996, 47 per cent of fish processing facilities in the Fraser Basin had implemented these practices. This inspection program will continue, with a target of achieving more than 90 per cent implementation.

A third example is FRAP's guide to best management practices on golf courses: Greening Your BC Golf Course. This booklet, aimed at golf course designers, managers, and employees, gives advice on managing stormwater and irrigation, dealing with pests, and running the maintenance area.

Any business can improve its environmental performance.





Environmental management is shown to have implications for every aspect of golf course operation and to be an indispensable part of competent overall management.

Public education

In cooperation with partners, FRAP coordinated a public awareness campaign on non-point sources of pollution in the Fraser Basin. The campaign focused on lawn care practices, car maintenance, and alternative household products. Posters were distributed, television advertising was undertaken, and fact sheets were distributed at conferences and shows. FRAP also cosponsored a circular, Current Trends, which focused in part on urban and agricultural runoff in the Lower Fraser Valley, its effects, and how it can be reduced.

FRAP funds and reviews contributed to an overview report, Multiple Account Analysis for Non-Point Source Pollution in B.C. This document estimates the economic losses and the social and environmental harm caused by non-point source pollution across the province. The report shows them to be

considerable and provides strong support for an action plan.

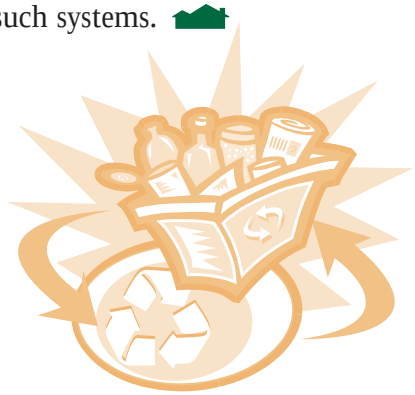
FRAP has worked closely with BC Environment in designing, reviewing, and supporting development of a Non-Point Source Action Plan.

recycle

User-pay for garbage disposal

The provincial objective to reduce by half the quantity of waste going to landfills has challenged many municipalities inside and outside the Fraser Basin. As valuable as the Blue Box system has been for awareness, participation, and effectiveness, it is limited in its ability to divert waste from landfills.

One strategy is a user-pay system for garbage collection, with bag limits and over-limit pricing. Such a system is already operating successfully in parts of Victoria and Vancouver. FRAP, in partnership with BC Environment and various local governments, sponsored workshops in the Lower Mainland, Kamloops, and Prince George. The workshops outlined key issues and methods, and were well attended by local government staff. By December 1997, out of 43 communities surveyed, 34 had already implemented, or were about to implement, such systems.



RICHARD GLUE

CONTAMINATED SITES

Contaminants are still present in, and leaching from, many old sites, since abandoned, where traditional material handling and waste management practices were environmentally unsound.

As of December 1997, half the contaminated sites registered in SITE, the provincial database supported by FRAP, were in the Fraser Basin. Of these 1627 sites, 68 per cent were in the Lower Mainland, 10 per cent around Kamloops (Thompson), 5 per cent around Williams Lake (Middle Fraser), and 17 per cent around Prince George (Upper Fraser).

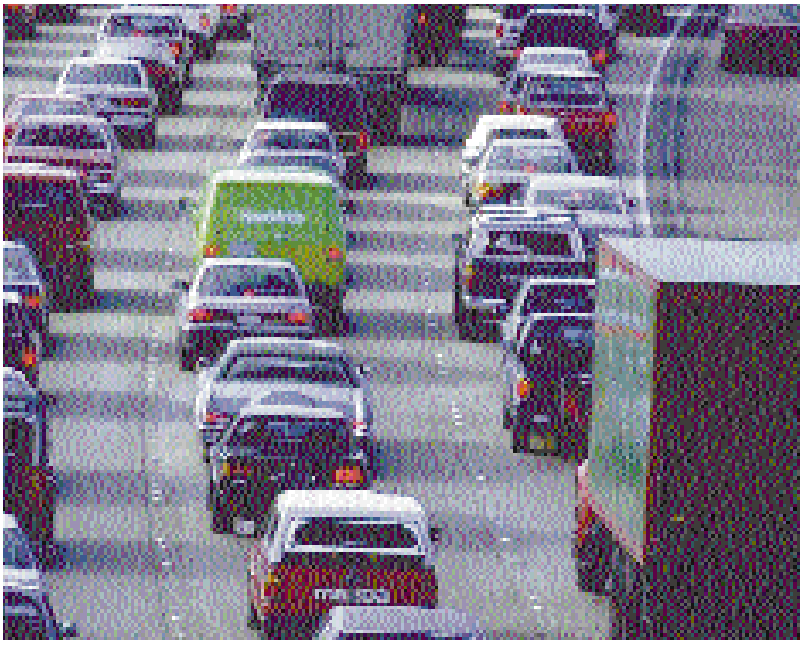
At the beginning of FRAP, Environment Canada was negotiating the assessment and clean-up of approximately 35 sites in the Basin. As of December 1997, the department was involved actively with 140 sites on federal land, of which 15 were cleaned up during FRAP's mandate.

Although better industrial practices have reduced the number of abandoned sites requiring clean-up, more old sites are being discovered all the time, particularly in the Lower Fraser.

RICHARD GLUE

Oozing tar at an abandoned industrial site before clean-up

AIR QUALITY



BENEFIT-COST ANALYSES

Air quality in the Lower Mainland is a long-standing and growing environmental issue. A variety of pollutants, especially from vehicle emissions, pose a threat to human health and to plants and animals. When combined with meteorological conditions that often occur in the areas of the Lower Fraser Valley where mountains trap the air, certain emitted chemicals produce an unsightly layer of photochemical smog. To deal with deteriorating air quality, the Greater Vancouver Regional District has implemented and strengthened an air management plan, with associated research, monitoring and control activities. Some of the measures contemplated or implemented impose significant costs on owners of factories and vehicles and are the subject of continuing political debate and public consultation. Whether the results of proposed changes will be worth their cost is a question that continually arises in public policy development.

In cooperation with the provincial government and the GVRD, FRAP developed the terms of reference for a full benefit-cost analysis of the air management plan. The extensive study, conducted by a consortium of consulting firms, concluded that, over 25 years, the plan would save at least $2.8 billion more than it would cost. Most of the benefits would consist of reduced risk of human death and reduced medical costs. Other benefits would include improvements in crop yields and visibility. After completion of this study, the provincial government continued to refine the methodology, applied it to other parts of the province, and produced an updated analysis which concluded that the benefits would be even greater than originally estimated.

A variety of pollutants, especially from vehicle emissions, pose a threat to human health

EC AIR QUALITY SECTION

Fraser Valley mountains trap polluted air.

The study, and its approach, attracted a great deal of interest from industry and government. Both GVRD and provincial politicians used the findings to urge stronger air quality controls. The data were used by planners and in public information and educational pamphlets. Public agencies and industry associations scrutinized the study method, and the Canadian Petroleum Producers Institute sponsored some critical examinations of the approach. As the first study that justifies air quality control on economic grounds, it could set a precedent for similar studies elsewhere in Canada.

The relationship between fine particulates in the air and human death has drawn much attention

The study method uses epidemiological evidence to predict human health effects from airborne pollutants. The Canadian Council of Ministers of the Environment is now using a similar method to review the benefits of reformulating fuels to make them cleaner, such as by reducing sulphur content. The relationship highlighted by the study between fine particulates in the air and human death has drawn much attention. The GVRD is now reviewing particulate standards in the Lower Mainland, and national agencies are developing a national standard for particulate concentrations in ambient air.

WAYNE BELZER

Left–Measuring air quality at Burnaby Lake

garbage disposal fee

Environment Canada and its partners in the air quality study formed a standing committee to address air quality issues from an economic standpoint. This committee sponsored further studies and contributed substantially to the province's new pilot program on greenhouse gas emission trading. FRAP also helped support the development and 1997 launch of the pilot greenhouse gas emission trading program.

effluent charges

ECONOMIC INSTRUMENTS OF POLICY

water metering

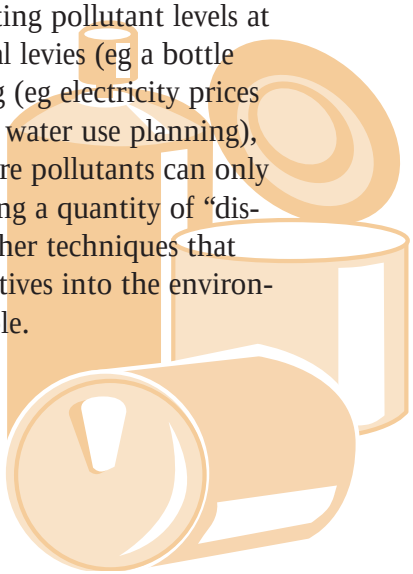
Environmental policy has traditionally relied heavily on regulation as an instrument of change. Regulation specifies what is permissible or prohibited. This might be a concentration level of a pollutant, such as in effluent or vehicle exhaust, or a technology, such as secondary treatment of sewage. An abatement authority works with industry to help it meet the regulated standards, and an enforcement authority monitors and penalizes.

emission trading

A different approach to implementing environmental policy uses what are known as "economic instruments." With these, the goal is not to restrict choice but rather to steer it in desirable directions by changing prices to create incentives and disincentives. People (and communities and industries) often make poor environmental choices when prices do not reflect the real environmental costs involved. By altering prices to make them better reflect the relative environmental costs of the alternatives, people can be encouraged to make better environmental choices.

People often make poor environmental choices when prices do not reflect the real environmental costs

Economic instruments of this kind include user charges (eg a fee for garbage disposal), effluent charges reflecting pollutant levels at outfalls, environmental levies (eg a bottle deposit), social costing (eg electricity prices that cover the costs of water use planning), emission trading (where pollutants can only be discharged by buying a quantity of "discharge space"), and other techniques that insert economic incentives into the environmental choices available.



BOB TORTORELLI

A thermal power station

Emission trading in air pollutants

The GVRD had earlier explored the concept of emission trading for selected air pollutants being discharged by industrial point sources: nitrogen oxides (NOX) and volatile organic compounds (VOCs). But the idea had languished because of insufficient public and political awareness and interest. FRAP, in partnership with BC Environment and the Society for the Prevention of Environmental Contamination, presented a stakeholder workshop on the issue. The partners then sponsored a study which concluded that an emission trading program for NOX, VOCs, and fine particulates would be feasible and cost-effective for the region. However, broad support for the concept was still lacking.

FRAP and partners then commissioned further investigation of the kinds of research, consultation, and decisions that would be required to develop a full emission trading system. The GVRD continues to explore the possibility of using emission trading as one of its air management strategies.

Emission trading among firms discharging pollutants can take several forms. The central idea is that firms that reduce their contaminant emissions substantially beyond what is required of them are allowed to sell these "surplus reductions" to other firms who can use them as credits instead of making their own reductions. In effect, the purchasing firm pays the selling firm to make the required reductions on its behalf. Businesses tend to prefer emission trading to traditional plant-by-plant emission regulation because it avoids "micromanagement" of their technology by outsiders and it allows the reductions to be made by those firms best able to afford them.

BOB TORTORELLI

A petroleum refinery

PROTECTING HABITAT

GRAHAM OSBORNE

FRAP and its partners purchased 441 hectares of wetland and associated upland property in five Lower Mainland locations. The total cost was $9.1 million, of which FRAP's share was $1.3 million.

The most secure way of protecting habitat is to buy it

PURCHASES

The most secure way of protecting habitat is to buy it. But land costs in the Fraser Valley are high, so purchases were originally expected to be limited to a few hectares at most. However, purchasing opportunities were opened by partnerships with other agencies. Environment Canada's partners in securing habitat included Transport Canada, BC Environment, The Nature Trust of BC, Ducks Unlimited Canada, Wildlife Habitat Canada, the Greater Vancouver Regional District, and various municipalities and organizations in the Lower Mainland. Purchases were made through the Lower Mainland Nature Legacy Program, and the Pacific Estuary Conservation Program.

IDENTIFICATION AND PROTECTION

FRAP participated in the Wetlands Working Group, whose members included Environment Canada's Canadian Wildlife Service, BC Environment, Ducks Unlimited Canada, Land For Nature, The Nature Trust of BC, and others. This Group undertook an inventory of wetlands in the Lower Mainland, identified priority sites, advised on habitat purchases, and provided guidance to planners on protecting wetlands on crown land.

WOOD WASTE – A POTENTIAL RESOURCE?

Wood waste is becoming a substantial environmental problem in the Fraser Basin. It is being generated in growing amounts by urban expansion, with its land clearing, new construction, and demolition of old buildings. Most of this waste goes to landfills. Lumber processing, by contrast, produces less and less wood waste. What was once seen as waste is now used for pulp chips, cogeneration projects, livestock bedding, and remanufactured products, leaving only bark and very rough material as residues. Even so, provincial regulations phasing out beehive burners make it difficult for lumber companies to dispose of the waste they do produce. A portion of wood waste from many sources finds its way into watercourses, where its decomposition raises BOD levels and threatens habitat.

To help find reuse and recycling opportunities for this waste, FRAP conducted an inventory of wood waste streams in the Fraser Basin. In all, 4.3 million cubic metres of unused wood waste is generated in the Basin every year. About half comes from land clearing, and only one-fifth from lumber processing. Building construction and demolition account for most of the rest. A further FRAP study examined the feasibility of diverting land clearing waste from landfills to pulp mills. A pilot project is under way.

To date, more than 12,400 hectares of vulnerable wetland areas on crown land have been given a protected designation, including Boundary Bay (11,470 ha), South Arm Marshes (886 ha), and McIntyre Creek (87 ha).

More than 12,400 hectares of vulnerable wetland areas on crown land have been given a protected designation

The Wetlands Working Group also produced a report, Wetlands of the Fraser Lowland: Ownership, Management, and Protection Status, which, together with the inventory, is an essential resource for securing and managing wildlife habitat throughout the Lower Mainland.

An intertidal vegetation mapping project was conducted in the Boundary Bay, Semiahmoo Bay, and Roberts Bank areas, an important habitat for migratory birds. The distribution of plant species and their ground cover have been digitally mapped. The Vancouver Port Corporation has used these data in restoring the area between the Roberts Bank and BC Ferry causeways, and a number of private remote-sensing companies have used the mapped data to calibrate their image analysis.

MICHAEL DUNN

Unappreciated by most people, eelgrass is a staple for migratory birds.

COMMUNITY AWARENESS AND ACTION

FRAP and partners sponsored a number of programs and publications aimed at promoting habitat conservation by communities on private land. For example:

- Community Greenways – linking communities to country and people to nature. This program encourages local governments to designate "greenways," which are landscape corridors that link natural areas and provide wildlife habitat and recreational opportunities. The published guide explains the concept, offers practical advice on community planning approaches, and provides recommendations for implementation and management and for addressing land tenure and regulatory issues.

Greenways concepts are being integrated into community plans (Salmon Arm, GVRD), implemented as such (Prince

JIM HAWKINGS

BOB SCHEER

Yellowthroat

Naturescape helps people improve habitat in their own backyards

George, Maple Ridge, Pitt Meadows), used in developing trail/bridge networks (Williams Lake), and used in environmental protection programs (North Vancouver). The approach is heightening public awareness, bringing together recreation, fish, wildlife, and greenspace interests, and fostering a stewardship ethic among urban residents and local governments.

• Naturescape – caring for wildlife habitat at home: This stewardship program helps people improve habitat in their own backyards. A series of region-specific publications explains types of habitats and how wildlife use native plants. Public demand for the booklets is very strong, and about 3000 participants in the Georgia Basin, including the Lower Fraser Valley, have each paid $20 to register with the program.

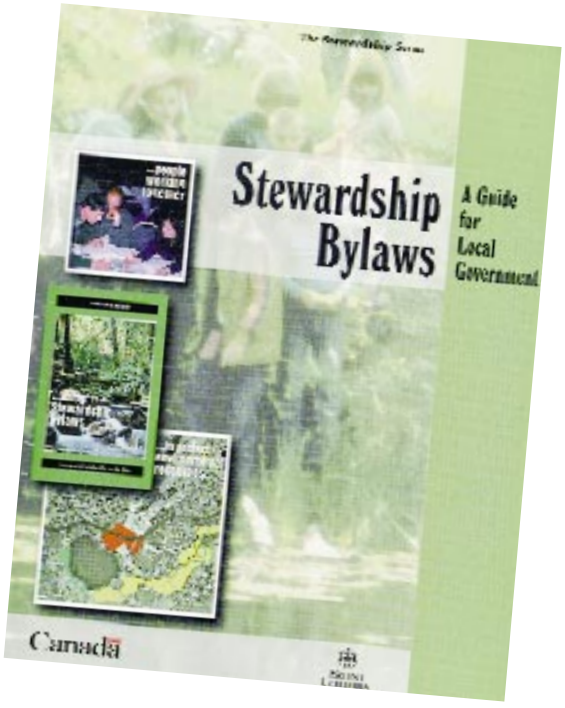
• Wetlandkeepers: This program, modelled on the successful Streamkeepers program developed by the Department of Fisheries and Oceans, is for people or groups interested in stewarding a wetland. Associated with an intensive two-day training course offered through Langara College, the Wetlandkeepers Handbook provides information on ecology and protection and gives practical step-by-step advice on wetland monitoring and stewardship. About 100 people have taken the course, and there have been requests for the handbook from individuals, landowners, community groups, and students from around the province. In addition, about 65 unemployed fishers have taken Wetlandkeepers training as part of a six-month retraining program offered in Surrey.

• Stewardship Bylaws – a guide for local government: This publication offers municipal planners model language for stewardship bylaws and practical advice for incorporating wildlife habitat stewardship concepts into local planning and decision-making.

These reports are available from Environment Canada.

EC AQUATICS SECTION

Children learn to care for the environment.



WHAT'S NEXT

new focus

THE NEW POLLUTION FOCUS: NON-POINT SOURCES AND URBAN RUNOFF

FRAP studies confirm that non-point sources and urban runoff are becoming the main pollution concern in the Fraser Basin. These are connected with urban sprawl and vehicle use and therefore with population growth, which is forecast to be dramatic in the next 25 years, especially in the Lower Mainland.

This will be a different and more difficult challenge than dealing with large fixed pollution sources like pulp mills and sewage treatment plants. Addressing non-point pollution sources means dealing with a vast number of small industries and with the general public. It means changing attitudes and behaviours, not just technologies and processes. How progress can be made in these directions has been demonstrated by many FRAP-sponsored programs. A continuing scientific inquiry into the many ecological connections to human and community well-being will play a vital role in persuading people to accept their responsibility to make changes in their use of vehicles, toxic chemicals, and fertilizers.

Although recent improvements to sewage treatment plants have reduced pollution from this source to the main river, population growth, particularly in the Lower Fraser Valley, will eventually overwhelm these improvements unless improved sewage treatment technologies are developed and implemented.

habitat conservation

PROTECTING AND ENHANCING HABITAT

Good progress has been made in habitat conservation, thanks in part to FRAP's cosponsorship. But the challenge remains as important as ever:

- A large proportion of natural habitat has already been lost, especially in the Lower Fraser Basin, so that the surviving areas of habitat have become even more critical for wildlife and biodiversity.

- The pressures of urbanization and intensive agriculture on habitat will be increasing strongly in the next 25 years.

FRAP programs have shown that habitat conservation is popular with the public, can be linked with sustainable forms of urban design, such as Community Greenways, and can mobilize much volunteer labour. This good work must be continued by Basin residents and stakeholders, including Environment Canada.