RE-INVENTING RAINWATER MANAGEMENT

A Strategy to Protect Health and Restore Nature in the Capital Region

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Environmental Law Clinic
UNIVERSITY OF VICTORIA

RE-INVENTING RAINWATER MANAGEMENT:

A STRATEGY TO PROTECT HEALTH AND RESTORE NATURE IN THE CAPITAL REGION

A Submission to the Capital Regional District on behalf of the Veins of Life Watershed Society

Environmental Law Clinic
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Contents

EXECUTIVE SUMMARY

When it rains in the Capital Region, water sweeps over roofs, streets and parking lots, picking up a multitude of pollutants on the urban landscape. Storm sewers then convey that tainted water at high speed and volume into sensitive water bodies.

This stormwater runoff is our biggest water pollution challenge. Indeed, most toxic chemicals entering local waterways likely come from runoff. Runoff also periodically delivers fecal contaminants to waterways, leading to public health advisories. The following report describes exactly how runoff carries toxins and fecal material into waterways and documents the public health and environmental concerns.

Stormwater has helped destroy our once-abundant salmon streams. Its high velocity erodes stream banks and silts water, destroying salmon habitat—and its temperature and toxins kill fish. This report documents the history of how local salmon streams have been devastated. It also recounts poignant stories of how stormwater thwarts the efforts of volunteers trying to restore local salmon streams. Runoff is the biggest obstacle to restoring those streams.

Runoff has also been documented as the chief source of PCB contamination in orcas—one of the main threats to survival of that endangered species. The report describes the latest scientific studies that draw the link between local storm gutters and survival of this region's most majestic animal.

Polluted runoff is a major reason why the Capital Region's bountiful shellfish beds are closed to harvest. The report cites numerous government studies that link runoff to such closures, and that identify runoff as a problem that we can and must solve if we want to harvest local shellfish again.

The report also explains how current stormwater management wastes water, which may eventually necessitate costly expansion of water supply infrastructure.

All the above problems are the legacy of our obsolete 19th century stormwater management system—a system that fails to respect natural systems and water cycles. However, in recent years rainwater management practices have been developed that make the 21st century Green City possible—a city that designs rainwater management in concert with natural systems, not at cross purposes.

Traditional stormwater management broke the natural water cycle. It viewed stormwater as a site-specific problem solved by rapidly piping water away from properties and converting streams at the end of the pipe into drainage ditches. In contrast, modern rainwater management looks at the dynamics of the entire watershed and identifies how development can use "green infrastructure" to maintain natural systems *and*

protect buildings. Instead of relying heavily on pipes and concrete, it works to restore the function of trees, soil and open space that provide natural absorption, storage, evaporation and filtration services. Typically, this Low Impact Development approach mimics the natural water cycle by allowing water to infiltrate down through the soil and slowly release into the watershed.

The report documents how green rainwater management has now been adopted by engineers, developers, planners and governments across North America. The report also demonstrates that these Low Impact Development techniques are not only environmentally superior, they are often cheaper. In addition, they can provide incalculable benefits in the form of enhanced urban green space as well as improved urban aesthetics and recreational opportunities.

The report describes a number of notable innovative projects in the Capital Region and elsewhere. It then makes its first recommendation: that local governments reform policies and legislation—and work with partners—to ensure implementation of Low Impact Development (LID) across the landscape.

A second major recommendation deals with the aging infrastructure that allows sanitary sewage releases from local stormwater outlets. The report argues that our system of financing infrastructure through property taxes is the reason why essential infrastructure has been neglected for over a century. Therefore, it calls on local governments to follow the lead of many North American cities and shift the financing of drainage services from property taxes to a "user-pay" utility charge with fees based on actual use. Just as citizens pay to have water piped to their houses, they would pay to have it piped away. The utility charge can be linked to an equivalent reduction in property taxes.

Such a measure not only provides dedicated funding for essential infrastructure. It also encourages residents to implement simple "Low Impact Development" (LID) techniques on their property in order to reduce their utility charge. Fortuitously, when residents do that, it reduces the community's need for expensive new infrastructure.

The report recommends the implementation and enforcement of the CRD Model Storm Sewer and Watercourse Protection Bylaw across the entire Capital Region, a model which has yet to be fully adopted by most municipalities.

Next, the report recommends the formation of a Capital Regional District Rainwater Commission to undertake an integrated watershed management approach for managing rainwater across the region. A

Regional Commission is necessary to overcome the main barrier to rational rainwater management: the fragmented jurisdiction over runoff in our region.

The problem is that storm sewers are separately owned and regulated by each individual municipality. However, modern rainwater planning requires a watershed-wide approach, and local watersheds often include more than one municipality. Single municipalities lack legal capacity and resources to carry out the necessary watershed planning. A Regional Rainwater Commission could redress this.

The report recommends that the new Commission create a long-term Regional Integrated Watershed Management Plan with a number of mandatory targets, including: the enactment of source pollution control regulations throughout the region; the elimination of stormwater discharges rated "high" for environmental concern or public health concern by 2015; the reduction of Victoria Harbour and Gorge runoff pollution with the goal of making fish and shellfish there edible by 2035; and a firm deadline of 25 years for repairing pipes and infrastructure that allow sewage releases from storm sewers.

The report recommends that the Commission work to ensure that local governments create a set of financial motivations for the private sector to implement LID; and that the Commission work with municipalities to implement LID practices in their own buildings and streets. The report also calls for the restoration and enhancement of the currently suspended monitoring program for stormwater runoff.

Finally, the Report recommends that the Commission launch an educational strategy for residents, developers, and others; provide resources and support to local stewardship groups to promote watershed protection and restoration; collaborate with community groups and educational institutes to conduct more extensive water quality monitoring; and publish a biennial "State of the Watershed" Report.

A number of other recommendations are made including recommendations for senior government action to deal with stormwater and rainwater issues.

In sum, it is time for the Capital Regional District—in partnership with other governments and the private sector—to implement a region-wide rainwater management strategy. The rewards will be great.

If we act now, our grandchildren will benefit dramatically. They'll be able to walk on beaches free of stormwater fecal contamination. From those clean beaches they'll be able to spot the occasional orca still wild in the Straits. They will walk along the banks of local urban streams awed by the magic of restored salmon runs. They will harvest shellfish from long-closed shellfish beds. They will hike in remote watersheds that might otherwise have been dammed.

We can do all of this, but first the leaders of the Capital Regional District must take action and establish a rainwater management strategy. Below we propose such a strategy.

SUMMARY OF RECOMMENDATIONS

1. Reform the policies and legislation of all governments in the region to ensure the implementation of Low Impact Development (green infrastructure) across the landscape.

2. Form collaborative partnerships with stewardship groups, developers, homeowners, planners, engineers and other experts, and all levels of government to implement Low Impact Development across the landscape.

3. Shift drainage system financing from property taxes to Rainwater Utility charges, with fees based on actual use to motivate residents to manage rainwater onsite and reduce use of storm sewers.

4. Use Rainwater Utility charges to finance necessary infrastructure upgrades, comprehensive Low Impact Development programs, and a new Regional Rainwater Strategy and Commission.

5. Ensure the implementation and enforcement of the CRD Model Storm Sewer and Watercourse Protection Bylaw across the entire Capital Region.

6. Establish a Capital Regional District Rainwater Commission to undertake an integrated watershed management approach for managing regional rainwater.

7. Base this integrated management approach on an environmental protection perspective for maintaining a healthy hydrologic cycle and a liquid waste management perspective.

8. Create a long-term, comprehensive Regional Integrated Watershed Management Plan that is incorporated into the Regional Growth Strategy, the implementation of which would be a commitment by each municipality through its regional context statement and bylaw amendments.

9. Base the Plan on the overarching provincial goals for rainwater management:
    - Volume Reduction (Put water back into the ground);
    - Water Quality (Preserve or improve the water); and
    - Rate Control/Detention (Hold back the water).

10. Commit to the following mandatory targets in the Plan:
    - Eliminate discharges rated "high" for environmental concern by 2015;
    - Eliminate discharges rated "high" for public health concern by 2015;
    - Enact source pollution control regulations through Watercourse Protection Bylaws and Codes of Practice throughout the region by 2012;
    - Demonstrate a reduction in storm sewer contaminants at source by monitoring and enforcing source control regulation by 2014;
    - Set a firm schedule to meet a deadline of 25 years for repairing pipes and infrastructure that cause sewage to be released from storm sewers;
    - Adopt subdivision and other standards that mandate zero net additional post-construction rainwater runoff from all new or re-development in the region by 2012.
    - Reduce the volume of runoff in existing developed areas by 30 per cent by 2020, by focusing on infiltration and retention techniques;
    - Establish maximum percentages of effective imperviousness for different areas of the region, with a schedule for decreasing the amount of effective imperviousness over the life of the plan;
    - Following the regional plan, finalize integrated watershed management sub-plans for each watershed in the Region by 2017;
    - Reduce stormwater contamination of the Gorge and Victoria Harbour with the aim of making fish and shellfish from those water bodies edible by 2035.
    - Tie the updated Regional Urban Containment and Servicing Area (RUCSA) boundaries in the Regional Growth Strategy to watershed management, with a view to achieving the target of maintaining at least 90 per cent of regional development within the RUCSA. This will contain urban areas, create compact complete communities, and reduce stormwater management.

11. The proposed Rainwater Commission take steps to ensure that:
    - Stringent performance-based regulations are established across all watersheds of the Region;
    - A comprehensive set of financial motivations encourage the implementation of Low Impact Development across the Region; and
    - Local governments adjust Development Cost Charges to create incentives for Low Impact Development.

12. The proposed Rainwater Commission work with all CRD municipalities to implement LID practices in their own buildings and streets and encourage the implementation of Low Impact Development Demonstration Projects.

13. The proposed Rainwater Commission work with Local Governments to ensure that obsolete stormwater infrastructure is upgraded by taking the following steps:
    - Identify the infrastructure problems by restoring and enhancing the stormwater monitoring program;
    - Repair and replace obsolete infrastructure by a set date;
    - Accelerate replacement of Oak Bay's Combined Sewer System; and
    - Install state-of-the-art "end-of-pipe" stormwater treatment where needed and appropriate, guided by a careful inventory of problematic outfalls that require such measures. However, priority should be given to upstream preventative LID measures.

14. The proposed Rainwater Commission launch an intensive educational strategy for residents, developers, businesses, stewardship groups, schools, and others who can improve rainwater management.

15. The proposed Rainwater Commission provide resources and support to local stewardship groups to promote watershed restoration and protection.

16. The proposed Rainwater Commission collaborate with community groups and educational institutes to conduct more extensive water quality monitoring.

17. The proposed Rainwater Commission publish a biennial "State of the Watershed" Report. Among other things, this Report should include:
    - A report card on the health of each of the watersheds in the Capital Region;
    - Documentation of total impervious cover in the Capital Region and of the trends in effective impervious cover for each municipality;
    - Targets for reducing total impervious cover, mitigating existing impervious cover, replacing obsolete infrastructure, installing end-of-pipe treatments, etc.;
    - Goals for re-opening shellfish harvesting area and re-establishing urban salmon streams.
    - Data currently compiled for the Stormwater Quality Annual Reports; and
    - Data regarding stormwater discharge into key fresh waters in addition to currently monitored sites.

18. Recommendations to the Province:

- Amend the legislative authority of the Capital Regional District and municipalities to facilitate implementation of the above recommendations.

- In particular, mandate regional integrated watershed management plans to address, inter alia, land use, low impact development, the restoration of hydrological conditions, and environmental enhancement. Best Management Practices should be required in the preparation and implementation of the Plans. The plans should be required to include statutorily defined minimum content.

19. Recommendations to the Federal Government:

- Enforce the *Fisheries Act* prohibition against the deposition of deleterious substances into waters frequented by fish and the prohibition against destruction of fish habitat when stormwater discharges violate those provisions.

- Conduct an inquiry to investigate why the Federal Government fails to enforce *Fisheries Act* provisions against the wholesale breach of the Act by those in charge of stormwater.

THE PROBLEM

Background: Environmental and Health Impacts of Rainwater (Stormwater) Runoff

Stormwater is the leading contributor to water quality pollution in the state's urban waterways, and is considered to be the state's fastest growing water quality problem as urbanization continues to spread throughout the state.
Washington State Pollution Board[1]

Stormwater runoff from the built environment remains one of the great challenges of modern water pollution control.
National Research Council[2]

PHOTO CREDIT: TAYLOR DAVIS

We don't normally think of rainfall as pollution. However, over the last 150 years we have built cities in a way that transforms rainwater into an agent of considerable environmental harm: urban stormwater runoff.[3]

Changing pristine rainwater into pollution occurs in stages. The first step is the creation of pollutants from driving and fixing cars, using chemicals on houses and yards, and commercial and industrial processes. Heavy metals, PCBs, oils, grease, antifreeze, solvents, pesticides, herbicides, fertilizers, paint chips, PAHs, road salt, and detergents fall to the ground across the urban landscape.

The second step involves our construction of impervious surfaces such as roofs, paved streets, sidewalks, and parking lots. As a city develops, the vegetation and natural soils that absorb and filter rainwater are replaced by impervious surfaces. When we pave over nature's absorption and filtration system, the next heavy rain sweeps across the landscape's hard surfaces picking up pollutants.

In the final step, the storm sewer system rapidly conveys all this polluted water to the nearest water body and flushes it at high speed into a sensitive aquatic ecosystem. In addition to the pollutants from the landscape, the water often contains paint and motor oil that people have dumped into the storm sewer. To make things worse, in older municipalities, this stormwater often contains sanitary sewage.

1 *Puget Soundkeeper Alliance v. Washington Dept. of Ecology*, August 7, 2008, PCHB Nos. 17-021-030 and 037, Washington State Pollution Control Hearings Board, at 25, lines 4-6.
2 Urban Stormwater Management in the United States, National Research Council, 2008 Report prepared for the US Environmental Protection Agency, p. vii http://www.epa.gov/npdes/pubs/nrc_stormwaterreport.pdf
3 Note that when this report speaks of rainfall and rainwater we include snowmelt water as well.



Stormwater runoff causes a large proportion of all water pollution.[4] For example, the US EPA estimates that the bulk of all the toxic chemicals that enter Puget Sound come from runoff.[5] Every day stormwater washes more than 100,000 pounds of toxic chemicals – including petroleum, copper, lead, zinc, and PCBs – into the Sound.[6] And every 24 months Puget Sound stormwater carries a volume of oil into the Sound equal to the Exxon Valdez spill.[7]

Stormwater runoff poses numerous environmental problems:

Threats to human health: When stormwater mixes with sanitary sewage—as often happens because of outdated infrastructure—water bodies become contaminated with fecal coliform. Stormwater runoff also delivers fecal material from animal feces. Exposure to such water can cause gastrointestinal and other infections, such as salmonella infection, shigella, E. coli infection, giardiasis, hepatitis, pinworms, polio, toxoplasmosis, adenovirus, tapeworms, rotavirus, asthma, and Weil's disease.[8] This raises serious health concerns.

Polluted beaches and diminished recreational opportunities: Contaminated stormwater causes the closure of swimming beaches and renders water unsafe for activities such as beachcombing, boating, windsurfing, and diving.

4 For example, a Puget Sound study concluded: "In Washington State, stormwater pollution contributes to 30 per cent of the pollution in waters with some pollution problems." See Puget Sound Action Team four-page PDF available at http://www.epa.gov/nps/toolbox/other/psatpipe.pdf.

5 Control of Toxic Chemicals in Puget Sound, Initial Estimates of Loadings, US EPA and Washington State Department of Ecology, p. 2 http://www.ecy.wa.gov/pubs/0710079.pdf

6 "Some Facts about Puget Sound," People for Puget Sound, online: http://www.pugetsound.org/about/some-facts-about-puget-sound, citing Control of Toxic Chemicals in Puget Sound, Development of Simple Numerical Models, Phase 2, Washington State Department of Ecology, 2008; www.ecy.wa.gov/Programs/wq/pstoxics/index.html

7 According to Jay Manning, Director of Washington State's Department of Ecology in an interview on "Poisoned Waters" PBS Frontline Documentary. See: http://www.pbs.org/wgbh/pages/frontline/poisonedwaters/view/

8 See http://www.drgreene.com/azguide/fecal-oral-transmission for a listing of some diseases associated with fecal material.

Damage to streams: The velocity picked up by runoff travelling through storm sewers leads to erosion, straightening and "channelling" of streams, and flash flooding.

Threats to fish: High velocity stormwater destroys fish spawning grounds and causes sedimentation that can kill fish.[9] Elevated stormwater temperatures can also kill fish. The rapid diversion of water into storm sewers ultimately reduces summertime stream levels that are critical for fish. Finally, the broad range of toxins found in stormwater devastates fish populations.[10]

Other threats to wildlife: The toxins carried in stormwater impact a broad range of animals and plants. For example, stormwater runoff is the chief source of the PCBs that directly threaten the survival of local orcas.[11] And runoff was a major source of the PAH compounds linked to precancerous lesions in Burrard Inlet fish.[12]

Closure of shellfish beds: Fecal matter and other pollutants in runoff contaminate shellfish beds and lead to harvest closures. A US study of five coastal states found that stormwater runoff was the single most pervasive source of shellfish closures.[13] Similar dynamics have closed most local shellfish beds, as documented below.

Leads to unnecessary dams: As will be discussed below, stormwater management wastes a valuable resource – the water that falls from the sky. Instead of using this resource efficiently, traditional storm sewers transport quantities of rainwater away from properties—water which must be replaced in dry seasons by importing water to those same properties. This mismanagement depletes local water supplies, undermines water conservation efforts and eventually leads to demand for expensive new dams and water supply infrastructure.

Pollution of drinking water supplies: Whenever stormwater flows into drinking water supplies, it can contaminate them. This is not an issue in the CRD, because of our remote drinking water supplies. However, it is a major issue in many places, and can necessitate the expenditure of millions—or billions—to filter human water supplies.[14]

9 For more information, see Riversides: Toronto Homeowners' Guide to Rainfall, Community Program for Stormwater Management, funded by the City of Toronto: http://www.riversides.org/rainguide/riversides_hgr.php?cat=1&page=78&subpage=90&subpage2=123

10 See Riversides: Toronto Homeowners' Guide to Rainfall, Community Program for Stormwater Management, funded by the City of Toronto: http://www.riversides.org/rainguide/riversides_hgr.php?cat=1&page=78&subpage=90&subpage2=122 The BC Water and Waste Association has described how urban stormwater runoff has contributed to the loss of salmon:

Over the past century, salmon have disappeared from over 40 per cent of their historical range, and many of the remaining populations are severely depressed…. The cumulative effects of land use practices, including timber harvesting, agriculture and urbanization have all contributed to significant declines in salmon abundance in British Columbia.

The [Puget Sound] studies found that stream channel instability is a result of the urbanization of watershed hydrology. The alteration of a natural stream's hydrograph is a leading cause of change in instream habitat conditions. The physical and biological measures generally changed most rapidly during the initial phase of watershed development, as total impervious area changed from 5 per cent to 10 per cent. With more intensive urban development in the watershed, habitat degradation and loss of biological productivity continues, but at a slower rate.

The research findings clearly demonstrate that the most important impacts of urbanization that degrade the health of streams, in order of importance, are: Changes in hydrology; Changes in riparian corridor; Changes in physical habitat within the stream; and Water quality.

Stormwater runoff seriously exacerbates all of the above problems. In addition, the pollutants in stormwater can harm both fish and the organisms they depend upon. -- For one study that examined the impact of stormwater carrying pesticide residue on the organisms that fish feed on, see http://www.sciencedaily.com/releases/2010/02/100202151051.htm?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+sciencedaily+%28ScienceDaily%3A+Latest+Science+News%29&utm_content=Google+Reader See below for further documentation of impacts on fish.

11 See the discussion below.

12 D. Goyette and J. Boyd, Distribution and Environmental Impact of Selected Benthic Contaminants in Vancouver Harbour, BC, 1985 to 1987 (Vancouver,: Environment Canada Regional Program Report, 1989) p. xii.

13 The Natural Resources Defence Council has stated: "Pathogens in stormwater…contaminate shellfish beds, and this contamination, along with pollution from other sources, causes closure of shellfish beds nationwide. Data collected from five coastal states indicate that urban runoff and storm sewers are the most pervasive source of shellfish harvesting restrictions, contaminating over 30 percent of the area reported as subject to such restrictions in those states." See Stormwater Strategies: Community Responses to Runoff Pollution, Chapter 3 "The Consequences of Urban Stormwater Pollution," Natural Resources Defence Council http://www.nrdc.org/water/pollution/storm/chap3.asp.

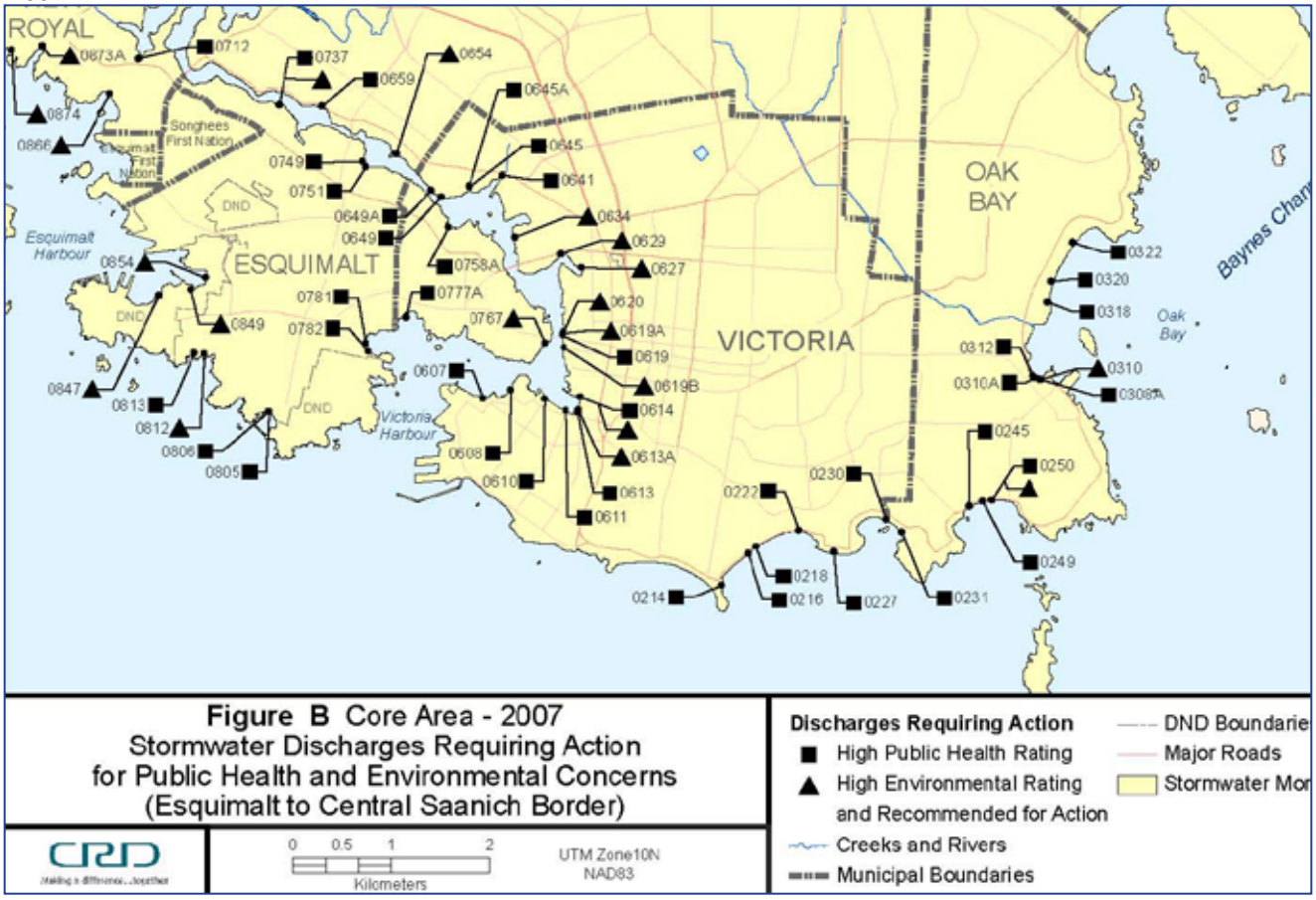
14 A nationwide survey of US surface drinking water supply utilities found an increased concern among managers over runoff pollutants, particularly nutrients, bacteria, and toxic organic chemicals. The costs can be astronomic. For example, runoff pollution from suburban and agricultural sources is one of the largest threats to New York City's currently unfiltered drinking water supply. If this pollution cannot be prevented, New York City may need to filter its water supply at a capital cost of perhaps $5 billion or more. See Stormwater Strategies:

Rainwater Runoff Problems in the Capital Region

If we are looking for real risks to public health, this [stormwater] is the one... My plea is do not ignore this, in terms of planning for our aging sewer system. ...This is something that should be causing some angst.

Richard Stanwick, Chief Medical Health Officer, Vancouver Island Health Authority[15]

FIGURE 1



Credit: CRD Core Area 2007 ***Stormwater Quality Annual Report***[16] ***Note that this map shows areas of the CRD most heavily impacted by stormwater.***

As you can see in Figure 1, numerous Capital Region stormwater outfalls pose risks for both human health and the environment.

Community Responses to Runoff Pollution, Chapter 3 "The Consequences of Urban Stormwater Pollution," Natural Resources Defence Council http://www.nrdc.org/water/pollution/storm/chap3.asp

15 "Stormwater is fouling our beaches," *Times Colonist*, July 28, 2008 http://www.canada.com/victoriatimescolonist/news/story.html?id=34f8a3a6-b6c2-4c7e-a9bd-4402f8332084.

16 Main report, http://www.crd.bc.ca/watersheds/documents/2007CoreStormwaterReport.pdf, p. v.

Above: local beach closure sign

Human Health Risks

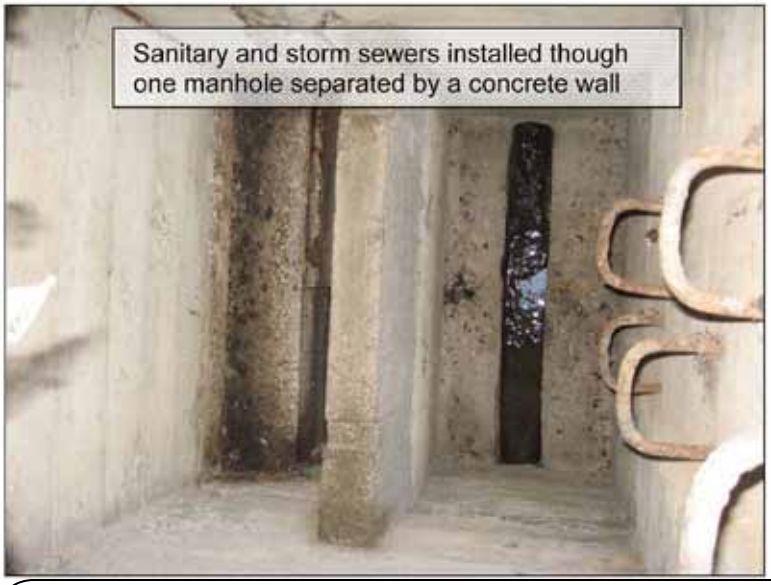
Stormwater outfalls in the CRD are periodically contaminated with human sewage. Such sewage may contain infectious bacteria, viruses and parasites that can cause gastroenteritis, salmonella infection, shigella, *E. coli* infection, giardiasis, hepatitis, pinworms, polio, toxoplasmosis, adenovirus, tapeworms rotavirus, asthma, and Weil's disease.[17] The link between stormwater/sewage overflows and diseases such as children's diarrhea and other gastrointestinal and respiratory diseases has been documented.[18]

Esquimalt, Victoria and Oak Bay have the highest concentration of problematic discharges contaminated by sewage because these municipalities have the oldest stormwater infrastructure. In some cases their storm sewers were installed more than a century ago and are in desperate need of repair or replacement. Much of their storm sewer system is literally crumbling.

From a human health perspective, the CRD is plagued by three distinct problems in its aging stormwater system:

17 See http://www.drgreene.com/21_1088.html for a discussion of some of these diseases. Gastroenteritis can be caused by cryptosporidium, which was the cause of the major public health crisis in North Battleford, Saskatchewan in 2001, or by E. coli, which killed seven people in Walkerton, Ontario in 2000. The North Battleford outbreak was caused by human sewage while the E. coli at Walkerton came from cow manure entering their drinking water via wells. Weil's disease is a flu-like illness with persistent and severe headache in which damage to liver, kidneys and blood may occur http://www.hse.gov.uk/pubns/indg198.htm.
US data indicates that each year 1.8 million to 3.5 million illnesses are caused by swimming in water contaminated by sewage, and an additional 500,000 from drinking contaminated water. US Medical costs associated with eating sewage-contaminated shellfish range from $2.5 million to $22 million each year (Natural Resources Defence Council Report, http://www.nrdc.org/water/pollution/sewage.asp).

18 For example, a 2007 study of one Milwaukee hospital indicated that the number of children suffering from serious diarrhoea rose whenever local sewers overflowed. See "As Sewers Fill, Waste Poisons Waterways," Charles Duhigg, New York Times, November 23, 2009, citing the study published in the journal Pediatrics. Another US study noted: "Stormwater carries disease-causing bacteria, viruses, and protozoa. Swimming in polluted waters can make you sick. A study in Santa Monica Bay found that swimming in the ocean near a flowing storm sewer drain during dry weather conditions significantly increased the swimmer's risk of contracting a broad range of health effects. Comparing swimming near flowing storm-drain outlets to swimming at a distance of 400 yards from the outlet, the study found a 66 per cent increase in an group of symptoms indicative of respiratory disease and a 111 per cent increase in a group of symptoms indicative of gastrointestinal illness within the next 9 to 14 days. Increased sediment in receiving water is also related to human illness: sediment prolongs life of pathogens and makes it easier for them to reproduce." --From Natural Resources Defence Council, Stormwater Strategies: Community Responses to Runoff Pollution, Chapter 3 "The Consequences of Urban Stormwater Pollution" http://www.nrdc.org/water/pollution/storm/chap3.asp. Additional health information is found in the Toronto Homeowner's Guide to Rainfall at http://www.riversides.org/rainguide/riversides_hgr.php?cat=1&page=78&subpage=90&subpage2=12



L: Combined Manhole - Combined manholes are manholes that contain both a sanitary sewer pipe and a stormwater pipe. The pipes may be benched at different levels or separated by a dividing wall. In some cases, one pipe maybe open while the other is closed. Combined manholes are found in two of the Core Area municipalities.
R: Surcharging Manhole - A manhole is considered to be in a "surcharged" condition if the level of the sewage in the manhole rises above the top of the sewer pipe. (Photos and information from CRD Core Area Sanitary Sewer Overflow Management Plan - June 2008)

1. **Cross-connections**: This common problem occurs when a property owner[19] has incorrectly connected their building's sanitary plumbing to stormwater pipes instead of sewage pipes. As a result, fecal material is discharged from stormwater outlets directly into water bodies and onto beaches.
2. **Leaking or broken pipes**: In older municipalities, stormwater and sanitary sewage pipes are not adequately separated – they often run adjacent to each other. When these old pipes overflow, leak or break, sewage flows into storm sewer pipes, which then deliver the fecal material to local water bodies and beaches. In addition, water from nearby stormwater pipes (or simply flowing through the soil) can infiltrate the sanitary sewer system. During heavy rains, such infiltration can overwhelm the capacity of sanitary sewage facilities, forcing the near-shore discharge of large amounts of overflow raw sewage.
3. **Combined sewers**: In the Uplands area of Oak Bay, the potential for raw sewage to be discharged to nearshore areas is even greater, as the area still operates a combined sewer system. This means that stormwater and wastewater are carried in the same pipe to a sewage facility before being discharged into the deep water outfall. However, during heavy rainfalls the capacities of the pipes and sewage facility are often exceeded. When this happens much of the combined sewage bypasses the sewage facility and is discharged directly onto the coast.

These problems can be substantial. For example, in January 2009, heavy rain combined with quickly melting snow caused a major Combined Sewer Overflow (CSO), prompting the Vancouver Island Health Authority to issue a public health advisory for the eastern coastline.[20]

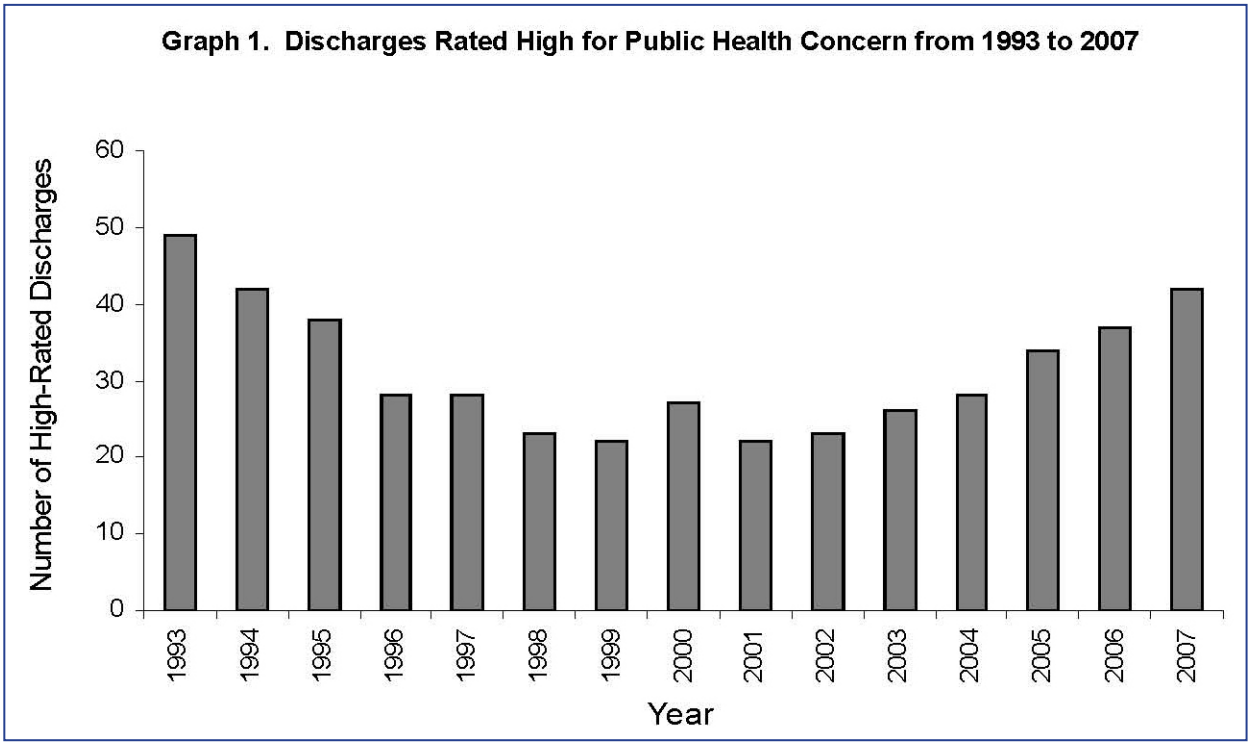
19 Or contractor.

20 *Storm water overflows pose health risk on Victoria shoreline,* CBC news homepage, January 7, 2009, at: http://www.cbc.ca/canada/british-columbia/story/2009/01/07/bc-victoria-sewage-overflows.html

According to the CRD's annual stormwater quality reports, public health warnings from stormwater discharges in the CRD core area are currently at a 14 year high.[21] Despite initial progress starting in 1993, the number of 'high health concern" discharges has been on the rise since 2001 (see Figure 2). Of the 175 discharges monitored in 2007, 41 were assigned a high level of concern for public health and 87 were rated moderate. The CRD notes that the bulk of these high ratings occurred in Oak Bay, Esquimalt and Victoria because of their aging infrastructure.[22]

The widespread contamination of stormwater is particularly worrisome because of increasing recreational use of Victoria Harbour and Gorge. Today, thousands of people not only fish, boat and swim in these waters but also beachcomb, windsurf, row, dragon boat, scuba dive, and engage in eco-tourism.

FIGURE 2



Credit: ***CRD Core Area 2007 Stormwater Quality Annual Report***, main report[23]

The CRD's response to this public health threat has been hamstrung by a remarkable lack of resources.

To effectively address health risk, outfalls must be monitored so that efforts can be made to investigate and fix the source of detected problems. For example, when monitoring finds sewage at a stormwater outlet, investigators focus on finding upstream cross connections. However, since CRD stormwater budgets are extremely limited, in 2008 the CRD decided to discontinue annual stormwater sampling and rating and focus resources on upstream investigations.[24] The next Stormwater Quality Annual Report is now not expected until 2012.[25]

21 2007 Stormwater Quality Annual Report (Core Area)
http://www.crd.bc.ca/watersheds/documents/2007CoreStormwaterReport.pdf
22 2007 Stormwater Quality Annual Report (Core Area)
http://www.crd.bc.ca/watersheds/documents/2007CoreStormwaterReport.pdf., pg. ii.
23 http://www.crd.bc.ca/watersheds/documents/2007CoreStormwaterReport.pdf, pg. ii.
24 This decision was made in the context that CRD work plans require simultaneous monitoring of outflows and upstream investigations.
25 http://www.crd.bc.ca/watersheds/documents/2007CoreStormwaterReport.pdf, p. iii, and personal communication with CRD officials.

Environmental Damage

How Stormwater Destroys Salmon Streams

Stormwater's devastating effects on salmon are well-documented. In fact, stormwater's impact on salmon populations is the primary reason that rainwater management is being transformed in the US Pacific Northwest. It is a key reason why the Washington State Pollution Control Hearings Board now requires comprehensive use of Low Impact Development stormwater practices throughout the western portion of the State. In addition, the US *Endangered Species Act* requires massive upgrading of rainwater management to protect disappearing salmon species. [26]

Under conventional management, stormwater flows across impervious surfaces (roofs and pavement) and gathers contaminants and velocity – both of which damage fish streams. In fact, studies show that when impervious surfaces exceed the relatively low level of 10-15 per cent of a watershed's area, streams generally become poor habitat for fish.[27]

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26 Curtis Hinman, Adjunct Faculty, Washington State University, Dept. of Natural Resource Sciences, presentation to LID conference, University of Victoria, August 28, 2009. The Washington State Pollution Control Hearings Board now requires maximum site dispersion and infiltration of stormwater through the comprehensive use of Low Impact Develoment practices for the entire western portion of the state. See Puget Soundkeeper Alliance v. Washington Dept. of Ecology, August 7, 2008, PCHB Nos. 17-021-030 and 037, Washington State Pollution Control Hearings Board. In another case, the Board described stormwater impacts on salmon:
Associated General Contractors… contend that salmon can adapt to high levels of turbidity and that salmon are impacted by chronic discharges of turbidity, which are unlikely to come from a construction site. The Board finds, however, that even low levels of suspended solids and turbidity "may cause chronic sublethal effects to salmonids such as loss or reduction of foraging capability, reduced growth, resistance to disease, increased stress, and interference with cues necessary for orientation in homing and migration… The effects from suspended solids and turbidity may produce mortalities and population decline in salmonid species over time. [Associated General Contractors et al. v. Washington State Dept. of Ecology, Findings of Fact, Conclusions of Law and Order, June 4, 2007, PCHB NO. 05-157-159, pp. 23-24.]

27 "The Importance of Imperviousness," *Watershed Protection Techniques*, Vol. 1, No. 3, Fall 1994, p. 106.

At that level of imperviousness, a watershed destabilizes. Streams begin to erode, straighten and channelize, losing the pool and riffle sequences that fish need. [28] They begin to suffer from "urban stream syndrome" described by one local scientist:

> *Urban watersheds with a high percentage of impervious area experience high peak flows and low summer flows, and steep peaks in response to rainfall events, due to fast runoff from impervious surfaces and low hydrological storage… [This] results in a suite of problems and due to cumulative effects and feedbacks, this has recently been referred to as the "urban stream syndrome." These effects are well described and include:*
>
> - *increased surface runoff and peak flow events;*
> - *increased mobilisation and transportation of nutrients such as nitrogen and phosphorus;*
> - *erosion, enlargement and aggradation of stream channels;*
> - *conveyance of urban pollutants into aquatic ecosystems and toxicity effects on aquatic biota;*
> - *degraded aquatic biological conditions and reduced biodiversity, for example loss of sensitive species such as salmonids."*[29]

Studies in the Pacific Northwest indicate that Coho salmon are seldom found in watersheds that have more than 10-15 per cent impervious cover.[30] Stormwater has played a key role in devastating Coho salmon throughout the Georgia Basin. The region's Coho originate almost entirely in urbanized areas. Urban stormwater—along with logging and overfishing—has had a devastating effect on the fish. Since the 1950s, the number of streams supporting Georgia Strait Coho runs has decreased from 100 to about 20, and the very survival of the fish is in question.[31]

If the Capital Region hopes to rehabilitate and restore historic salmon runs in this region, it simply must improve its management of rainwater runoff. For this reason alone, we should shift from conventional stormwater management to greener rainwater management.

Amount of Impervious Cover on Selected CRD Watersheds

Bowker Creek:	50 per cent
Douglas Creek:	over 30 per cent
Swan Lake:	25 per cent
Hagan Creek:	12 per cent[32]

Note: When impervious cover in a watershed exceeds 10-15 per cent, streams in the watershed become poor habitat for fish – unless mitigative measures are carried out.

Table 1

28 "The Importance of Imperviousness," *Watershed Protection Techniques*, Vol. 1, No. 3, Fall 1994, p. 100-101.
29 Lise Townsend, *Urban Watershed Health and Resilience, Evaluated Through Land Use History and Eco-Hydrology in Swan Lake Watershed (Saanich, BC)*, Thesis for Masters in Science, Royal Roads University, 2004, p. 106.
30 i.e. roofs, pavement, concrete. "The Importance of Imperviousness," *Watershed Protection Techniques*, Vol. 1, No. 3, Fall 1994, p. 106.
31 Province of British Columbia, *BC Salmon Habitat Conservation Plan: Strategy Paper* (Victoria, September 1995), p. 4.
32 Bowker Creek: See: http://communications.uvic.ca/edge/. This estimate comes from a GIS study done for the Bowker Creek Initiative, according to Tanis Gower, Bowker Creek Initiative Coordinator, CRD. Douglas Creek: "Detention Options for the Douglas Creek Watershed," Royal Roads University student report for Friends of Mount Douglas Park, p. 16, August 27, 2003. Swan Lake: Lise Townsend, "Looking to the Watershed to Save Swan Lake" in CRD's Stormwater, Harbours and Watersheds Program News, Spring 2009. Hagan Creek -- Katrina Bennett, "Impervious Study of the Hagan Creek-Kennes Watershed," June, 1999 Geography 490 Directed Studies, unpublished, p. 1.

Above: Bowker Creek no longer supports salmon. Pictured is the last salmon documented in the Creek, a stray found in 2005. R: Poster courtesy of Washington Department of Ecology and Puget Sound Action Team.

Destruction of this Region's Salmon Streams: The Cost of Stormwater

In 1843, Governor James Douglas noted that salmon "ascend the straits in August, and are caught in great quantities" and "continue to yield well until September," the "bad salmon" until November and "excellent salmon" until the middle of February. The Spring salmon entered Victoria harbour all winter and Coho and Chum salmon ran up the Gorge in greatest numbers in June, when the Pink and Sockeye were available in the outer waters. [34]

Salmon once ran up most of the local small creeks. For example, Coho and Spring salmon once ran up Colquitz creek and its tributaries north of West Saanich Road.[35] Salmon in the Colquitz were reported as "so thick you could just walk across them" and so plentiful that farmers speared them and scattered them on their fields for fertilizer.[36] At one time, trout "some 4-6 pounds" were found in all the local streams and lakes. In the late nineteenth century some local lakes were reported as "full of fine speckled fish [rainbow and steelhead trout]."[37]

However, today, most Regional urban streams (e.g., Douglas Creek and Bowker Creek) no longer support trout and salmon. The Colquitz River is one of the few remaining salmon-bearing streams in the Greater Victoria area, and its fish population is much diminished.[38]

33 This "Stormwater Runoff Pollution Zone" poster was taken from a publication of the Puget Sound Action Team and the Washington Department of Ecology: http://www.epa.gov/nps/toolbox/other/psatpipe.pdf.

34 Grant Keddie, *Supplement to the 2003 Book: SONGHEES PICTORIAL A History of the Songhees People as Seen by Outsiders 1790-1912*, (Royal BC Museum, Victoria BC) p. 80.

35 Keddie, *SONGHEES PICTORIAL*, p. 80.

36 *Colquitz River Watershed Proper Functioning Condition Assessment*, Aqua-Tex Scientific Consulting, Ltd., p. vii.

37 Keddie, *SONGHEES PICTORIAL*, p. 80. Apparently at that time there were no trout in Langford Lake.

38 *Colquitz River Watershed Proper Functioning Condition Assessment*, Aqua-Tex Scientific Consulting, Ltd., pp. vii and 11.

Local Examples of Stormwater Impacts on Salmon

Bowker Creek – From Salmon Stream to Stormwater Drainage Ditch

As late as the 1920s, Coho salmon went up Bowker creek past Haultain Street, and trout lived in Bowker Creek tributaries past Hillside and Shelbourne Streets.[39] However, over the years Bowker Creek was converted into a stormwater drainage ditch. Today over 50 per cent of the Bowker Creek watershed is impervious surface, which periodically flash floods polluted stormwater into the creek. There is an increasing problem with flooding.[40]

To control flooding, Bowker Creek has been turned into a narrow, deep ditch, and many parts (63 per cent of its length) have been put into underground pipes. Other parts of Bowker are "armoured" with rip rap, gabions, cement sand bags, stone walls, or cement walls. In Oak Bay's Bowker Creek Park, Bowker is a deep, concrete-lined ditch.

39 Keddie, *SONGHEES PICTORIAL*.

40 It is estimated that about 50 per cent of the watershed surface is impermeable due to roads, buildings and pavement. See UVic Geographer Chris Jensen's statement at: http://communications.uvic.ca/edge/ This estimate comes from a GIS study done for the Bowker Creek Initiative, according to Tanis Gower, Bowker Creek Initiative Coordinator, CRD.

These changes, plus water quality problems caused by stormwater runoff mean that the creek can no longer support any salmon or trout at all.[41]

The Bowker Creek Initiative is spearheading a remarkable restoration plan, and over the long term could restore the creek and its salmon. However, before salmon can run there again, Saanich, Victoria and Oak Bay all have to improve their management of stormwater. They have to stop washing their communities' surface pollutants and floodwater surges into the creek. However, if we restore habitat and adopt the rainwater management reforms suggested below, our grandchildren could enjoy watching salmon spawn in Bowker Creek again.

Stormwater Toxins Kill Trout and Coho in Reay Creek

In March 2003, Ian Bruce of Peninsula Streams Society received an email that dead fish had been found in Reay (Kelset) Creek in Sidney. When he arrived at the creek, he found the Creek filled with small dead fish.

41 An exhaustive survey of the Creek revealed no fish other than hardy sculpin and stickleback near the mouth of the Creek. See "Bowker Creek Watershed Assessment" conducted for the CRD in 2000, p. 15. http://bowkercreekinitiative.ca/about/documents/assess_BowkerCreekWater.pdf

Bowker Creek photos showing sandbags, creek erosion, channelization, and armouring

Phoro: Ian Bruce at Reay Creek

There were 500 dead Coho salmon, 80 cutthroat trout, and countless sticklebacks. Among the dead was a two-kilogram male spawner: a golden-hued sea-run cutthroat trout.

The Sidney Anglers had spent 20 years restoring this stream with support from local governments, Victoria airport, neighbours, funding organizations and others. Collectively, they had turned a drainage ditch through a junk-filled ravine into a productive Coho stream, with 100 spawners in 2000. The restored stream was colonized by wild cutthroat trout coming up from the ocean near Sidney. Reay Creek had become a "poster child" for urban creek restoration.

But now it was wiped out, apparently by stormwater runoff coming from the area near the airport. Analysis of the dead fish showed clinically significant levels of the toxic heavy metal cadmium in their tissues.[42] Investigations were undertaken but ultimately no one was held responsible. A single flush of metal-tainted water had destroyed 20 years of community work.

However, local school children raised new Coho to restock the creek. Anglers and the kids began to again hope for long-term recovery of the stream. Tragically, on October 30, 2004, Bruce again received a call about dead fish in Reay Creek.

As it was getting dark, this time he could only recover a few of the Coho fry. A few days later, the *Times Colonist* ran a front page photo of Bruce holding the dead Coho fry. Subsequent investigation found cadmium was likely linked to this fish kill too—again likely due to stormwater from an area near the airport.

Today wild cutthroat trout have successfully recolonized Reay Creek. However, despite repeated

42 See the May 26, 2003, Memorandum of test results on the fish tissue from the dead fish in Reay Creek, Dr. Andrea Osborn, Fish Health Veterinarian.

Photo: Stormwater erosion at Douglas Creek. Friends of Mount Douglas Park Society website: http://www.mountdouglaspark.ca/PhotoAlbums/Douglas%20Creek%20Storm%20Surge%20Erosion/index.html?delay=2&fullscreen=yes

restocking efforts, Coho adults failed to return to the creek until this last year when just five spawners returned. Asked what lessons we can learn from the Reay Creek fish kill incidents, Ian Bruce is succinct: ***The big lesson here is that stormwater can kill!***

Douglas Creek: Erosion, Oil Spills and Fish kills

The need to develop better stormwater management practices in the CRD is poignantly illustrated by Douglas Creek, where the Friends of Mount Doug have worked hard since 1997 to re-introduce salmon into the creek. Their work has been consistently undermined by inadequate stormwater management techniques, which have led to destructive stormwater surges and pollution-related fish kills.

> *If one follows along the Creek, the evidence of severe bank erosion is everywhere. The strength of the [Stormwater] surges last year was sufficient to wash out some of the salmon spawning beds.*
>
> Friends of Mount Doug[44]

The Douglas Creek watershed includes about 5,000 homes and 10,000 resident vehicles, many of which leak motor oil and coolant. In addition, about 20,000 vehicles pass through the Mount Douglas Park corridor

43 http://www.mountdouglaspark.ca/PhotoAlbums/Douglas%20Creek%20Storm%20Surge%20Erosion/index.html?delay=2&fullscreen=yes]

44 Spring 2009 *Newsletter* of the Friends of Mount Douglas Park Society http://www.mountdouglaspark.ca/Newsletters/2009-Spring.pdf See photos of storm surge erosion on Douglas Creek at http://www.mountdouglaspark.ca/PhotoAlbums/Douglas%20Creek%20Storm%20Surge%20Erosion/index.html?delay=2&fullscreen=yes

daily. The 34 per cent of the watershed that is impervious collects the resulting contaminants—until rainfall washes them straight into Douglas Creek via the storm sewers.

For example, on November 5, 2006, members of Friends of Mount Douglas Park gathered at Mount Douglas Park preparing for the next day's event – a gathering of volunteers to plant shrubs along the creek. The Friends' Director of Streams Bob Bridgeman describes what happened:

> *The script we dreamed of was to have the volunteers planting riparian shrubs above Ash Roads while the chum flapped in the Creek at their feet. We started at the Creek mouth just to have a look at the 'fresh' chum that were coming in and we smelled OIL! The oil was all down the Creek and the chum were splashing around in it and spawning—a disaster!*

While Bridgeman called authorities and helped set an oil boom at the weir, the spill was exacerbated by a falling rain. As Bridgeman describes it:

> *I stood on the weir as the water from the rain overtopped the crest of the weir and poured downstream in a steady sheet of oil—on top of those spawning chum.*

The next day was tragic. Volunteers of all sorts arrived at the planting event only to discover oil flowing downstream onto the salmon that everyone had worked so hard to bring back. In this case it turns out that the oil originally spilled from a tank at the fire hall near the University of Victoria.

But Bridgeman notes that this incident was not an isolated problem:

> *Every time it rains in Gordon Head there is a fisheries violation in Douglas Creek and Cordova Bay.*

Bridgeman notes that oil is always brought down to the creek in a rainstorm and the weir always overtops and spills downstream. According to Bridgeman, "the weir provides a useful function intercepting the day to day pollution associated with automobiles etc.,...but for large spills the weir is useless."

This is especially problematic, considering how often larger amounts of oil and other pollutants enter the creek. After helping a fire crew respond to yet another oil spill into Douglas Creek in May 2009, Mr. Bridgeman noted:

> *There must be a more effective means of spill protection than setting up absorbent booms and oil pads. If it rains at all tonight all of the pads will be down on the beach.*
>
> *What we are doing now is not working. It is not just about fish: there are birds, mammals, shellfish, human health, and then there is Cordova Bay.*

This second spill delayed the Friends of Mount Douglas Park transplanting 50,000 chum fry into the creek, which had been scheduled for just five days later.

Apart from oil spills, there have also been sewage spills into the creek, one involving 130,000 litres of sewage. According to a letter that Friends of Mount Douglas Park received from a municipal engineer, several of the lift stations are constructed to spill into the environment when the pump station fails. Mr. Bridgeman has witnessed human excrement and toilet paper flowing downstream and believes there are several cross-connections on the watershed.

Ultimately, better stormwater management is the key to meaningful stream restoration. Without it, the work of groups such as Friends of Mount Douglas Park will constantly be undermined.

The experience with salmon restoration at Douglas Creek is consistent with experience elsewhere. A Puget Sound study of the high mortality rates in salmon restoration projects concluded that the extremely high failure rate is likely due to stormwater pollutants.[45]

45 See Acute Die-offs of Adult Coho Salmon Returning to Spawn in Restored Urban Streams, Northwest Fisheries Science Center study concerning Coho restoration projects: http://www.nwfsc.noaa.gov/research/divisions/ec/ecotox/fishneurobiology/acutedieoffs.cfm

Photos (provided) of channelization and erosion on Bowker Creek.

Jesus-Walking Salmon and Stormwater by Lisa Stiffler[46]

Stormwater screws up salmon and shellfish and causes floods and landslides. One salmon skitters across the water doing the "Jesus walk" before succumbing to a premature death. Another swims in dazed circles near the water's surface then limply drifts downstream. Still another lies on its side, no longer swimming, mouth gaping open and shut and fins splayed out. All are the likely victims of stormwater pollution.

The Coho were captured in videos collected by the Northwest Fisheries Science Center, a Seattle office of NOAA Fisheries. Scientists there are studying what's called pre-spawn mortality in Coho that return to urban waterways to lay eggs. The fish are killed off with bellies full of roe before they have the chance to spawn, and pollution running off the urban landscape is the prime suspect in their demise. Those that aren't killed outright can have their noses deadened by the chemicals, eliminating a key sense for survival.

And that's only one way in which stormwater is taking its toll across the Northwest. The runoff that streams across pavement and buildings carries with it a wallop of toxic chemicals that harm everything from tiny herring to the region's iconic orcas... It threatens to make drinking water undrinkable, and shellfish unsafe to eat from BC's Georgia Basin to the Puget Sound's southern reaches.

Table 2

46 See *Jesus-Walking Salmon and Stormwater*, Lisa Stiffler, Sightline Institute, at: http://daily.sightline.org/daily_score/archive/2009/12/03/jesus-walking-salmon-and-stormwater?portal_status_message=Your%20comment%20has%20been%20published.

Stormwater and Orcas

If we want to preserve the orca, we must clean up stormwater runoff. Runoff is a major threat to the continued survival of orcas on our coast, because it contaminates their food supply with PCBs. Studies show that BC and Puget Sound southern resident orcas are among the most PCB-contaminated whales in the world—and stormwater is the ultimate source of much of that PCB contamination.[47]

PCBs have been identified as one of the three most serious threats to survival of the Southern community of resident Orcas.[48] PCBs harm the animals by:

- suppressing immune function;
- damaging brain development; and
- significantly reducing the ability to reproduce.[49]

These impacts are clearly critical for a whale population that struggles on the brink of extinction.[50]

47 P.S. Ross et al., "High PCB Concentrations in Free-Ranging Pacific Killer Whales, Orcinus orca: Effects of Age, Sex and Dietary Preference", 40(6) *Marine Pollution Bulletin* 504.
http://www.sciencedirect.com/science?_ob=MImg&_imagekey=B6V6N-40CJYDY-6-4C&_cdi=5819&_user=1007916&_orig=browse&_coverDate=06%2F30%2F2000&_sk=999599993&view=c&wchp=dGLbVtz-zSkWA&md5=afc2715b33ea9b8b41986645d5536c73&ie=/sdarticle.pdf
Also see Marla Cone, *Los Angeles Times*, February 16, 2001, citing research of Dr. Peter Ross, indicated that area orcas had 250 ppm of PCBs, the highest concentrations he had ever seen.

48 The other two are depleted food supplies and disturbance by boats. Personal communication, Dr. John Ford, orca specialist, 1996.

49 For example, scientists with US Fish and Wildlife have said since PCBs cause behavioural and learning deficits, they may make it harder for orcas to find food. See "Port rethinks dumping of PCBs in Elliott Bay: Contaminated mud may go into landfill instead," *Seattle Post-Intelligencer,* September 12, 2007, http://www.seattlepi.com/local/331350_port12.html. Also see "Harmful PCB Levels Found in Orcas, Vancouver Sun, October 10, 2007, http://www.canada.com/vancouversun/news/story.html?id=a1e01c61-1c53-42b4-9300-68941fdd7396

50 See "PCBs May Threaten Killer Whale Populations for 30-60 Years," Science Daily, http://www.sciencedaily.com/releases/2007/09/070910094122.htm and

Significantly, research shows that stormwater is now the number one source for the PCBs that enter Puget Sound.[51] Although the long-lasting chemical was banned 30 years ago, it is widely distributed across the landscape, occurring in old asphalt roofing materials, paint, lubricants, adhesives, caulking and grout, and coolant for electrical equipment. Stormwater washes the chemical into the ocean where the PCBs bio-accumulate in organisms that form the orca's food chain.[52]

Washington State Department of Ecology official Josh Baldi has called for stormwater cleanup to save the orcas:

> *This new science and the advances of the last several years show us how enormous and complex the stormwater problem is, and that we are going to need a lot of help to fix it. Orca whales, salmon, herring and rockfish accumulate and carry PCBs in their bodies. The toxic pollutants make our resident orcas more vulnerable to infectious disease, impair reproduction, and impede normal growth and development."*[53]

Canada's official *Recovery Strategy* for saving resident orcas recognizes the critical importance of this problem. The *Strategy* document calls for action to reduce the toxic chemicals that are adversely affecting orca health.[54]

It's important to remember that the documented PCB problems relate to just a single chemical. And stormwater carries a multitude of other toxic substances into the ocean ecosystem.

Clearly, if we want to preserve orca, we need to clean up the stormwater that is delivering toxins into the diet of endangered orcas.

http://www.canada.com/vancouversun/news/story.html?id=a1e01c61-1c53-42b4-9300-68941fdd7396. Also see Jesus-Walking Salmon and Stormwater, Lisa Stiffler, from Sightline.org, 12/03/2009, Sightline Institute.

51 *Jesus-Walking Salmon and Stormwater*, Lisa Stiffler, from Sightline.org, 12/03/2009, Sightline Institute. This is consistent with other studies showing that stormwater runoff is a dominant source of PCB contamination. See Luca Ross et al, "Urban stormwater contamination by polychlorinated biphenyls (PCBs) and its importance for urban water systems in Switzerland," Science of The Total Environment, Volume 322, Issues 1-3, 25 April 2004, pp. 179-189 http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V78-496NMR2-6&_user=1007916&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&view=c&_searchStrId=1138455837&_rerunOrigin=google&_acct=C000050229&_version=1&_urlVersion=0&_userid=1007916&md5=0ce745d3d5439121f2180c1427f1112c

52 PCB contamination in Puget Sound herring, Chinook salmon, and different kinds of sole are at levels that would warrant human consumption warnings from the EPA, according to a Washington State Department of Ecology study. See *Jesus-Walking Salmon and Stormwater*, Lisa Stiffler, from Sightline.org, 12/03/2009, Sightline Institute.

53 "Everyone Needed in the Fight Against Stormwater and Polluted Runoff," *Department of Ecology News Release*, April 22, 2009, http://www.ecy.wa.gov/news/2009news/2009-089.html

54 *Recovery Strategy for the Northern and Southern Resident Killer Whales (Orcinus orca) in Canada. Species at Risk Act Recovery Strategy Series*, Fisheries & Oceans Canada (Ottawa, 2008). See 5.3.2 [Recovery] Objective 2 Strategies at: http://www.sararegistry.gc.ca/virtual_sara/files/plans/rs_Resident_Killer_Whale%20_0308_e.pdf

Swan Lake: Stormwater's Toll

Swan Lake Nature Sanctuary in Saanich provides a vivid illustration of the damage caused by current management of stormwater runoff. A recent study in Swan Lake has concluded:

> *...degraded water quality, unhealthy streams and invasive species are some of the main problems, many of which arise from sources far from the lake itself, in the watershed.*[55]

In the past, rainwater was mostly caught by vegetation or filtered and cleaned by the soil, but now 25 per cent of the watershed (which includes Swan Creek and Blenkinsop Creek) is covered with impervious surfaces serviced by conventional storm sewers. The increased rainwater runoff has resulted in stream channel erosion and transportation of heavy metals and nutrients into local streams and lakes. Among other deleterious effects, this has led to more than 2.3 tonnes of excess phosphorous flowing into Swan Lake annually – which has created algae problems and other degradation. [56]

Table 3

55 Lise Townsend, "Looking to the Watershed to Save Swan Lake," in CRD's *Stormwater, Harbours and Watersheds Program News, Spring 2009*, referring to a thesis she has completed.

56 Townsend, "Looking to the Watershed to Save Swan Lake."

Stormwater and Shellfish

Oysters, clams, butter clams, littleneck clams, horseclams, cockles, and mussels have long provided bounty to the people of the Capital Region. The many middens found across the region mark the importance of shellfish to Aboriginal people. From the Gulf Islands to Saanich Inlet, and from Victoria to Sooke and beyond, shellfish formed a significant part of the Aboriginal diet.[57] For example, the shellfish beds of the Inner Harbour were known as some of the most productive shellfish beds on Vancouver Island.[58] Settlers continued to enjoy this bounty until the shellfish beds were contaminated by stormwater, faulty septic systems and agricultural operations.

Unfortunately, most of the shellfish beds in the CRD are now closed to harvest, as indicated in the maps in Figures 4a, 4b and 4c.[59]

57 For example, in discussing Saanich Inlet, Environment Canada has stated: "The Saanich Inlet shellfishery has been long recognized as an important food source to the three First Nations and the larger community on the Saanich Peninsula." See Achieving Clean Water, Environment Canada, Georgia Basin Ecosystem Initiative: http://www.pyr.ec.gc.ca/georgiaBasin/reports/5_year_perspective/report_c6_e.htm

58 Personal Communication, Professor Maxine Matilpi, Faculty of Law, University of Victoria. Professor Matilpi is Kwakwaka'wakw and a citizen of the Kwakiutl First Nation of Tsaxis (Fort Rupert),

59 DFO, Current closures - http://www.pac.dfo-mpo.gc.ca/fm-gp/contamination/biotox/index-eng.htm

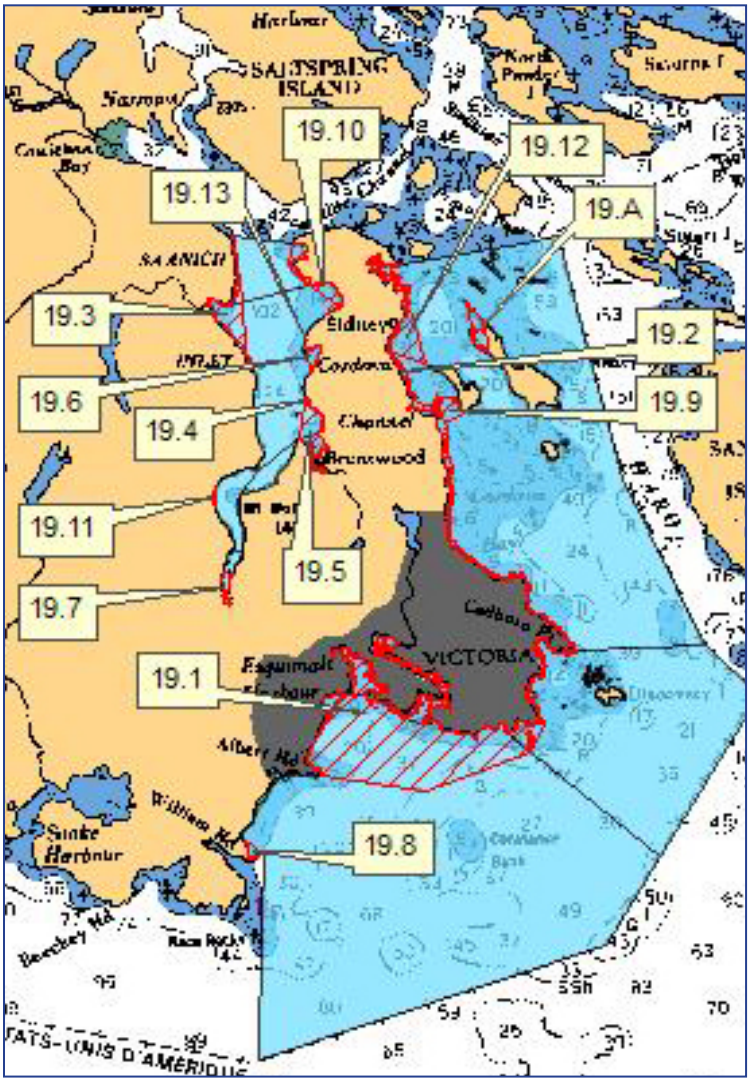

FIGURE 4A

Areas in red are closed Jan 1 to Dec.31 (DFO, Current closures - http://www.pac.dfo-mpo.gc.ca/fm-gp/contamination/biotox/index-eng.htm)

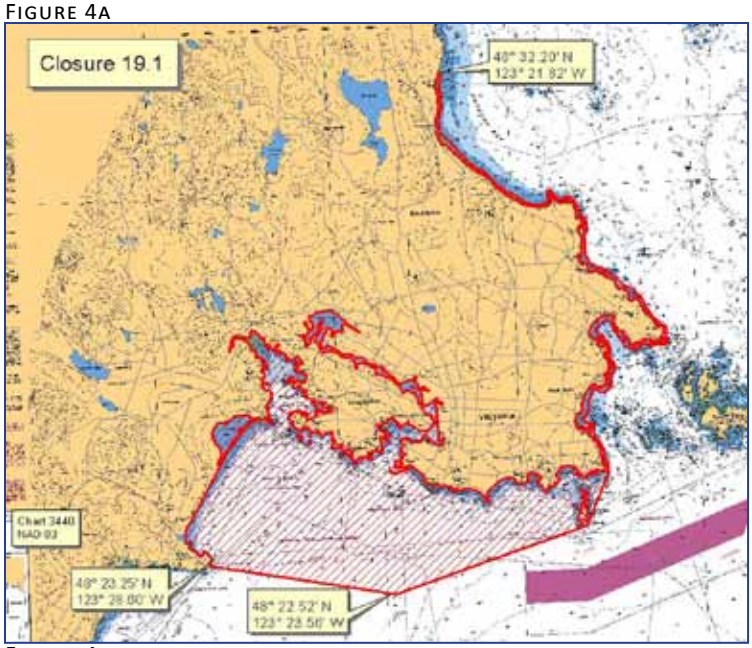

FIGURE 4B

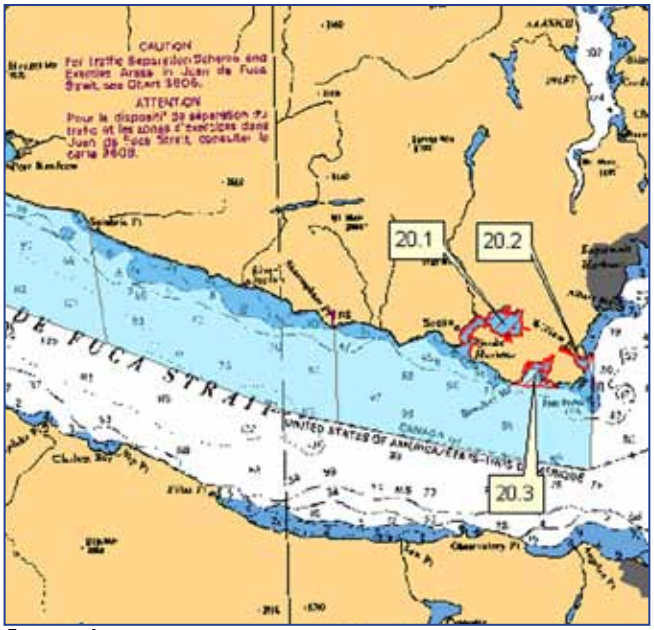

FIGURE 4C

Why Oysters are in the Gorge – The Legend of Camossung

Haylas the Transformer, Raven and Mink found a young girl, named Camossung, and her grandfather. She was crying, so Haylas asked her why. She answered, "My Father is angry with me and will not give me anything to eat."

Haylas asked her if she liked sturgeon, and when she answered "no" he threw the sturgeon to the Fraser River. That is why there is sturgeon there and not here. He asked her if she liked cranberries and when she answered "no," he threw them into Shawnigan Lake. That is why there are cranberries there now.

She refused many things but duck, herring, Coho, and oyster she accepted, and that is why these are plentiful on the Gorge Waterway. Because she was greedy, Haylas told her she would look after the food resources for her people and he turned her and her grandfather into stone.

Esquimalt and Songhees Legend[60]

Table 4

60 Gorge Waterway Initiative Infosheet http://www.gorgewaterway.ca/initiatives-projects/documents/FIRSTNATIONSINFOSHEETPRINT.pdf

Left page (Clockwise): Victoria's Galloping Goose trail; mucky mollusks (photo courtesy Drains of My City); toilet paper covered human excrement in Victoria storm drain (photo courtesy Drains of My City). Right page: various photos of beach advisory and shellfish closure signs.

Stormwater washes contaminants from across the landscape into the ocean—including toxins and fecal material from failing onsite septic systems and animal feces. Shellfish concentrate such material, making the shellfish hazardous for human consumption. A US study of five coastal states found that stormwater runoff was the single most pervasive source of shellfish harvesting closures.[61] Similar dynamics have closed most local shellfish beds as illustrated in the local reports and studies cited below.

A joint CRD-Environment Canada effort to re-open Saanich Inlet shellfisheries recognized that solving stormwater pollution was a prerequisite for success.[62] Numerous CRD reports recognize that reducing stormwater pollution is critical if we want to re-open shellfish beds:

61 The Natural Resources Defence Council has stated: "Pathogens in stormwater…contaminate shellfish beds, and this contamination, along with pollution from other sources, causes closure of shellfish beds nationwide. Data collected from five coastal states indicate that urban runoff and storm sewers are the most pervasive source of shellfish harvesting restrictions, contaminating over 30 per cent of the area reported as subject to such restrictions in those states. A key contributing factor is the fact that levels of bacteria and viruses are usually much greater--100 to 1,000 times greater--in the bottom sediment, where shellfish live, than in the water above." See "Stormwater Strategies: Community Responses to Runoff Pollution" Chapter 3 "The Consequences of Urban Stormwater Pollution," NRDC: http://www.nrdc.org/water/pollution/storm/chap3.asp.
US Medical costs associated with eating sewage-contaminated shellfish range from $2.5 million to $22 million each year. See Sewage Pollution Threatens Public Health, Natural Resources Defence Council Report, http://www.nrdc.org/water/pollution/sewage.asp.

62 For example, from 1999 to 2007, Environment Canada and the CRD worked cooperatively to open shellfish beds along the west coast of the Saanich Peninsula by reducing non-point sources of bacterial contamination, such as stormwater, septic systems and agricultural runoff. This Open Saanich Inlet Shellfish Beds (OSISB) project ended in 2007, due to the closure of the Environment Canada Georgia Basin Ecosystem Initiative

The majority of the exceedances of the SHWP and shellfish harvesting standard throughout the years has been in Victoria Harbour. BST samples collected to date have indicated humans as one of the sources of the high fecal coliform counts. ***The most likely source of human waste in the marine waters are stormwater discharges.*** *…* ***There are three stormwater discharges with high fecal coliform counts that flow into the inner harbour that may be the source of the high fecal coliform counts.***[63]

Shellfish Closures: ***Stormwater flows are the major pathway for contaminants from the land to the marine environment.*** *Fecal*

program. See *Stormwater Quality Annual Report, Saanich Peninsula–2008* http://www.crd.bc.ca/watersheds/documents/EXECUTIVESUMMARY.pdf Also see Environment Canada, Georgia Basin Ecosystem Initiative, "Achieving Clean Water." http://www.pyr.ec.gc.ca/georgiaBasin/reports/5_year_perspective/report_c6_e.htm and Open Saanich Inlet Shellfish Beds, [Monitoring Report] September 2005 to March 31, 2006, Dalia Hull-Thor http://www.crd.bc.ca/watersheds/documents/AppendixF_003.pdf

63 4.3 and 3.4.3 of *Annual Stormwater Quality Report Core Area – 2007 (Including the jurisdictions of: City of Colwood, Township of Esquimalt, City of Langford, District of Oak Bay, District of Saanich, City of Victoria, Town of View Royal, Esquimalt First Nation, Songhees First Nation, Department of National Defence)* http://www.crd.bc.ca/watersheds/documents/2007CoreStormwaterReport.pdf

coliform sampling has focused on human health issues; however, most of the shellfish beds in the Sooke Inlet, Harbour and Basin and Saanich Inlet are currently closed for recreational harvesting.[64]

Shellfish beds in Sooke Inlet, Harbour and Basin are presently closed to recreational harvesting. ***Many of these closures are based on elevated fecal coliform levels related to stormwater discharges contaminated with effluent from failing onsite sewage treatment facilities and inappropriate farming practices.***[65]

Stormwater discharges are a major source of fecal coliform bacteria contamination in the Coles Bay marine environment. *…Three stormwater discharges…entering Coles Bay consistently had fecal coliform counts greater than 200 FC/100mL…*[66]

Almost all shellfish beds along First Nations and municipal land on the Saanich Inlet coastline, from Deep Cove to Tod Inlet, are currently closed to recreational harvesting… ***The closures are largely due to bacterial contamination from stormwater discharges.***

The Open Saanich Inlet Shellfish Beds Project (OSISB) has reduced the number of stormwater discharges with elevated fecal coliform levels.[67] ***Stormwater flows are the major pathway of contaminants from land to the marine environment.***[68] *[from a report on Sooke Inlet, Harbour and Basin]*

64 See: *Stormwater Quality Report, Juan de Fuca Electoral Area, 2005-2006, Executive Summary*, "Shellfish Closures" at: http://www.crd.bc.ca/watersheds/documents/EXECUTIVE_SUMMARY_2005_2006_JUAN_DE_FUCA_STORMWATER_REPORT.pdf

65 See: *Stormwater Quality Report, Juan de Fuca Electoral Area, 2005-2006, Executive Summary*, "Nearshore Marine Investigations" at: http://www.crd.bc.ca/watersheds/documents/EXECUTIVE_SUMMARY_2005_2006_JUAN_DE_FUCA_STORMWATER_REPORT.pdf

66 *Open Saanich Inlet Shellfish Beds, [Monitoring Report] September 2005 to March 31, 2006*, Dalia Hull-Thor http://www.crd.bc.ca/watersheds/documents/AppendixF_003.pdf

67 *Stormwater News, CRD Stormwater Quality Program*, Vol 1, Issue 2, Dec. 2003 at http://commons.bcit.ca/greenroof/press/2003_dec.pdf

68 Stormwater Quality Annual Report, District of Sooke – 2007, Executive Summary, "Shellfish Closures" http://www.crd.bc.ca/watersheds/documents/2007_SOOKE_EXECUTIVE_SUMMARY_HDM-236016-v3-.pdf

> *All of the Saanich Peninsula creeks have had fecal coliform concentrations above the BC shellfish harvesting standard almost every year since the monitoring program began in 1998. .. In many cases when precipitation levels increase, septic fields become saturated and can overflow, causing an increase in fecal coliform concentrations. As well,* ***precipitation causes domestic animal or wildlife feces to enter stormwater flows along the surface and through groundwater****.*[69]

Similarly, the BC Ministry of the Environment notes:

> *...In Saanich Inlet, most embayed areas are closed to shellfish harvesting due to fecal contamination associated with* ***agricultural runoff, onsite sewage systems, and stormwater runoff. High levels of heavy metals have been measured in sediments near stormwater outfalls****. These contaminants can cause sublethal toxicity to bottom-dwelling organisms.*[70]
>
> [emphasis added]

Clearly, cleaning up stormwater runoff is a prerequisite if we want to again enjoy shellfish harvesting in this region.

69 Stormwater Quality Annual Report, Saanich Peninsula – 2008, 4.5.1 Shellfish Closures on the Saanich Peninsula http://www.crd.bc.ca/watersheds/documents/EXECUTIVESUMMARY.pdf

70 See Ministry of Environment website publication, *Water Quality: Understanding Non-Point Source Pollution in BC, chapter "Impacts on Communities"* **at** http://www.env.gov.bc.ca/wat/wq/nps/NPS_Pollution/nps.htm

Toxic Pollutants in the Harbour and Gorge

If we want to clean up our most polluted marine waters—including Victoria and Esquimalt Harbours and the Gorge—we must clean up the contaminated stormwater entering those water bodies.[71] Although the historical industrial uses of the harbours are responsible for much pollution in these areas, the CRD has acknowledged that stormwater outfalls are one of the principal ways in which those historical contaminants and other contaminants continue to enter these waters.[72]

For example, a federal survey concluded that stormwater runoff was the primary source of contamination of Rock Bay, the most polluted bay in the Victoria and Esquimalt Harbours. This stormwater is contaminated by, among other things, heavy traffic use and the historical contamination from an old coal gasification plant and other industrial uses.[73]

The problem is complex and large in scope: there are over 550 drainage pipes in Victoria Harbour between Ogden Point and the Selkirk Trestle.[74]

The CRD Marine Monitoring Advisory Group has expressed concern over government's neglect of stormwater pollution:

> *There is potential that the stormwater discharges could be a greater source of some contaminants to the marine environment than the [sewage] wastewater outfalls. Concern was also expressed that stormwater issues will largely not be addressed by infrastructure improvements associated with the move to advanced treatment in the region.*[75]

Table 5

71 The July, 2000 CRD Core Area Liquid Waste Management Plan states: "Victoria and Esquimalt Harbours are the most polluted marine environments in the CRD. The harbour sediments contain high levels of metals and organic contaminants. Sediment contaminant levels in some areas have the potential to be acutely toxic to marine life and could pose a threat to human health if a fishery was allowed. Evidence of this is the closure of the commercial crab fishery in Victoria Harbour due to high dioxin levels in crab tissue. In addition, both harbours have experienced habitat loss and alteration, particularly in the highly urbanized areas." See http://www.crd.bc.ca/wastewater/lwmp/index.htm, Chapter 11, "Harbours Environmental Action," p. 1.

72 For example, see CRD *Liquid Waste Management Plan* at Chapter 11, p. 2: "Current regulations are more stringent, however contaminants continue to enter the harbours through storm drains, from boating activities and from shoreline industries." See http://www.crd.bc.ca/wastewater/lwmp/index.htm

73 The bay is located alongside a six-lane roadway, which serves as a major throughway into the City. The existing storm drain discharged storm flows from a 32.9- hectare (81.3 acre) area that was predominantly paved. Because of the impervious nature of the area, and the historical industrial uses of the Rock Bay region, the bay's ecology was being contaminated. See http://www.esemag.com/0904/victoria.html

74 http://griffiths.disted.camosun.bc.ca/100_pdf/discussion1_rockbay.pdf

75 Jason Youmans, "Flushing it Out: Could Stormwater Be the Real Culprit," *Monday Magazine*, 12/02/2009 http://mondaymag.com/articles/entry/flushing-it-out/

A Final Problem: Depletion of a Valuable Resource

Conventional Development and Stormwater Management: Breaks the Water Cycle and Wastes An Invaluable Resource

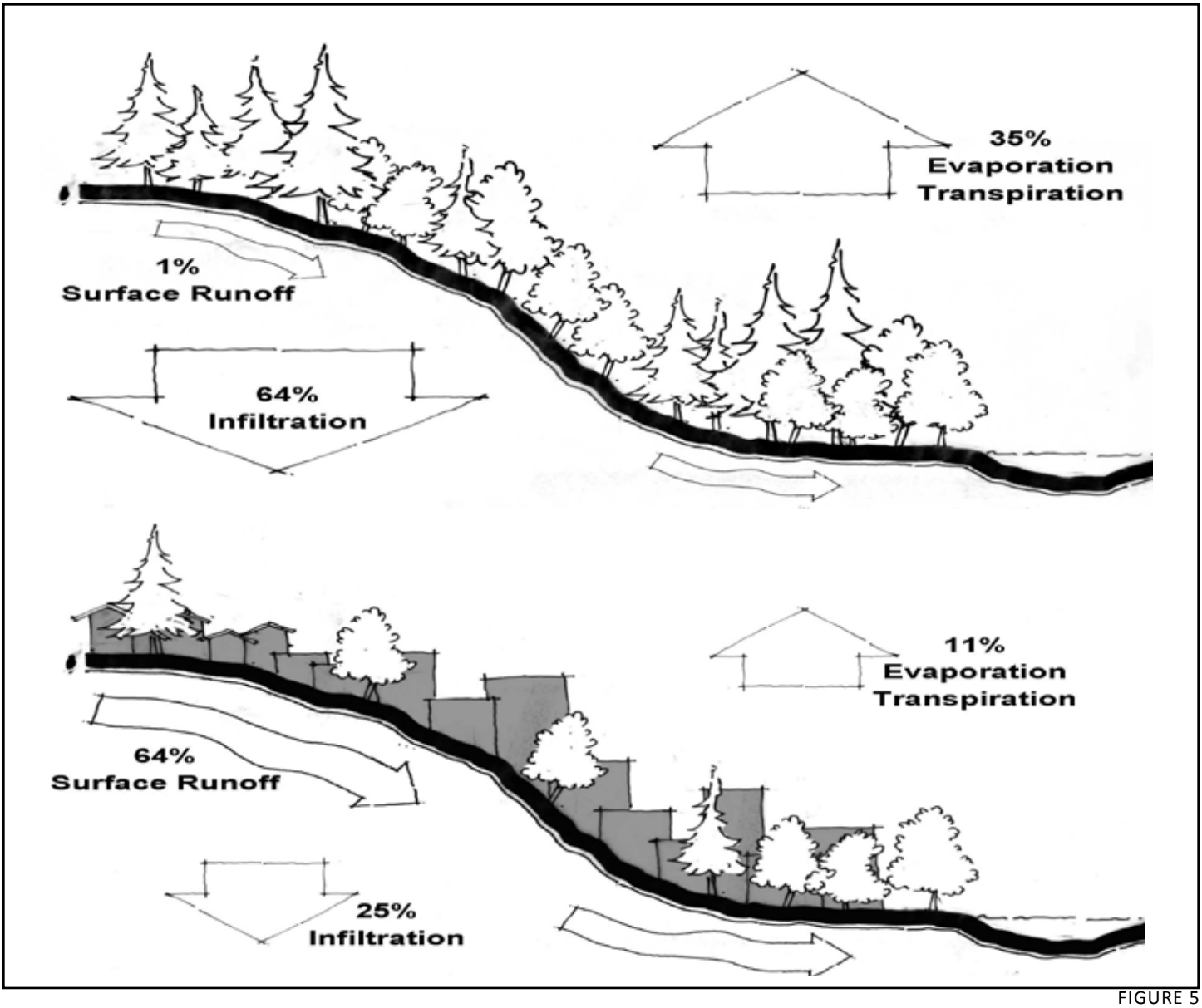

FIGURE 5

Credit: Portland Bureau of Environmental Services[76]

Conventional stormwater management can lead to unnecessary demand for new dams. Conventional management fails to recognize that rainwater is a valuable resource. Instead of using this resource efficiently, current practices waste it. Storm sewers transport quantities of rainwater away from properties—water which must eventually be replaced by piping water to those same properties from limited reservoir supplies.

76 The drawing in Figure 5 are from the "TABOR to the River" Powerpoint presentation of the Portland, Oregon Bureau of Environmental Services.

This mismanagement depletes local water supplies, undermines water conservation efforts and eventually leads to demand for additional expensive water supply infrastructure.

As illustrated in Figure 5, urban development with large areas of impervious roofs and pavement dramatically increases surface runoff. This breaks the natural water cycle in which rain usually infiltrates the soil, moistens it, and recharges groundwater supplies.

Conventional stormwater systems break the water cycle irrevocably by transporting the increased runoff away from the land as quickly as possible. Using an extensive network of gutters and ever-larger pipes and tunnels, stormwater systems immediately deliver masses of water to local water bodies.

Because storm sewers immediately pipe water off-site, the water no longer has a chance to infiltrate and moisturize the soil where it falls. It no longer replenishes groundwater supplies. This leaves both soil and groundwater depleted – which eventually requires residents to pipe greater quantities of water to the site in dry seasons.

Diverting the water off-site wastes a critical resource that could be used for water conservation as is being done in many places. For example:

> *In some countries, rainwater collected from roofs or other impermeable surfaces is a viable source of water for outdoor irrigation, and for many indoor uses such as laundry washing or toilet flushing…Rainwater harvesting systems for residential use are gaining acceptance in North America, and are already well-established in Australia, Europe and throughout the Middle East.*[77]

It has been estimated that rainwater harvesting can save up to 40 per cent of water indoors (for toilet flushing and washing clothes) and, along with Xeriscaping, can result in 50 per cent savings in outdoor water use.78 However, when storm sewers divert water away from homes and businesses, it is impossible to use that water onsite as a substitute for piped water from regional reservoirs.

Our waste of rainwater is a classic failure to implement Integrated Resource Management. The waste of the stormwater resource contributes to the eventual need to raise dams, increase reservoirs, and construct new water supply infrastructure—all of which are expensive and damage the environment.[79]

In contrast to conventional stormwater management, smart rainwater management techniques can help avoid those environmental and financial costs.

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77 Oliver Brandes et al, *Thinking Beyond Pipes and Pumps: Top 10 Ways Communities Can Save Water and Money*, POLIS Project on Ecological Governance, University of Victoria, 2006, p. 25. See http://www.polisproject.org/PDFs/ThinkingBeyond_eng_lowres.pdf.,.

78 Xeriscaping is environmental design, landscaping and use of native plants to minimize the need for water use. See Oliver Brandes et al, *Thinking Beyond Pipes and Pumps: Top 10 Ways Communities Can Save Water and Money*, POLIS Project on Ecological Governance, University of Victoria, 2006, p. 25. See http://www.polisproject.org/PDFs/ThinkingBeyond_eng_lowres.pdf.

79 Researchers in Australia found that using rainwater tanks in drier regions deferred infrastructure needs by 28 to 100 years with savings of $78 million in Lower Hunter and $47 million in the Central Coast. Wetter areas like Sydney or Brisbane yielded even greater water savings. The key to success in these examples was to provide water for outdoor uses such as garden watering, and also make rainwater available for toilet flushing, laundry and hot water. For further information on how smart water management can save infrastructure and money, see Oliver Brandes et al, *Thinking Beyond Pipes and Pumps: Top 10 Ways Communities Can Save Water and Money*, POLIS Project on Ecological Governance, University of Victoria, 2006. See http://www.polisproject.org/PDFs/ThinkingBeyond_eng_lowres.pdf.

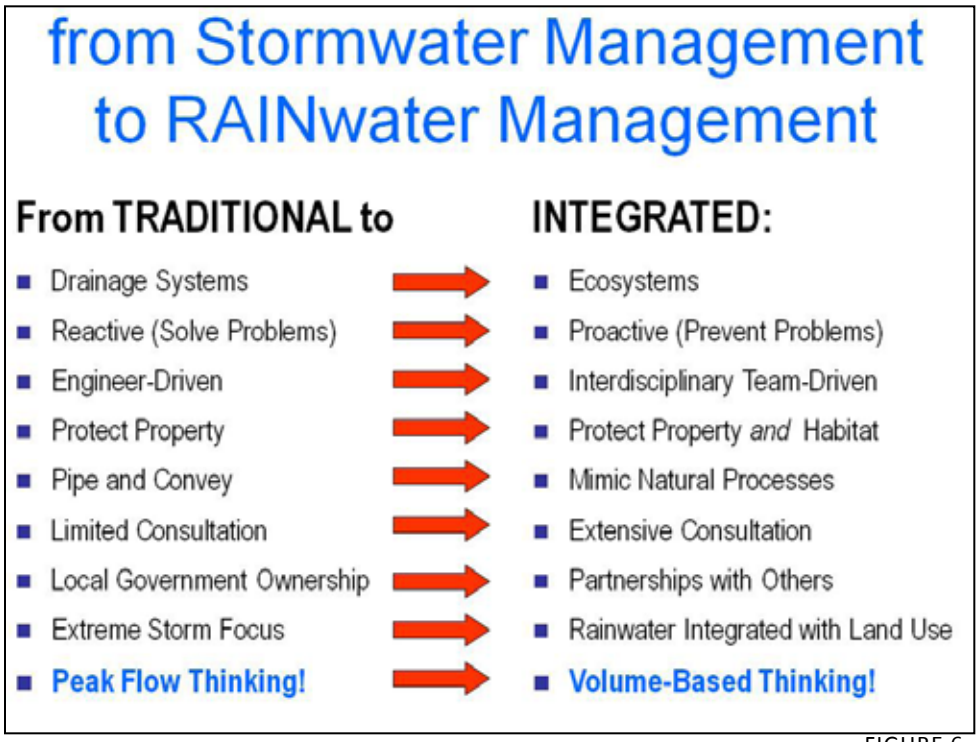
SOLUTIONS

WHAT ARE THE SOLUTIONS?

A Paradigm Shift – From Managing Stormwater to Managing Rainwater

Most of the problems discussed above can be dramatically reduced. However, to do so, we must replace our 19th century stormwater management techniques with modern rainwater management that works in harmony with natural water cycles. This report advocates Smart Management of rainwater. Smart Rainwater Management can not only restore the natural water cycle; it can avoid many economic and environmental costs of stormwater management.

What's in a name? Stormwater Management or Rainwater Management



Credit: Waterbucket.ca[80]

FIGURE 6

"Stormwater management' is the term traditionally used to describe managing rainfall runoff with conventional "storm-based" drainage facilities. Viewing runoff as a problem, it emphasizes engineered "cement and pipes" as the solution.

Modern science and engineering have evolved new ways to address rainfall events in a way that reflects natural water systems. "Rainwater management" describes this more ecological and holistic approach.[81] This approach is being embraced by growing numbers of scientists, engineers, designers, planners, developers, environmentalists and governments.

80 Graphic from Waterbucket.ca at: http://www.waterbucket.ca/rm/index.asp?sid=44&id=276&type=single

81 Greater Vancouver *Sewerage & Drainage District, Stormwater Source Control Guidelines 2005*, p.3, http://www.waterbucket.ca/rm/sites/wbcrm/documents/media/65.pdf .

Traditional "stormwater management" had a narrow focus, was event based, and concentrated on a handful of runoff events each year. In contrast, "rainwater management" looks at the big picture. It considers all the rainfall days of the year and takes a systems-based approach. It considers the entire landscape, soils, vegetation, and pervious and impervious cover. It takes into account ecosystem dynamics, complex hydrological relationships, and natural water cycles.

Then it designs a system that works with nature, not against her.

Rainwater management takes a preventative approach attempting to restore natural processes. It re-balances the natural water cycles that development disrupts. In doing so, it restores and protects the environment. As one leading rainwater expert has said:

> *Rainwater management is all about developing in a way that restores the function and value of trees, soil and open space in our communities.*[82]

Another puts it this way:

> *Rainwater management is about integration and an interdisciplinary approach that is landscape-based, and therefore goes well beyond the narrow engineering definition for conventional stormwater management.*[83]

As discussed below, we believe that adoption of this ecologically based approach to rainwater management is critical if we are to solve the region's rainwater runoff problems.

82 Tim Liptan, landscape architect who works as a stormwater specialist for the City of Portland's Bureau of Environmental Services. This quote is from a CAVI (Convening for Action on Vancouver Island) pamphlet found at http://www.waterbucket.ca/rm/sites/wbcrm/documents/media/89.pdf.

83 "Stormwater Management, Low Impact Development, Sustainable Drainage, Green Infrastructure, RAINwater Management...what is an appropriate term to use?" http://www.waterbucket.ca/rm/sites/wbcrm/documents/media/89.pdf

TWO FUNDAMENTAL SOLUTIONS

Solution One:
Implement Low Impact Development Practices

Clearly, conventional stormwater management has created environmental devastation. However, this transformation of rainfall into pollution and environmental harm is not inevitable. It is now quite practical to re-design our cities to dramatically reduce stormwater's toll. Smart land use planning, integrated watershed management and innovative green technologies and techniques can solve most of the problems discussed above.

By properly designing new development (and retrofitting old development), we can keep rainwater on the land where it falls – and dramatically reduce most of the negative impacts of runoff. Modern "Low Impact Development" (LID) techniques mimic the natural water cycle, by allowing water to percolate into the ground and gradually release into the watershed.

Even if a watershed is covered with a high percentage of impervious surface, the use of LID can reduce the *"effective impervious surface area"* by facilitating infiltration of water to the ground.

Photos (provided) of LID techniques (Clockwise starting from upper L) Railyards bioswale; green roof; Burnside Gorge extensive roof; cut curbs in Saanich

The table below outlines the different categories of LID techniques with specific examples under each heading.[84] Note that ideal LID begins with proper land use and watershed plans that respect natural water systems. Such proactive planning is then optimized by the use of innovative site-specific techniques and technologies. Altogether, this approach maintains and creates a Green Infrastructure to deal with rainwater.

Low Impact Development Practices – Creating Green Infrastructure

Table 6

Conservation Planning	• Cluster development • Open space preservation • Integrated watershed management plans
Conservation Designs	• Reducing impervious surface, through reduced pavement widths (streets, sidewalks) • Shared driveways • Reduced setbacks (shorter driveways) • Site fingerprinting during construction
Infiltration Practices	• Infiltration basins and trenches • Porous pavement • Disconnected downspouts • Rain gardens and other vegetated treatment systems
Runoff Storage Practices	• Parking lot, street, and sidewalk storage • Rain barrels and cisterns • Depressional storage in landscape islands and in tree, shrub, or turf depressions • Green roofs
Runoff Conveyance Practices	• Eliminating curbs and gutters • Creating grassed swales and grass-lined channels • Roughening surfaces • Creating long flow paths over landscaped areas • Installing smaller culverts, pipes, and inlets • Creating terraces and check dams • Integrate runoff into the built environment
Filtration Practices	• Bioretention/rain gardens • Vegetated swales • Vegetated filter strips/buffers
Low Impact Landscaping	• Planting native, drought-tolerant plants • Converting turf areas to shrubs and trees • Reforestation • Encouraging longer grass length • Planting wildflower meadows rather than turf along medians and in open space • Amending soil to improve infiltration

84 This table is adapted from the US Environmental Protection Agency Report, *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices* (December 2007) http://www.epa.gov/owow/nps/lid/costs07/documents/reducingstormwatercosts.pdf, pp. 3-5.

Photos (provided) of LID techniques (L to R) CRD intensive green roof; UVic infiltration pond.

The US Environmental Protection Agency vigorously promotes the implementation of LID practices:

> *A stormwater management approach and set of practices that can be used to reduce runoff and pollutant loadings by managing the runoff as close to its source(s) as possible. A set or system of small-scale practices, linked together on the site, is often used. LID approaches can be used to reduce the impacts of development and redevelopment activities on water resources. In the case of new development, LID is typically used to achieve or pursue the goal of maintaining or closely replicating the predevelopment hydrology of the site. In areas where development has already occurred, LID can be used as a retrofit practice to reduce runoff volumes, pollutant loadings, and the overall impacts of existing development on the affected receiving waters.*[85]
>
> *By means of infiltration, evapotranspiration, and reuse of rainwater, LID techniques manage water and water pollutants at the source and thereby prevent or reduce the impact of development on rivers, streams, lakes, coastal waters, and ground water.*[86]

LID offers other benefits, including expanding urban green spaces and recreational opportunities, improved aesthetics, reduced air pollution, reduced urban heat island effect, and recharged groundwater. It can also reduce inflow and infiltration (I & I) problems that overwhelm sewage facilities and lead to sewage overflow.

Because LID takes advantage of the absorption, evaporation and filtration services provided free of charge by Mother Nature, significant savings can be realized. Incorporating green infrastructure into the earliest stages of development can limit the need for larger-scale, more expensive stormwater controls. Indeed, the US EPA states: **"in the vast majority of cases, the EPA has found that implementing well-chosen LID practices saves money for developers, property owners, and communities while protecting and restoring water quality."**[87]

85 *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*, US Environmental Protection Agency Report, December 2007, p.2. http://www.epa.gov/owow/nps/lid/costs07/documents/reducingstormwatercosts.pdf

86 *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*, US Environmental Protection Agency Report, December 2007, p.iii. http://www.epa.gov/owow/nps/lid/costs07/documents/reducingstormwatercosts.pdf,

87 *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*, US Environmental Protection Agency Report, December, 2007, p.iii. http://www.epa.gov/owow/nps/lid/costs07/documents/reducingstormwatercosts.pdf.

The Economics of LID: New Development

Green infrastructure is generally less costly than conventional stormwater management, which requires construction of expensive pipes, tunnels, storage systems, stormwater ponds, and treatment plants. Storing and treating stormwater runoff is more costly than reducing the amount of stormwater generated at the source by minimizing impervious surfaces and maximizing infiltration.[88]

For example, studies in Maryland and Illinois showed that new residential developments using green infrastructure stormwater controls **saved $3,500 to $4,500 per lot** compared to conventional new development. The green developments reduced runoff by preserving natural vegetation, reducing overall site imperviousness, and installing green stormwater controls. These developments saved on stormwater infrastructure, paving and site preparation costs. As a bonus, developers typically get higher prices for more natural-looking lots – and get more lots to sell by eliminating land-consuming infrastructure.[89]

The Economics of LID: Existing Development

Although some small-scale retrofit green infrastructure projects can be more expensive than conventional approaches, green infrastructure is generally cost-effective when incorporated into larger redevelopment projects or when major infrastructural improvements are needed as the green infrastructure costs are often minimized relative to the scope and cost of the overall project.[90]

For example:

- Analysis conducted by the city of **Vancouver** indicates that retrofitting green infrastructure into locations with existing conventional stormwater controls will cost only marginally more than rehabilitating the conventional system, but introducing green infrastructure into new development will cost less.[91]

Although green infrastructure may sometimes be more expensive, many municipalities believe that the additional benefits of green controls—including the creation of more aesthetic city space and the significant reduction in water pollution—justify the added cost. In addition, green infrastructure can be incrementally introduced into urban environments, allowing the costs to be incurred over a longer period of time.[92]

- In 2009, the **City of Philadelphia** commissioned a study to compare traditional stormwater management techniques to an LID approach, using a "triple bottom line" analysis. The study monetized the benefits from increased recreational opportunities, improved aesthetics/property value, reduction in heat stress mortality, water quality/aquatic habitat enhancement, and other social, environmental and economic benefits associated with each approach. The results were startling: $122 million in benefits were expected to result from the traditional approach (cumulative through 2049), while the LID option was expected to yield benefits of $2,846 million. In other words, the LID approach economically outperformed the traditional infrastructure by an order of 23 to 1![93] As will be discussed later, Philadelphia is pursuing

88 Christopher Kloss & Crystal Calarusse, *Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combine Sewer Overflows*, Natural Resources Defence Council, June 2006, Chapter 4 "Economic Benefits of Green Solutions."
89 Kloss & Calarusse, *Rooftops to Rivers*, Chapter 4, p.12.
90 Liat Podolsky and Dr. Elaine MacDonald, *Green cities, great lakes: using green infrastructure to reduce combined sewer overflows*, Ecojustice, August 2008, p.24 online: http://www.ecojustice.ca/publications/reports/the-green-infrastructure-report.
91 Kloss & Calarusse, *Rooftops to Rivers*, Chapter 4, p.12.
92 Kloss & Calarusse, *Rooftops to Rivers*, Chapter 4, p.12.
93 Stratus Consulting, *A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds*, conducted for the Office of Watersheds, City of Philadelphia Water Department, August 24, 2009 at 5-5. The triple bottom line assessment measured benefits minus external costs (costs outside the "traditional" expenses of constructing and operating infrastructure) (3-1, 3-2). The "traditional" model used in this study was based on a system of storage pipes effectively 30 feet in diameter (5-1). The LID model used assumed managing runoff from 50 per cent of Philadelphia's impervious surfaces through green infrastructure such as green roofs, vegetation, and permeable pavement (5-1 and S-1).

one of the most ambitious LID programs on the continent.

- **Seattle Public Utilities** estimated that by using LID techniques instead of traditional techniques (sidewalks, curbs, gutters, catch basins, etc), building costs can be reduced 24 to 45 per cent in street redesign projects.[94] Natural drainage systems also have broad public appeal and may increase the property values in the retrofitted neighbourhoods.[95]

- The **City of Bellingham, Washington** estimates that it reduced costs by 75-80 per cent by constructing bioretention rather than in-ground vault systems in two parking areas.[96]

- Through the large-scale integration of LID techniques and targeted pipe replacement and repairs in its Brooklyn Creek Basin project, **Portland's Bureau of Environmental Services** will save more than $58 million. The total price tag will be 40 per cent less than the cost of traditional grey water infrastructure solutions.[97]

- **Johnson County, Kansas**, saved $120 million on stormwater controls by setting aside $600,000 worth of riparian greenways.[98]

94 *Low Impact Development: How Can We Protect Puget Sound as We Grow?* Puget Sound Action Team. See: http://www.psparchives.com/publications/our_work/stormwater/lid/lid_brochure/lid_brochure06_8.5x11.pdf

95 *Using Rainwater to Grow Liveable Communities*, Water Environment Research Foundation http://www.werf.org/livablecommunities/studies_sea_wa.htm.

96 Low Impact Development: How Can We Protect Puget Sound as We Grow? Puget Sound Action Team.

97 Attachment from Dan Vizzini, Policy, Legislative and Intergovernmental Affairs Specialist, Office of the Director of Environmental Services, City of Portland, Oregon.

98 Calvin Sandborn, *Green Space and Growth: Conserving Natural Areas in BC Communities*, West Coast Environmental Law Association, p. 44, citing Healing America's Cities, Trust for Public Lands, San Francisco,

Comparison of Monetized Financial, Social and Environmental Benefits from Stormwater Management Techniques in Philadelphia

Expected Benefits under Traditional (pipe) Stormwater Management	$
Expected Benefits under LID Approach (50%)	$$$$$$$$$$ $$$$$$$$$$ $$$
One "$" = $120 Million	

Conclusion?

LID Approach =

FIGURE 7

British Columbia: An Emerging Leader in Low Impact Development

British Columbia has become a North American leader in designing Green City rainwater management. BC communities are beginning to devise watershed management strategies that incorporate LID practices across the urban landscape. In fact, BC planners, engineers, designers, landscape architects, and developers are at the leading edge of implementing practical LID practices.

In partnership with others, the Province has initiated the *Water Sustainability Action Plan* which encourages local governments to implement LID, as does *Living Water Smart: BC's Water Plan*. The Province has also produced a *Stormwater Planning Guidebook*, and collaborated with others[99] to create a website (**Waterbucket.ca**) and the *Water Balance Model* to assist those implementing Low Impact Development.[100] [See Table 8]

1994, pp. 14-15.

99 Including government agencies, the BC Water and Waste Association, businesses and NGOs.

100 Information about the *Water Balance Model* is found at: http://beta.waterbalance.ca/index.asp?sid=16&id=17&type=single. See *Stormwater Planning: A Guidebook for British Columbia*, which introduces and orients local governments towards addressing stormwater management in a progressive way. See: http://www.env.gov.bc.ca/epd/epdpa/mpp/stormwater/stormwater.html

Waterbucket.ca

The waterbucket.ca website is the communications site for the Water Sustainability Action Plan. Waterbucket.ca provides important information on how LID and other water conservation measures can be implemented. The website is designed to provide this information to elected officials, government agencies, water utilities, water suppliers and managers. However, the website has a wealth of information on the topic and is of keen interest to developers who want to implement LID as well as to all other water users—domestic, industrial, commercial and agricultural.

The website:

- highlights conservation success stories;
- tracks progress and trends throughout the province;
- identifies gaps, barriers, and opportunities for improved conservation; and
- outlines further actions needed by public, private, and volunteer sectors.[101]

Waterbucket.ca is a partnership initiative led by the Water Sustainability Committee of the BC Water & Waste Association. The site is stand-alone, but is hosted by and integrated with the Stewardship Centre for BC website. The Centre is part of a national coalition of government and non-government organizations that functions under the Stewardship Canada umbrella.

The WaterBucket Website Partnership has representation from provincial ministries, federal agencies, Crown corporations, non-government associations and the private sector.

TABLE 7

101 See "About this site" http://www.waterbucket.ca/.

The Water Balance Model: A tool for designing with nature

In 2002, an Inter-Governmental Partnership was formed to develop the web-based Water Balance Model for British Columbia (http://waterbalance.ca) as an extension of the provincial *Stormwater Guidebook*.[102]

The Model provides an important technical tool for those implementing LID development. It provides an easy-to-use tool so that practitioners can easily calculate annual runoff volumes under different combinations of building coverage, rainfall, soil type and depth, tree canopy coverage, and source controls.

West Coast Environmental Law Association lawyer Susan Rutherford describes the importance of this tool:

The Water Balance Model is greatly facilitating greener approaches to management of stormwater, by incorporating known science into an interactive tool that allows local governments to predict the "water balance" consequences of one kind of infrastructure versus another. This bank of knowledge is also growing: research is now being conducted by the University of British Columbia and District of North Vancouver on the rainfall interception of single trees and small stands in urban environments.[103]

TABLE 8

102 Begun as an inter-agency technical committee of the GVRD, it quickly expanded to become a provincial group with municipal representation from four regions.

103 Susan Rutherford, *The Green Infrastructure Guide: Issues, Implementation Strategies and Success Stories*, West Coast Environmental Law, 2007, p. 71, online: http://www.wcel.org/sites/default/files/publications/The%20Green%20Infrastructure%20Guide%20-%20Issues,%20Implementation%20Strategies,%20and%20Success%20Stories.pdf,.

Many BC communities are implementing Low Impact Development. Integrated stormwater management planning that promotes the use of LID is in place in Metro Vancouver. LID practices have been widely proven in the field—from Kelowna to Chilliwack, from Nanaimo to Penticton, from Saanich to Greater Vancouver.

For example, 19 local governments and Metro Vancouver have joined the Water Balance Model partnership, which promotes LID practices.[104] And momentum is rapidly building to implement LID more broadly in BC communities. A long list of success stories and LID-related resources are found at the communications site for the Water Sustainability Action Plan, waterbucket.ca.[105]

In the Capital Region, a number of successful LID projects have already proven the practicality of this approach. A variety of LID techniques are currently in place, including green roofs, living walls, rain gardens, permeable pavement, bioswales, erosion control, etc.[106]

For example, the City of Victoria, Saanich, Oak Bay, Langford, View Royal and the University of Victoria are all taking important first steps to implement LID schemes. For a virtual tour of the many exciting rainwater management projects that have already been carried out in the Capital Region, see: http://www.waterbucket.ca/rm/?sid=107&id=503&type=single.

Above: Photos (provided) of Crown Street. Opposite page: Willowbrook project photo (from website).

A Vancouver Example: Designing a Street That Protects Fish

Vancouver's **Crown Street** has become the city's first Sustainable Streetscape, an innovative approach to residential street design and rainwater management. The design helps to integrate transportation into an environmentally sensitive setting.

104 Local governments that have become partners in the Water Balance model partnership include Central Saanich, Town of Comox, Corp of Delta, City of Courtenay, City of New Westminster, City of Chilliwack, District of North Vancouver, City of North Vancouver, City of Abbotsford, City of Coquitlam, District of Highlands, City of Vancouver, Township of Langley, West Vancouver, Cowichan Valley Regional District, District of Metchosin, Maple Ridge, City of Kelowna, City of Surrey, and Metro Vancouver.

105 http://www.waterbucket.ca/ Waterbucket.ca is a partnership initiative led by the Water Sustainability Committee of the BC Water & Waste Association, with representation from provincial ministries, federal agencies, Crown corporations, non-government associations and the private sector.

106 See descriptions at http://www.crd.bc.ca/watersheds/lid/index.htm

The Crown Street design features a narrow, meandering roadway flanked by vegetated swales and retention ponds. Pollutants are filtered by the native vegetation and rainwater runoff infiltrates into the ground naturally. The system is designed for a 10-year storm, with overflow directed into the adjacent park. As a result, the salmon-bearing streams are protected from rain-induced volume surges and the rainwater is filtered naturally, instead of the roadway runoff being directly discharged into the streams. Water quality in the retention ponds and creek discharged is monitored by the University of British Columbia, and will be compared with traditional neighbourhood street design which utilizes standard curb-and-gutter drainage.

The Sustainable Street demonstration project reduces the hydrological footprint of street construction and can serve as a design model for future street improvement projects.[107]

Capital Region Examples

Designing Rainwater Management to Restore Swan Creek

Cadillac Homes won the 2001 Saanich Environmental Award for its Swan Creek restoration project. The award recognized the developer's work in rehabilitating portions of Swan Creek where it runs through Cadillac's 35-home Willowbrook project on McKenzie Avenue.

According to the project's environmental consultant, Patrick Lucey of Aqua-Tex Scientific Consulting Ltd., the creek had deteriorated to a non-functioning state, which put the entire Swan Creek/Blenkinsop Creek watershed at risk.

Cadillac Homes responded by donating the land surrounding the creek as parkland then provided the funding and assistance needed to restore the creek. Its efforts have created a working equilibrium in the surrounding watershed not seen in two decades.

Ponds were engineered to take 100 per cent of the storm water from the neighbourhood, slow it down and naturally filter it before re-introducing it to the creek. Rocks, logs, flowers and plants such as bull rushes were strategically placed in each pond to help with the eventual return of spawning salmon and continuing regeneration of this small but important ecosystem.

107 From: http://www.waterbucket.ca/gi/?sid=144&id=65&type=single

Forty-five students from the University of Victoria, St. Michael's University School, the Pacific Christian School and volunteers from the Saanich Tree Appreciation Day spent weeks planting up to 40 different species of vegetation. This vegetation was natural to the shoreline before the creek became choked with blackberry bushes.

On many days the developer had more people planting onsite than were building houses. As the developer noted with some satisfaction:

> *We have again demonstrated that thoughtful development and environmental stewardship are a winning combination.*

Trent Street Rain Gardens Protect Bowker Creek

In a recent pilot project, the City of Victoria took a proactive approach to stormwater issues by constructing two new rain gardens (planted depressions that allow rainwater runoff to be absorbed) to protect Bowker Creek.[108]

Planted with hardy plants like grasses, rain gardens are designed to reduce the flow of rainwater and naturally filter out pollutants before the water enters natural water bodies. Rain gardens can play an important cleansing role in the water system by helping to ensure that stormwater pollutants -- such as oil, grease and dog feces, a major cause of health warnings at local beaches -- can be separated out or broken down by bacteria in the dirt.

Victoria's two new rain gardens are built on a 160-square metre property located on Trent Street and will reduce and treat stormwater before it enters Bowker Creek. The gardens have also been designed so that major oil spills will collect in a depressed area of the garden, where the oil can then be cleaned up rather than entering the creek.

According to Steven Fifield, a manager in the City of Victoria's Engineering Department, if the pilot garden is successful, the design will be used more widely. He says, "It will become one of the tools in our toolkit."[109]

Retrofitting the Old Island Highway to Protect Portage Inlet

The Town of View Royal's approach to the reconstruction of the Old Island Highway, part of the town's Transportation Master Plan, is a compelling example of local innovation in addressing stormwater.

Aiming to restore water quality in Portage Inlet—sometimes called "the jewel of Victoria"—the Town has developed a strategy to retrofit the Old Island Highway. The strategy integrates transportation, drainage and water quality objectives with specific rainwater management enhancements.

Rain gardens are a core element of the enhancement strategy. Much work will go into engaging local homeowner interest in rain gardens and ensuring homeowner "buy-in." It is hoped that widespread use of rain gardens will lead to significant and long-term improvements in reducing stormwater pollution.

108 City of Victoria Media Release, August 11, 2009.

109 Richard Watts, "Rain garden to protect Ocean," *Times Colonist*, August 12, 2009.

To facilitate homeowner interest in rain gardens, a portable rain garden, designed to be representative of a feature that could be created in someone's front yard or a parking lot has been constructed for show-and-tell purposes. As a live model, people will be able to see dirty water being cleansed as it flows through the rain garden. Further, homeowners fronting on roadways will be involved in the decision-making for rain garden plant selection.

"We believe this is the first step to generating the personal interest that will lead to homeowner commitment to undertake ongoing rain garden maintenance," says Emmet McCusker, Municipal Engineer. Indeed, developing community spirit and a sense of ownership around the rain gardens will be important to the longer-term goal of restoring the water quality in Portage Inlet.

As McCusker puts it, "We are talking in terms of a major shift in the way people think about their road frontage."[110]

Project Urban Rain Garden: Victoria West Elementary School

Project Urban Rain Garden was designed to connect inner city children with natural ecosystems, while making an impact on stormwater management issues. The initiative was a Leadership Victoria Community Action Project, carried out in partnership with Victoria West Elementary School.

The project, which students helped design, develop and maintain, converted a 300-square metre concrete school courtyard into a native plant rain garden. The rain garden is designed to take stormwater from an overhead walkway and discharge the water into a catchment area. The water is filtered and cleaned by the soil bed in the catchment and remains in the trench until enough clean water fills it. Once the trench has filled with clean water, the water is carried to the catch basin and discharged into the stormwater system. The native plants were chosen for their ability to withstand large amounts of water, their low maintenance requirements and their capabilities to adapt to local weather conditions.

Project Urban Rain Garden is a successful model of collaboration, shared leadership and community involvement in a sustainable ecological project. It has provided an excellent educational tool to students, showing them how they can make a positive contribution to environmental improvement.[111] The project also has a website that shares the concept with other students and communities.

Left page: Photos (provided) of rain gardens. Above: Rain gardens photos courtesy of Victoria West Elementary School.

110 Extracted from Waterbucket.ca

111 See the Website: http://www.urbanraingarden.ca/index.html

Saanich Municipal Hall Parking Lot: Permeable Pavement

Saanich Engineering Department used a permeable concrete mix over a deep gravel base for new parking spaces at the Saanich Municipal Hall. Permeable pavement has a much larger than usual void space with little or no "fines" material in the mix. This allows water to move quickly through the material to the soils below dramatically reducing runoff volumes, peak discharge and pollutant runoff levels.[112]

Above: Photos (provided) of permeable paving. Left: photos of bioswales at Pearkes Recreation Centre; Right page: University of Victoria LID examples.

Protecting Colquitz Creek at Pearkes Recreation Centre

The recent expansion of the Pearkes Recreation Centre complex included several rainwater management strategies to protect nearby Colquitz Creek. Innovations included bioswales, permeable pavement and underground stormwater storage. The attractive natural-looking bioswales have a deep granular base and are tied into the drainage system with under-drains. They are designed to slow the flow of water and remove silt and pollutants.

112 See: http://www.crd.bc.ca/watersheds/lid/parking.htm

Sidewalks and plaza areas are all made using permeable pavement on a deep granular base. The porous pavement allows the movement of water through it to the soil below reducing stormwater runoff and pollutant discharge. The front plaza stormwater detention chamber is an underground basin that helps to regulate water runoff rates. It temporarily stores excess runoff while discharging the water at a manageable rate to downstream watersheds.

The combination of these rainwater management strategies improves water quality, protects natural environments and habitats. The project shows that LID can be easily implemented in expansion and upgrade projects.[113]

113 See: http://www.crd.bc.ca/watersheds/LID/pearkes.htm

Case Study: The University of Victoria and Water-Centric Planning[114]

The University of Victoria (UVic) is a community of more than 25,000 people situated at the headwaters of Bowker Creek. UVic has pioneered low-impact development strategies focusing specifically on green buildings and compact growth strategies within a "water-centric" framework.

The 2003 campus planning process marked a significant turning point in achieving campus sustainable development:

> *Through leadership, partnership and collaboration, UVic has been able to transition from an incremental approach in planning and resource management to a much more holistic and integrated approach…This transformational experience resulted in a new vision for constructing water and energy efficient buildings in a built environment that respects the natural environment.*
>
> Sarah Webb, UVic Office of Campus Planning and Sustainability

The campus now houses a number of different LEED[115] buildings and green roofs and has been working on comprehensive water management over the past decade. Its successes include the integrated rainwater/stormwater management plan, the green building program, and the treated wastewater program, which have helped reduce both potable water consumption and rainwater leaving campus -- even though the campus has grown considerably.

Noting that the UVic Plan could provide a useful template for other watershed renewal initiatives, Jody Watson, Harbours and Watersheds Coordinator with the CRD states:

> *UVic is applying water-centric planning across the campus, and is leading by example in doing business differently in the Bowker Creek watershed. The UVic experience can inform how three partner municipalities guide watershed redevelopment.*[116]

114 Extracted from Waterbucket.ca

115 LEED is the Leadership in Energy and Environmental Design (LEED) Green Building Rating.

116 Note that Jody Watson is also Chair of the Bowker Creek Initiative,

A 100-Year LID Plan for an Entire Watershed: Bowker Creek

It is widely acknowledged that the key to improving rainwater management is to plan for an entire watershed at a time—and develop a strategy for how to manage all the water in the watershed.[117] The Bowker Creek Initiative (BCI) is developing such a strategy for Bowker Creek.

Over a decade ago, the Friends of Bowker Creek, a community stewardship group, began to lobby for restoration of the creek. Their efforts have become a classic example of how effective a citizen initiative can be when governments are receptive and collaborative.

Today the Bowker Creek Initiative is a partnership of individuals, organizations and governments working to address the problems of pollution, flooding, and habitat degradation in the watershed. The Initiative has developed a *Bowker Creek Blueprint: A 100-year action plan to restore the Bowker Creek Watershed*. The Blueprint provides Saanich, Victoria and Oak Bay, the Capital Regional District, the community and other land stewards with information and guidance to manage and restore the watershed and creek corridor over the next 50 to 100 years.

Creek restoration opportunities typically arise with little warning, and the Blueprint ensures the partners are ready to seize those opportunities. For example, opportunities to improve stormwater management come up when buildings wear out or population density increases—leading to redevelopment of individual lots. With re-development comes opportunity for creek restoration or creek day-lighting (opening buried sections).

However, since restoration opportunities arise unpredictably on a lot-by-lot basis over time, a long-term plan and policies need to be in place. Otherwise, unique opportunities can be lost. But with the Blueprint

117 See, for example, the *BC Stormwater Planning Guidebook* produced by the BC Water and Waste Association and the Comox Valley's Integrated Watershed Approach to Settlement. Also see the US Environmental Protection Agency publication *Why Watersheds?*, http://www.epa.gov/owow/watershed/why.html, and the Portland Watershed Management Plan http://www.portlandonline.com/bes/index.cfm?c=38965 which discuss the importance of a watershed-wide approach. EPA's requirement for watershed-based water management dates back to 1996. Portland's Bureau of Environmental Services first organized and adopted their own form of watershed management principles in 1999-2000 with the development of their Clean River Plan. Five years later, Portland published the *Portland Watershed Management Plan*, a document that brings into full form Portland's commitment to integrated, multi-purpose and sustainable actions to restore and maintain the health of Portland's watershed. Thanks to Dan Vizzini, Policy, Legislative and Intergovernmental Affairs Specialist, Office of the Director of Environmental Services, Portland, Oregon, who works on Portland's leading strategy for managing rainwater management.

in place, opportunities for major improvements can be discerned and immediately seized as they come up. Positive changes can happen incrementally.

The proposed re-development at Oak Bay High School highlights the need for such a long-term plan. Currently, Bowker Creek runs along the edge of the property in a narrow, deep ditch with a concrete bottom. This ditched section at Oak Bay High school is typical—when most buildings in the watershed were constructed, creeks were not valued like they are today.

Instead, native vegetation was removed, the floodplain was filled for development, and the channel was deepened and straightened to move water more quickly off the land. Creek banks eroded, habitat was destroyed, and flood and pollution problems increased.

However, guided by the Blueprint, the construction of the new school gives us the chance to undo these mistakes of the past. It may be possible now to use LID to reduce runoff from the campus, reduce flooding and erosion, and leave a wider creek corridor with a more natural stream channel and native streamside plants and trees. This will add to the green space and aesthetics of an emerging regional greenway.

The Bowker Creek Blueprint calls for key activities and policies, including:

- Incorporate the goals of restoring Bowker Creek into municipal plans;
- Adopt effective impervious area requirements for new development;
- Use creek-friendly management approaches wherever possible;
- Construct infiltration and retention features in boulevards;
- Complete a pilot project to locate and build a demonstration rainwater infiltration/retention structure in each municipality;
- Identify current and future opportunities for creek restoration, rainwater infiltration and/or greenway development
- Plant trees and shrubs and protect existing trees;
- Purchase and protect key land in the watershed; and
- Incorporate proposed greenways into land use planning.[118]

This visionary 100-year Blueprint is broadly supported by the citizens and governments that have created it. The Bowker Creek Initiative is an inspiring model for reform of watershed rainwater management. Where possible, it should be emulated in watersheds across the region.

118 See the Bowker Creek Blueprint, http://www.bowkercreekinitiative.ca/ Note that the Blueprint is now a final draft document, but has not been formally authorized by the Municipal Councils yet.

Recommendation:

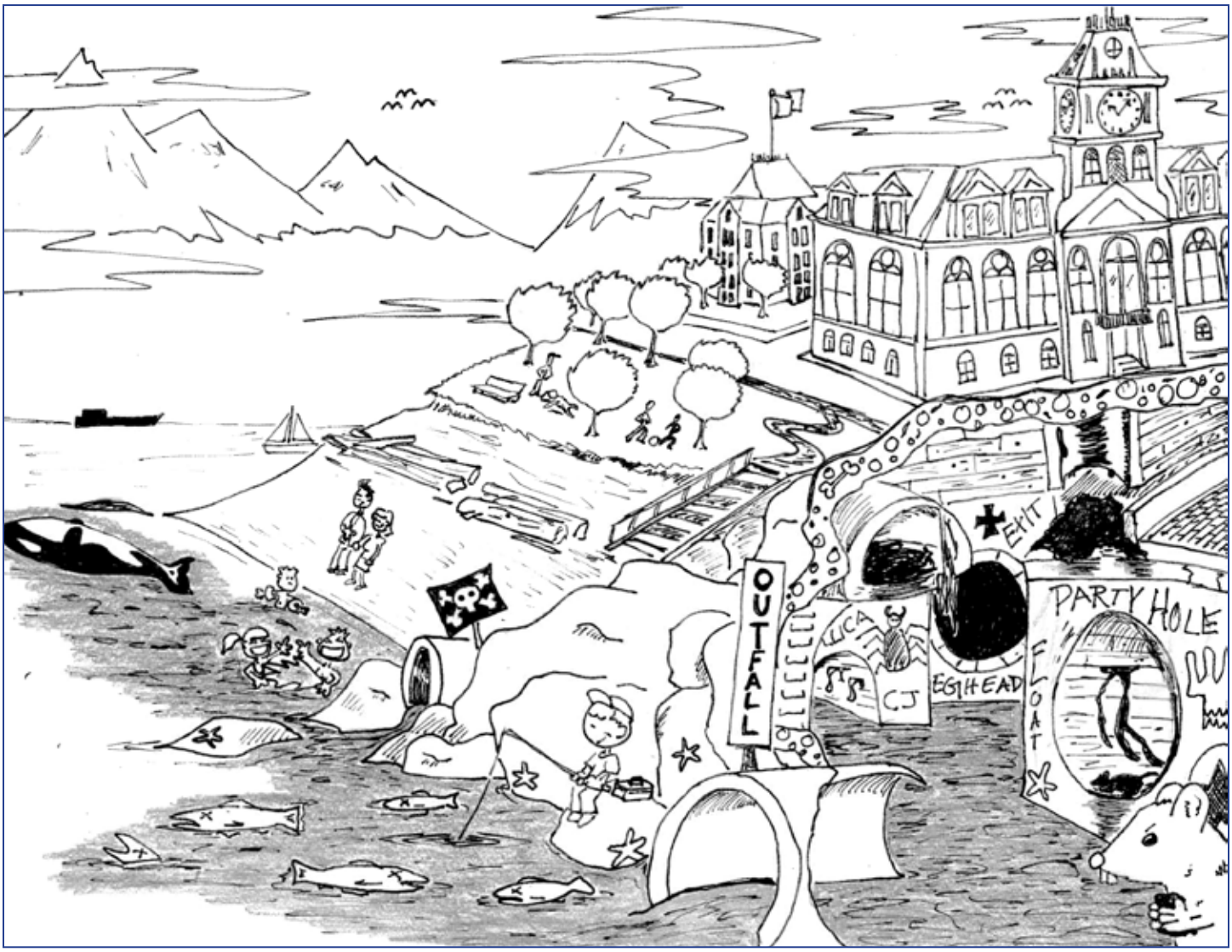
Reform the policies and legislation of all governments in the region to ensure the implementation of Low Impact Development (green infrastructure) across the landscape.

Recommendation:

Form collaborative partnerships with stewardship groups, developers, homeowners, planners, engineers and other experts, and all levels of government to implement Low Impact Development across the landscape.

Solution Two:
Fix Obsolete Infrastructure, and Pay for It

FIGURE 8



Human fecal material ends up on beaches largely because of our broken and obsolete drainage infrastructure. The sewage/stormwater infrastructure—particularly in older municipalities like Victoria, Esquimalt, View Royal, Saanich and Oak Bay—is outdated and leads to periodic sewage overflow of sewage into the stormwater system, and then into water bodies and onto beaches.

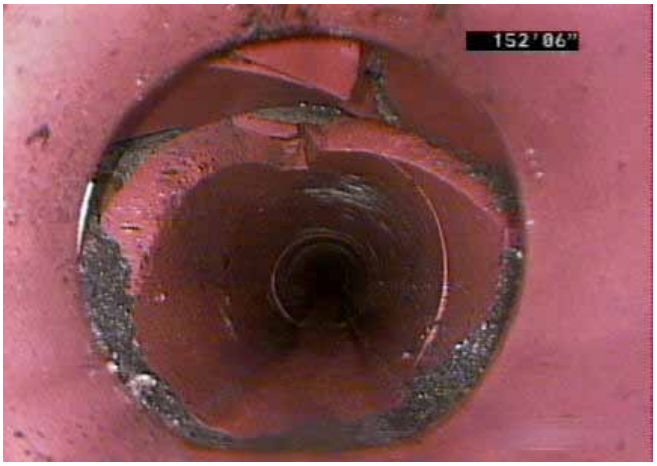
A recent CRD report linked obsolete infrastructure to the recent increase in stormwater discharges that are of "high public health concern":

> *The recent increase in high ratings has occurred primarily in the three municipalities of Esquimalt, Oak Bay and Victoria. These increases do not indicate a lack of effort on the part of these municipalities to identify and repair problems. What they do indicate is the larger infrastructure issues that these*

municipalities have to deal with. These municipalities have some of the oldest sewer and stormwater infrastructure in the region. ***Issues such as aging, collapsed and cracked pipes, old construction practices such as inadequate separation of sewer and storm sewer pipes, and cross-connections all can cause sewage contamination of stormwater.***[119]

The old infrastructure includes vestiges of the 19th century, including pipes and tunnels actually made of wood and brick, as well as vitreous clay, asbestos pipe, and cast iron. In some cases, sewage and stormwater run in the same pipe or tunnel, and in other cases the sewage is not adequately separated from the stormwater. All too often this old infrastructure allows sewage to intermingle with stormwater and be discharged out of storm sewer outlets. In addition, stormwater infiltrates into sewer pipes and overwhelms sewage facilities, causing facilities to release overflow contaminated waters. The Oak Bay Combined Sewer pipe is an outmoded structure designed to carry both sanitary sewage and stormwater runoff, and it releases more sewage to the near-shore. Throughout the region, numerous buildings have improperly connected their sanitary sewage to the storm drainage system.

These infrastructure problems result from over a century of neglect. Monies for drainage systems come from general property taxes and seldom have gotten the priority that they require. Since drainage



119 *2007 Stormwater Quality Annual Report (Core Area)* http://www.crd.bc.ca/watersheds/documents/2007CoreStormwaterReport.pdf., p. ii.

Top to bottom: Broken pipe; wooden pipe; wooden pipe and concrete connection; Old Victoria tunnel. Sewage runs on one side of the short wall and storm water on the other. During heavy rains they run together, and sewage is released from stormwater outfalls.

systems and their problems are underground and largely invisible, they have been last in line for public funding. When political funding decisions are made, higher-profile and more politically popular initiatives consistently out-compete infrastructure. As a result, stormwater infrastructure is crumbling.

Drainage is not only last in line for funding—it's first in line to be cut during hard times. For example, regional funding for monitoring stormwater problems has been eliminated recently even though many stormwater pollution problems have gotten significantly worse in recent years.

Across North America it is now recognized that proper funding of stormwater infrastructure requires a dedicated budget for such infrastructure. It requires a "User Pay" rainwater utility approach. Cities are moving away from funding drainage out of property taxes and are establishing separate utility charges similar to the utility charges now imposed for water and sewer services by CRD municipalities.

After all, governments charge to pipe water to your house. Why shouldn't they charge for the cost of piping it away?

Hundreds of local governments in the United States have established rainwater (drainage) utilities. In the state of Florida alone, more than 100 cities and counties have established a rainwater/drainage utility with utility charges.[120]

Though the stormwater utility idea is new in Canada, a growing number of Canadian municipalities have adopted the utility structure or are now considering it. Edmonton, Surrey, Regina, Saskatoon, Calgary, the Ontario cities of London, St. Thomas and Aurora, and the District of Maple Ridge have all established rainwater utilities. Kitchener and Waterloo, neighbouring cities in Southern Ontario, are in the late stages of developing a proposal for a shared rainwater utility. (See Table 9)

For example, Edmonton has shifted funding for its drainage system from property taxes to a new utility structure. Property owners are charged a fee based on a formula related to land area, permeability and zoning. The charge appears on the utility bill.[121]

120 See http://www.florida-stormwater.org/manual/chapter1/1-2.html

121 See *Final Report on Draft Liquid Waste Management Plan*, Metro Vancouver Liquid Waste Management Plan Reference Panel. See http://www.waterbucket.ca/cfa/sites/wbccfa/documents/media/268.pdf.

Citing the Edmonton experience, Metro Vancouver's independent expert Liquid Waste Management Reference Panel has recommended that Metro Vancouver establish a Rainwater Utility Charge. The Panel noted that this "User Pay" approach can not only fund infrastructure, but also reduce long term demands on the system. The Panel recommended that:

> *rate-setting…adopt and implement the principles of 'polluter pay' and equity to provide municipalities (and homeowners and businesses) with an incentive to reduce their wet-weather flow contributions to the regional conveyance and treatment system.*[122]

Many cities now motivate residents to use LID by reducing utility charges for those who reduce runoff.

How Would a Rainwater Utility Charge Work?

A rainwater utility charge would be a regional or local public service charge on property owners based on the measured area of impervious ground cover on their lots (e.g. parking lots, driveways, building rooftops). The extent of a property's impervious ground cover is a good rough indicator of how much runoff the property contributes to the municipal storm sewers.

How much would a utility charge cost property owners?

In the US, the average rainwater utility billing unit is generally in the range of two to six dollars per residential unit per month. Canadian utility rates appear to conform to this range as well,[123] although Surrey's Drainage Parcel Fee was $161 per lot in 2009, just over $13 per month. Charges could be significant in areas with a large backlog of infrastructure needs.

Rainwater utility charges can be introduced in a manner that is revenue-neutral to the municipality. For example, the Waterloo proposal would reduce the property tax levy by the corresponding rainwater rate revenue in each year of the recommended phase-in period.

Reasons Why this is a Superior Method of Delivering Rainwater Services:

Dedicated funding: Currently, drainage systems compete each year for funding against more visible programs like fire, police, public transit, libraries, social and cultural programs, etc. A utility charge provides a line item on the annual budget dedicated exclusively to rainwater - and ensures this vital service gets the funding it needs.

A modest utility charge on properties should raise sufficient money to deal with long-neglected infrastructure. In addition, the utility charge could support the innovative regional Rainwater Commission (discussed below), which can ensure implementation of 21st century rainwater management.

122 See Recommendation 15, *Final Report on Draft Liquid Waste Management Plan*, Metro Vancouver Liquid Waste Management Plan Reference Panel. See http://www.waterbucket.ca/cfa/sites/wbccfa/documents/media/268.pdf. The Liquid Waste Management Reference Panel appointed by Metro Vancouver provided an independent review and recommendations on the Liquid Waste Management Plan update. The Panel is a community advisory group that brings expert knowledge and relevant experience in liquid waste/resource and rainwater management. It provided a blend of technical, legal, scientific, academic, business, industry and community perspectives and values.

123 As of August, Denise McGoldrick of the City of Waterloo informed us that their proposed rates were $4.40 per month for an average sized residential property. An official with the City of Edmonton stated that the average residential property owner pays roughly $4.50 per month. The City of Surrey's charge is reported to be $55/year by the BC Guidebook.

Fortuitously, this modern management approach will ultimately save governments substantial sums by reducing long-term infrastructure costs.[124] It will not only protect the environment and augment the amount of urban green space – it also economically outperforms traditional stormwater management by a ratio of 23 to 1 according to a City of Philadelphia study.[125]

Self-sustaining funding: Under a utility structure, the amount of revenue for rainwater management can be predicted for years to come. As a result, real long-term planning can take place. This enables scheduling and implementation of (a) capital and maintenance programs over multi-year periods and (b) long-term proactive measures.

An incentive to protect the environment: The rainwater utility can create nuanced fee structures that reduce charges for those who reduce runoff (e.g., reduce pavement, disconnect downspouts, create a rain garden). This motivates them to provide on-site controls to reduce rainwater runoff and pollutant loads.[126]

Such a system of charges and offsetting credits can create an incentive to reduce overall drainage and move our region towards smart, 21st century rainwater management. Ultimately, the resulting reduction in drainage demand will save local governments money on infrastructure. (See discussion above.)

Greater fairness: implementing the "User Pays" principle: When rainwater services are funded from general tax revenue, the amount property owners pay is based on the assessed property value. But assessed value is not necessarily linked to how much one uses the rainwater system. By adopting a user-pay approach, a rainwater utility charge allows the municipality to bill its ratepayers more fairly. If the utility charge is based on the percentage of impervious land cover on a lot, those who contribute more to stormwater problems pay more—and those who contribute less to the problem save money.

Charging tax-exempt properties: When rainwater services are funded through property taxes, churches, libraries, hospitals, governments, and other tax exempt owners do not pay for these services -- regardless of how much they use them. A utility charge could provide a mechanism to ensure these properties pay for the utility services they actually consume. Like other property owners, they could be offered the opportunity to avoid charges by dealing with rainwater onsite.

Implementing the Polluter Pays Principle: Canada and other developed countries have adopted the "Polluter Pays Principle."

> *Whoever causes environmental degradation or resource depletion should bear the full cost.*[127]

A rainwater utility is in keeping with this fundamental principle. By charging more to those

124 According to the EPA, "In the vast majority of cases, the US Environmental Protection Agency (EPA) has found that implementing well-chosen Low Impact Development (LID) practices saves money for developers, property owners, and communities while protecting and restoring water quality." *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*, US EPA, December, 2007, p. iii. See http://www.epa.gov/owow/nps/lid/costs07/documents/reducingstormwatercosts.pdf

125 Stratus Consulting, *A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds*, conducted for the Office of Watersheds, City of Philadelphia Water Department, August 24, 2009.

126 Examples of jurisdictions doing this (such as Portland, Oregon) are provided below. Although such incentives may or may not be offered to residential property owners, revenue from the rainwater utility can be used to support other incentive programs such as compensation for downspout disconnection.

127 For example, *Canada's Green Plan for a Healthy Environment* stated this principle succinctly: "*To encourage efficient use of resources, we must adopt the rule that the polluter or user pays. Whoever causes environmental degradation or resource depletion should bear the full cost.*" Government of Canada, *Canada's Green Plan for a Healthy Environment* (Ottawa: Ministry of Supply and Services, 1990) p. 16. The Province of BC adopted it in their *Land Use Charter* in the mid-1990s, and the principle appears in the *Rio Accord* that Canada signed and ratified.

who create excess runoff, and less to those who reduce runoff, it ensures that polluters pay—and that clean actors benefit.

Recommendation: Shift drainage system financing from property taxes to Rainwater Utility Charges, with fees based on actual use – to motivate residents to manage rainwater onsite and reduce use of storm sewers.

See the discussion later in this submission regarding the specific local infrastructure upgrades that need to be funded—and the comprehensive LID programs that need to be implemented.

Recommendation: Use Rainwater Utility Charges to finance necessary infrastructure upgrades, comprehensive LID programs, and the proposed Regional Rainwater Strategy and Commission discussed below.

A rainwater utility charge could be implemented by each individual local government; however it may be desirable to establish one regional utility charge administered by the Rainwater Commission that is recommended below. If individual municipalities set up their own utilities, charges should still flow to the Regional Rainwater Commission.

An example: Kitchener-Waterloo's Proposed Stormwater Utility Charge

Under a current Kitchener-Waterloo proposal, residential properties would pay one of three rates, depending on if the property is small, medium or large in area. Medium residential properties pay a base rate, while small and large properties pay 0.6 and 1.6 times the base rate, respectively.

Industrial, commercial and institutional (ICI) properties will be assessed individually to determine the measured area of impervious ground cover. The property will then be charged a multiple of the base rate for residential properties according to the factor by which its measured area of impervious ground cover exceeds that of a medium-sized residential property. ICI properties are to receive a rebate of up to 50 per cent of their rainwater utility charge if they provide on-site controls to reduce rainwater runoff and pollutant loads from their properties.[128]

The proposal would reduce the property tax levy by an amount equal to the new revenue raised by the charge.

The proposal specifically includes properties that are exempt from property tax.

TABLE9

128 This particular proposal did not offer a rebate program for residential properties, because of concerns about administrative costs.

TOWARDS A RAINWATER MANAGEMENT STRATEGY

The Legal Barrier to a Strategic Solution

Before we can create an effective strategy to deal with rainwater runoff, we must first address a significant barrier – the fragmented legal jurisdiction over rainwater.

See Appendix A "Legislative Context: Jurisdiction over Rainwater" for background on the legal jurisdiction of local governments over rainwater.

TABLE 10

The Problem of Fragmented Jurisdiction over Rainwater Runoff

Modern rainwater management techniques that solve stormwater pollution and runoff problems are now well established. We know exactly how to improve rainwater management effectively—and how to do it cost-effectively.

British Columbia governments, communities, developers, engineers, and other experts have been in the forefront of the "Rainwater Management Revolution." The Province has partnered with the BC Water and Waste Association and others to advance this transformation.[129] Federal agencies have also contributed to the Waterbucket.ca partnership and others.

Engineers in professional organizations like the BC Water and Waste Association are promoting LID. Conservation groups have also promoted LID in initiatives, such as the Green Bylaws Toolkit. Developers, such as Dockside Green and University of Victoria, are making great strides in moving towards smart management of rainwater. Finally, many local governments like Chilliwack and Metro Vancouver are leading the way.[130] Local governments in the Capital Region have also taken a lead in demonstrating the practicality of progressive rainwater management techniques.

However, experts agree that in order to move from destructive, narrowly focused "Stormwater Management" to beneficial "Rainwater Management," it is absolutely essential to deal comprehensively with the entire watershed, the entire landscape. You must be able to study the characteristics of the entire watershed, analyze those characteristics and devise a systems approach to the broad landscape. Integrated management of rainwater must address the complex interdependent dynamics of water, land, human activities, and aquatic and wildlife resources across a landscape. This cannot be done in a piecemeal fashion.[131]

129 Key Provincial initiatives in promoting this change have included the *Water Sustainability Action Plan* and *Living Water Smart: BC's Water Plan.*

130 For example, see GVRD/Metro Vancouver stormwater management materials, including the *Stormwater Source Control Design Guidelines, the Stormwater Best Management Practices Guide*, and other materials at: http://www.metrovancouver.org/services/wastewater/sources/Pages/StormwaterManagement.aspx

131 Personal communication with Dan Vizzini, City of Portland, Bureau of Environmental Services. For more discussion of the necessity to plan across entire watersheds, see the *BC Stormwater Planning Guidebook* produced by the BC Water and Waste Association and the US Environmental Protection Agency publication, *Why Watersheds?* http://www.epa.gov/owow/watershed/why.html..

A group of leading scientists made this same point to the Washington State Pollution Control Hearing Board, which quoted them in a recent decision:

> *We have well documented evidence that the impairment associated with stormwater runoff is primarily a land use problem, and that we cannot fully mitigate its effects if we approach it only site-by-site. We know that the problems must be addressed at a basin or landscape level…*[132]

If only portions of a watershed properly manage their water, you cannot achieve watershed integrity. ***For example, Bowker Creek won't be protected if Oak Bay takes environmental measures but the upstream municipalities of Victoria and Saanich fail to.***

The Capital Region's problem is that the same runoff may cross two or three municipal boundaries on its way to the ocean or a lake. There must be a way to consistently deal with all that trans-boundary water. We cannot have the necessary watershed-wide approach to rainwater runoff unless all municipalities act in concert.

While local governments can undertake a variety of supportive LID and funding activities under current jurisdiction (see Appendix A for a summary of jurisdiction in this area), the fragmented approach to stormwater management in this region is a major barrier to real reform. Neither the CRD nor its constituent municipalities have exclusive jurisdiction over rainwater (stormwater) management. While the CRD has the power to develop planning for rainwater runoff, the actual storm sewers are owned, operated and regulated by municipalities.

The CRD's role to date in rainwater management has been facilitative, largely limited to coordinating, encouraging, monitoring, educating and planning.[133] As the CRD Liquid Waste Management Plan (2000) notes:

> *The role of the CRD is to develop an overall stormwater quality management plan, carry out discharge monitoring, coordinate inter-municipal stormwater*

132 *Puget Soundkeeper Alliance v. State of Washington*, August 7, 2008, PCHB Nos. 17-021-030 and 037, Washington State Pollution Control Hearings Board, paragraph 63 -- quoting the statement of a group of leading scientists that gave evidence. The Board went on to require widespread use of LID stormwater practices throughout western Washington State.

133 Including the Liquid Waste Management Plan process and developing a number of non-binding integrated watershed management plans, e.g. Bowker Creek. Outside of municipalities, it acts as the subdivision regulator/land use planning authority that can require drainage works etc. as part of its planning powers under Part 26 of the *Local Government Act*.

> *quality improvement projects and provide technical information, direction and assistance. The storm drain systems are owned and operated by the municipalities, so the municipalities have the responsibility to budget for and carry out any remedial measures necessary.*[134]

In 2006, a Society of Environmental Toxicology and Chemistry (North America) expert panel conducted a Scientific and Technical Review of the CRD Liquid Waste Management Plan. That expert review raised serious questions about the feasibility of implementing effective stormwater management across regional watersheds within this fragmented jurisdictional landscape.[135] In particular, the expert panel cited the CRD's "weak system of power for program implementation."[136]

The Panel went on to state:

> *Perhaps the most significant challenge the CRD faces is that it appears to have responsibility for stormwater, while at the same time it does not have authority to regulate stormwater.*[137]

After examining current institutional arrangements, the review questioned whether effective regional management of stormwater could actually be achieved under the *status quo:*

> *The CRD is responsible for stormwater, but only the municipal authorities appear to have the authority to enforce stormwater bylaws [e.g. stormwater source control.] Watershed management plans seem to be approved at a political level. The Panel poses the question to the CRD about whether their effectiveness in delivering on their commitments in the LWMP [Liquid Waste Management Plan] is hindered by present institutional arrangements.*[138]

To overcome jurisdictional obstacles, the panel recommended the creation of a common authority to oversee stormwater:

134 This quote is from the Liquid Waste Management Plan (2000), Chapter 10 "Stormwater Quality Management," p. 10.2. See: http://www.crd.bc.ca/wastewater/lwmp/index.htm

135 *The Scientific and Technical Review: Capital Regional District Core Area Liquid Waste Management Plan*. Note that the Liquid Waste Management Plan outlines the plans of the CRD and its municipal partners for the management of liquid waste from communities within the plan area for the next 25 years. The experts' review is available at: http://www.crd.bc.ca/wastewater/documents/SETACCRDFinalReportv2_000.pdf.

136 *The Scientific and Technical Review: Capital Regional District Core Area Liquid Waste Management Plan*, p. 17.

137 *The Scientific and Technical Review: Capital Regional District Core Area Liquid Waste Management Plan*. p. 21.

138 *The Scientific and Technical Review: Capital Regional District Core Area Liquid Waste Management Plan*. p. 21.

> *While the Liquid Waste Management Plan (LWMP) is thorough and detailed, CRD's ability to affect practices differs greatly across the different aspects of the LWMP. Of significant concern is that the LWMP identifies several areas of program responsibilities without corresponding authority; the Panel believes there is a weak system of power for program implementation in some cases. CRD can be most effective in managing those elements which it controls most directly; at a minimum, for those aspects where CRD shares responsibility with other bodies, coordination among the participating bodies is key to effectiveness.* ***In this regard, the Panel recommends that the watersheds making up the region be managed by a common authority****. Adequate management requires coordination among the many aspects of the plan, and this would best be accomplished by a common authority with an ecosystem- and watershed-level perspective.*[139]
>
> [emphasis added]

This call for a common authority to ensure integrated action on rainwater is significant. We cannot have an integrated, watershed-level, ecosystem approach to rain water runoff, unless all municipalities are acting in concert.

The experience with the CRD's *Model Storm Sewer and Watercourse Protection Bylaw* is a striking example of the current failure to integrate watershed protection across the region.

CRD Model Stormwater Bylaw – A Failure of Concerted Action

The disposal of inappropriate substances into storm sewers by industry, businesses, institutions and households is a major cause of stormwater contamination. There is a pressing need to stop businesses and others from releasing contaminants into storm drains.

In response to this problem, the CRD created a Model Storm Sewer and Watercourse Protection Bylaw.[140] The model bylaw was a proactive regulatory tool that addresses this problem by prohibiting the discharge of certain materials into storm sewers. It included sophisticated Codes of Practice that set industry-specific rules governing what can be put into storm drains. Individual Codes of Practice were drafted to govern key stormwater polluters—customized Codes of Practice were written for each of the following activities: Construction and Development; Automotive and Parking Lot Operations; Recreational Facilities; Streets and Roads; Outdoor Storage Yards and Recycling Operations.

However, the CRD does not have the authority to enforce such a bylaw. Rather, it can only encourage the 13 municipalities to adopt the model bylaw. So far, only Victoria has done so.[141] Many municipalities have implemented their own version of the bylaw, and others deal with stormwater in other bylaws. This is not altogether surprising as most of the municipalities lack the resources and the expertise to

139 The Scientific and Technical Review: Capital Regional District Core Area Liquid Waste Management Plan, p. 17, http://www.crd.bc.ca/wastewater/documents/SETACCRDFinalReportv2_000.pdf.

140 http://www.crd.bc.ca/watersheds/regulations.htm

141 The only municipality to have adopted the current revision of the CRD model bylaw with all the most important powers is the City of Victoria. The other municipalities currently all have their own variations of stormwater bylaws, many of which are based on the "pre-Enhanced" model stormwater bylaw or they cover off stormwater-related regulations in other bylaws.

implement the stormwater bylaw in its "model" form. However, this lack of uniformity leads to both inconsistent environmental outcomes and an inconvenience for businesses operating in more than one CRD municipality.

Uniform application of the Model Stormwater Bylaw could occur in one of two ways. Since the CRD does not have jurisdiction to enact a regional bylaw, the Province could be asked to amend legislation to provide such authority.

Municipal jurisdiction currently stems from the concurrent jurisdiction authority from section 9 of the *Community Charter* and a regulation enacted under that section that allows municipalities to prohibit pollution to sewers or watercourses.[142] The provincial government could amend the *Local Government Act* to make that regulation apply to regional districts, as it has done with the *Buildings and Other Structures Bylaws Regulation*, the concurrent jurisdiction authority for buildings.[143]

Alternatively, all municipalities could adopt the regional model bylaw as part of an Integrated Watershed Management Plan incorporated into the Regional Growth Strategy and adopted by all municipalities.

Recommendation: Ensure the implementation and enforcement of the CRD *Model Storm Sewer and Watercourse Protection Bylaw* across the entire Capital Region.

142 Spheres of Concurrent Jurisdiction Environment and Wildlife Regulation, BC Reg. 144/2004 at section 2(1)(a). That section specifically allows a municipality to regulate, prohibit and impose requirements in relation to polluting or obstructing, or impeding the flow of, a stream, creek, waterway, watercourse, waterworks, ditch, drain or sewer, whether or not it is located on private property.

143 BC Reg. 86/2004.

One Reason for a Strong Bylaw: A Central Saanich Example

Ian Bruce and the Peninsula Streams Society were concerned about pollutants they had measured flowing from the Keating Industrial Park into Graham Creek and a ditch nicknamed "Stinky Ditch." For example, the ditch regularly registers excessive fecal coliforms, ammonia, PAHs, TEHs, and heavy metals.

The Society decided to try a stewardship approach to help improve stormwater quality. Over 100 businesses were contacted and asked to participate in an anonymous survey about their stormwater facilities and practices. Almost 50 per cent of the businesses participated.

While some businesses were knowledgeable about what they were doing, many were unaware of their potential impacts on stormwater. Nine of the 21 businesses with floor drains did not even know if those drains connected to the sanitary sewer system or went to stormwater. Of 78 outdoor catch basins that were checked, many were not being maintained. Stormwater was simply escaping without settling out the pollutants and sediments.

Many businesses were unaware of what was happening with catch basins in shared parking lots—assuming that the neighbour, the landlord or somebody else would take care of it. On one property, all 13 catch basins had not been maintained. They were all full—and thus useless.

Similar results were found in a 2007 survey conducted on the Tetayut (Sandhill) Creek drainage side of the "Park." These results demonstrate the need for a strong bylaw as well as monitoring and enforcement.

Table 11

Establish a Rainwater Commission

Recommendation: Establish a Capital Regional District Rainwater Commission to undertake an integrated watershed management approach for managing regional rainwater.

Base this integrated management approach an environmental protection perspective for maintaining a healthy hydrologic cycle; and a liquid waste management perspective.

We strongly support the recommendation and conclusion of the Scientific and Technical Review for the CRD that a common regional approach is needed to address rainwater runoff.[144] A Regional Rainwater Commission could overcome jurisdictional fragmentation and provide the necessary comprehensive approach.

The Commission would have broad responsibilities to deal with stormwater in a comprehensive, integrated way utilizing the best practices in planning and bylaw approaches proven elsewhere. It could ensure consistent action for different types of landscapes across the region to make a watershed-based approach to rainwater management possible.

One important reason for a Regional Rainwater Commission is that smaller municipalities do not have the in-house expertise needed to address the challenges of integrated rainwater management. A Regional Rainwater Commission would provide the necessary region-wide perspective and measurable goals as well as expertise and resources for effective rainwater management and would also provide a counterweight to local but outdated rainwater management.

Structure of a Rainwater Commission

There is considerable flexibility in the *Local Government Act* section 796.2 to craft a service that is highly responsive to different areas, times, conditions or circumstances, or to different classes of persons, places, activities, property or things.

One example is from Halifax where in 2007, it merged its water, stormwater and wastewater services. The new Halifax Water utility is responsible for all those water services from "source to source." This merger is viewed as an opportunity to deliver water and wastewater services (sewer/stormwater infrastructure and sewage treatment facilities) in an integrated, cost effective and environmentally sound manner with a commitment to long-term sustainability.[145]

144 See above for a discussion of that recommendation.

145 See http://www.halifax.ca/hrwc/documents/LakeMajorNewsletter_Vol1No2.pdf and http://www.osisoft.com/resources/articles/articles-content/Metered_Districts,_Software,_Help_Stem_Water_Leakage.aspx

Several recent reports have pointed to watershed-scale governance as a key focus for addressing water sustainability in BC:[146]

> *Fundamentally, such a reformed system would require local governments to ensure that new development has no net impact on the hydrological systems and would balance water use with water availability without degrading the resource. Local governments and institutions would focus on local data gathering, information generation, and engaging stakeholders and community. They would also be empowered to determine the local public interest, balance needs and demands, and resolve water use conflicts. Senior governments (provincial and federal) would ensure that binding principles and guidelines ensure instream flow requirements are met and would harmonize other activities such as forestry, mining and fisheries management. Senior government would also enforce rules, support research and informational needs, provide local capacity for decision-making, and would protect the broader public interest.*

The proposed Commission can be viewed as a downstream water management function whose first task is to develop an integrated watershed management plan (See below.) The Commission would coordinate that process and provide expertise and support to municipalities in their local implementation. This approach builds on the direction in which water and local governance is moving – towards planning that integrates jurisdiction and environmental elements such as land and water. One can see this in entities such as the Okanagan Basin Water Board, and the discussion of governance models that is informing the 2010 *Water Act* Reform process of the provincial government.[147]

New governance models:

- Emphasize collaborative engagement with a variety of stakeholders (e.g., Bowker Creek example);
- Focus on the watershed as the appropriate scale for water management (and in some cases governance);

146 Oliver M. Brandes and Deborah Curran, *Water Licenses and Conservation: Future Directions for Land Trusts in BC*, Salt Spring Island, The Land Trust Alliance of BC, 2008.

147 See, for example, the 2009 discussion paper on water governance by Oliver M. Brandes and Deborah Curran, *Setting a New Course in British Columbia: Water Governance Reform Options and Opportunities*, Victoria, Polis Project on Ecological Governance, 2009.

- Secure resources for crucial activities such as monitoring, compliance and enforcement, protection (including restoration) of ecosystem function and natural capital, and investment in green infrastructure; and
- Embed conflict avoidance and resolution mechanisms.

Other functions of the Commission could include:

- Monitoring and reporting – There are many streams and watercourses for which there is little scientific data that would point to management priorities for both water quality and quantity. A core role of the Commission could be to undertake and synthesize a comprehensive scientific program. Part of this program could be to identify appropriate instream flow requirements and hydrologic characteristics that would direct the establishment of standards for total effective imperviousness and other macro indicators of watershed health;
- Municipal support – Regional districts such as Metro Vancouver and the CRD have played an important role in supporting municipalities to move towards a low impact development approach to managing stormwater. Based on a mandatory integrated watershed management plan for the region, CRD staff can assist municipalities to put in place the bylaws, policies and technical standards necessary to achieve the targets agreed to in the plan;
- Water licensing and allocation – the Commission could have a role in the future in influencing the allocation of water, as watershed-based monitoring and management shifts the understanding of hydrology in watersheds to the local level. This could be in the context of overarching provincial standards for instream flows and conservation prior to extractive uses;
- Integrated Resource Management – the Commission could evaluate the potential for various integrated resource management and integrated design planning approaches;
- Enforcement – Through scientific monitoring it is important to identify where the targets contained in the regional integrated watershed management plan are not being met. The Commission is well placed to identify these infractions and work with municipalities to correct the problems. Amendments to part 25 (regional growth strategies) of the *Local Government Act*, the *Environmental Management Act* and other legislation may be necessary to enshrine better enforcement jurisdiction to the Regional Board or Commission when enforcing regional plans.

It is important to note that the CRD and other regional districts such as Metro Vancouver already fulfill some of these functions. The goal is to formalize coordination amongst municipalities and mandate an integrated watershed management approach that begins with land use standards that are the basis for volume, rate, and quality of rainwater runoff.

Given the different hydrological status of different areas of the CRD, the Commission's mandate could begin with application in only part of the CRD with a view to expanding the area over which it attends in the future. It may make sense for water quality and volume reasons for the Commission to first focus on implementation in the core municipalities.

Finally, the Commission as a water utility could obtain additional revenue through stormwater management utility charges. Funding for a rainwater management function could be recouped by charging a utility service fee for rainwater management functions as discussed above.

Create an Integrated Watershed Management Plan

Recommendation: Create a long-term, comprehensive Regional Integrated Watershed Management Plan that is incorporated into the Regional Growth Strategy, the implementation of which would be a commitment by each municipality through its regional context statement and bylaw amendments.

Local governments have authority as part of their planning function under parts 25 and 26 and section 548 of the *Local Government Act* and section 24 of the *Environmental Management Act* to undertake community plans, regional growth strategies, agreements on interjurisdictional watercourses, and liquid waste management plans. Indeed, under section 849(2) of the *Local Government Act* the goals of a regional growth strategy include protecting environmentally sensitive areas, reducing air, land and water pollution, and protecting the quality and quantity of ground water and surface water. Developing an integrated watershed management plan approach would address the fragmented rainwater management jurisdiction in the CRD—and would also link the quality and quantity of managed rainwater with subdivision standards and other land use planning decisions.

It is important to be clear that such a plan would bind municipalities and affect their land use planning jurisdiction. It would set targets and actions for subdivision servicing and impermeability and may affect growth management.

Creating a 25-Year Plan Based on Provincial Goals for Rainwater Management

The Commission's long-term (25 year or longer), integrated watershed management plan would set the goals and targets for re-establishing a functioning hydrologic cycle in the many watersheds of the CRD and improving water quality. The plan will clearly set out what condition we want our runoff, ecosystems and storm sewer systems to be in at the end of the day. By defining regional and watershed-specific targets, the plan is transparent and all local governments, other agencies and landowners have access to clear direction. The targets also serve as a measuring stick, now and in the future, to determine whether our rainwater system is operating as we planned.

Recommendation: Base the Plan on the overarching provincial goals for rainwater management:

- Volume Reduction (Put water back into the ground);
- Water Quality (Preserve or improve the water); and
- Rate Control/Detention (Hold back the water).

These three goals adequately capture the core of rainwater management – reducing the volume and thus rate while improving water quality. This approach allows the Plan to focus on best management practices for land use as well as regulatory jurisdiction. For example, improving water quality would likely involve commitments to adopt watercourse protection bylaws - and volume reduction points to the need to infiltrate more water at its source, thus decreasing the impermeability of the landscape.

Recommendation: Commit to the following mandatory targets in the Plan:

- Eliminate discharges rated "high" for environmental concern by 2015;
- Eliminate discharges rated "high" for public health concern by 2015;
- Enact source pollution control regulations through Watercourse Protection Bylaws and Codes of Practice throughout the region by 2012;
- Demonstrate a reduction in storm sewer contaminants at source by monitoring and enforcing source control regulation by 2014;
- Set a firm schedule to meet a deadline of 25 years for repairing pipes and infrastructure that cause sewage to be released from storm sewers;
- Adopt subdivision and other standards that mandate zero net additional post-construction rainwater runoff from all new or re-development in the region by 2012; and
- Reduce the volume of runoff in existing developed areas by 30 per cent by 2020 by focusing on infiltration and retention techniques;
- Establish maximum percentages of effective imperviousness for different areas of the region, with a schedule for decreasing the amount of effective imperviousness over the life of the plan;
- Following the regional plan, finalize integrated watershed management sub-plans for each watershed in the Region by 2017;
- Reduce stormwater contamination of the Gorge and Victoria Harbour, with the aim of making fish and shellfish from those water bodies edible, by 2035.

- Tie the updated Regional Urban Containment and Servicing Area (RUCSA) boundaries in the Regional Growth Strategy to watershed management – with a view to achieving the target of maintaining at least 90 per cent of regional development within the RUCSA. This will contain urban areas, create compact complete communities, and reduce stormwater management.

Incorporating the Regional Integrated Watershed Management Plan into the Regional Growth Strategy

Incorporating the Plan into the Regional Growth Strategy (as an appendix) would commit all municipalities and the CRD to meet the goals and targets of the plan, the CRD directly and municipalities indirectly (through commitments in their regional context statements of the OCPs). This approach would provide a framework for annual reporting on monitoring and enforcement activities within the Regional Growth Strategy reporting. Combining the RGS monitoring with other regional-scale monitoring will help to consolidate a comprehensive picture of growth, development and environmental management in the region.

Amendments to part 25 (regional growth strategies) of the *Local Government Act*, the *Environmental Management Act* and other legislation may be necessary to enshrine better enforcement jurisdiction to the Regional Board or Commission when enforcing regional plans.

Examples of Long Term Rainwater Plans

In 2003, the **City of Toronto** committed to reducing stormwater runoff problems and pollution by adopting the Water Pollution Solution Plan along with a 25-Year Implementation Plan. The city committed to $42 million in capital spending per year over the next 25 years. In addition, an estimated operating budget of $16 million is anticipated. One commentator has noted:

> *This plan is a comprehensive strategy to deal with surface water quality and quantity, sewage overflows, and habitat protection. Toronto's approach includes increasing traditional methods of stormwater storage capacity and improving conveyance structures, but it also includes greener approaches, especially for some short-term solutions.*

The Commission might also consider Portland's "Grey to Green" five-year plan. Under this Plan, **Portland's** Bureau of Environmental Services is investing an additional $50 million over the next five years to protect and enhance watershed health. In the next five years, the city will:

- add 43 acres of eco-roofs
- construct 920 green street facilities
- plant 33,000 yard trees and 50,000 street trees
- step up the fight against invasive weeds
- replace eight culverts that block fish passage
- purchase 419 acres of high priority natural areas

As previously discussed, the Bowker Creek Blueprint sets out a 100- Year Action Plan for that watershed.

Table 12

Legislating the Content of Rainwater Management Plans

Recommendation to the Province: The Province should mandate regional integrated watershed management plans to address, inter alia, land use, low impact development, the restoration of hydrological conditions, and environmental enhancement. Best Management Practices should be required in the preparation and implementation of the Plans. The plans should be required to include statutorily defined minimum content.

In accordance with section 24(1) of the *Environmental Management Act* ("the Act"), municipalities may develop a liquid waste management plan (LWMP) for approval by the Minister of Environment:

> ***24*** *(1) A municipality, alone or with one or more other municipalities, may submit for approval by the minister a waste management plan, that complies with the regulations respecting the management of municipal liquid waste.*

Although municipalities and regional districts are expected to develop their LWMPs voluntarily, the Act authorizes the Minister to direct that a plan be prepared or revised.[148] Once the LWMP has been approved by the Minister, it has the force and effect of a regulation.

The Ministry of Environment has prepared a set of guidelines for developing the LWMP.[149] Pursuant to section 1.3 of these guidelines, the LWMP is to include a schedule and means to address all municipal liquid waste. The section lists eight types of municipal liquid waste, with "urban stormwater runoff" being one of the eight. However, there is no specific requirement for a standalone rainwater quality management plan.

Given the distinct characteristics of rainwater pollution, and the magnitude of the current problem, we recommend amending section 24 of the *Environmental Management Act* to mandate regional integrated watershed management plans. These would include the traditional liquid waste management plan but be much broader and address land use, low impact development, the restoration of hydrological conditions, and environmental enhancement as described above.

The legislative amendment would include a requirement to use best management practices (BMPs) in preparing and implementing the plan at both the regional and municipal scale.

For example, the City of Portland, a North American leader in rainwater management, requires that its comprehensive plans contain specified Best Management Practices. In Portland, rainwater management plans are required to address each of the following BMP categories: Public involvement; Operations and maintenance; Industrial/commercial controls; Illicit discharge controls; New development standards; Structural controls; Natural systems; Program management; and Environmental and program monitoring.[150]

Also relevant is section 548 of the *Local Government Act*, which allows regional districts to make agreements with municipalities and/or landowners with respect to works on interjurisdictional watercourses, the removal of obstructions on such watercourses to address flood concerns, or funding of such works or removal efforts.

Advancing the Regional Integrated Watershed Management Plan

In addition to the measures discussed above, the proposed Rainwater Commission needs to do the following to advance a progressive regional Integrated Watershed Management Plan:

- Take steps to ensure that stringent performance standard regulations are established across all watersheds of the Region;

- Shift from Stormwater Management to Rainwater Management by promoting the "Low Impact Development Revolution" in new and existing development;

148 See BC Ministry of Environment, *Guidelines for Developing a Liquid Waste Management Plan*, http://www.env.gov.bc.ca/epd/epdpa/mpp/gfdalwmp.html. This requirement is made explicit in s. 24(3) of the *Act*.

149 Available online at: http://www.env.gov.bc.ca/epd/epdpa/mpp/gfdalwmp.html.

150 These are the nine BMP categories currently employed by Portland. See pg. 14-15 of Portland's most recent Stormwater Management Plan: http://www.portlandonline.com/bes/index.cfm?c=37842&a=126065.

- Identify problems with infrastructure and upgrade it;
- Provide educational materials;
- Enhance citizen-driven initiatives and work collaboratively with the community; and
- Improve monitoring and reporting regarding rainwater/stormwater in the region.

Recommendation: The proposed Rainwater Commission take steps to ensure that stringent performance-based regulations are established across all watersheds of the Region.

In addition to adoption of the CRD's current model stormwater bylaw across the entire region (see above), other performance standard regulations need to be implemented. There are good precedents for such regulations.

Examples of Standards Requiring No Increase in Runoff After Development

As mentioned above, Saanich requires that new development not increase stormwater flows from a property. The District is committed to no net increase in post-development stormwater flows from pre-development quantities. The District requires that all developments provide drainage structures that will:

- reduce the rate of post development site runoff to predevelopment levels;
- improve the quality of site drainage water; and
- minimize erosion and retain sediments.

The municipality is open to consideration of site specific drainage solutions brought forward by the applicant.[151]

Similar no-net increase requirements are found elsewhere including the entire state of New Jersey.[152]

Similar performance standards now apply in Washington State west of the Cascades. The Washington State Pollution Control Hearings Board recently required that construction of all development in Western Washington use comprehensive LID practices with maximum site dispersion and infiltration of stormwater.[153] Stormwater runoff must not exceed prescribed amounts of sediment, etc.[154]

151 *District of Saanich Engineering Specifications (Schedule H, Subdivision Bylaw No. 7452, February 2004*.

152 New Jersey's state stormwater standards require: No change in groundwater recharge volume following construction; Infiltration must be used to maintain predevelopment runoff volumes and peak flow rates; Any increase in runoff volume must be offset by a decrease in post-construction peak flow rate; and a reduction in stormwater nutrient loads to the "maximum extent feasible" and total suspended solids (TSS) reductions of 80 per cent. If the receiving water body is a high-quality water or tributary, the required TSS reduction is 95 per cent See "Stormwater Management Rule," New Jersey Register, N.J.A.C., Vol. 7, No. 8 (February 2, 2004).

153 See *Puget Soundkeeper Alliance v. Washington Dept. of Ecology*, August 7, 2008, PCHB Nos. 17-021-030 and 037, Washington State Pollution Control Hearings Board.

154 *Associated General Contractors et al. v. Washington State Dept. of Ecology, Findings of Fact, Conclusions of Law and Order*, June 4, 2007, PCHB NO. 05-157-159.

Examples of Saanich Projects with No Increase in Flow

In 1998 Council approved the Sayward Gravel Pit development (the redevelopment of a gravel pit for residential use), less than a kilometre from the ocean. The municipality required surface stormwater collection that is directed to a pond. The surface pond is designed as a community amenity and will be used to water the adjacent golf course. No stormwater from the old gravel pit, streets, or houses will flow into the ocean, and the golf course can rely on a recycled source for part of its watering needs.

The Christmas Hill area in Saanich is located at the height of two watersheds. Stormwater flows south into Swan Lake and north through Rithets Bog with both systems reaching the Colquitz River. The Christmas Hill development incorporated on- and off-site stormwater detention in the form of two ponds. Runoff treatment techniques included engineered wetlands (using an existing wetland supporting cattails) and grassy swales.

TABLE 13

Performance standards for retrofitting LID

The District of North Vancouver is contemplating a bylaw that would require that property owners that are redeveloping a lot or doing major renovations achieve a 30 per cent hydraulic improvement on their lot after the work is done.[155] The District has developed specific prescriptions for accomplishing such a 30 per cent hydraulic improvement on lots with different profiles (e.g., treed lot, lot with built lawns). The prescriptions include increasing absorption dramatically by amending soil, using absorptive landscapes with rain gardens, etc.[156]

This initiative is given impetus by a study on MacKay Creek Watershed that projected that over the next 20 years, 10 per cent of existing lots could be redeveloped. If no standards were set, impervious area was projected to increase 25 per cent and runoff volume 10 per cent.

Promoting Low Impact Development

Recommendation: The proposed Rainwater Commission take steps to ensure that a comprehensive set of motivations encourage the implementation of Low Impact Development across the Region.

Many jurisdictions are achieving success by creating incentives for property owners to adopt LID practices. Examples of such incentives include expedited permitting, favourable zoning allowances or the waiving of various fees.

Examples of incentive programs:

155 Major renovations might be in the range of $50,000-100,000.

156 Personal communication, Richard Boese, District of North Vancouver.

- The **City of Tacoma** reduces charges for stormwater services if one uses an approved LID stormwater and surface water runoff system.[157]

- The **Milwaukee** Metropolitan Sewerage District offers grants to property owners who plant their own rain garden and disconnect downspouts.[158]

- The **City of Toronto's** Green Roof Incentive Pilot Program will fund $50 per square metre of green roof up to a maximum of $10,000 for single family homes and $100,000 for other building types.[159]

- The **City of Chicago** provides grants, waives fees and expedites the permitting process grants if a green roof is included in a building plan. It allows density bonuses (allowing more units) for green roofs.[160]

- **New York** provides a tax credit for roofs with absorbent vegetation.[161]

- **Philadelphia e**xempts redevelopment projects from various regulatory requirements if they reduce impervious area by 20 per cent or more. Almost all of redevelopment projects now reach the 20 per cent reduction.[162] And most developers now build on infill sites instead of undeveloped, natural areas.[163]

- **Portland's** Clean River Rewards Program gives residential ratepayers a discount on their *stormwater utility fees*, if they reduce runoff. Credits are offered for creating or maintaining tree coverage, disconnecting downspouts, installing rain gardens or drywells and other initiatives.[164] More than 35,000 property owners have signed up since 2006.[165] Portland's Green Street Policy sets a fee for infrastructure projects that fail to manage stormwater on site using vegetated practices. [166]

157 *Tacoma Municipal Code*, tit. 12 s. 12.08.560 (2006), revised 2009.

158 An additional incentive is available for those who provide the total square footage of their roof, number of downspouts, and number of downspouts to be redirected. Their application is fast-tracked and they may be awarded early grant approval. See *Managing Wet Weather with Green Infrastructure: Municipal Handbook: Green Infrastructure Retrofit Policies*, US EPA, p. 14 http://www.epa.gov/npdes/pubs/gi_munichandbook_retrofits.pdf

159 *Managing Wet Weather with Green Infrastructure: Municipal Handbook: Green Infrastructure Retrofit Policies*, US EPA, p. 5 http://www.epa.gov/npdes/pubs/gi_munichandbook_retrofits.pdf

160 Liat Podolsky and Dr. Elaine MacDonald, "Green cities, great lakes: using green infrastructure to reduce combined sewer overflows", Ecojustice, August 2008, p.39. online:http://www.ecojustice.ca/publications/reports/the-green-infrastructure-report.

161 See Charles Duhigg, "As Sewers Fill, Waste Poisons Waterways," *New York Times*, November 23, 2009.

162 Through a variety of green infrastructure practices, including roof downspout disconnections, porous pavement, tree plantings, and green roofs.

163 See: http://cfpub.epa.gov/npdes/greeninfrastructure/gicasestudies_specific.cfm?case_id=62

164 Podolsky and MacDonald, "Green cities, great lakes," p.38.

165 http://www.portlandonline.com/BES/index.cfm?c=41976

166 *Managing Wet Weather*, US EPA, p. 13 http://www.epa.gov/npdes/pubs/gi_munichandbook_retrofits.pdf

Incentives and Regulations to Disconnect Downspouts

Downspouts contribute about 20 per cent of total runoff in many communities.[167] This runoff can be eliminated, if buildings disconnect downspouts from the stormwater system and manage water on the property by digging rain gardens, creating swales, and a number of other fairly low-tech techniques. The following are initiatives taken to disconnect downspouts.

- The **City of Portland** either sends city workers to disconnect downspouts free of charge or pays residents $53 per downspout if the resident disconnects them. At last count, more than 58,000 homeowners had disconnected.[168]

- **Seattle Public Utilities** has subsidized rain barrels and cisterns for citizens to promote rainwater-harvesting throughout the city.[169]

- Toronto first addressed downspout disconnections with a voluntary program for homeowners to disconnect their downspouts. The city disconnected residences for free and provided splash guards and rain barrels. Tens of thousands of homes were disconnected under this program.[170] In 2007, Toronto implemented mandatory downspout disconnection for the area of the city served by combined sewers. The new bylaw requires homeowners to disconnect their homes' downspout from the City's sewer system within three years. Limited exemptions are available, and subsidies are available for low income residents.[171] City modelling showed that this program gave the most "bang for the buck" of all runoff reduction initiatives.[172]

Table 14

Recommendation: The proposed Rainwater Commission take steps to ensure that local governments adjust Development Cost Charges to create incentives for Low Impact Development.

As discussed above, under section 933.1 of the *Local Government Act* local governments may waive or reduce Development Cost Charges for eligible developments that result in a low environmental impact. Local governments must identify what makes a project an "eligible development" -- which could include rainwater infiltration and low impermeability on a parcel.

Properly designed DCCs could create an economic motivation for developers to implement LID on their properties.

167 See, for example, http://www.nrdc.org/water/pollution/gutter/gutter.pdf p. 17
168 http://www.portlandonline.com/BES/index.cfm?a=177702&c=43081
169 Christopher Kloss & Crystal Calarusse, *Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combine Sewer Overflows*, Natural Resources Defence Council, June 2006, pg. 31.
170 20,000 homes were disconnected by the year 2000. Kloss & Calarusse, Rooftops to Rivers, p. 32.
171 See this City of Toronto Fact Sheet: http://www.toronto.ca/water/pdf/mandatory_downspout_disconnection_program-qa.pdf.
172 According to Dr. Bill Snodgrass, Ontario stormwater expert,

Recommendation: The proposed Rainwater Commission work with all CRD municipalities to implement LID practices in their own buildings and streets, and encourage the implementation of Low Impact Development Demonstration Projects.

As discussed above, many LID projects have now been constructed in the region by local governments. The Commission should consider these fine examples as well as other examples of governments using Low Impact Development principles in their own buildings and streets:

- In **Portland**, Oregon, new city-owned buildings are required to have a green roof that covers at least 70 per cent of the roof area.[173]

- **San Francisco, Boston**, **Chicago**, **Houston**, and **Seattle** require all new major city-owned facilities to achieve a LEED Silver certification from the US Green Building Council.[174]

Greening Streets

- The **City of Calgary** planned the construction of a model residential street in a neighbourhood not served by stormwater facilities.[175]

- **Philadelphia** has announced it will spend $1.6 billion over 20 years to transform the city into an urban oasis -- by "peeling back" concrete and asphalt, installing rain gardens, planting thousands of trees, and installing porous sidewalks.[176]

- **Portland's** SW 12th Avenue retrofit project introduced bioretention planter boxes into the landscaping strip between the sidewalk and the street. The planters, which cost only $30,000,

173 The remaining roof area must be covered with Energy Star roofing material, See Kloss & Calarusse, *Rooftops to Rivers*, p. 26.
174 See http://ewweb.com/ar/LEED/ LEED is the Leadership in Energy and Environmental Design (LEED) Green Building Rating.
175 See the Calgary 2006 *Stormwater Management Report*: http://www.calgary.ca/docgallery/bu/water_services/emergency_planning/stormwater_report.pdf.
176 Charles Duhigg, "As Sewers Fill, Waste Poisons Waterways," *New York Times*, November 23, 2009. Also, click on Philadelphia's bold plan envisions giant sponge.at waterbucket.ca.

manage 180,000 gallons of runoff annually, and reduce the peak flow of a 25-year storm event by 70 per cent.[177]

- **Vancouver** installed three Country Lanes as a pilot project to introduce green space and encourage on-site stormwater infiltration. The project replaced paved alleys and lanes with more permeable materials -- two concrete or gravel strips surrounded by structural grass.[178] Connections from the lane to residences were constructed of permeable materials, including paving blocks, broken concrete sections, and structural grass or gravel. The initial cost of a Country Lane was approximately $71 per linear foot, four times greater than the typical alley cost of $18 per foot. However, with practice, the city estimated that the cost of a Country Lane in a few years would decrease to $30 per linear foot.[179]

- **Seattle's** 2nd Avenue Street Edge Alternative (SEA) Street project redesigned an entire 660-foot block of 2nd Avenue with green infrastructure techniques that reduce runoff and provide a more liveable community. The original 25-foot-wide straight street was replaced with a 14-foot-wide curvilinear street. Vegetated swales designed to infiltrate and treat stormwater were installed within the right-of-way on both sides of the street. Street parking was replaced with designated angled parking slots, and a sidewalk was installed on one side of the street. The final constructed design reduced imperviousness more than 18 per cent—and added 100 evergreen trees and 1,100 shrubs. The redesign reduced runoff by **99 per cent.** In fact, stormwater runoff has not been recorded at the site since December 2002, a period that included record-breaking rainfall.[180]

- **Seattle** has begun an urban forestry initiative to reduce stormwater runoff. The goal is to increase the city's tree canopy from 27 per cent of city surface area to 40 per cent."[181]

Demonstration Projects

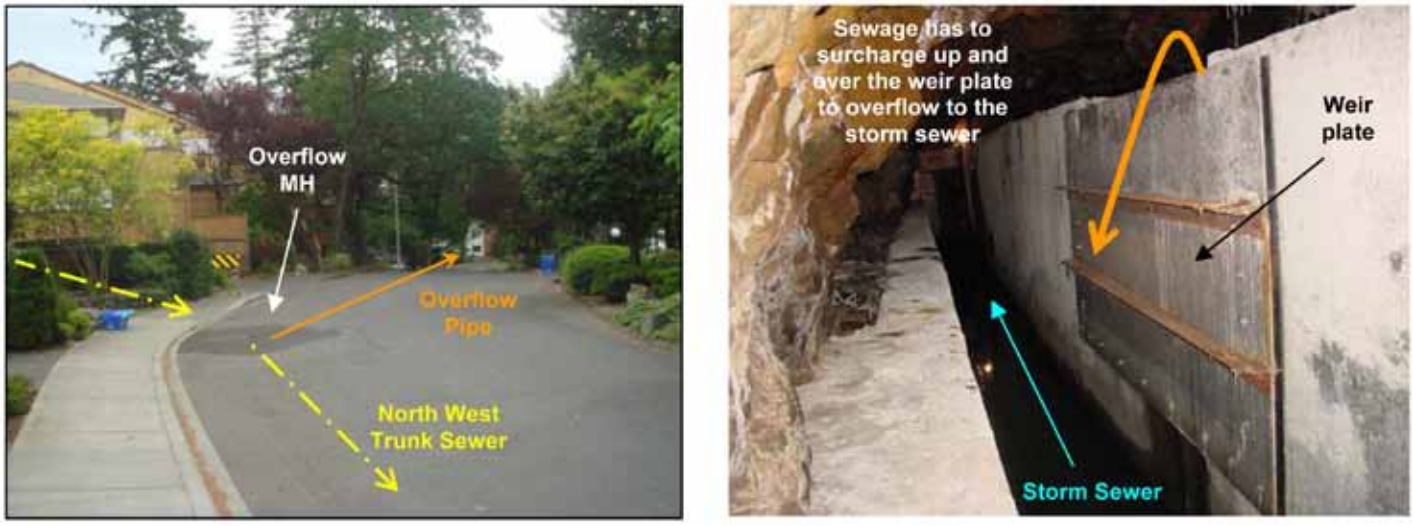
- **Seattle** promotes rainwater harvesting with a demonstration project at the giant King Street Center. The Center installed three 5,400 gallon tanks to collect rainwater from the building's roof and reused it for toilet flushing and landscaping needs. This system provides 1.4 million of the approximately 2.2 million gallons—60 per cent—of the toilet flushing water needed annually. It also reduces the stormwater discharged from the building by the same amount.

- **Seattle** initiated the Freemont rainwater harvesting study where 10 single-family homeowners have tested the effectiveness of slow-draining cisterns to retain peak stormwater runoff.[182]

Upgrading Infrastructure

Recommendation: The proposed Rainwater Commission work with Local Governments to Ensure that Obsolete Stormwater Infrastructure is Upgraded by taking the following steps:

177 *Managing Wet Weather*, US EPA, p. 13 http://www.epa.gov/npdes/pubs/gi_munichandbook_retrofits.pdf
178 Structural grass is supported by a grid and soil structure that prevents soil compaction and root damage.
179 Kloss & Calarusse, *Rooftops to Rivers*, p. 35.
180 Kloss & Calarusse, *Rooftops to Rivers*, p. 29.
181 Kloss & Calarusse, *Rooftops to Rivers*, p. 31.
182 Kloss & Calarusse, *Rooftops to Rivers*, p. 31.



Sea Terrace Overflow (from CRD's *Core Area Sanitary Sewer Overflow Management Plan - Appendix D*)

- **Identify the Infrastructure Problems by restoring and enhancing the stormwater monitoring program.**
- **Repair and replace obsolete infrastructure by a set date.**
- **Accelerate replacement of Oak Bay's Combined Sewer System.**
- **Install state-of-the-art "end of pipe" stormwater treatment where needed and appropriate, guided by a careful inventory of problematic outfalls that require such measures. However, priority should be given to upstream preventative LID measures.**

LID strategies can reduce much of the inflow and infiltration (I & I) of water into aging sewer pipes that overwhelms sewage facilities and leads to sewage overflows[183]; however, in designing smart municipal infrastructure, we are not starting from scratch. We have large areas of impervious surface that are connected to storm drains, and we can't retrofit these overnight. Even with widespread adoption of LID techniques, there is still a need for traditional "big pipes" infrastructure to manage the stormwater that is not controlled on-site. In some parts of the Capital Region that infrastructure includes leaking, cracked, cross-connected, and poorly placed stormwater pipes, some of which have been in the ground since the 1800s.

As a result, sanitary sewage is leaking into the stormwater system at unprecedented rates: discharges rated "high" for public health concern are the highest they've been in 14 years.

Identify the Infrastructure Problems -- Restore and Enhance the Stormwater Monitoring Program.

The first step in achieving the Commission's goal of eliminating stormwater discharges rated "high" for either environmental or human health concern is to identify the sources of contamination. This process, known as "upstream investigation," involves various investigative techniques to expose illegal cross-connections (buildings releasing sanitary sewage into storm sewers), identify other sources of sanitary sewage

183 For example, Seattle Public Utilities has identified large scale rainwater harvesting as one of the most effective ways of reducing I & I problems. See Lakewood RainCatchers, *Evaluation of Methods for Reducing Combined Sewer Overflows to South Lake Washington*, prepared for Seattle Public Utilities, October 2008.

contamination and uncover storm drains being utilized for inappropriate waste disposal. Both the CRD and the municipalities are directly involved in these investigations.

Though much effort has been expended in these investigations, and considerable gains made, many sources of contaminants remain elusive. **Unfortunately, a lack of funds has forced temporary discontinuation of the CRD stormwater discharge monitoring program.** It is clear that there are not adequate resources to deal with the problem. It is urgent that sufficient resources be provided to investigate and uncover *all* sources of contamination in the stormwater system.

In addition, the Commission should encourage and collaborate with community groups and educational institutions to augment monitoring efforts. Many jurisdictions make extensive use of citizen monitors, and local groups like the Friends of Fork Lake have been conducting water monitoring for years. (See below)

Adequate monitoring is absolutely essential if we want to discover health and environmental problems and fix them. And it is vital if we want to create a rainwater management system that will continually get better over time:

> *Put simply, unless you actually monitor performance and gather data, there is no way to really know how a system is doing and what is needed to improve performance. Without data, all you have is an impression of how you are doing. With data, you can satisfy yourself that you are meeting measurable goals and you are equipped to prove the merit and performance of your system to third parties. Such data can help to build the case for cost-savings, and it can inform your efforts to adapt, to improve your design and your future performance, as well as the design and future performance of developments elsewhere that may look to you for learning. A failure to institute monitoring and data collection misses these important opportunities.*[184]
>
> Susan Rutherford, West Coast Environmental Law Association

Another issue with monitoring is that past stormwater monitoring has been almost exclusively focussed on coastal areas. This is somewhat curious as non-coastal receiving waters such as lakes and streams are far more sensitive to rainwater discharges. Monitoring should be expanded to fresh water habitats, such as Colquitz Creek that still has a remnant salmon population. Since stormwater surges cause extensive damage, monitoring should be expanded to include runoff *quantity* data in addition to *quality* data.[185]

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184 The *Green Infrastructure Guide: Issues, Implementation Strategies and Success Stories*, Susan Rutherford, West Coast Environmental Law, 2007, p. 66. See online: http://www.wcel.org/sites/default/files/publications/The%20Green%20Infrastructure%20Guide%20-%20Issues,%20Implementation%20Strategies,%20and%20Success%20Stories.pdf.

185 Rainwater expert Lise Townsend has described the importance of monitoring non-coastal areas in a personal communication: *"In my opinion (based on my research) it would absolutely be important to continue to do monitoring, as we currently have very little feedback between water quality and land use practices. I also think that fresh water environments should be monitored, especially streams like Colquitz Creek that still DO have salmon. Another critical piece that is missing from most water quality programs is flow monitoring. This is critical so that one can calculate the loading rates, i.e. the actual mass of a pollutant that is discharged into an aquatic environment. Concentration by contrast doesn't tell you much since it could be in a trickle of water or gushing and in the latter case a lot more of the substance would be present. For example in my study I was able to calculate nutrient loading into Swan Lake, which is critical to water quality and ecology of the lake. Stream gauging can also give important information about the behaviour of a stream, i.e. its 'flashiness' which is a measure of urbanization effects - and much reduced when Low Impact Development is implemented."*

Repair and Replace Obsolete Infrastructure by a Set Date

The second step is to repair or replace the infrastructure that is found to be causing the problems. Much of the 100-year-old stormwater infrastructure in CRD municipalities is wearing out. Discussions with municipal personnel reveal their struggle to simply maintain the status quo—as quickly as old problems are repaired, new ones arise. Existing resources are barely sufficient to maintain the status quo. If CRD municipalities are to actually make progress and eliminate dangerous stormwater discharges, considerably more funding must be made available for this purpose. That is why our recommendation to establish a rain water utility charge is of fundamental importance.

Note that the **City of Toronto's** Wet Weather Flow Master Plan initiated a project to locate and fix cross-connections of stormwater pipes and sanitary sewer pipes in its underground sewer system. It has committed to locating and repairing all such cross connections by the end of the 25-year plan.[186] The Capital Region needs to set a date for fixing its obsolete infrastructure.

Accelerate replacement of Oak Bay's Combined Sewer System

The Uplands area of Oak Bay is home to the major combined sewer system in the Capital Region. As only a single pipe collects both sanitary waste and stormwater in this area, even moderate rainfall can trigger an overflow of sanitary waste onto the coast.[187] Data showing the number of combined sewer overflows (CSOs) dating back to 2000 are provided in Figure 9.

186 See: http://www.toronto.ca/water/protecting_quality/wwfmmp/25year_plan.htm.
187 Sanitary Sewer Overflow Management Plan, 2009, pg. iii.

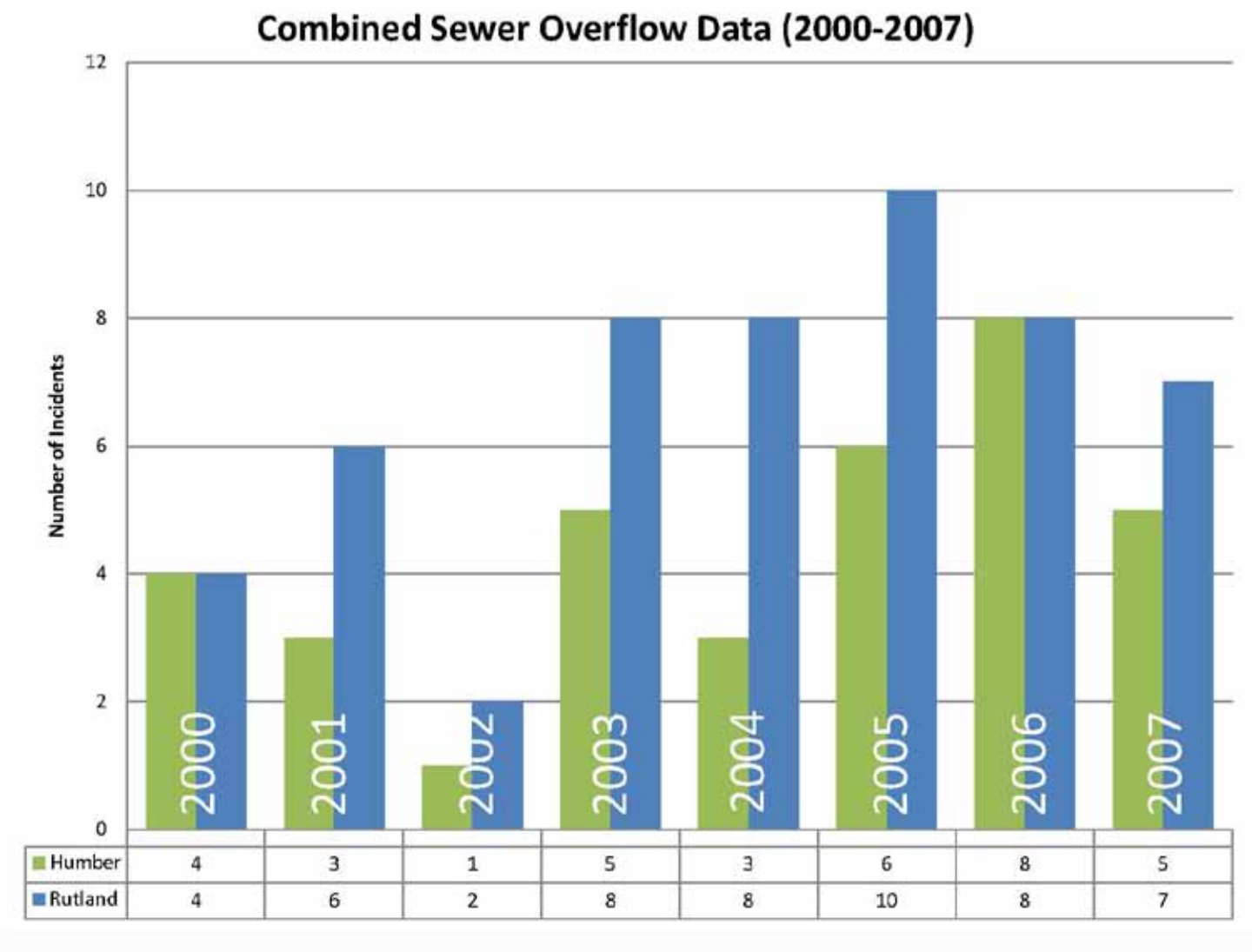

FIGURE 9

Under the CRD's Liquid Waste Management Plan and the Municipal Sewage Regulation, the District of Oak Bay must separate their combined system. The plan submitted to the Minister originally proposed doing this over an approximately 50 year period.[188] That timeline was then adjusted when federal stimulus funds were provided, leading to a revised plan of completing sewer separation by 2015.[189] However, council recently decided against proceeding with that method. As a result, there is no current completion date for sewer separation.[190]

The timeline for replacement of this combined system must be accelerated. Given the gravity of the threat posed to human health and the environment by a single CSO event, replacing the old system should be treated with more urgency.

188 Sanitary Sewer Overflow Management Plan, 2009, pg. 35.

189 CRD Core Area Liquid Waste Management Plan, Amendment No. 7, December 2009, at 5.5.

190 See Oak Bay Municipal Council, minutes from December 14, 2009, online: http://www.oakbaybc.org/minutes/c_dec14-09.pdf, Oak Bay Municipal Council, minutes from January 11, 2010, online: http://www.oakbaybc.org/minutes/c_jan11-10.pdf, and Oak Bay Municipal Council, minutes from January 25, 2010, online: http://www.oakbaybc.org/minutes/c_jan25-10.pdf. Also see "Uplands sewer options to get another spin through pipeline," *Times Colonist*, online: http://www.timescolonist.com/Uplands+sewer+options+another+spin+through+pipeline/2485297/story.html#ixzz0f9rrrbcD.

Install "end of pipe" stormwater treatment where needed and appropriate

The above actions should solve most stormwater problems, but there may still be a need to address acute problems at some stormwater outlets. The above initiatives should be the priority, but the region needs to address whether "end-of-pipe" treatment is necessary for some sites.

Local governments have taken a few measures to install modern end-of-the-pipe mechanisms to reduce stormwater pollution. For example, as part of the cleanup of Rock Bay, Victoria recently installed a stormwater rehabilitation unit (SWRU) at an outfall that discharges into Rock Bay and has two other units in operation.[191]

An SWRU is a passive, flow-through system consisting of a vault and baffles that allow silts to settle out and floatables and oils to be trapped and contained. It captures much of the stormwater's copper, lead, chromium, cadmium, zinc, lead, mercury, silver and arsenic. These units are commonplace in the US, but are still relatively new in Western Canada. [192]

Examples of End of Pipe Solutions from Elsewhere

Treatment and Wetlands Processing

- **Toronto** is installing tanks and tunnels to capture and hold Combined Sewer Overflows and stormwater—and subject them to ultraviolet light to kill bacteria before the water is slowly released into the lake. In addition, the city will utilize a technique known as flow balancing to capture runoff and treat it through the use of ponds and wetlands.[193] The City's Wet Weather Flow Master Plan calls for the creation of 180 ponds/wetlands.[194]

- **Calgary** is planning to systematically retrofit infrastructure in older neighbourhoods. The City has identified 37 potential sites for the construction of Storm Water Quality Retrofit projects. The projects consist of retention ponds to capture stormwater before it enters a waterway, and man-made wetlands to naturally filter out sediment and other impurities.[195]

Large recent wetlands construction projects in Calgary include:

- East Village Wetland treatment facility—a series of constructed wetlands that will take rainwater from city streets and sewers, remove sediment and other contaminants, and treat water before discharging it into the Bow River. [196]

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191 Email from Steven Fifield, Manager, Underground Utilities, Engineering Department, City of Victoria, dated February 5, 2010). Also see: http://www.pyr.ec.gc.ca/GeorgiaBasin/keyActivities/water_e.asp

192 The Vortechnics Inc. technology that will be installed at Rock Bay uses a unique "grit chamber" design, which enhances the removal capability over a conventional settlement chamber unit. A vortex is created within the unit, which allows sediments to "drop" out of the incoming flow and remain contained until such time as it is removed. Pump equipment gains access through manhole lids where the solids and oils are removed and disposed of, allowing clean storm water to enter the harbour. See the government press release. http://griffiths.disted.camosun.bc.ca/100_pdf/discussion1_rockbay.pdf

193 http://www.toronto.ca/water/protecting_quality/wwfmmp/25year_plan.htm#endpipe

194 http://www.toronto.ca/water/protecting_quality/wwfmmp/index.htm

195 Since 2007, the annual budget for these projects has been about $11 million. http://www.secalgarynews.com/news/se-calgary/storm-water-quality-retrofit-program-cleans-fish-creek-bow-river/

196 http://www.joconl.com/article/id33781.

- Shepard Stormwater Diversion Project, which will intercept stormwater from a large area of the City and pass it through a 560- acre constructed wetland that will filter the water before release into the River.[197]

- **London, Ontario** has constructed two engineered wetlands and 60 engineered wet ponds to manage and clean stormwater. Construction of approximately 80 wet pond facilities is planned for the next 10 to 20 years.[198]

Educational Materials

Recommendation: The proposed Rainwater Commission launch an intensive educational strategy for residents, developers, businesses, stewardship groups, schools, and others who can improve rainwater management.

The successful redesign of rainwater management depends on changes in behaviour by everyone; from the renter to the property owner; from the developer to the official inspector; from the stewardship group to the local body shop; from the elementary school child to the university expert. Many destructive stormwater management practices take place because people don't realize there is a smarter way to deal with stormwater. Information provides citizens with the ability to change their ways. The Commission must play a leading role in educating citizens on this issue.

The Commission can collaborate with senior governments, educational institutes, waterbucket.ca, the BC Water and Waste Association, and civil society in educating society about modern rainwater management. It can also play an important role in assisting with the technology transfer necessary for implementation of such management in the Capital Region in ensuring that these concepts and techniques are known by the construction and development industry.

Local governments have close contact with developers and property owners seeking permits and rezoning. Thus, they are strategically placed to ensure that those touching the land know the latest rainwater management techniques. The Commission can provide integrated educational resources and support to local governments for that purpose.

Enhance Citizen-Driven Initiatives

Recommendation: The proposed Rainwater Commission provide resources and support to local stewardship groups to promote watershed restoration and protection.

Recommendation: The proposed Rainwater Commission collaborate with community groups and educational institutes to conduct more extensive water quality monitoring.

The Bowker Creek Initiative is a great example of just how effective citizen-driven initiatives can be in protecting and enhancing watersheds. (See above) Government must take aggressive action to transform

197 http://www.calgary.ca/portal/server.pt/gateway/PTARGS_0_0_784_203_0_43/http%3B/content.calgary.ca/CCA/City+Hall/Business+Units/Water+Services/Construction+Projects/Shepard+Stormwater+Diversion+Project/Shepard+Stormwater+Diversion+Project.htm.

198 *Green cities, great lakes: using green infrastructure to reduce combined sewer overflows*, Ecojustice, August 2008, p. 45, online: http://www.ecojustice.ca/publications/reports/the-green-infrastructure-report.

rainwater management in the region, but it cannot accomplish that by itself. A top-down, bottom-up strategy will bring the most success.

Community stewardship groups play a key role. As was described earlier, groups like the Friends of Mount Douglas Park, the Friends of Bowker Creek, Peninsula Streams, and others have provided leadership in rehabilitating streams and fish stocking. When supported by government, as with the Bowker Creek Initiative, they have accomplished remarkable things.

As senior water engineer Eric Bonham has stated:

> *Major breakthroughs happen when decision makers in government work with grass-roots visionaries in the community to create desired outcomes. This is the essence of the Bowker Creek story.*[199]

The Convening for Action on Vancouver Island (CAVI) initiative is an example of the type of group the Commission should collaborate with. CAVI is a grassroots, collective partnership committed to achieving settlement in balance with ecology, beginning with water-centric planning. CAVI encourages green infrastructure and "Design with Nature" outcomes for all of Vancouver Island.

CAVI has done important work. They initiated discussions with Kate Miller Environmental Policy Manager of the Cowichan Valley Regional District to promote local government involvement in expanding use of green infrastructure and LID. This citizen-led collaboration eventually led three Regional Districts and

199 *Convening for Action in the Georgia Basin*, p.3 http://www.waterbucket.ca/cfa/sites/wbccfa/documents/media/353.pdf

their member municipalities to co-host a *Showcasing Green Infrastructure Innovation Series*—a series that celebrated successes, built regional capacity and motivated those communities to move forward with designing with nature.[200]

The proposed Rainwater Commission might consider the model used in the province's former Urban Salmon Habitat Program, which coordinated community groups with local governments to rehabilitate urban streams and habitat. This highly successful model could be used again to implement rainwater harvesting and other LID initiatives, water quality monitoring and other efforts.

Reference was made earlier to the lack of funding to monitor stormwater quality. This is significant. Authorities can't address problems if the problems have not been identified and measure. However, community stewardship groups and university students may be able to make a substantial contribution to such monitoring efforts. The precedent of the long-time monitoring of the Highland's Fork Lake by its residents is encouraging.

Enhance Reporting

Recommendation: The proposed Rainwater Commission publish a biennial "State of the Watershed" Report. Among other things, this Report should include:

- **A report card on the health of each of the watersheds in the Capital Region;**
- **Documentation of total impervious cover in the Capital Region, and of the trends in effective impervious cover for each municipality;**
- **Targets for reducing total impervious cover, mitigating existing impervious cover, replacing obsolete infrastructure, installing end-of-pipe treatments, etc.;**
- **Goals for re-opening shellfish harvesting area and re-establishing urban salmon streams; and**
- **Data currently compiled for the Stormwater Quality Annual Reports.**
- **Data regarding stormwater discharge into key fresh waters, in addition to currently monitored sites.**

The CRD already periodically publishes a "State of the Environment" report.[201] To keep track of progress on stormwater issues, the Commission should publish a State of the Watershed Report every two years.

200 *Convening for Action in the Georgia Basin*, p.3 http://www.waterbucket.ca/cfa/sites/wbccfa/documents/media/353.pdf
201 http://www.crd.bc.ca/rte/statereports/2009/

Other Recommendations:

Recommendations to the Province:

- Amend the legislative authority of the Capital Regional District and municipalities to facilitate implementation of the above recommendations.

- In particular, mandate regional integrated watershed management plans to address, *inter alia,* land use, low impact development, the restoration of hydrological conditions, and environmental enhancement. Best Management Practices should be required in the preparation and implementation of the Plans. The plans should be required to include statutorily-defined minimum content.

Recommendations to the Federal Government:

- Enforce the ***Fisheries Act*** prohibition against the deposition of deleterious substances into waters frequented by fish, and the prohibition against destruction of fish habitat, when stormwater discharges violate those provisions.

- Conduct an inquiry to investigate why the Federal Government fails to enforce ***Fisheries Act*** provisions against the wholesale breach of the Act by those in charge of stormwater.

Appendix A

Legislative Context: Jurisdiction over Rainwater

The control of rainwater falls under local government jurisdiction for drainage, subdivision, development permit areas for protection of the natural environment and water conservation, landscaping, parking, development cost charges, and some environmental regulatory bylaws such as tree protection and soil erosion and deposit. In addition, municipalities also have authority for additional regulatory authority over watercourse protection and pesticide control, which includes pollution prevention. Overall, particularly for municipalities, local governments have comprehensive jurisdiction for rainwater management through a range of discretionary authorities.

Most often, local governments simply use these powers to respond to individual applications for development. However, to deal effectively with rainwater management, local governments can link the exercise of their powers with integrated watershed or rainwater management planning, neighbourhood plans and design and policy manuals (on rainwater or low-impact development) that are incorporated by reference into all manner of development approvals. There are also a few local governments that address water quality through regulatory environmental bylaws.

Most of these powers enable a site-specific approach to the control of stormwater, and in the context of a regional district it is individual member municipalities who are primarily responsible for rainwater management. Currently the only formal mechanism by which a region, represented by a regional district, can plan for rainwater management is through liquid waste management planning, which is narrowly focused on liquid waste as opposed to integrated watershed management that strives to maintain the hydrology of a watershed or region.[202] This fragmented jurisdiction for stormwater management precludes an integrated watershed-based approach, and establishes a regime in the CRD where the 15 local governments each handle rainwater management very differently.

Two options would fundamentally address this fragmentation:

- Incorporating a regional integrated watershed management plan into the Regional Growth Strategy (RGS); and

- Creating a stormwater commission, which could be accomplished through increasing the jurisdiction of the existing regional Water Commission.

The purpose of this section is to explain local government jurisdiction over rainwater management, which points to the variety of ways a regional watershed management plan and/or Commission could comprehensively address stormwater in the CRD.

202 Authority for liquid waste management planning can be found in the *Environmental Management Act*, S.B.C. 2003, c. 53 s. 24. It is important to note that a municipality is authorized to voluntarily submit a liquid waste management plan for approval by the minister, however a regional district's ability to submit such a plan appears to be at the written request of the minister (s.24(2)).

Drainage

The primary authority for regulating how rainwater is treated is through local government authority over drainage found in sections 69 of the *Community Charter* (for municipalities) and sections 540 to 542 of the *Local Government Act* for regional districts. In summary, a local government may—by bylaw in relation to drainage and sewerage works provided by someone other than the local government—regulate its design and installation and require property owners to connect their structures to the works. They may also require those who are constructing drainage works to maintain the proper flow of water in a stream or ditch or to reclaim land or protect it from erosion. Finally, a local government may impose requirements for the operation or construction of dikes and may make a watercourse part of the municipal drainage system.

Additional authority for runoff control is found in section 907 of the *Local Government Act*, which enables local governments to require an owner who constructs a paved area or roof to manage and provide for the ongoing disposal of the surface runoff in a specified manner. A local government may also establish the maximum percentage of the area of land that can be covered by impermeable material. This section specifically addresses the ability to require infiltration of rainwater from impervious areas and to limit imperviousness to manage rainwater as part of the hydrologic cycle.

Finally, section 906 of the *Local Government Act* gives local governments jurisdiction over aspects of off-street parking design including the size and surfacing materials used. Design standards can include drainage management and treatment of runoff through infiltration and pollution control devices such as stormceptors.

Subdivision

Local governments have the jurisdiction to regulate and require the provision of works and services by bylaw in relation to subdivision pursuant to section 938 of the *Local Government Act*. This lengthy section includes the ability to require drainage collection, drainage disposal, sewage collection, or sewage disposal systems located and constructed according to the standards established in the bylaw. Drainage standards may be different depending on the circumstance, area, land use, zone, or class of highway.

In practice, many regional districts have not enacted their own subdivision servicing standards, relying instead on the provincial Ministry of Transportation standards applied by provincial approving officers. Municipalities enact a subdivision servicing bylaw that establishes the design standards for works and services upon subdivision. Typically these standards require collection of rainwater and pipes to convey it to a rainwater disposal system (through pipes or watercourses). Increasingly, municipalities are requiring drainage systems using different technology based on infiltrating rainwater into the soil or requiring specified infiltration performance to better mimic natural hydrological cycles. Finally, through the subdivision approval process local governments may require erosion and sediment control plans and their implementation during construction.

No Net Increase in Post Development Flows

Through its subdivision standards the District of Saanich requires all drainage structures to reduce the rate of post development site runoff to predevelopment levels, improve the quality of site drainage water and minimize erosion and retain sediment.[203]

TABLE 15

Development Permit Areas for Protection of the Natural Environment

Local governments may designate development permit areas for protection of the natural environment (EDPAs) under section 919.1 of the *Local Government Act* to protect the natural environment, its ecosystems, and biological diversity. They impose additional site-specific development requirements that shape the form, location, and construction of new developments. Under section 920 of the *Local Government Act*, if a parcel is in a designated EDPA, a landowner must obtain a development permit before subdividing, constructing or altering a building or other structure, or altering the land.

A development permit for land within an EDPA can:

- specify areas of land that must remain free of development, except in accordance with any conditions contained in the permit;
- specify natural features or areas to be preserved, protected, restored, or enhanced;
- require dedication of natural watercourses;
- require construction of works to preserve, protect, restore, or enhance natural watercourses or other specified natural features of the environment;
- specify protection measures, including planting or retaining vegetation or trees in order to conserve, protect, restore or enhance fish habitat or riparian areas, control drainage, control erosion, or protect banks; and
- impose conditions on the sequence and timing of construction.

Guidelines for EDPAs are contained in OCPs and can include standards for rainwater management systems with the purpose of environmental protection. These standards may be performance based or specify an approach to rainwater management, for example requiring no net increase in post-development flows off the site or requiring infiltration of 90 per cent of rainfall to maintain hydrologic cycles.

Landscaping

Section 909 of the *Local Government Act* gives jurisdiction to local governments to require, set standards for and regulate the provision of landscaping to, among other things, preserve, protect, restore and enhance the natural environment or to prevent hazardous conditions. Examples of such regulation include landscaping with native species and a specified density of trees to promote rainwater retention.

203 Schedule H, Subdivision Bylaw No. 7452 February 2004 www.gov.saanich.bc.ca/business/development/eng/specs.html

Green Roofs

Relying on its authority to require landscaping, the City of Port Coquitlam amended its zoning bylaw in 2006 to require green roofs on commercial or industrial buildings occupying a minimum building area of 5,000 square metres (53,821 square feet). The primary purpose is to obtain environmental benefits including intercepting and reducing stormwater run-off and decreasing energy consumption. While green roofs cost 10 per cent more than conventional roofs, this cost is usually recovered within two years and the roofs last twice as long. Council may approve a variance where a green roof is inappropriate for a specific building.[204]

TABLE 16

Development Cost Charges

Local government may require the payment of development cost charges (DCCs) under section 933 of the *Local Government Act* by development applicants to recover some of the capital cost that new development imposes to infrastructure systems, including drainage. Local governments can calculate DCC rates based on rainwater systems that revitalize the hydrologic system and use infiltration-based approaches on a community-wide basis.

City of Surrey – Natural Areas for Rainwater Management (Box 19)

The City of Surrey acquires passive parkland and greenways using DCCs and holds them for a variety of uses, including rainwater management and ecosystem protection. This approach is set out in the Grandview Heights Neighbourhood Concept Plan Area #2.[205]

TABLE 17

Under section 933.1 of the *Local Government Act*, local governments may also waive or reduce DCCs for eligible developments that result in a low environmental impact. Local governments must identify what makes a project an "eligible development," which could include rainwater infiltration and low permeability on a parcel.

Regulatory Environmental Bylaws

The *Community Charter* and *Local Government Act* permit local governments to enact a variety of regulatory bylaws that address environmental protection and can implicate rainwater management.[206] These include tree protection, soil deposit and removal, watercourse protection, pesticide control and alien invasive species. Bylaw provisions under this type of jurisdiction can include retention or restoration of trees

204 Report to Council http://www.city.port-coquitlam.bc.ca/__shared/assets/Green_Roofs3177.pdf

205 Susan Rutherford, *Green Infrastructure Guide*, Coast Environmental Law, 2008, at p.35.

206 Municipalities have some jurisdiction for tree protection (*Community Charter* ss.8(3)(c) & 50), soil deposit and removal (*Community Charter* ss. 8(3)(m) & 9(1)(e) and *Local Government Act* s.909), watercourse protection (*Community Charter* ss.8(3)(j) & 9(3)(a) Spheres of Concurrent Jurisdiction – *Environment and Wildlife Regulation* s.2(1)(a)), pesticide control (*Community Charter* ss.8(3)(j) & 9(3)(a) Spheres of Concurrent Jurisdiction – *Environment and Wildlife Regulation* s.2(1)(b)(ii)), and alien invasive species (*Community Charter* ss.8(3)(j), 8(3)(k) & 9(3)(a) Spheres of Concurrent Jurisdiction – *Environment and Wildlife Regulation* s.2(1)(b)(iii)). Regional districts have some jurisdiction for tree protection (*Local Government Act* s.923) and soil deposit and removal (*Local Government Act* ss.909 and 723).

and vegetation for rainwater retention (tree and watercourse protection, alien invasive species), or the prohibition of harmful substances entering the hydrologic cycle (watercourse protection, pesticide control).

In particular, municipalities have the authority to prohibit or regulate the use of cosmetic pesticides on residential properties. Watercourse protection bylaws can regulate and prohibit polluting, obstructing, and impeding the flow of a watercourse. This can take the form of:

- prohibitions on fouling a watercourse that specify the kinds of substances and amount of suspended solids that will be considered fouling;
- an open-streams policy that prohibits enclosing watercourses and identifies opportunities for daylighting watercourses;
- requirements for obtaining permits, the conditions of which are based on best management practices;
- requirements for developing and implementing sediment and erosion control plans or for undertaking sediment and erosion control measures contained in appended guidelines or best management practices documents; and
- terms of reference for the development of plans to be attached to permit applications; or
- prohibiting the discharge or washing of concrete into watercourses during construction.

Examples of Regulatory Bylaws

The District of North Vancouver's Environmental Protection and Preservation Bylaw is the only example of a comprehensive environmental bylaw in B.C. It deals with tree protection, soil deposit and removal, and watercourse protection.[207]

The City of Surrey enacted an Erosion and Sediment Control Bylaw in 1997 to regulate any contractor who may generate sediment.[208]

The District of Saanich's Watercourse and Drainage Regulation Bylaw requires oil and grease interceptors to treat runoff from parking lots and developers to design and install stormwater management facilities where there is insufficient existing capacity. [209]

See also the District of Metchosin's *Rainwater Protection and Management Bylaw.*[210]

Table 18

207 http://www.dnv.org/article.asp?a=3654&c=74
208 http://www.surrey.ca/Living+in+Surrey/Environent/Protecting+Our+Environment/Erosion-+and+Sediment+Control/default.htm
209 http://www.saanich.ca/municipal/clerks/bylaws/pdfs/watercourse7501.pdf
210 http://www.district.metchosin.bc.ca/467/467.pdf