A photograph of a forest waterfall. The water is cascading down a rocky ledge, creating a misty spray at the bottom. In the foreground, a large, textured tree trunk is visible on the right side. The background is filled with green foliage and branches, some of which are out of focus. The overall scene is a natural, serene forest environment.

# Muddied Waters

The Case for Protecting  
Water Sources in B.C.

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\*For more information on these groups, turn to the inside back cover.

# Muddied Waters



When logging dirties clean water,  
communities and the environment pay the price.

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*Front cover photo: Stream flowing through pristine forest in McFayden Creek, Slocan Valley, July 1997. Photo by Garth Lenz.*

*Back cover photo: Forest Practices Code-approved streamside logging on Hawkesbury Island, south of Kitimat, August 1999. Photo by Ian McAllister.*

*Inside front page photo: Kim Davidson in a Forest Practices Code - approved clearcut, in the Datlaman watershed, Haida Gwaii, June 1997. Photo by Garth Lenz.*

# Muddied Waters: Executive Summary

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Each year in British Columbia more than 200,000 hectares of forest is logged, the majority of it clearcut.

Almost all of that logging activity takes place in watersheds or forested valleys that contain important surface water supplies such as reservoirs, lakes, rivers or streams. Often, valleys contain a multitude of water bodies connected with one another. The small ephemeral streams in a valley's upper reaches feed into bigger creeks that carry water into valley-bottom rivers.

This report examines the costs to human communities and fisheries when logging-related damage to these interconnected and finely balanced water systems occurs. What price do resident salmon pay when clearcut logging or other destructive land uses disrupt the natural processes in streams and rivers? What do we as a society pay to try and undo this damage? Similarly, what health and fiscal costs do human communities confront when the drinking water they depend on is degraded?

As this report reveals, the costs are extremely high. If the 100 B.C. communities outside of Vancouver and Victoria who currently use unfiltered water from surface sources were forced to filter their water to get rid of unwanted sediments, the cost would be about \$700 million. The ongoing cost of running the new filtration plants would be about \$30 million annually. Such costs can be avoided, but only if land-use practices around surface supplies don't muddy the water.

The health risks associated with waterborne disease outbreaks are obvious. In the summer of 1996, as many as 17,000 people were estimated to have fallen ill when a potentially fatal parasite was washed into the surface waters that provided the residents of Kelowna and Cranbrook their drinking water. The City of Cranbrook's Chamber of Commerce later estimated that the disease outbreak cost the city \$5 million in lost business.

Many public health officials insist that the only way to deal with waterborne diseases is to increase the use of commonly employed chemicals such as chlorine. Yet Health Canada reports that prolonged drinking of chlorinated water is linked to increased incidence of bladder cancer. Research continues into the chemical's possible contribution to other cancers, stillbirths and premature births. Furthermore, lots of chlorine must be used to neutralize common waterborne pathogens such as Giardia and it is completely ineffective in dealing with Cryptosporidium, the parasite that infected so many of Kelowna's and Cranbrook's residents.

Logging in watersheds also poses significant threats to the environment, particularly the critically important in-stream habitats of spawning and rearing salmon. Every time a logging road or logging operation triggers increased water runoff into streams, chances are high that elevated levels of sediment and debris are washed into waterways inhabited by fish.

To date, more than \$300 million in public money has been channeled through the Crown Corporation, Forest Renewal BC, to pay for "watershed restoration" projects in the province. Expenditures to clean up streams and surrounding hillsides damaged by logging activities continue. It was recently estimated that up to 40 years of funding might be required to rehabilitate salmon habitat and surrounding forests damaged by logging.

*What health and fiscal costs do human communities confront when the drinking water they depend on is degraded?*



Community members from the New Denver area protested logging in the New Denver Flats in the summer of 1997. Nine people were arrested in the protest.

*Clearly, the public has paid and continues to pay a steep price for land-use practices that damage surface waters.*

According to the Ministry of Environment, the cost to do that work would range between \$1 billion and \$4 billion.

Clearly, the public has paid and will continue to pay a steep price for logging practices that damage surface waters.

A lucky few communities may be spared the big expenditures that others face, however. That's because the lands surrounding their water supplies are protected from clearcut logging and associated road networks.

While some communities have convinced the provincial government to protect their watersheds, others are told that they must accept clearcut logging and other potentially destructive activities in theirs. This places these communities in an extremely vulnerable position. Under provincial laws, communities must provide water that meets strict quality guidelines. If their water supplies are damaged as a result of a forest company logging in a nearby watershed, it's the water provider that must carry out, and pay for, everything required to render tap water safe to drink. These costs are, inevitably, passed on to local residents and taxpayers.

This report suggests that communities without protected water supplies should be given greater powers to determine what occurs in watersheds supplying their drinking water. Perpetuating a situation where water providers bear legal responsibility for delivering clean water to their constituents, yet have no power to prevent activities that degrade that water, is an affront to community residents and their elected leaders.

# Muddied Waters: Introduction

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**F**orests play an important role in the protection and replenishment of water, our most precious natural resource. When forests are cleared of large sections of trees through land-use practices such as logging and road-building, watercourses are often degraded, in some cases for decades.

When trees are removed in blocks or clearcuts, the forest's ability to regulate water flows is often compromised. In the absence of trees, the timing, duration and speed of water runoff is altered. The resulting changes in water quality in nearby streams, rivers and lakes are often detrimental to resident fish populations and important forest-dwelling species that feed on fish.

While sharp declines in wild salmon stocks on Canada's West Coast cannot be attributed solely to logging and other land-uses, land-based activities continue to cause loss of life for resident salmon and other fish species. At a time when many fish stocks are seriously over-harvested, and when climate change is warming our oceans causing stress and death to fish who spend parts of their lives at sea, continuing to allow destructive land-use practices makes a bad situation worse.

Changes in surface water quality are also of serious concern to people, particularly in British Columbia. The vast majority of residents in Canada's westernmost province rely on surface sources for their drinking water. In 1997, fully 88% of municipal water use in B.C. was from surface water sources, such as lakes, reservoirs, rivers or streams.<sup>1</sup>

In recent years, waterborne disease outbreaks in some B.C. communities occurred when surface water sources became awash in dirt particles and parasites. Thousands of people fell ill when these contaminants leached into the water from lands which once were forested but are no longer. Such outbreaks forced many municipal governments to contemplate spending millions of dollars to "treat" water by installing expensive filters and/or injecting more chemicals into water delivery systems. B.C.'s Office of the Auditor General recently concluded that continuing to allow land-use practices to degrade municipal water supplies will carry a heavy price-tag. For example, for the 100 municipalities outside Victoria and Vancouver that use unfiltered surface water "the capital cost of installing filtration would be about \$700 million and the extra cost of financing, operating and maintaining the new treatment



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*The vast majority of residents in Canada's westernmost province rely on surface sources for their drinking water. In 1997, fully 88% of municipal water use in B.C. was from surface water sources, such as lakes, reservoirs, rivers or streams.*

*Intact streamside forests protect fish and human health.*

*“Effective water protection hinges on managing the land uses on the surfaces over or through which water flows”*

plants would be about \$30 million a year.”<sup>2</sup>

Much the same can be said when it comes to rehabilitating salmon streams that have been damaged by logging activities. In its first five fiscal years, the Crown corporation Forest Renewal B.C., spent slightly more than \$302 million on various “watershed restoration” projects. These projects included everything from sinking logs in streams to try to recreate the deep pools that existed prior to the advent of logging, to hydro-seeding hillsides in an effort to decrease the erosion that follows after trees are clearcut. As significant as this funding may seem, it is far less than is needed. Ministry of Environment officials estimated in 1997 that between 20 and 40 years of funding is required to restore riparian and upslope areas damaged by logging and which contribute to salmon declines. The cost for this work was estimated at \$50 million to \$100 million per year, meaning up to \$4 billion in tax dollars would have to be spent to restore wild salmon habitat.<sup>3</sup>

The health and welfare of human and wildlife communities depends on policies and practices that reflect a proper understanding of the interconnectedness of ecosystems.

If we want to have clean water for fish and wildlife, if we desire water of a quality that is safe for humans to drink and is reasonably priced, we cannot divorce water from land. Because what we do on the land can have long lasting impacts on water, we need to see our water and land resources as inextricably linked.

As Auditor General George Morfitt says: “Effective water protection hinges on managing the land uses on the surfaces over or through which water flows. Accordingly, one key condition for successful water protection is integrated management of both water and the land uses that affect it.”<sup>4</sup>

Muddied Waters examines why forested lands around watercourses are so important. It looks at some of the more salient findings to emerge from longstanding scientific studies of watercourses in logged valleys. This work shows numerous and varied impacts from logging and related road-building activities on drinking water and on resident fish populations. The report considers the health and fiscal implications for human communities faced with degraded water supplies. The challenges facing water users in a few communities are profiled. The report includes a discussion of some of the legal tools that citizens can use to protect their water sources. Throughout, alternatives to current land use practices, water treatment and water management are discussed.

In a world rapidly running out of dependable sources of clean fresh water, it is vitally important that policies and practices reflect an understanding of the forest’s role in regulating and filtering the water that flows into streams. When that role is disrupted, we all pay a price.



*Auditor General  
George Morfitt*



# The Forest: Nature's Great Filter

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In 1996 water users on Bowen Island, to the north of Greater Vancouver, issued a guidebook to local residents. While the publication focused on issues of local importance, much of what it offered reflected the concerns of water users across the province.

For Bowen Island residents and others in the Howe Sound area several challenges loom. First, the region is experiencing rapid growth, something common to many areas of the province. If present trends continue, the population of the Sunshine Coast Regional District will increase from 22,000 to 30,000 residents in the five years ending in 2001. Within the same time frame, residency in the Squamish area is expected to soar from 12,000 to 40,000<sup>5</sup> people. Whether these exact projections are realized, there will be increased demand for water. And that has serious implications.

“Several times a day, most plants and animals replenish roughly 66% of their structure that’s made of water,” the guidebook’s authors D.G. Blair-Whitehead and Will Husby report. “As well, we humans use this precious liquid for cooking, cleaning, bathing and washing our clothes. Add the amount poured into our industries and institutions daily, and you’ll find that, in south-western B.C., each person uses about 700 litres of water every day ... In the Howe Sound region, the quality and amount of clean water directly affects the survival of local salmon populations, the viability of threatened species of frogs, newts and other amphibians, and the many wetland plants that occur throughout our watershed. Close to 80% of local animal species use lakes, ponds, and streams and their associated riparian habitat at some time during their lifetime: for food, nesting areas, predator escape, mating, or raising their young.”<sup>6</sup>

From the near defenseless newt to humans who are altering the planet, we all depend on water for survival. And as we are increasingly aware, we depend on the forests surrounding our watercourses to protect that precious resource.

These days when people talk about conserving water supplies they often focus on areas of land called watersheds. Throughout this report we will be talking about watersheds or community watersheds. How do we define such areas? What is their importance?

Watersheds consist “of a valley, or inter-connected system of valleys, that contain a river system. Water that falls anywhere within a watershed will either seep into soil and bedrock to become ground water, or find its way into the river system and flow out of the watershed and into the sea.”<sup>7</sup> “Community watersheds” is a term used in this report to refer to watersheds that supply drinking water to communities.\*

In such areas, forests are essential. When they are altered through clearcut logging, road building, or other land uses, water quality and quantity changes. “When you remove trees, you increase the amount of water that runs through the system into streams, because trees suck water out of the soil by their roots, and their branches intercept water that would otherwise hit the ground,” says Michael Feller, an associate professor of forestry at the University of British Columbia. Feller goes on to say that in the absence of trees more snow collects on exposed ground in the winter. When spring’s warmer temperatures arrive, “you’ve got more snow to melt and a bigger flow (of water) in the spring

*Alternative logging methods, be they patch cuts or selection logging of individual trees, are less damaging to the environment than conventional clearcuts.*

\* Lands can also be designated Community Watersheds under the Forest Practices Code. If they are designated, they appear in capital letters in this report. For a discussion of issues surrounding designation see: Page 24.

# A Proud Legacy

For years, coastal forest companies insisted that there really was only one way to log in watersheds. It was simply too dangerous to log individual big, old trees on the coast's wet, steep mountain-sides. And even if you could, the industry claimed the standing trees left behind after logging would blow down anyway. You had no choice but to clearcut.

In 1992, in one of the windiest and wettest regions on the coast, these myths were laid to rest. An experienced logging crew, under the watchful eyes of researchers with the Forest Engineering Research Institute of Canada (FERIC), took part in an ambitious experiment at Rennell Sound on Haida Gwaii (the Queen Charlotte Islands). Areas of forest were subject to different types of logging including conventional clearcutting, patch cuts, and single-tree selection logging.

In the clearcuts, all standing trees of commercial value were cut down. In the patch cuts, smaller clearcuts were spread over a wide area with either half or three quarters of the total land base remaining forested. In the last case, individual trees were selected for logging. In some cases only a quarter of the trees were removed. In others only 15 per cent were. In the selectively logged sites, the trees that were logged were in proportion to the makeup of the forest's tree species and sizes.

As FERIC's Ray Kragg explains, the reason for conducting the study was to examine ways to minimize logging-related environmental damage.

"The program was initiated in response to concerns that the road-building and logging practices of the day were increasing the frequency and magnitude of landslides on steep slopes, resulting in loss of productive forest land and damage to salmon habitat," Kragg reported in 1998.<sup>16</sup>

The Rennell Sound experiments involved the use of helicopters capable of lifting the heavy, big trees characteristic of old-growth forests. This proved an environmental bonus, because no roads needed to be built on the logging sites. (Helicopters do, however, have environmental down sides. They require large amounts of fuel to operate, and the noise they make has a disruptive effect on wildlife.)

On the ground, the environmental gains associated with the least intrusive logging method (single-tree selection logging) and the next least intrusive (patch cuts) were immediately evident. FERIC reported that 82 per cent of the ground surface remained undisturbed on the site where 15 per cent of the trees were selectively logged. On some of the sites that were patch-cut, the area of ground surface undisturbed ranged from 67 to 80 per cent. On those sites that were clearcut, however, the area of ground surface undisturbed never exceeded 58 per cent and was as low as 35 per cent.<sup>17</sup>

Labour and operating costs associated with the alternative logging at Rennell Sound were definitely higher, Kragg reported. Clearcutting came in the cheapest at \$52 a cubic metre. Patch cutting came second at between \$52 and \$54 a cubic metre. And single-tree selection cuts came last, ranging between \$57 and \$61 a cubic metre (all costs rounded to the nearest dollar).<sup>18</sup>

Despite these higher costs, there is room to facilitate more of this kind of work in British Columbia. That's because the provincial govern-

ment controls a major cost of logging in the province. It sets the stumpage fees that companies pay the Crown in return for logging trees on public lands. Stumpage prices are routinely lowered to reflect higher operating costs.

Six years after taking part in the experiment at Rennell Sound, faller Robert DuDoward returned to one of the single-tree selection sites for a look around.

Scattered amidst the tall spires of spruce, hemlock and cedar trees were the graying stumps of trees that he and others had cut down years before. Three quarters of the trees on the logging site remained standing to intercept rain and snowfall and to moderate water flows.

Looking around, DuDoward took pride in what he saw and said he hoped to see more of this thing done elsewhere on the coast.

"... this is the way it should be," DuDoward said. "This is the wave of the future."<sup>19</sup>



PHOTO: GARTH LENZ

*Faller Robert Dudoward inspects a selection-logged coastal forest in Rennell Sound, Haida Gwaii*

runoff period.”<sup>8</sup> Running over exposed earth, that water picks up all manner of organic matter, fine silt, large and small gravel, tree branches and broken logs left behind after industrial logging. Some or all of that material later ends up deposited into streams and other watercourses.

Forest ecologist, Herb Hammond, has studied the relationship between forests and water extensively. He has championed a more balanced approach to the management of natural resources. He has also spearheaded the development of a community-based resource use plan for his native Slocan Valley which he and others say would conserve water quality while allowing for site-specific, low impact removal of trees for conversion into high-value wood products.

In *Seeing the Forest Among the Trees*, Hammond repeatedly emphasizes the forest’s vitally important role as a filter and distributor of water. Following clearcutting, the dense green canopy of needles and leaves on tree branches is gone. “The forest canopy is no longer there to intercept precipitation and send it to another location,” Hammond writes. “Removal or disturbance of soil organic layers during clearcutting or road building construction activities also breaks water connections, exposing mineral soil to greater rain-drop impact and increasing erosion.”<sup>9</sup>

In the forest’s absence, Hammond continues, snowpacks in exposed clearings melt at least a third faster than they would otherwise. And as ongoing research indicates, the risks of landslides greatly increase when forests on steeper slopes are removed.<sup>10</sup> This is partly because the ground underneath the soil destabilizes as the tree roots, which die once the tree is cut, begin to rot and lose their hold on the soil.

Of particular concern to Hammond and others who study the forest’s influence on water quality and quantity, is the shade that thousands of trees provide. Forests play a vital role in moderating the climate globally but also on a site-specific basis. By keeping things cool, forests moderate the rate at which snow melts and water evaporates. This has obvious consequences for the ability of streams, rivers and lakes to retain their water levels, particularly in periods of warm weather. This has led Hammond to conclude that:

“The value of forests as a source of water will likely become more and more obvious as global warming proceeds. In general, Canadian climates are expected to become warmer and drier. Water will become less plentiful... Since we can’t drink logs or money, there may come a day when society decides that using the forest for water is the best choice.”<sup>11</sup>

## Riparian Areas

In a watershed, forests immediately adjacent to watercourses are of obvious importance. These stream side environments are often referred to as riparian areas. As Blair-Whitehead and Husby write, “these zones are thin ribbons of dense vegetation adjacent to streams and the edges of woodlands, lakes and ponds. They provide a transition area between wet and dry habitats. Riparian areas include plants specialized for wet soils such as willows... and birch as well as some wetland plants.”

“In (natural) floods, the density of plant life in riparian zones slows down water flow and the roots bind the soil of stream banks—a two-pronged approach to reducing stream bank erosion.”<sup>12</sup> Forests also perform this valuable function further upslope from riparian areas. This is important because in many parts of British Columbia ground on steep terrain can easily become unstable following logging. Slopes that give way in slides or debris torrents can trigger dramatic, long-lasting changes in downslope water quality.

Because streamside forests parallel the length of a stream or river, they are sometimes referred to as “corridors,” and are considered of high value to wildlife, which use them to

*“The value of forests as a source of water will likely become more and more obvious as global warming proceeds. In general, Canadian climates are expected to become warmer and drier. Water will become less plentiful... Since we can’t drink logs or money, there may come a day when society decides that using the forest for water is the best choice.”*

move from one area to another. Almost all wildlife species in coastal temperate forests use riparian zones at some point for food, shelter or breeding.

“Of all the components of a watershed, riparian zones are one of the most vulnerable to human activity,” Blair-Whitehead and Husby conclude. “They are long, thin sections of forest which at times are not easy to distinguish visually from adjacent forest. Also, they occupy areas where people tend to build houses, roads and bridges. Disruption of small parts of a riparian zone may have widespread catastrophic effects (including substantial increases in turbidity levels in drinking water). Erosion may (also) cause silting of major salmon spawning areas downstream or an important wildlife corridor may be blocked, preventing deer from moving to their wintering quarters.”<sup>13</sup>

As important as these areas are to the diversity of life in a watershed, it must be remembered that land-use activities throughout the watershed can have significant impacts on water quality and the environmental integrity of streams. As more evidence is gathered from long-term studies in watersheds, a growing number of field scientists note that clearcut logging and other land-use activities have profound, long-term impacts on streams, rivers and lakes. One such study was conducted over a 36-year period in the Andrews Experimental Forest in Western Oregon. In findings published by the American Water Users Association, a scientific team found that water yields in a logged-over watershed

dramatically decreased during summer months, a time when certain wildlife species—juvenile salmonids being a good example—are generally under stress due to rising temperatures. These decreased yields were noted for 19 years running, and were predicted to continue for another 20 to 40 years.<sup>14</sup>

The same study noted higher than expected water levels in the same watercourses during the months of October through March, an indication that snow was melting faster than normal on the clearcut hill slopes above the streams. The increase was in the order of 25 per cent. As we will see in other sections of this report, higher peak stream flows are also problematic for water quality and fish habitat.

Among the more interesting aspects of the study was that it looked not only at those watershed lands that were conventionally logged, but at those lands that were logged using alternative methods. The authors noted that in areas where trees were removed in small patches as opposed to big clearcuts, summer water flows were similar to those in undisturbed forests that were also monitored as part of the study.<sup>15</sup> This strongly suggests that alternative logging methods, be they patch cuts or selection logging of individual trees, are less damaging to the environment than conventional clearcuts. The use of alternative logging methods, including selection logging of old-growth forests, has, in general, been dismissed by the forest industry as being too expensive and not necessarily environmentally friendly. But selection logging trials in old-growth forests in places such as Haida Gwaii confirm that it is possible. *See Side Story - A Proud Legacy*

While the area analyzed by the scientists was not in a region of Oregon where resident salmon are found, the report’s authors hypothesized that in areas where salmon are present clearcutting could have an impact on fish health and survival. Much the same could be said for clearcutting’s impacts on the health and well being of human communities. And as we will see, communities often feel they are powerless to stop it

JILL THOMPSON



*Clearcut logging in the Port Alberni Forest District's China Creek watershed, April 1999.*

*Clearcut logging and other land-use activities have profound, long-term impacts on streams, rivers and lakes.*

# Drinking Water and Watersheds: Challenges and Opportunities

When it comes to protecting local water supplies, many communities in B.C. find themselves in a difficult position. Under the provincial Safe Drinking Water Regulations passed in 1992, communities that deliver water are required to meet certain water quality standards. However, almost all water providers find that they have little or no control over activities in their watersheds that may serve to degrade water supplies.

As water supplies are muddied, there is more and more pressure on water purveyors to treat the water. Treatments ranging from the installation of filters, to the creation of settling ponds, to the use of chemicals such as chlorine all carry a price. And, in the case of the latter treatment option, raise health concerns of their own. *See Side Stories - The Concern with Chlorine and Chlorine Overkill?* Because the provincial government is responsible for determining what industrial activities occur on public lands in the province, communities often find part or all of their watershed lands used or licensed to forestry, mining, oil and gas and agricultural interests. Each of these industries can do serious damage to water supplies.

Pig farms, chicken farms and cattle feedlots can be major sources of nutrient overload to surface and groundwater supplies. Fecal matter from cattle feedlots and range lands can also wash into surface waters passing pathogens on to humans. (Cattle were one of the prime suspects in the contamination of the Cranbrook and Kelowna water supplies in 1996 when thousands of people were estimated to have fallen ill during a waterborne disease outbreak of cryptosporidiosis.) Mining and gravel operations can disturb soils causing sediments to wash into waterways. Waste rock from mining can also generate acids that kill fish and endanger human health. Logging can cause increased soil erosion and high turbidity in surface water supplies. This turbidity can “mask” parasites and other harmful agents making them harder to neutralize with commonly used chemicals such as chlorine. Depending on the watershed, all or some of these activities may occur. And this is by no means an exhaustive list.

Despite this, “the Health Act holds a water supplier responsible for providing safe water to its customers,” Auditor General, George Morfitt, wrote in his report *Protecting Drinking-Water Sources*. “Even if its source has been contaminated by the activities of another party, the water supplier must carry out, *and pay for*, any steps required to render the tap water safe (emphasis added).”<sup>25</sup>

In recent years, a number of B.C. municipalities have raised concerns with the provincial government about the costs they incur to meet their legal responsibilities to provide safe drinking water. They point out that they are required to absorb the costs of water treatment, but that they have no control over land use practices which can determine how much they end up paying to treat their water. The experiences of some of these communities are discussed elsewhere in this report as well as in Appendix 2.

*Almost all water providers find that they have little or no control over activities in their watersheds that may serve to degrade water supplies.*



PHOTO COURTESY OF VALHALLA WILDERNESS SOCIETY

*Canadian forest ecologist, Dr. Stan Rowe, is arrested by RCMP at New Denver Flats*

# The Concern With Chlorine

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*“Despite the undisputed benefits of chlorination in controlling waterborne infectious diseases,” Health Canada concludes at the end of a report it released in 1998, “the epidemiological evidence now available clearly suggests that CBPs pose a cancer risk to humans, particularly a risk of bladder cancer.”*

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In 1774, Swedish chemist Karl Wilhelm Scheele discovered chlorine. The chemical went on to be credited with helping rid certain parts of the world of some of the nastiest waterborne diseases then known to humanity.

The first municipal drinking water to be chlorinated in the United States was in Jersey City, New Jersey in 1908. Canada is thought to have followed suit in Peterborough, Ontario in 1916.

Used as a treatment in drinking water, chlorine “virtually eliminated typhoid fever, cholera and other waterborne diseases, representing one of the great achievements in public health,” a Health Canada publication reported in 1998.<sup>20</sup> But with the passage of time, chlorine has lost some of its luster. It is now known that concentrated discharges of chlorinated water can kill fish. More important, from a public health perspective, long-term ingestion of chlorinated drinking water is now considered a health risk of its own.

“It has been estimated that 14-16% of bladder cancers in Ontario may be attributable to drinking water containing relatively high levels of CBP’s [chlorination disinfection by-products]; the US Environmental Health Agency has estimated the attributable risks to be 2-17%,” Health Canada says.<sup>21</sup>

Colon and rectal cancers are also thought to increase in humans who drink chlorinated water over many years. In addi-

tion, studies continue into whether increases in spontaneous abortions, stillbirths and premature births are attributable to chlorinated drinking water.

Despite these findings, Health Canada suggests it may be premature to assume that other disinfectants such as ozone are necessarily a better alternative. Ozonated water can have its own disinfection by-products such as bromate, a known genotoxic carcinogen.

CBPs are formed when chlorine comes into contact with naturally occurring organic materials in a water supply.<sup>22</sup> A chlorinated water supply can be relatively absent of CBPs if it is free of sediment. This can be accomplished either through strict control of land-use activities such as logging which increase sediment loads and/or through the use of filters which screen out sediments prior to chlorine treatment.

“Despite the undisputed benefits of chlorination in controlling waterborne infectious diseases,” Health Canada concludes at the end of a report it released in 1998, “the epidemiological evidence now available clearly suggests that CBPs pose a cancer risk to humans, particularly a risk of bladder cancer. Given the wide and prolonged exposure of Canadians to this risk, public health authorities must decide if the available evidence warrants action to at least reduce exposure to CBPs while safer alternatives are sought.”<sup>23</sup>



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*Concentrated discharges of chlorinated water into streams are a known hazard to fish.*

The provincial government has attempted to deal with some of these concerns through various consultative or planning processes and through pieces of provincial legislation such as the Forest Practices Code, which sets out planning guidelines for lands designated as Community Watersheds. But Morfitt found that most of these processes “focussed their efforts on other issues of importance to local governments, such as local economic development, rather than on water-source issues ... these planning processes were not consistently gathering and considering information about the values and impacts of the competing resource uses in watersheds.”<sup>26</sup>

For example, Morfitt reported, “the cost difference for a municipality between protecting its local water source and adding extra treatment to compensate for declining source quality is a measure of the value of that resource.” Similarly, “the amount that Forest Renewal B.C. has to spend to restore a stream damaged by past logging practices is a measure of the value of preventing that damage in the first place, and can be weighed against the economic return from logging practices.” Likewise, “the costs resulting from an outbreak of water-borne illness are a measure of the value of avoiding the outbreak through, among other things, having a good water source.” Those costs might include the extra “costs to the province for extra doctor visits, increased private spending at pharmacies, the cost to employers to replace absent employees and lost business for the tourism industry.”<sup>27</sup>

The Chamber of Commerce in Cranbrook estimates that the city lost \$5 million in business and tourism revenue following the 1996 cryptosporidiosis outbreak which was linked to the presence of grazing cattle in the community watershed. (Grazing permits on public lands in B.C. are issued by the Ministry of Forests. Often, these permits apply to lands recently logged by the forest industry.) Across Canada, the estimated annual medical costs associated with treating patients with waterborne diseases is unknown, but could be as high as \$1 billion, given that the United States reports spending \$10 billion annually on this health care issue.<sup>28</sup> These costs are on top of the expenses that water providers absorb when disease outbreaks or regulations force them to install new treatment systems to deal with water-quality problems. Such expenditures often result from ill-considered land use activities.

In his report, Morfitt recommended that water users and suppliers need to be on a better footing when it comes to dealing with other major resource users at the planning table.

“... (In) all major integrated resource management processes in the province to date,” Morfitt said, “there has been participation by Ministry of Forests staff, who are knowledgeable about concerns of the forestry sector.” The same could not be said, however, for water users and water suppliers who had no “lead agency in government... focussed on their particular concerns.” This prompted the Auditor General to recommend that the Province “designate within government a lead agency for drinking-water interests, to coordinate government policy and action on drinking water issues.”<sup>29</sup> This was particularly important for the many small water users in the province, the estimated half million people who reside in rural areas and smaller centres and do not have the resources to spend on elaborate water treatment systems.

“Because these areas are also more likely to support activities such as logging, agriculture, mining, grazing and outdoor recreation, there is a strong possibility that these activities will occur near the drinking-water source of a small system,” Morfitt wrote. “In addition, small surface systems are more likely to rely on small water bodies, which have less capacity to dilute contaminants and greater natural variation in flow levels than larger bodies. This makes small surface drinking-water systems more vulnerable to any impacts that other resource users might have on the water source.”<sup>30</sup>

To get an idea of what small and not-so-small water providers confront when it comes to protecting their watersheds and providing clean drinking water, let's take a look at the experiences of some coastal and Interior communities.

*The Chamber of Commerce in Cranbrook estimates that the city lost \$5 million in business and tourism revenue following the 1996 cryptosporidiosis outbreak which was linked to the presence of grazing cattle in the community watershed.*

# Chlorine Overkill?

When health officials try to determine whether or not a water supply is safe for human consumption, they routinely test for the presence of coliforms. Coliforms are a common group of bacteria, which includes *Aerobacter aerogenes* and *Escherichia coli*.

Coliforms are ubiquitous in the environment. There is a subset of coliforms called fecal coliforms that grow better at higher temperatures and usually originate from the digestive tract of warm-blooded animals. When fecal coliforms are found in drinking water, health officials consider this “presumptive evidence” of possible fecal contamination of the water supply.

At the time that such tests were conceived, focussing on fecal coliforms made some sense. “It’s a test that originated around the turn of the century, when typhoid was a real problem,” Dr. Lee Hutton, pathologist for the West Kootenay region explains. “People were dying all over the place back then. I looked at the record in the Nelson area at the turn of the century, and a third to half of the people that died, died from typhoid.”<sup>24</sup>

At the time, water in Nelson and other Canadian cities was not chlorinated and sewage treatment was almost unheard of. The typhoid bacterium was difficult to identify in water samples, let alone to kill. So public health officials looked for the presence of fecal coliforms and, if they found them, they looked around for a new water supply.

Nelson’s typhoid troubles were traced to a water supply at a mining camp above town, which was contaminated with human feces. When a new water supply was found, the typhoid outbreak ended.

Improvements in where drinking water is drawn from, as well as advances in the handling and disposal of human waste, dramatically eliminated outbreaks of typhoid, cholera and other infectious diseases in many parts of the world. But the testing continues to focus on fecal coliforms, something that puzzles Hutton.

Hutton notes that some public health officials justify ordering communities to chlorinate their water supplies on the basis of the presence of fecal coliforms in the water supply. Chlorine may inactivate the coliforms, Hutton says, but it has absolutely no effect on other problematic organisms that health officials are anxious to rid from water.

For example, *Giardia* and *Cryptosporidium*, two hardy single-cell parasites that have been responsible for small and large waterborne disease outbreaks, are highly resistant to standard chemical water treatment. Protective cysts, which harbor the parasites,

cannot be killed by normal, or even in some cases extensive, chlorine use. And any waterborne *Giardia* or *Cryptosporidium* cysts that pass into their human hosts after a standard chlorine treatment may cause serious illness.

“*Cryptosporidium*, apparently, can survive in a bottle of household bleach. It’s almost totally resistant to chlorine. And *Giardia* has to be exposed to chlorine for long lengths of time,” Hutton says.

To deal effectively with these parasites and other problematic waterborne pathogens, requires a lot of work before the water actually enters the pipes that deliver it to households and industrial users. If devices like slow sand filters (described elsewhere

in this report) can remove virtually all of the *Giardia* and *Cryptosporidium* cysts, along with most of the bacterial matter, then, Hutton asks, what is the point of adding chlorine to the treated water?

“If you’re killing 99.99 per cent of the *Giardia* and *Cryptosporidium* and presumably the bacterial pathogens before the water enters the delivery system, then all you’re going to get in the pipes is regrowth of wild organisms, soil organisms, not pathogenic bacteria which favor high temperatures. And we all have billions of bacteria, including fecal coliforms in our bodies and they’re not

causing us to be sick,” Hutton says.

If the water distribution system that the treated water flows into is intact, there’s really no need to treat the water further. “If you’ve killed the pathogens, they’re not going to re-grow in the pipes,” Hutton says. “*Giardia* won’t grow. Viruses won’t grow. *Cryptosporidium* won’t grow. They have to live in an organism to grow.”

Once in a while, Hutton says, water purveyors might want to flush out the distribution system with chlorine to get rid of some of the harmless bacterial regrowth in the pipes that may affect water taste. Other than that, the only reason to introduce chlorine into a water delivery network following treatment would be if periodic testing at the end points in the system showed that the water had been contaminated through a pipe break or cross-connection that allowed fecal matter to enter the drinking water stream.

In that case, adding chlorine really wouldn’t be addressing the fundamental problem, which is a faulty distribution system, not the treated water entering into it.



Dr. Lee Hutton



# Sliding Downhill: Water Quality in Chapman and Gray Creeks

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When Linda Williams wants to get safe, clean drinking water she doesn't turn to the water coming out of her kitchen tap. A resident of the small community of Tuwanek, Williams says she doesn't trust the cloudy, heavily-chlorinated water provided her and some 20,000 residents in a number of communities on the Sunshine Coast.

"Many members of my small community get drinking water from an old watershed reserve behind us, which used to be our community water supply," says Williams, who is also president of the local ratepayers association. "We have to go to the old intake and carry it out in bottles. But it's worth it. It's very, very good drinking water."<sup>31</sup>

The place that Williams and many of her neighbours make frequent trips to is known as the Irvine Creek watershed reserve. It's a small, steep-sloped valley that Williams describes as "self-protecting." Its terrain is inhospitable for industrial logging interests, so it has been spared the kind of development that has damaged the region's major Community Watersheds to the point where most residents no longer trust the safety of the water.

What has happened to the quality of water in the Chapman and Gray Creek watersheds leaves Williams and many of her fellow Sunshine Coast residents badly shaken. So shaken, that when the Sunshine Coast Regional District put a question to area residents in 1998 asking them if they supported a plan for a resumption of limited logging in the watershed 87 per cent of voters said no.

That the vast majority did so is not surprising.

In 1967, a 10-year Timber Sale Harvest License was granted to Jackson Bros. Logging Co. allowing the company to log the watershed's old-growth forests. Just three years later, the Ministry of Forests' district forester wrote B.C.'s Chief Forester to complain about the effects of logging on water quality and to urge that "extraordinary measures" be taken to ensure that the water courses in Chapman Creek were protected for the benefit of the region's expanding population.

Despite repeated complaints by area residents, logging continued in the watersheds and the damages mounted. Most of the new logging in Chapman Creek took place on lands that were identified as slide-prone years earlier. Meanwhile, huge "progressive" clearcuts systematically liquidated mature timber in Gray Creek. In 1993, a "cumulative effects analysis" of logging's impacts on Chapman and Gray Creeks confirmed what many expected. The analysis, carried out by Ministry of Forests hydrologists, found that of the 287 landslides in Chapman and Gray Creeks, 85% were caused by logging activity or logging roads. The other 15% were attributed to natural causes.

Bowing to intense public pressure, the Ministry of Forests launched an Integrated Watershed Management Plan in 1990. Its hope was that the plan, which brought together representatives from the SCRD, International Forest Products and Canadian Forest Products, Ministry of Forests and Ministry of Environment, and the Sechelt First Nation, would buy peace in the woods. It was mistaken.

There was from the beginning a high level of public mistrust about the process, Williams says. Many area residents felt that forestry interests (both government and industry)

*The analysis, carried out by Ministry of Forests hydrologists, found that of the 287 landslides in Chapman and Gray Creeks, 85% were caused by logging activity or logging roads.*



Linda Williams

COAST INDEPENDENT

# Cleaning with Sand

They have been around since the days of the Roman Empire, and they continue to work wonders when it comes to providing clean drinking water. They are called slow sand filters, and their beauty lies in their simplicity.

Centuries ago when Roman engineers were looking at ways to purge their water of impurities, they didn't have the quick-fix chemicals that we have today. So they looked for something in nature to provide the answer. Tightly packed fine sand, Rome's enterprising engineers soon found, provided a screen that effectively and cheaply cleaned the water.

Sand filters have been refined over the millennia. But the principles of earlier times remain. Pipes placed in a surface water source such as a creek, river or lake divert water down to a pen where tightly packed sand is contained. The incoming water then seeps down with the tiny particles of sand trapping the organic sediments and many of the pathogens that can be contained in a surface water supply. Over time, the upper layer of the sand is colonized by bacterium that feeds on the other bacterium carried in the surface water. In this way a new natural barrier is created which effectively eliminates potentially harmful agents from entering the drinking water stream.

"There are a number of mechanisms at play with sand filters," says Peter Gigliotti, of Urban Systems Ltd. in Kelowna, a company that has built both slow and fast sand filters. "The sand is very fine and it is tightly packed. So it physically strains the tiny particles that are floating in the water itself. It also adsorbs. In other words, organic matter in the water sort of sticks to the particles of sand in the filter. The other mechanism at play is biological filtration. As the water sits on top of the first few inches of sand, after a period of time that they call maturation, it forms a colony of bacteria in this top layer of sand. And these bacteria consume. They eat. So they consume bacteria in the water. So the sand acts as a biological filter as well."<sup>34</sup>

Gigliotti and Urban Systems were responsible for installing a pilot slow sand filter in the Rossland area. During testing of the pilot system, a large number of pathogens were placed in the water to see how the filter would perform. "The pilot filters were spiked with giardia cysts (which when ingested can cause giardiasis or beaver fever). We got some cysts from a lab, I believe in Medicine Hat. They gave us a vial with three or four

billion giardia cysts. On average there was 99.99 per cent removal of the giardia cysts [after passing through the filter]" Gigliotti says.

The annihilation of all but one one-hundredth of one per cent of the cysts prompted Rossland to have a new water treatment plant installed for the benefit of the city's residents and the many tourists who travel to this scenic area to downhill and cross-country ski. The cost to install the new filter and equipment that bombards the treated water with ozone was \$4.5 million.

Ironically, the effectiveness of the filters themselves proved somewhat problematic. According to Mark Martin, Rossland's Engineering and Land Development officer, the water coming through the filters was so clean that the disinfectant, ozone, had nothing to make contact with and kill.

"It may ultimately be that the ozone is not necessary except for the brief periods of time following sand filter cleaning when you have a lag before the formation of a new bacteria layer," Martin says.<sup>35</sup>

Despite the strong performance of slow sand filters, Ministry of Health officials routinely ask water purveyors to hit their filtered water with a final shot of chlorine so that a "residual" element of the chemical is maintained in the pipes carrying water to homes and businesses. The Ministry says the residual is necessary to kill any coliforms or bacteria that

may regrow in the lines or enter the lines through a line break or a cross connection.

Not all municipalities are happy with this view. Some, including Rossland, say they don't believe in the need to put chemicals in the water after it is treated. In July 1998, Rossland Council sent a letter to B.C. Minister of Health, Penny Priddy, saying that the city was canceling the use of chlorine. The city did not use chlorine for a seven-week period, during which routine testing of the water turned up some water samples in which no fecal coliforms were found and others in which a single coliform was recorded. This appeared to meet B.C.'s Safe Drinking Water Regulations that specify that no fecal coliforms are allowed to be present in test samples. If a municipality tests its water only once every 30 days, no total coliforms are to be present either. If more tests are done, 90 per cent of them must be coliform-free, and no more than 10 total coliforms may be present in any one sample.

Rossland's water treatment system is relatively new, and Martin says that ozone treatment may ultimately be required before not after sand filtration.

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*Some municipalities, including Rossland, say they don't believe in the need to put chemicals in the water after it is treated.*

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dominated the planning process and that it would ultimately result in recommendations for more logging.

“So much logging had already occurred, and there was so little mature timber remaining, that people couldn’t understand the unwillingness of government and industry to place a moratorium on logging while the IWMP was underway,” Williams says. “People were also quite aware that the 1974 Integrated Resource Management Study process had not resulted in a better standard of management. And that process was supposed to be the model for

IWMP’s in coastal watersheds,” Williams continues. “Anyone who still harbored hope that the IWMP would finally put water first was quickly set straight when the Ministry of Energy and Mines tabled draft guidelines for mining in Community Watersheds. Chapman and Gray Creeks had the dubious honour of being selected as candidate sites for the new guidelines.”

Pressured by area residents, the SCRCD took the unusual step in 1992 of seeking a court injunction to prevent further logging and road-building while the latest planning process was underway. The SCRCD position was that Chapman and Gray Creeks were Section 12 (now Section 16) Land Act Watershed Reserves, and as such the Ministry of Forests did not have the legal authority to approve logging plans in them. The statement of defence filed on behalf of the Ministry of Forests denied that MOF had ever authorized or acquiesced in any practices or activities that caused or contributed to any of the damage alleged by the SCRCD. It also stated that the SCRCD had no right to expect that the Crown “would utilize its property rights in the watershed in a manner that was acceptable” to the SCRCD. The following year, just before the matter was scheduled to go before the courts, a deal was struck between the SCRCD, Interfor and the provincial government and a moratorium was placed on logging and road-building. There has been no industrial logging activity since.

The IWMP for Chapman and Gray Creeks was eventually signed off by its government participants in 1997.

Barry Miller, the Ministry of Forests’ representative on the IWMP, says the aim was to “produce an integrated resource management plan. And the number one priority was the protection of water characteristics, the quality of the water, the quantity of the water, and the timing of the water which is very critical for fish stocks.”

“But,” Miller continues, “it was not signed off by the industry representatives at the table. They said that the plan was too restrictive on harvesting. However, they said that they would live with the plan if it was accepted and approved by the regional manager of the



*Clearcut logging increases the amount of debris and organic material entering small creeks and other water bodies.*

*Many area residents felt that forestry interests (both government and industry) dominated the planning process and that it would ultimately result in recommendations for more logging.*



*Logging on steep slopes in rain-prone areas greatly increases the risk of land slides and debris torrents.*

Ministry of Forests and also by the Regional Director for the Lower Mainland Region of Environment, Lands and Parks.”<sup>32</sup>

The regional managers have yet to approve the plan, however. Both are hoping for its eventual acceptance by the SCRD. The SCRD, as the other “stakeholder” at the planning table, did not sign off on the plan. “They would not sign off because they felt the plan was not restrictive enough on harvesting,” Miller says. “So we had one interest or stakeholder that felt that the plan was too restrictive, and the other felt it was not restrictive enough.”

With 87% of SCRD residents voting to reject the IWMP, it’s unlikely the provincial government is going to get buy-in from the regional district any time soon. Meanwhile, the logging moratorium at Chapman and Gray Creeks continues, but it is on increasingly shaky ground.

Despite all the evidence of logging-related damage to the watersheds, despite the strong and persistent opposition of area residents to renewed industrial forestry, new logging plans for Chapman and Gray Creeks were recently submitted by International Forest Products. The plans are now working their way through the approval process within MOF.

“We’re left to wonder what it will take before the government stops trying to impose on water users unworkable, and after 30 years unproven, theories about watershed management,” Williams says. “It’s time we moved beyond that to a free and open debate on whether industrial forestry activities in community watersheds make any sense at all.”

As for the water at Chapman and Gray Creeks, years of logging-related slides have resulted in muddy water that will require extensive treatment to be made acceptable for drinking. Sieg Lehmann, the District’s general manager of infrastructure services, says a “membrane filtration” system has been pilot tested. If a full-fledged filtration system is installed it will cost between \$4.3 million and \$6.1 million. And it will only be able to treat the water during winter, fall and spring months, not during the peak summer season. Lehmann says the hope is that a larger and more expensive filter system that could treat water year round may not have to be built if current patterns continue and the water remains less cloudy in summer months.<sup>33</sup> The use of the filters would reduce the amount of chlorine needed to treat the water, but chlorination would still continue. Other communities in the province that have installed expensive filters are, however, hopeful that they can eliminate the use of chlorine. *See Side Story - Cleaning with Sand.* “The treatment at this point in time is chlorination with a large settling reservoir and a shut off valve which is integral to this because the water is so often turbid. The water is almost completely unusable at this time because it is so heavily chlorinated,” Williams says.

On the Sunshine Coast, it seems nobody is happy with the water quality, and nobody is anxious to see the water supply degraded any further.

# Prince Rupert: A Protected Water Supply

With 17,000 residents, Prince Rupert is the largest community on B.C.'s northern and mid coasts. Located on an island, the city draws its water from a watershed on the adjacent mainland. The watershed encompasses Woodworth and Shawatlan Lakes. The former supplies the city's water needs. The latter is used as a backup water supply. The watershed is on Crown land, but it is difficult to access. You can only get to it via boat and by crossing over privately owned city land or an Indian Reserve.

Prince Rupert's watershed stood out as the exception to the rule in a number of watersheds profiled by the Auditor General in his report. "The watershed has never been

logged and local Ministry of Forests officials consider the environment too sensitive to allow harvesting," Morfitt reported. "Testing has not shown evidence of Cryptosporidium or Giardia in the water. City officials believe there are few wild animals present to introduce these parasites, probably because of the steep sides of the watershed."<sup>36</sup>

Prince Rupert treats its water with both chlorine and fluoride. But Bob Thompson, the city's director of engineering services, says there is no need to build an expensive filtration system because the lakes' waters are so clear.

"It's pretty much virgin bush up there," Thompson says. "And we don't allow any people up there."<sup>37</sup>

In 1995, Prince Rupert spent a considerable amount of money building a gravity-feed water line from Woodworth

Lake. The \$5.4 million expenditure allowed the city to switch from using a pump feed at Shawatlan Lake. During the planning stages for the new line, there was some feeling that the city could partially offset costs by allowing logging in the watershed. A consultant acting on behalf of logging interests approached the city in 1993 suggesting that the area could be logged in an environmentally friendly way and that the city could pocket about \$500,000 from that logging activity.

At the end of the day, the city opted not to support the logging plans. Thompson says the risks were just too great. "We didn't have \$15 million to spend on a treatment plant (if things went wrong)," Thompson says. "The decision was made not to pursue that. We didn't want to get into logging that watershed. We've always been proud that the watershed was pristine. And we wanted to keep it that way."

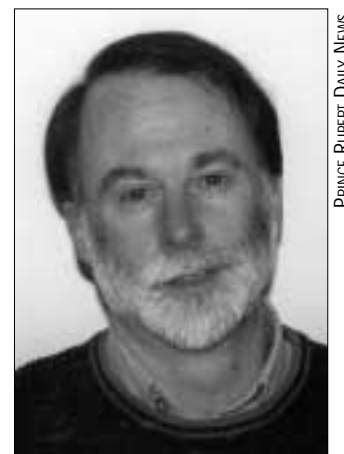
In his report, Morfitt notes that Prince Rupert's watershed is also designated as a Community Watershed under the Forest Practices Code, and he suggests that this desig-

*"We didn't want to get into logging that watershed. We've always been proud that the watershed was pristine. And we wanted to keep it that way."*

PHOTO HEATHER DAYNARD



*In addition to saying no to logging, Prince Rupert maintains a strict No Trespassing policy in its watershed.*



PRINCE RUPERT DAILY NEWS

*Bob Thompson*

nation adds a further degree of protection to the lands around the lakes. But as we will see elsewhere in this report, Community Watershed designation does not preclude logging.

In this case, however, there seems to be an agreement between Ministry of Forests and city officials that the lands will not be developed. Brian Wesleyson, operations manager with the North Coast Forest District office in Prince Rupert, says the lands are also designated as a “watershed reserve” under the Land Act, a designation that some people have argued precludes logging but that the Ministry says allows for “integrated resource management” which includes logging. Nevertheless, Wesleyson says local Ministry of Forests officials consider the area off-limits to logging in recognition of its importance as a source of clean drinking water.

*“ ... if they were to decide to unilaterally mess with our watershed, they'd have problems on their hands.”*

“The reserve area has no proposed forest activity,” Wesleyson says. “That area is not in any of the chart areas for our small business program or any of the region’s major licensees.”<sup>38</sup>

Adds Thompson: “They (the Ministry of Forests) seem to have the same sensibilities we do. And if they were to decide to unilaterally mess with our watershed, they'd have problems on their hands.”



*Mist hangs over a lake near the reserve pump house above Shawatlan Lake, part of Prince Rupert's water supply.*

# TIMM-BERRRR in Kimberley?

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In a town that has relied on the fortunes of one industry for many years, the impending loss of that industry is a difficult and frightening thing. In the case of Kimberley, a community of 6,700 people nestled in the picturesque East Kootenay region, mining giant Cominco has for decades been the economic mainstay of the local economy.

When local business owners, planners and elected councilors realized several years ago that Cominco's lead and zinc reserves were running out and that it would be closing its local operations in 2001 or so, they began to plot a new course for the local economy.

A major and much publicized initiative involved an aggressive move into tourism. The city centre was transformed, with buildings getting a Bavarian-style make over. New 18-hole courses were built to attract North American and overseas golfing enthusiasts. And skiing-related enterprises were expanded to take advantage of the world-class ski hills above the city.

A less-publicized but equally important initiative involved the upgrading of existing infrastructure, in particular the local water collection and delivery system. The city had relied for decades on a water system built by Cominco. But with the company pulling up stakes the city couldn't afford to use an antiquated system to deliver water to local residents and the increased number of tourists patronizing local businesses. It just wouldn't be good for the burgeoning hotel and bed-and-breakfast trade to have water that was below standards.

The city spent \$7 million building a new reservoir and water delivery system in the Mark Creek Watershed. But as this ambitious capital project was nearing completion, the city found itself struggling to prevent proposed logging-related developments in the watershed.

During an exhaustive land-use planning process spearheaded by the Commission on Resources and Environment (CORE) and the subsequent Kootenay-Boundary Land-Use Plan approved by the B.C. government in March 1995, the 9,400-hectare Mark Creek watershed failed to receive what many area residents hoped for, namely, protected status.

Subsequent attempts to have the area declared protected also failed. In addition, the city was turned down when it asked the provincial government to grant it a long-term lease to the watershed's Crown lands. The lease sought was similar to a 999-year lease that the Greater Vancouver Regional District holds to the Seymour, Capilano and Coquitlam watersheds, which supply Greater Vancouver's residents and businesses with their water.

*During an exhaustive land-use planning process... the 9,400-hectare Mark Creek watershed failed to receive what many area residents hoped for, namely, protected status.*



JILL THOMPSON

*A recently logged mountain slope south of Port McNeil, January 1998*

As far as the provincial government is concerned, Mark Creek remains part of an “integrated resources management” zone. As such, it is open to industrial development, including forestry and mining. Kimberley mayor, Jim Ogilvie, has said that if proposed logging in the watershed proceeds, something he and others on Kimberley council are opposed to, the city might be forced to put in a water filtration system. “A filter system is... in the millions and probably more than we could afford as a community,” Ogilvie says, adding that the projected costs could top \$10 million.<sup>39</sup>

Like the Sunshine Coast Regional District, Kimberley also sent a participant to be part of an Integrated Watershed Management Planning team, in this case for Mark Creek. But it did so reluctantly because it felt that at the end of the day the plan would result in some logging being recommended. And that is what happened, with the planning team ultimately suggesting that the Ministry of Forests consider three possible options for logging in Mark Creek. The least intrusive of the options would see five per cent of the forest in the watershed logged over 20 years. The most intensive logging scenario would see 17 per cent of the forest logged over the same time period.

*The largest issue with the Code is that the final authority for making decisions under the Community Watershed Guidelines is vested in the District Forest Manager.*

Concerned about a planning process that it felt did not adequately address the fiscal and health costs to the community of degraded water supplies, Kimberley enlisted the help of the local Health Services Society in nearby Cranbrook. Under a regionalisation initiative, public health officials formerly employed by the Ministry of Health now work from within health services societies whose boards are composed of elected representatives from the various municipalities in the region.

After looking at Kimberley’s concerns and at the outcome of the Integrated Watershed Management Plan, the East Kootenay Community Health Services Society wrote to various provincial government leaders including the Health Minister, Forests Minister and Environment Minister, to complain about inadequacies in the planning and decision-making around Mark Creek. The Society was particularly critical of the “Community Watershed Guidelines” contained in the Forest Practices Code, the legislation governing forestry in Mark Creek and other public-land watersheds.

“There are a number of deficiencies within the Forest Practices Code which make the Community Watershed Guidelines contained in the Code unworkable,” Society chair, Tom Beardsley wrote in April, 1998.<sup>40</sup> “The largest issue with the Code is that the final authority for making decisions under the Community Watershed Guidelines is vested in the District Forest Manager. The decisions of the District Forest Manager are often in conflict with the need to place the protection of water quality for drinking purposes as the highest priority in community watersheds. This is further exacerbated by the fact that both the local community through the municipal council and the Ministry of Health or Regional Health Authority... have been excluded from the formal decision making process.”

“The possible outcome to (logging in Mark Creek)... is a degradation of water quality in the City of Kimberley, which will increase the risk of a significant waterborne disease outbreak. Should this occur, experience tells us that the City of Kimberley will be responsible for any remediation or upgrade costs to the water system, estimated at \$5 - \$10 million, as well as the lost economic value due to lost tourism,” Beardsley continued.

For Kimberley and local health officials, the decision about what happens in Mark Creek must involve meaningful input from community leaders. And that means giving community representatives decision-making powers on par with the Ministry of Forests. To maintain the status quo and leave the Ministry with final say, means that Kimberley bears all the costs of logging-related damages to its water supply while having no power to stop the damages before they occur.



# Hasty Creek: A Community Without a Community Watershed

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The struggle of 100 or so residents who draw their water from Hasty and Vevey Creeks is a classic example of what people in small water systems throughout the province face.

Approximately 45 families have their homes in these two connected watersheds which drain into the east side of Slocan Lake, 10 kilometres south of New Denver. They rely on surface sources for their drinking water, and they have been in a 15-year-long battle with the Ministry of Forests and Slocan Forest Products to prevent road building and logging in their watersheds.

About half a million British Columbians (one-seventh of the provincial population) get their drinking water from small systems like those in Hasty and Vevey Creeks. The Auditor General's office classifies such systems either as supplying a single family or household, or as somewhat larger community systems that "supply two or more connections, or have a single connection providing drinking water to the public."<sup>41</sup>

Such systems, Morfitt reported, are vulnerable because local residents may not have the resources, local expertise, or political clout to protect their catchment lands from damage by logging and related road-building.

"Small water systems lack dollars and staff to create their own protection processes [This often results in local residents seeking out cost-effective water treatment systems that can only run effectively with relatively clean water—*See Side Story—Lighting the Way to Clean Water*]. Large systems are able to employ full-time water-quality managers to monitor their systems, plan and implement ongoing preventative maintenance programs, and stay informed about water-quality threats and protection mechanisms. Small systems do not have this capability. Problems are often not foreseen, and when they occur, there is not enough money to correct them," Morfitt says.<sup>42</sup>

Problems may, indeed, not always be foreseen. But in many small watersheds, including Hasty and Vevey Creeks, most residents are, in fact, acutely aware of the potential for problems to arise when their watersheds are logged or otherwise developed. In 1991, Hasty and Vevey Creeks were the site of a major protest when a permit was signed authorizing the construction of a small logging spur road, in what was then a largely undeveloped region. Eighty-three people were arrested for protesting the construction of the road, which ultimately was built. The protest did, however, put a temporary halt to the logging that was supposed to follow road construction.

Area resident, Paul Gibbons, explains why so many of his neighbours fought that development. The Hasty and Vevey watersheds get a lot of precipitation, Gibbons says. As a result, large hemlock and cedar trees, many of which rival in size their cousins on the coast, dominate the forest. Parts of the watersheds have extensive wetlands and numerous underground streams. "It's very boggy," Gibbons explains, "full of devil's club, skunk cabbage, and other indicator species of wetlands."<sup>45</sup>

Parts of the watersheds are also quite steep. Others are relatively flat, which makes the area of interest for commercial forestry. "Our concern is with the soil erosion and sedi-

*The continued success of small water users that employ treatment technologies such as filtration and UV may well depend on maintaining optimum conditions in the catchment lands around the water supplies.*

# Lighting the Way to Clean Water

As a rule, public health officials in British Columbia want surface-water suppliers to not only treat their water at the source, but to add some kind of disinfectant to it as it enters into the distribution system that carries water to people's homes.

Public health engineers and health officers call this "maintaining a residual." What they mean by this is that they want a residual or trace amount of the disinfectant present in the water coming out of the household tap.

By maintaining a residual, health officials say, you eliminate most of the possibilities for some kind of contamination of the water supply once it is in the distribution system itself. It so happens that the most commonly used disinfectant is chlorine. Consequently, when health officials tell water users that they must maintain a residual in their water, the implication is that chlorine is to be used.

Adding chlorine to a water distribution system is not, however, a legal requirement under the Health Act's Safe Drinking Water Regulations. And there are cases in the province where communities are not putting the chemical into their water distribution systems.

One such community is Sitkum, a short distance east of Nelson. The unincorporated Sitkum Improvement District is home to approximately 80 people, living in 27 houses. The houses are all hooked up to a surface water supply, Sitkum Creek. The water is filtered with a sand filter and then treated with ultraviolet light. The filter helps to rid the water of sediment and organic debris, making it clear enough for the powerful light to kill bacteria that may be present in the water.

Area resident, Jim Vincent, describes how the community used to draw its water from a well. But as more houses were built in the 1970s and 1980s, the demand on the well water became too great.

"For the first few years nobody had any lawns and there were only 10 houses," Vincent says. "But eventually 17 lots were built and the water supply wasn't enough to satisfy everybody's needs. So we incorporated as an improvement district ... And then about 14 years ago we installed the UV system, coupled with a sand filter."<sup>43</sup>

The treatment system consists of two six-inch pipes that carry water from the creek to a covered sand filter. After filtration, the water flows downhill several hundred metres to a shed containing eight ultraviolet lights encased in tubes. The water flows over the immersed tubes for disinfection. The cost of installing the UV equipment was about \$6,000.

Vincent says the community could have gone the route of chlorinating its water, but opted for the filtration and UV treatment. "We could have used chemicals," he says. "But people are scared of the chlorine."

The treated water is routinely monitored by an environmental health officer in Nelson to ensure that it is of a quality that meets health guidelines.

But senior health officials remain far from convinced that filters and UV without subsequent disinfection (which maintains a residual, something UV light cannot do) is a desirable water treatment option for larger communities.

"From a public health perspective if you're looking at the entire water system, not just the source, the water going through the system also has to be potable," says Louise Egan, senior public health engineer for B.C. "By practice, not by policy, that implies a disinfectant residual at the tap."<sup>44</sup>

For those people who are concerned about the health risks that may be associated with chlorinated water, there is always the option of installing a filtering device in the house that removes the chemicals in the water, Egan says.

So how do small communities such as Sitkum get around not chlorinating their water?

"In smaller systems, really small systems where you have a small compact distribution system and you haven't had a waterborne disease outbreak, some of the health authorities have looked and said UV is better than no treatment at all," Egan replies. "If it works, you're disinfecting the water supply. And if you can have potable water at the tap, that's a move forward. That's been the historic approach to this."

In Sitkum's case, Vincent says there have been few developments in the watershed. That means that opportunities for increased sedimentation of the water, or the transfer of pathogens such as giardia or cryptosporidium, are greatly reduced.

The same cannot be said for the adjoining Bourke Creek watershed. In the spring of 1999, the 100-plus residents of the Bourke Creek Improvement District had their water supply shut off for more than six weeks after a slide, attributed to an old logging road, washed sediment into their water supply. The slide may be over, but area residents will have to live with periods of high sediment in their water for years to come as a result of that slide. And the logging company, Slocan Forest Products, is intent upon logging in both the Bourke Creek and Sitkum watersheds.

mentation that follows logging and road-building,” Gibbons continues. “It’s well established that by removing forest cover you increase peak water flows. And by doing that you can decrease the low flows. All of this is bad for water users because when you get peak-flow increases following snow melt there’s the potential for channel instability and soil erosion. And that’s when people’s water intakes and pipes can get clogged up with silt.”

The completion of the spur road turned out to be the first of many proposed developments in the watersheds. Of even more concern to Gibbons and other area residents is the proposed construction of the “Branch 200” road, which would cut across just about every creek and stream in the Hasty and Vevey watersheds.

Construction of Branch 200 would also coincide with the logging by Slocan Forest Products of two cutblocks in the northern part of the watershed. Once Branch 200 is constructed, “a bunch of cutblocks” would follow, Gibbons says, adding: “When you look at Slocan Forest Products long-term plans for the area, they want to log most of the watershed.”

For some time, residents at Hasty and Vevey Creeks hoped that the provincial government would see fit to declare their land and resources protected. But when the Kootenay-Boundary Land Use Plan was approved, the B.C. government ruled their lands were open to development. The same plan, however, granted protected status to watershed lands that 9,500 residents of the largest city in the region—Nelson—draw their water from. In declaring the West Arm Wilderness, which included Nelson’s watershed, as protected, the provincial government followed on the earlier recommendations of the Commission on Resources and Environment or CORE. The Commission said the area deserved protection precisely because of its importance as a source of clean drinking water to Nelson’s residents.

Hasty’s and Vevey’s residents, like their counterparts on the Sunshine Coast and in Kimberley, were left to fight for the protection of their water resources through processes such as a local Integrated Watershed Management Plan.

The stated goal of the IWMP, Gibbons says, “is the protection of water quality, water quantity, and timing of water flow.” However, Gibbons and others came to see their IWMP as one in which participants met “to figure out a way to enable resource extraction to happen. All we could see coming out of it was the forest company benefiting and us assuming all the risks and future costs.”<sup>46</sup>

In August 1997, a local group, the Red Mountain Residents Association, applied under the Forest Practices Code to have their lands declared Community Watersheds. The application was the beginning of a long and ultimately frustrating process by local residents to elevate the status of their watersheds in the hope that this would offer greater protection to water resources.



*Seven local residents are arrested for protesting proposed logging that they say threatens their water supply and property at Perry Ridge, 1997*

*About half a million British Columbians (one-seventh of the provincial population) get their drinking water from small systems like those in Hasty and Vevey Creeks.*

# Community Watersheds: Who Decides?

There are 465 community watersheds in B.C., and the number may rise as different communities or water-user groups make applications for Community Watershed status.<sup>47</sup>

Prior to the Forest Practices Code, many of the lands that now have Community Watershed status had water licenses that applied to them. These lands were then declared Community Watersheds under the Code. The Code allows for more lands to be declared Community Watersheds. But, as the experience at Hasty and Vevey Creeks suggests (*see main report*), smaller water-user groups may be fighting an uphill battle in having this status bestowed.

Why smaller water users want Community Watershed status is understandable. The Code provides for greater protection of water supplies in areas with this designation. The enhanced protection includes extra planning and a ban on certain practices in certain areas. While some will argue that these provisions may not be sufficient to protect water supplies, they are a step forward from the scant protections that existed prior to the Code.

Under the Code, a new area of land can be designated a Community Watershed if, in the opinion of the regional manager of the Ministry of Forests and a designated Ministry of Environment official, it should be.

The main criterion set out in the Code for determining whether a new area can be given Community Watershed status is if that area is “all or part of the drainage area above the most downstream point of diversion for a water use that is for human consumption and that is licensed under the Water Act for a domestic purpose or a water-works purpose.”<sup>48</sup>

On the basis of that criterion, residents drawing water from Hasty and Vevey Creeks should have qualified for Community Watershed status. Yet they didn’t get what they asked for. Why?

The answer lies not so much in the Code as it does in related guidelines and agreements negotiated between the Ministry of Forests and other ministries at the regional level, after the Code was passed.

For example, a Community Watershed Guidebook developed by the Ministry of Forests gives the Ministry’s regional managers

wide latitude to determine what constitutes a community by saying that they can look at “the number of residences concentrated along a short reach of a stream, from which most (residents) are withdrawing water” and determine if their numbers are “sufficient to constitute a community.”

In other words, if the regional manager feels the number of water users is not large enough, he or she may deny a Community Watershed application. The language in this guideline is vague and it gives broad discretionary powers to regional managers. Just what does “sufficient” mean?

Another way in which applicants for Community Watershed status may find themselves hamstrung is through agreements reached between Ministry of Forests and Ministry of Environment officials at the regional level. This is particularly true for small water users described elsewhere in this report.

A Memorandum of Understanding between the ministries in the Nelson Forest Region is a case in point. It stipulates that Community Watershed applicants must be in compliance with B.C.’s Safe Drinking Regulations and that they must provide accurate mapping of their drainage areas to government officials.<sup>49</sup>

The financial and human resources required to provide such mapping can be significant and may be beyond the reach of many small water users. But this provision pales in comparison to requirement for compliance with the Safe Drinking Water Regulations, which is often interpreted to mean chlorination of water supplies.

Many small water users in the province are distinctly uncomfortable with the idea of chlorinating their water supplies. Furthermore, they may lack the resources to do such water treatment. And if they can’t afford to do that, they almost certainly can’t afford to do the much more expensive additional work that may be required under the Safe Drinking Water Regulations, such as installing filters.

Finally, if these things are done, then it becomes much easier for the government and industry to argue that the proper “protections” are in place, and that land-use activities which can damage water supplies can safely proceed.



COURTESY OF VALHALLA WILDERNESS SOCIETY

*Kootenay resident, Jack Ross, is arrested at Perry Ridge*

Over a period of several months, communications with the Ministry of Forests yielded little information about the request. As Gibbons recalls: “We were basically told, ‘We can’t decide anything. We don’t really know the criteria for determining whether or not you qualify. We’ll let you know in a few months.’”

Finally in October 1998, the Association received an application form from the Ministry. “We wrote back and said: ‘Look, we haven’t been waiting for an application form, we’ve been waiting for a decision.’ After that, we asked the Sierra Legal Defence Fund to file a formal complaint with the Forest Practices Board. The gist of the complaint was that the Ministry of Forests and the Ministry of Environment failed to make a timely decision on our application.”

The Board ruled that the delay was not unreasonable because time was needed to develop criteria to evaluate Community Watershed applications. In what was an ominous conclusion for local residents, the Board also said that the proposed building of Branch 200 would not be precluded by the watersheds receiving Community Watershed designation.

“We were advised (by MOF) that the building of the road would be the same anyway, whether we had Community Watershed designation or not,” Gibbons says. However, Gibbons and others remain convinced that if their watersheds receive designation, provisions under the Code regarding “cumulative effects analysis” may preclude at least some logging from proceeding. Ultimately, this would work to the benefit of water users by protecting some resources above water intake pipes.

“Under the Code’s provisions for Community Watersheds, detailed soil erosion assessment and mapping must occur before any logging-related development happens,” Gibbons says. “That would be a big improvement over what we have now.”

In May 1999, the Association received notice from the Ministry of Forests and the Ministry of Environment that its attempt to have Community Watershed status bestowed on Hasty and Vevey Creeks had been denied on what residents see as a technicality. Given the Forest Practices Code’s definition of what a Community Watershed is, the rejection of the application left many local residents puzzled. *See Side Story—Community Watersheds: Who Decides?*

Local residents are now contemplating whether to apply for a judicial review into why its request was denied (an appendix at the end of this report lists the pros and cons of various legal remedies available to people interested in protecting water supplies). Meanwhile, development plans for the watershed continue and area residents must wait to see if their water becomes degraded.

On February 11, 2000, 70 area residents gathered on a road leading into the watershed as Slocan Forest Products readied to log trees for the Branch 200 road right-of-way. The company subsequently served a writ of summons on one area resident for allegedly blocking its path and preventing the company from proceeding with its work. It also applied for an injunction in BC Supreme Court in Vancouver that would prevent any interference with its road-building activities.

Slocan’s injunction application was granted until the end of the month. The injunction term was subsequently extended after lawyers representing local water users and the company appeared in BC Supreme Court in Nelson at the end of February.



Paul Gibbons

*Gibbons and others remain convinced that if their watersheds receive designation, provisions under the Code regarding “cumulative effects analysis” may preclude at least some logging from proceeding.*

# Protecting Watersheds, Protecting Health: Elevating Water's Status

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*Residents across B.C. believe strongly that ensuring continued delivery of clean, safe supplies of surface water begins not with the water itself, but with the lands surrounding the water.*

As the experiences outlined in these community profiles attest, residents across B.C. believe strongly that ensuring continued delivery of clean, safe supplies of surface water begins not with the water itself, but with the lands surrounding the water.

This view is shared by Auditor General George Morfitt who stated early in his report that “effective water protection hinges on managing the land uses on the surfaces over or through which water flows.”<sup>50</sup> Inappropriate land uses will almost certainly degrade water supplies to the detriment of wildlife and human communities.

Morfitt favours a greater integration of planning processes in watersheds, a restructuring that gives greater voice and power to water users through the creation of a lead agency to represent their interests. In the latter part of his report, however, it is clear that the provincial government does not support this recommendation.

“The recommendation to establish a lead agency to represent drinking-water interests is served by the office of the Provincial Health Officer and the regional health authorities,” the provincial government said in response to the Auditor General’s recommendation. “The Provincial Health Officer is a credible voice for safe drinking water ... Regional health authorities should increase their participation in local land use planning, along with their existing key roles in providing approvals and inspections of water treatment and distribution systems.”<sup>51</sup>

There are two parts of this response which are of interest to people who have seen their water supplies degraded. The first is that the Provincial Health Officer and regional health authorities are a “credible voice for safe drinking water.”

Water users could be excused for thinking that this isn’t the case, given that watersheds throughout the province continue to be damaged by land use practices which the Health Ministry did not sanction and seemed powerless to stop.

Public health officials have long been frustrated in efforts to change this. For example, at its annual meeting in 1975, the Associated Boards of Health of British Columbia passed a resolution which stated in part “that the provincial government be urged to enact, or amend, legislation which would require the Lands Service to seek the concurrence of the Medical Health Officer before issuing a permit authorizing any activity within a community watershed.”<sup>52</sup>

A multi-ministerial government task force later rejected this request. In a letter to Ben Marr, who at the time was with the Environment Ministry and would later go on to become Deputy Minister of Forests, the then chairman of a government Task Force on Multiple Use of Watersheds, J.D. Watts, said:

“A consensus was reached by the Task Force that it could not support the [Associated Boards of Health] resolution as passed, in that it would provide the Medical Health Officer with a veto power regarding all activities in a community watershed applying to both Crown and private lands. While the drafters of the resolution probably envisaged a small watershed comprised predominantly of Crown land, there are also many large

watersheds in the Province containing large areas of private land as well as Crown land and where the impact of a veto power by the Medical Health Officer could be severe, and at variance with Provincial and Local Authority objectives. The administration of such a veto power could also be costly and time-consuming.”<sup>53</sup>

Instead, medical health officers were to be “encouraged to participate in decisions which take cognizance of the water supply function of community watersheds.”<sup>54</sup> In other words they could comment and advise on proposed land uses activities and their impacts on water quality, but they would have no power to approve or reject those activities. Today, Sunshine Coast residents and others are left to contemplate how different their lands and waters may have looked had medical health officers got their way 25 years ago.

The current government position, captured in the reply to the Auditor General, is that health officials should “increase their participation in local land use planning” processes. This, the government implies, will ensure greater protection of drinking water sources. Given the history outlined briefly above, there is good reason why water users may be skeptical of this latest government position. However, certain things have changed in the 20-plus years since the Association’s resolution was rejected. Perhaps the most significant is that there is a far greater degree of regional autonomy in public health care and services today than there was during the 1970s.

Regionalisation of health services in the 1990s resulted in a situation where public health officials now report not to the Minister of Health, but to local Health Services Societies whose boards are composed of elected representatives from municipal and village councils. If a local Health Services Society or a municipality within the Society’s jurisdiction becomes concerned that a proposed land-use activity poses a risk to water quality, its health officers have powers under Sections 61 to 63 of the Health Act to step in and order a halt to that activity.<sup>55</sup>

During Kimberley’s protests over the proposed logging of its Community Watershed, Don Corrigan, chief environmental health officer for the East Kootenay Community Health Services Society, made it clear that the planning process in community watersheds had to be more equitable. Communities deserved not only to have input into what happened in their watersheds, but some decision-making powers as well.<sup>56</sup>

Corrigan went on to say that if communities such as Kimberley remained disempowered, their leaders could choose to notify him under the Safe Drinking Water Regulations that a proposed activity such as logging threatened their water supplies. As reported in an article in *The Georgia Straight*:

“If that happened, Corrigan said, and if he and other health officials concluded there was a possible problem, they could order a halt to logging or other developments in the watershed. Such orders have been made by health officials in the past as far as cattle ranging in community watersheds is concerned. And Corrigan said powers vested in health officials through the Health Act and related regulations are sufficiently broad

*How much is spent to rehabilitate damaged salmon streams? How much is spent to shore up failing slopes and logging roads? How much does the water user have to spend after logging to treat water so that it is fit for human consumption?*



GARTH LENZ

*Fresh water cascades through undisturbed forest in McFayden Creek, Slocan Valley.*

*The key to sound management of watersheds may well lie in finding ways to identify and protect the entire range of values on land and in the water. It may also lie in broadening decision-making and approval processes so that the Ministry of Forests doesn't override broader public interests.*

that an order involving logging-related developments could be made.”<sup>57</sup>

Where communities, local health officials and local environment officials seem to be increasingly butting heads with the provincial government is over the latter's fixation on generating revenues from the extraction of timber, mineral, oil and gas, and other natural resources on Crown lands. When those resources are found on lands around community water supplies, conflicts inevitably arise.

If land use planning in watersheds is to be properly integrated, and such conflicts avoided, then traditional approaches to the planning of activities such as logging will have to be changed. At present, commercially accessible forests in watersheds outside of protected areas contribute to an “Allowable Annual Cut” determined by the Ministry of Forests. To keep the AAC at the current level of approximately 70 million cubic metres of timber, virtually all commercially accessible timber must eventually be logged. That is almost certain to have continuing impacts on water quality, especially because a disproportionate area of land remaining to be logged falls within watersheds containing surface drinking water supplies.

The MOF and the provincial government have consistently stated that there are economic costs associated with reducing AACs. A review of any socio-economic analysis prepared by the Ministry for any one of the province's forest districts will confirm this. What is not taken into account in such publications is the costs that occur to communities after watersheds are logged. Just how much is spent to rehabilitate damaged salmon streams? How much is spent to shore up failing slopes and logging roads? How much does the water user or supplier have to spend after logging to treat water so that it is fit for human consumption? These costs routinely escalate into the millions of dollars for a given site.

If, as the Auditor General recommends, B.C. embraces a more integrated management of its watersheds, then traditional planning processes which set targets for the amount of resources to be extracted may have to be changed. They will have to be replaced by something that places greater emphasis on water protection. This is not to suggest that other needs and interests cannot be accommodated. But it is to say that past and current forest management policies that seek to maximize timber extraction may not be up to the task of protecting water supplies now and in the future. The key to sound management of watersheds lies in finding ways to identify and protect the entire range of values on land and in the water. It also lies in broadening decision-making and approval processes so that the Ministry of Forests doesn't override broader public interests.

At the end of the day, new planning processes may find that it makes little if any economic sense to further develop certain watersheds, because the downstream risks to water users are too high. In other cases, it may be that certain watershed lands can be safely developed without jeopardizing water supplies. In either case, the decision reached is unlikely to have broad public support unless it reflects an understanding of local conditions and unless it is arrived at by a team of players who each enter into the process with equal powers. To leave one or two players with all the power, and the rest with advisory functions, only perpetuates public mistrust and muddies the waters.



# Water and Fish Health

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Having examined how logging activities have degraded some community water supplies, we now turn to a detailed look at how industrial forestry operations threaten the well-being of resident fish populations, in particular salmon.

As today's often depressing headlines attest, many of B.C.'s genetically distinct salmon stocks are at risk of extinction. There are numerous reasons for this. For purposes of this report, however, we are interested in how industrial logging and related road-building activities contribute to long-term changes to streams and rivers. Do those changes lead to fish losses? And if so, why?

As we will see, long-term scientific studies show that there are significant links between commercial forestry operations in watersheds and losses of important fish habitat in nearby streams and rivers. Like the changes in drinking water quality that can follow on the heels of industrial logging, these changes can be of lasting duration, and difficult to reverse without considerable expense.

Before detailing some of the more salient scientific findings on logging-related impacts to resident fish populations, let's briefly look at what fish need in order to live and thrive in streams and rivers.

The in-stream habitat needs of salmon, trout and other fish vary depending on the stages of their life cycles and the season of the year. Conditions must be just right, for example, when adult salmon return from the sea to spawn in the streams and rivers in which they were born. As Theodore Bjornn and Dudley Reiser report in a special publication of the American Fisheries Society:

“Adult salmonids returning to their natal streams must reach spawning grounds at the proper time and with sufficient energy reserves to complete their life cycles. Stream discharges, water temperatures, and water quality must be suitable during at least a portion of the migration season.”<sup>58</sup>

One of the most important things influencing salmon behavior is water temperature. This is because “fish and essentially all other aquatic animals are cold blooded... their metabolism, reproduction, development, and scope for activity is largely controlled by environmental temperatures.”<sup>59</sup>

Temperature also plays a vital role in a host of other processes that help to determine whether watercourses are suitable for salmon. These processes include: aquatic plant photosynthesis and respiration, chemical reaction rates, gas solubilities, microbial mediated processes including decomposition and nutrient cycling.

If temperatures aren't right, fish are unable to eat, let alone move about in water. It is for these reasons that the US Federal Water Pollution Control Administration, in 1967, described temperature as “a catalyst, a depressant, an activator, a restrictor, a stimulator, a controller, a killer, one of the most important and influential water quality characteristics to life in water.”<sup>60</sup>



SDF

*Along fish-bearing streams, trees play a major role in moderating water temperatures.*

*If temperatures aren't right, fish are unable to eat, let alone move about in water.*

*One of the most important characteristics of streams for fish is the interplay between land and water. In particular, the land immediately adjacent to streams provides an important source of "cover" for fish.*

The obvious link between forests and water temperatures in streams and rivers is the shade provided by trees. In the absence of trees, solar radiation reaches the water more directly, causing it to heat up faster than it otherwise would. In some cases, stream temperatures can become too warm for salmonids, due to excessive exposure to sun. This can cause salmonids to move upstream or downstream in an effort to find more suitable waters. The degree to which a stream is impacted by human activities, plays a major role in determining what options fish have to move from inhabitable to uninhabitable waters.

Other factors also contribute to the warming of water. Sediments in the water column can attract heat, causing cloudy water to warm faster than clearer water.<sup>61</sup> Water made shallower by the deposition of gravel and other debris also warms faster than deeper water.

Migrating salmon also require water that is relatively free of high silt or sediment loads. Bjornn and Reiser cite one 1986 study that linked a halt in salmon movement with increased suspended sediment loads in water muddied by a landslide. The study found that salmon did not move in streams where the suspended sediment concentration was greater than 4,000 mg/L.<sup>62</sup> Numerous studies have linked increased turbidity of streams and rivers with landslides and other "mass wasting events." Some of this is associated with logging activities on unstable slopes and with failed logging roads.

The presence of silts or fine sediments in the water column or on the stream floor can hurt resident fish in a number of ways. It can clog or damage respiratory organs. It can affect the survival of salmonids during their intragravel incubation or in their alevin stages by depleting the availability of dissolved oxygen. It can also affect salmonids in their fingerling stages and during winter months.

"Fingerling density has often been associated with low concentrations of fine sediment deposited between and on the surface of larger substrate particles," a 1990 report by the US Forest Service stated. The same report noted studies showing that "after the installation of a sediment trap, the abundance of juvenile brown and rainbow trout in a Michigan stream increased by 40%... (this) suggested that fine sediment filled in pools and interstices between cobble, thus reducing the amount of habitat available to fingerling and adult salmonids."<sup>63</sup>

Turbid waters may also disrupt the feeding and territorial behaviors of juvenile coho salmon, and appear to harm emerging salmon and steelhead fry, causing them to grow less quickly than their counterparts inhabiting clearer waters.<sup>64</sup>

During spawning, adult salmon dig holes in gravel to deposit their eggs. Larger species such as chinook salmon may dig up to 43 centimetres below the streambed surface, although average pockets are between 20 cm and 30 cm deep. It is crucial in the aftermath of spawning for water to properly circulate through to the egg pockets in order to "supply the embryos with oxygen and carry away waste products."<sup>65</sup> Water flow depends on the "porosity" of the gravel. If the gravel is clogged with too much fine sediment, then porosity is reduced and less dissolved oxygen is available. Bjornn and Reiser note several scientific studies that conclude dissolved oxygen levels were reduced in important spawning and incubation sites "after adjacent areas were logged."<sup>66</sup>

In general, water in natural salmon streams has enough dissolved oxygen for juvenile salmon. But these levels can be reduced if water levels are low, temperatures are high, and the streams have been impacted by unusually large deposits of organic debris from surrounding lands.

One of the most important characteristics of streams for fish is the interplay between land and water. In particular, the land immediately adjacent to streams provides an important source of "cover" for fish.

As Bjornn and Reiser explain: “Cover is an important, but difficult to define, aspect of salmonid habitats in streams. Some of the features that may provide cover and increase the carrying capacity of streams for fish are water depth, water turbulence, large-particle substrates, overhanging or undercut banks, overhanging riparian vegetation, woody debris (brush, logs), and aquatic vegetation.” Cover also provides fish security from predation and “allows them to occupy portions of streams that they might not use otherwise.”<sup>67</sup>

Streamside forests are also important for salmon because they are the sources of tree trunks, large limbs, and root wads that occasionally fall into and lodge in streams. This so-called “Large Organic Debris” forms important habitat by creating pools of deeper and stiller water for fish to congregate in. It also affects upstream and downstream habitats by changing water flows. Over time, this can result in the buildup of gravel that is of use to spawning and rearing fish. Bjornn and Reiser cite the findings of several studies linking the influence of Large Organic Debris on fish including:

- coho salmon declines in southeast Alaska following the loss of Large Organic Debris;
- higher numbers of coho salmon in streams surrounded by mixed, older coniferous forests versus lower numbers of coho salmon in streams whose adjacent forests were logged and subsequently colonized by young deciduous trees;
- decreases in stream surface area, the number and size of pools, and Dolly Varden char following the removal of Large Organic Debris; and,
- a change in fish behavior, with steelhead being more abundant in clear-cut stream reaches in summer, but migrating in winter months to stream reaches with forest canopy and more Large Organic Debris.<sup>68</sup>

Streamside vegetation also secures or stabilizes the stream banks themselves. This helps to direct water flows and maintain various stream habitats. Vegetation also provides nutrients to the water that becomes a major food and energy source for resident fish.

At times, debris jams form in natural streams. In the pools that form behind these dams, significant amounts of organic detritus from the surrounding forest are trapped. This organic matter is the first link in the stream food chain.

*Streamside vegetation also secures or stabilizes the stream banks themselves. This helps to direct water flows and maintain various stream habitats.*

SJDF



*Numerous studies link declines in habitat for fish, like these pink salmon seen here, and clearcut logging activity.*

*Fisheries managers increasingly take the view that management and maintenance of in-stream fisheries habitat requires a comprehensive approach which looks at protecting water systems, not just individual streams or stream reaches.*

When leaves or needles from streamside trees enter the water, they provide an important food source to in-stream bacteria and invertebrates. This leafy material may contain carbon, nitrogen, phosphorous, potassium and other basic nutrients. As it breaks down in the water, it is consumed by bacteria, stream-dwelling insects such as stone flies, or other invertebrates such as copepods or daphnia. These organisms are eaten, in turn, by resident fish.

“Not only are plant materials from riparian vegetation important contributors to the energetics of stream communities,” a 1990 report published by the US Forest Service states, “but terrestrial insects flying or falling from these plants also provide important contributions to the nutrient and energy inputs of stream communities.” The same report goes on to note that stream inputs from surrounding forests “can contribute up to 100% of the organic material ingested by some invertebrate taxonomic groups.”<sup>69</sup> If the invertebrates are without food, so too are the resident fish.

In understanding how forests and streams interact, and how nutrients are transferred from land to water, it is helpful to think of the whole river system, not just an individual stream or a portion of it.<sup>70</sup> Rivers and larger streams usually receive water from numerous tributaries on higher ground. In the headwaters where these tributaries are found, water courses tend to be narrow and more shaded. Here, a large amount of leaf litter falls into the water and begins to decompose as it moves downstream. In upstream reaches, the organic material is shredded into coarse matter or fine particles by resident invertebrates. In the downstream reaches where water courses are wider and more exposed to the sun, there is less input of organic debris. However, the shredded debris from upstream is present, and as the sun interacts with it, algae forms. Algae and other aquatic plants in lower stream reaches are fed on by invertebrates, which in turn are fed on by fish. It’s in this way that fish in lower stream reaches benefit from events far upstream.

Events that disrupt the transfer of organic material to upstream reaches invariably have an impact on downstream processes. As Michael Marcus and three of his colleagues note in a 1990 US Forest Service report: “... disturbances within stream systems can disrupt the overall stream continuum by changing conditions over the disturbed reach to conditions more similar to those occurring either upstream or downstream of the disturbance.”<sup>71</sup>

Another important element that dictates whether waters are inhabitable for fish is streamflow. One of the principal forces governing streamflow is the volume and timing of water runoff from adjacent lands. “Runoff volumes to streams usually follow seasonal patterns of precipitation, generally with great overall variation,” Marcus and his colleagues note. “In mountainous headwater streams of the West, snowmelt provides most of the annual streamflow, with flow peaking from May to July. Minimum streamflow occurs during the fall and winter, and consists largely of groundwater influxes.”<sup>72</sup>

The in-stream needs of fish change depending on their age. Juvenile salmonids, for example, tend to use the space available in side channels for rearing. The amount of habitat required (a function of streamflow) also increases the larger the fish are.<sup>73</sup> As we will see elsewhere in this report, streamflows can be dramatically impacted by land-use activities such as logging and related road building. These activities can change the timing of peak flows and runoff events. This may mean that peak water flows in certain stream-reaches end prematurely. Because of the added sediments and debris that higher peak flows carry, streamflows can be permanently altered and fish habitat lost.

As with nutrient transfers, alterations in downstream flows may have their origins in upstream events. For these and other reasons, fisheries managers increasingly take the view that management and maintenance of in-stream fisheries habitat requires a compre-

hensive approach which looks at protecting water systems, not just individual streams or stream reaches.

A good example of this approach is captured in a 1997 Department of Fisheries and Oceans report, *Establishing Fisheries Management and Reserve Zones in Settlement Areas of Coastal British Columbia*. While the report deals mostly with fisheries management concerns in urban areas, the science behind its recommendations on unlogged buffers around water courses is applicable everywhere that salmon and other anadromous fish are found.<sup>74</sup>

One of the major focuses of the report is on limiting developments in streamside forests. These so-called “default management zones” or buffers are areas in which the Department report recommends no development. They include:

- 50-metre buffers on both sides of the stream channel on fish bearing permanent streams;
- 30-metre buffers on both sides of the stream channel of ephemeral and intermittent streams;
- 30-metre buffers around the high-water mark of lakes and wetlands;
- contemporary floodplains; and,
- ravines, escarpments, or other steeply sloped areas (in some cases with additional set backs from the crest of the slopes).<sup>75</sup>

As these recommendations make clear, the unique and varied habitat requirements of salmon extend well beyond the streams themselves into the forest. If streams and resident fish are valued, they must be seen within the wider context of the riparian zones of which they are a part. As following sections of this report show, watercourses can be, and often are, extensively damaged by logging activities in riparian zones. Some of those activities are legally permitted under the Forest Practices Code.

*If streams and resident fish are valued, they must be seen within the wider context of the riparian zones of which they are a part.*



JILL THOMPSON

*Trees rest across Pineetle Creek in Clayoquot Sound. Years after naturally coming to rest in the creek, sections of these trees will help provide important fish habitat.*

# Logging's Impacts on Fish and Water

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*In B.C.'s West Kootenay region, snow accumulated 37% greater in clearcuts than it did in surrounding intact forests. And when warm weather arrived, it melted 38% faster in clearcuts than in treed tracts.*

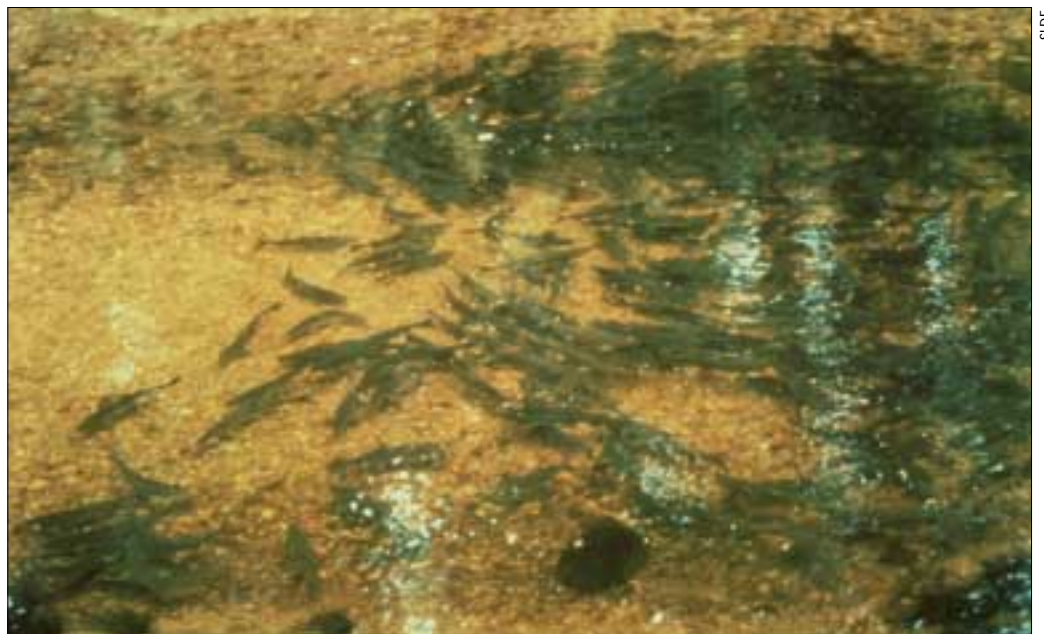
**W**ater in the form of rain or snowmelt plays a critical role in how watersheds function. In addition, water's ability to transport sediment from one place to another helps to shape habitats and determine their suitability for salmonids, other fish species, and aquatic organisms. The structure of water courses and the forests immediately surrounding them is also of great importance to the viability of streams and rivers for fish populations. In particular, things like stream bedrock, tree roots and fallen logs play central roles in regulating water flows and the movement of sediment.<sup>76</sup> Through the shade that they provide, streamside forests also regulate water temperatures and help determine their suitability for spawning and rearing fish.

As Thomas Chamberlin, R. Dennis Harr and Fred Everest explain in a 1991 American Fisheries Society publication, logging can seriously disrupt natural processes in watersheds, often to the detriment of salmon and other resident fish species.

"Timber management activities do not normally change the total amount of precipitation entering a watershed," Chamberlin and his colleagues reported. "(Logging) may, however, substantially alter the spatial distribution of water and snow on the ground, the amount intercepted or evaporated by foliage, the rate of snowmelt or evaporation from snow, the amount of water that can be stored in the soil or transpired from the soil by vegetation, and the physical structure of the soil that governs the rate and pathways by which water moves to stream channels."<sup>77</sup>

All of this can change the timing and volume of water entering streams and rivers at key points.

Why is this the case?



*By altering the amount of water that flows into streams, clearcut logging can cause long-term damage to important fish habitat.*

First, intact forests regulate when, where and how precipitation reaches the ground and percolates into the soil or flows downhill into streams and rivers. When portions of a forested watershed are logged, the trees that once intercepted snow are gone. Gone with them is the ability to intercept and hold the snow as it falls, to shade the snow that does reach the ground and to moderate the rate at which it melts, and to slow the winds that might accelerate snowmelt. Citing various scientific papers, Chamberlin and his colleagues note that in B.C.'s West Kootenay region, snow accumulated 37% more in clearcuts than it did in surrounding intact forests. And when warm weather arrived, it melted 38% faster in clearcuts than in treed tracts.<sup>78</sup>

Second, various logging methods including clearcutting and shelterwood cutting reduce or eliminate the tree branches and foliage that intercept rainfall and hold it until it evaporates. In addition, when trees are logged their roots no longer extract water from the soil. This generally means that groundwater runoff is higher in logged areas than unlogged areas. All of this can result in higher-than-normal peak flows of rainwater and snowmelt into receiving waters. Often, these higher peak flows trigger landslides or so-called "mass wasting events" which can deposit unusually large amounts of coarse and fine sediments into receiving waters.

"Fine sediment can enter streams during and after timber harvest," Brendan Hicks and three of his colleagues note in another section of the 1991 American Fisheries Society publication. Citing several scientific studies, they go on to say that "mass soil movements" are often associated with logging roads and logging operations, and that landslides are as likely to be triggered by logging roads as by the logging operations themselves.<sup>79</sup> As noted elsewhere in this report, the transporting of large volumes of fine sediment into stream courses can have serious consequences for salmonids.

Frequent landslides and mass wasting events can also deliver increased volumes of larger sediments or coarse debris into streams. Infusions of gravel can cause stream reaches to aggrade, which typically results in them becoming wider, shallower, and more prone to lateral movement and bank erosion. Again, all of this can have negative consequences for fish by reducing spawning and rearing habitat.

In areas prone to heavy rain such as Haida Gwaii (the Queen Charlotte Islands), there is increased damage to streams by logging-related landslides. Citing the findings of two different field reports (Tripp and Poulin, 1986, Rood, 1984), Hicks and his colleagues note that in streams on Haida Gwaii affected by debris torrents, the average pool depth in streams declined between 20 and 24 percent, while the total pool area fell by 38 to 45 percent. "The amount of landsliding was directly related to the proportion of the basin area logged," Hicks said, and "the effect of logging was to increase landsliding frequency by 34 times in this geologically unstable region... The frequency of debris torrents increased by about 40 times in logged areas compared to unlogged areas, and increased by 76 times in roaded areas compared to unlogged areas without roads."<sup>80</sup>

Third, logging activities can change water levels and flows by altering the way rain or snowmelt enters the soil and makes its way downhill to receiving waters. In unlogged forests, soils usually absorb water as quickly as rain falls or snow melts. Some of this groundwater percolates into streams and rivers. This process can be radically disrupted following logging. As Chamberlin and his colleagues explain, logging and road-building activities disturb the soil, either by exposing its organic layers to air, wind and water, or by making it harder or more compact, or both.

"Soil can be compacted by logging equipment... or by logs dragged over the ground during yarding and site preparation. When surface soils are exposed, their pores can be clogged by fine sediment and their structure can be broken down by the energy of falling raindrops... If the infiltration capacity of the soil is sufficiently reduced, water runs off

*The frequency of debris torrents increased by about 40 times in logged areas compared to unlogged areas, and increased by 76 times in roaded areas compared to unlogged areas without roads.*

over rather than through the soil. Higher peak flows and increased sediment transport result.”<sup>81</sup>

In logging’s aftermath, the impermeable surfaces of logging roads and side ditches, can intercept subsurface water flows. When these waters are captured and added to the water pouring off the roads themselves, the potential exists for significant deposition of silt-laden water into downhill streams.

*Simple clearing of forested watersheds cause significant changes in the hydrology of these basins. Studies have shown that 25% patch clearcutting and associated road systems induce a 50% increase in the magnitude of all runoff events in watersheds less than 100 hectares in size.*

There are many reasons why British Columbians should care about this. The province’s rivers, streams, lakes, wetlands, floodplains and surrounding riparian zones provide “a network of critical habitats for fish, wildlife and vegetation,” particularly in the coastal region.<sup>82</sup>

“Together these areas support a high proportion of the region’s biodiversity including at least thirty species of fish and twelve species of amphibian, in addition to the many species of birds, mammals, insects and plants that are dependent on aquatic and riparian habitats,” the Department of Fisheries and Oceans states in a 1997 report. The same report goes on to note that the clearing of forests in basins or watersheds can have negative impacts for a number of important habitat elements in permanent rivers and streams. Those elements include:

- pools of deeper stiller water, which can provide important habitat for rearing juvenile fish and adults who are looking for a calm holding area;
- shallow, more turbulent sections of streams known as riffles, which usually provide spawning and summer rearing habitats for salmonids and which are often important areas of benthic food production;
- stream or river banks, which confine water to the stream channel, and provide important cover for rearing and feeding fish;
- large organic debris such as downed trees, snags or rootwads, which naturally fall into streams and help to recruit and stabilize spawning gravel and provide important cover for fish;
- gravel bars, which are situated at the inside of bends in rivers and streams and can provide an important source of spawning gravel;
- bed substrate, the well-graded and uncompacted gravel which provide spawning and incubation habitat for trout and salmon, and which support invertebrate and algae communities that feed fish; and
- live trees and root systems along streams, which are important sources of large organic debris and overhanging vegetation, which provides protective cover for rearing and feeding fish and acts as a source of terrestrial insects (a fish food).<sup>83</sup>

All of these characteristics and others can be changed in significant ways by altered water and sediment flows. Logging-related activities can trigger many of these changes. As the Department of Fisheries notes in its 1997 report: “Simple clearing of forested watersheds cause significant changes in the hydrology of these basins. Studies... have shown that 25% patch clearcutting and associated road systems induce a 50% increase in the magnitude of all runoff events in watersheds less than 100 hectares in size.”<sup>84</sup> (Many watersheds in British Columbia have sustained even higher rates of clearcutting.)

Such runoff events may result in:

- spawning gravel being scoured by logs and debris which are washed into the creek channel;
- water being warmed by heat-trapping organic particles;



- logs and other large organic debris being washed out during higher-than-normal peak flows, causing the loss of fish habitat;
- the formation of large, impassable debris jams; and
- stream reaches being aggraded.

Given the documented changes to streams due to logging and other land-use activities, scientists have suggested that much more care needs to be taken with forestry activities in the critically important areas surrounding streams. Chamberlin (et al.) notes that larger and older trees are particularly important to maintain in such settings. “Yet rotation ages of more than 120 years (and much less on high land) seem absent from harvesting plans, despite their technical and economic feasibility. Urgent re-evaluation of management strategies for remnant old-growth and older second-growth forests seem warranted.”<sup>85</sup>

They also caution against the fast embrace of new policy initiatives. The switch, for example, from large continuous clearcuts to dispersed smaller clearcuts (as happened in British Columbia under the Forest Practices Code) may have some advantages in protecting streamside habitat. But then again, it may not. “Distributed small-patch cuts have important advantages in some ecosystems, especially where snowpack manipulation is a priority. However, their universal application as a magical panacea, as with “leave strips” (strips of uncut trees between patches) is inappropriate in unstable or windthrow-prone terrain where road construction and edge effects should be minimized.”<sup>86</sup>

In seeking to protect waterways and the fish in them, the Department of Fisheries and Oceans is promoting the idea of “Fisheries Management Zones” in coastal British Columbia. These zones are areas in which no logging activity would take place. As described previously in Water and Fish Health, they would vary in size depending on the characteristics of the nearby water body. Such zones, the Department wrote in 1997, “are not only critical for fish habitat protection; they also serve other ecological functions and provide a variety of community benefits. These include: providing an unbroken connection between high elevation and valley bottom ecosystems for wildlife, dissipating flood energy during wet periods, retaining water in soil during drought periods, filtering non-point sources of pollution, providing buffers and transition zones between different land uses, providing wildlife habitat viewing and nature interpretation opportunities in urban settings, accommodating pathways and trails for recreational use, and protecting surface water supplies for domestic consumption or agricultural use.”<sup>87</sup>

In the same report, the Department says that the importance of riparian forests as a source of large organic debris to streams and rivers “cannot be overemphasized.” It goes on to cite numerous studies suggesting that in order to maintain the natural recruitment of large organic debris into streams, a buffer of one mature tree height (in coastal B.C. this can equate to 50 metres) “is required to maintain 100% of predevelopment large organic debris recruitment.”<sup>88</sup>

The DFO’s thinking on habitat protection is clear. If we want to maintain natural processes in streams and ensure that salmon and other resident fish species have the habitat they need to spawn and rear in, then we have to look very carefully at restricting human activities in the critically important forests nearby streams and in modifying practices elsewhere in watersheds.

We turn now to some detailed findings on how logging activity has negatively impacted one of the most studied watersheds in coastal British Columbia as well as logging-related damages in one of the wetter regions in the province, Haida Gwaii (the Queen Charlotte Islands).



GAVIN EDWARDS

*Large, old trees like this one in K’iskwatsta Creek, north of Bella Coola, aren’t likely to be seen in managed second-growth forests.*

*Rotation ages of more than 120 years are absent from harvesting plans, despite their technical and economic feasibility. Re-evaluation of management strategies for remnant old-growth forests seem warranted.*

# How B.C. Stacks Up

The architects of B.C.'s Forest Practices Code promised that "world class" environmental standards would result when the Code became law. But in important respects, the Code delivers a lot less protection to watercourses than laws in other nearby jurisdictions do.

The Code is supposed to protect water by requiring unlogged sections of forest along some streams and rivers. The widths of these sections vary depending on the watercourse and the presence of fish.

The Code says there are to be 50-metre-wide unlogged sections of forest, or buffers, along fish rivers greater than 20 metres and less than 100 metres in width. For fish-bearing rivers that are less wide but still more than 5 metres across, the Code allows the buffer to shrink to 30 metres. For streams with fish in them between 1.5 and 5 metres in width, the "protective" buffer of trees mandated under the Code shrinks to only 20 metres. In addition to these no-logging buffers, all of these rivers and streams receive an additional 20-metre "riparian management zone" that is designed to protect the integrity of the inner buffer. In practice, however, these management zones can be, and often are, clearcut.

Any fish-bearing stream less than 1.5 metres wide (there are many of these in B.C.) require no buffer. Furthermore, all feeder streams emptying into large and small fish-bearing streams are afforded little or no protection under the Code. This means that clearcutting regularly occurs to the banks of these streams. It is only a matter of time before logging sediment and debris is washed into feeder streams where it causes significant downstream losses to fish-spawning and rearing habitat.

This latter requirement stands in sharp contrast to the Department of Fisheries and Oceans recommended approach to stream and fish protection. As noted earlier in this report, DFO's scientific analysis suggests more stringent protection of smaller streams, including 30-metre buffers along ephemeral and intermittent streams. Another area where the Code is considered

weak by many of its critics is in its failure to set enforceable standards for logging on private lands. In recent years some companies, such as TimberWest, have logged 1 million cubic metres of timber annually on private lands on Vancouver Island, often to a standard that does not meet Code provisions on public lands.

So how does B.C.'s Forest Practices Code stack up when compared to environmental protections in places like Washington State and Alaska?

In the US Pacific Northwest, all fish-bearing rivers or streams on federal land require 92-metre-wide buffers. It doesn't matter whether these watercourses are 1.5 metres wide or 100. They all receive equal treatment. In addition, all the tributaries flowing into these water courses, regardless of whether they have fish or not, are to be protected by leaving buffers strips of at least 46 metres in width.

"... (E)ven seasonal streams receive a 30-metre riparian protection zone," Terry Glavin, a respected author on fisheries issues in the Pacific Northwest, reported in a recent Greenpeace publication. "The bottom

line is that Washington State offers more protection to non fish-bearing creeks than B.C. gives to [many of] our top salmon streams."<sup>100</sup>

In Alaska, 30-metre-wide buffer strips are required along all Class 1 (fish-bearing) streams as well as all Class 2 streams flowing into fish-bearing streams. The state has also proposed 20-metre-wide buffers along important streams on private lands.

In several respects, Alaska and Washington are doing more to protect water quality and fish habitat than is B.C. A principle in both states appears to have been embraced, namely, that protecting water and salmon requires looking at a whole river system, not its distinct parts. This principle dovetails in important respects with DFO's recommendations on this issue.

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*The bottom line is that Washington State offers more protection to non fish-bearing creeks than B.C. gives to (many of) our top salmon streams.*

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# Logging's Aftermath in Carnation Creek and Haida Gwaii

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In 1998, a number of scientists gathered at a workshop in Vancouver to discuss findings gathered over 20 years of research in logged watersheds in coastal British Columbia. Their research showed conclusively that logging had not only an immediate impact on water quality, but that its impacts could last for generations to come.

The two regions studied were Carnation Creek, a small watershed on the west coast of Vancouver Island, and various watersheds on Haida Gwaii (the Haida name for the Queen Charlotte Islands). Much of the research focussed on the impacts of logging on resident salmon populations in coastal areas. This is because the health of fish species such as salmon is highly dependent on a healthy environment that has evolved over millennia to meet certain needs. As previously noted, spawning salmon seek out riffles with clean, stable gravel and well-oxygenated streams in which to lay their eggs. After emerging from their eggs, young salmon may spend months or years in a stream before moving out to the ocean. During that time, they need stable pools of water to feed and rear in and to use for predator avoidance.

When logging occurs in watersheds, particularly in areas adjacent to fish-bearing streams and the smaller “feeder” streams that supply them with water, numerous changes occur. At its most basic level, what logging activity does is “influence the amount, timing and nature of sediment and water moving through a stream system,” noted one trio of scientists to present their findings at the workshop.<sup>89</sup> Removal of stream side trees also increases water temperatures and removes the primary source of organic debris and leaf litter which supports the benthic or bottom-dwelling invertebrates, algae and bugs that provide food for salmon in their early life stages.

In general, clearcutting and related road-building leads to increased levels of sediment entering stream channels because rainwater or snowmelt runs unchecked off of lands where trees once intercepted and diverted that water. On lands that are clearcut, exposed soil, gravel, rock and logging debris is easily pushed along by falling rain or melting snow. Eventually, this material ends up in downhill streams. As scientists monitoring events in Carnation Creek noted, this results in expanded bars and riffles, infilled pools and destabilized stream banks. The nature of the gravel composition in the stream often changes as well, with devastating consequences for spawning fish. Stream reaches can be rendered unsuitable for the incubation of fish eggs or for the survival of fish from their egg to fry stages.<sup>90</sup>

These and other impacts are far from short-lived. As another trio of scientists to present their findings at the workshop reported, logging activity can be expected to have impacts on resident fish populations for decades.

“Increased levels of suspended sediment from disturbed soils and roads persist for 6-10 years in coastal watersheds, but can last longer if the roads are still being used and maintained,” say Charles Scrivener, Peter Tschaplinski and J. Stevenson-Macdonald. “Slope landslides and channel torrents increased in the Queen Charlotte Islands within just a few years after logging had begun... Channel erosion was still accelerating in Carnation Creek

*Sands and fine gravel from debris torrents and bank erosion were still being transported into spawning gravel 1-2 km downstream, 10 years after logging.*

*“Roads are regularly assumed to be the main source of the problems [along waterways],” Tripp said. “This may well be true in terms of overall site degradation or the loss of plantable sites, but it was clearly harvest operations that caused most of the stream damages observed.*

a decade after adjacent areas were logged. Sands and fine gravel from debris torrents and bank erosion were still being transported into spawning gravel 1-2 km downstream, 10 years after logging. Incubation success of salmonid eggs will probably be reduced for decades because of this streambed instability and increased sand.”<sup>91</sup>

It takes long periods of evolution for a new forest to develop the characteristics that make for optimal water quality and fish habitat. As forests mature, some of the large trees in riparian areas become old and unstable. Certain trees may eventually topple over and fall into or across a stream. The presence in the stream of this Large Organic Debris (LOD) is vitally important because it disrupts the flow of water and creates pools and other unique habitats for fish.

Scrivener and others to look at logging’s impacts in watersheds, note that the nature and frequency of LOD changes after logging. In some areas studied, LOD continued to decline 70 years after harvesting in riparian forests. More troubling is that in many stream side settings when an old-growth forest of large softwood trees is cut down, it is often replaced by a vigorous crop of hardwoods such as alders. Alders spring from streamside clearcuts, but they are relatively small and unstable trees and when they fall into water they quickly decompose. They are of little value to fish and are no replacement for large softwoods that can be preserved in freshwater streams for one to two centuries. It has been estimated that it may take up to 300 years following logging for alders to be replaced by softwoods; a clear indication that logging in riparian settings can have consequences that stretch into the future for several human generations.<sup>92</sup>

Obviously, clearcutting and road building activities adjacent to streams have immediate and long lasting impacts on water quality and fish habitat. But what about industrial forestry operations away from fish-bearing streams? This question does not generally form part of the public discourse about logging’s contribution to degraded waters. As the research at Carnation Creek and on Haida Gwaii confirms, it should.

Derek Tripp, a Nanaimo-based biologist, is a well-known and respected auditor of forest industry impacts on salmon streams. He has conducted independent environmental audits of logging activities in proximity to water courses for the provincial government. His findings suggest strongly that forest industry activities have noticeable impacts on both fish-bearing streams and the less-studied but equally important feeder streams that replenish downstream water supplies.

In 1994, a study Tripp prepared for the Ministry of Forests found that “half to two-thirds of the stream reaches with fisheries concerns inspected in each of the North Coast, Kalum and Sunshine Coast [Forest] Districts showed a major or moderate impact of some type” following logging.<sup>93</sup> At the time, Tripp was monitoring the industry’s performance in meeting guidelines which the industry and government had jointly developed to protect fish habitat. The industry’s consistent failure to meet its own guidelines was one reason why the provincial government subsequently passed the Forest Practices Code, a piece of legislation which sets out some limited legal requirements for the protection of habitat along certain fish-bearing streams.

Much of the emphasis on “protecting” salmon habitat, both before and after introduction of the Forest Practices Code, has focussed on requiring logging companies to leave so-called “buffers” of trees along certain fish-bearing streams. But as Tripp reported to his colleagues at the 20th anniversary Carnation Creek workshop:

“Of the streams inspected in the audits, almost half with fish or of direct concern to fish-bearing streams were affected by logging,” Tripp reported in 1998. “Streams most likely to be affected were those that lacked specific prescriptions for some sort of buffer strip or appropriate harvest techniques (such as upstream Class 3 and Class 4 streams<sup>94</sup>). Non fish-bearing streams with a reasonable potential of affecting fish resources downstream

were particularly prone to problems. This indicates that upstream or upslope risks are not always recognized or evaluated in a consistent fashion.”<sup>95</sup>

Tripp went on to report that much of the damage to Class 3 and Class 4 streams originated on logged hillsides which gave way in slides or debris torrents following logging.

“Roads are regularly assumed to be the main source of the problems (along waterways),” Tripp said. “This may well be true in terms of overall site degradation or the loss of plantable sites, but it was clearly harvest operations that caused most of the stream damages observed. Torrent or torrent-like events damaged the most habitat, but inappropriate, if not illegal, activities (such as machinery in streams and trespasses over streams) caused or contributed substantially to some of the greatest individual problems.”<sup>96</sup>

In other findings presented at the same conference, Gordon Hartman and Tom Brown joined Tripp in suggesting that these torrents had profound effects on fish in downstream habitats. When a portion of a single large tree falls into a stream, it serves to quickly form a deep still pool of water that is ideally suited to the needs of fish such as young coho salmon. But such Large Organic Debris must be distinguished from the materials deposited into fish-bearing streams by debris torrents. “Torrents that deposit piles of broken wood or whole trees up on the stream bank or in large, high debris jams within the channel do not soon create ideal habitat in proportion to the volume of wood deposited,” Tripp and his colleagues concluded.<sup>97</sup>

In areas prone to heavy rains, as much of the coast of British Columbia is, chances are high that clearcut logging on steep slopes will destabilize soils and trigger debris torrents. The frequency of these torrents generally increases the smaller and steeper the watershed is. Other researchers to present their findings with Tripp, noted that in 1978 an unusually large number of debris torrents or slides occurred on Haida Gwaii. The resulting increase in debris jams in down slope streams buried salmon spawning sites upstream of the jams; eroded salmon-spawning sites downstream of the jams; filled in important salmon-rearing pools; and smothered egg-incubation sites in fine silts and gravel. Research also showed that log and debris jams in downstream slopes increased by a factor of 3.8 in logged watersheds versus unlogged watersheds on Haida Gwaii.<sup>98</sup>

“A troublesome legacy of past forest management practices in steep terrain is the severity of the environmental damage produced by relatively low magnitude-high frequency storm events,” a research team headed by Dan Hogan said. “The 1978 storm on the Queen Charlotte Islands was not as intense as events occurring earlier in the century. Nevertheless, far more landslides occurred during 1978 than in earlier storms of the same or greater magnitude. Previous studies have confirmed that logging on unstable slopes accelerates the already high rate of landslide activity along much of coastal British Columbia. This leads to a corresponding increase in recently formed log jams, with all the associated channel morphology and fish habitat changes. New management initiatives, particularly the British Columbia Forest Practices Code, will attempt to minimize future environmental impacts in streams. However, the current recovery of stream channels to their pre-logging conditions is dependent on the time required - approximately 50 years - for a diverse array of log-jam ages to establish.”<sup>99</sup>

B.C.’s Forest Practices Code may indeed represent an attempt by the provincial government to minimize forest industry-related impacts to streams. But given what other jurisdictions are doing to protect streamside forests, how genuine an attempt is it? *See Side Story - How B.C. Stacks Up.*

In 1996, the Sierra Legal Defence Fund undertook an investigation to determine the performance of industry and government in protecting streams under the Code. The resulting



*Logging activity up to the edge of non fish-bearing streams can damage important fish habitat in receiving waters.*

*Logging activity  
alongside streams  
without fish in them  
can be as destruc-  
tive to fish else-  
where in the water-  
shed as logging  
alongside the fish-  
bearing streams  
themselves.*

report, issued in February 1997, presented findings based on the analysis of hundreds of forest development plans submitted to the Ministry of Forests by logging companies operating in four forest districts on B.C.'s coast. The paper audit included 158 cutblocks and 1086 streams. Following the paper audit, an SLDF biologist and soil scientist conducted field studies in 18 cutblocks containing 101 streams. The results of SLDF's report were supported by findings of a joint Ministry of Forests and Ministry of Environment, Lands and Parks review and a Forest Practices Board Special Investigation.<sup>101</sup>

The paper and field audits revealed several weaknesses in the Code.<sup>102</sup> For example, 83 per cent of all streams reviewed were clearcut to the banks (only 72 of the 1086 streams were required to have a buffer strip of trees alongside them). The Ministry of Forests 36% of the time approved yarding of felled trees across streams, a highly destructive practice. Less than half the streams on the cutblocks (43%) which should have been classified under the Code as fish-bearing were properly classified.<sup>103</sup>

The fact that more than 80 per cent of stream side forests surveyed were clearcut suggests strongly that many of the damages noted in the Carnation Creek and Queen Charlotte Islands studies are likely to continue under the Forest Practices Code. "This is a far cry from 'world class standards' promised by Ministry of Forests officials and provincial politicians and will not protect the forest or stream ecosystems. It is highly unlikely that this is what the public had understood would be the result of the new Code," SLDF auditors reported in 1997.<sup>104</sup>

As more and more studies report, there has been a marked decline in salmon numbers and in salmon health throughout coastal British Columbia. In 1996, for example, an American Fisheries Society study that used data supplied by the Department of Fisheries and Oceans found that: 142 distinct salmon populations in B.C. and the Yukon had been driven to extinction; another 624 stocks were considered at "high risk" of extinction; and another 308 were deemed to be at "moderate risk" of extinction or of "serious concern."

The blame for such widespread losses cannot be laid solely on destructive land use practices. Over-harvesting of fish in non-selective or "mixed stock" commercial fisheries is a significant factor, as is rising water temperatures in oceans, rivers and lakes. Nevertheless, after 20 years of field research at Carnation Creek scientists concluded that there is a strong link between declining resident salmon stocks and the logging of the watershed. The number of coho fry rearing in Carnation Creek are at about 57% of their pre-logging levels, while adult returns of chum salmon to the watershed are now only about 39% of their pre-logging levels.<sup>105</sup> Such precipitous declines, workshop participants were told, are a result of "loss of rearing habitat . . . associated with clearcut logging alongside streamsides and over steep-sloped terrain. Debris torrents and landslides from clearcut hillsides have introduced large volumes of sediment and woody debris into the stream channel, and this continues to cause pronounced changes to fish habitats 18 years after forest harvesting was initiated."<sup>106</sup>

This statement is all the more powerful for what it doesn't say. There's no mention of "fish-bearing" or "Class 1" streams. In omitting these words, the authors make the point, reinforced by others at the same workshop, that logging activity alongside streams without fish in them can be as destructive to fish elsewhere in the watershed as logging alongside the fish-bearing streams themselves. When logging companies clearcut along a feeder stream up slope of a fish-bearing waterway, it is only a matter of time before problems show up down slope. In watersheds, everything is connected in intricate ways. What you do in one place has impacts somewhere else. In the absence of integrated plans that place the maintenance of water quality first, fish, other wildlife species and humans inevitably suffer the consequences.

# APPENDIX 1

## Water Protection and the Law

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Citizens often seek to use the law to protect their rights and interests, including those relating to their water. There are several things water users must consider when contemplating using legal tools to help protect or repair threatened or degraded water supplies.

Some legal remedies are only useful after the fact, in other words, when the damage is already done. Others are preventive, and meant to gain protection of a water supply before it is degraded. It is important to choose which legal remedy best suits your goal. It is equally important to realize that no matter what route you choose, there are both pros and cons to consider.

Before deciding, remember that there are a number of sources that will assist you in making an informed choice. Organizations such as the Sierra Legal Defence Fund<sup>107</sup> and the West Coast Environmental Law Association<sup>108</sup> can provide free advice beforehand, and sometimes legal representation before courts and tribunals. The SLDF also runs Forest Watch, a program that among other things helps train people to identify logging-related infractions in watersheds. *See Side Story—Forest Watch.* Local lawyers and a variety of NGOs (non-governmental organizations) can also provide other assistance.

There are also a number of good citizen's legal guides available from libraries including those at the Environmental Law Centre at the University of Victoria<sup>109</sup> and the West Coast Environmental Law Association's Vancouver office.<sup>110/111</sup>

As much as possible, make use of civil servants within relevant government ministries at every opportunity. The provincial ministries of Health, Environment Lands and Parks, Forests, Energy and Mines and the federal Department of Fisheries and Oceans, Environment Canada and Canadian Environmental Assessment Agency all play roles in regulating activities which can degrade water supplies.

It is vitally important to ask questions of relevant ministries. They are there to serve you as a member of the public as much, if not more than, the industries they regulate. *You* are their client. Contact them when you feel a law isn't being enforced or to get information on such things as whether an environmental assessment is required before a proposed activity proceeds. If written and verbal requests for information fail to provide answers, consider making a formal request under the provincial *Freedom of Information and Protection of Privacy Act*<sup>112</sup> or the federal *Access to Information Act*<sup>113</sup>.

Following is a brief description of the various categories or types of legal tools available to you, each with some of their pros and cons outlined. After that, there is a brief overview of some of the statutes that may be useful in protecting water supplies and watersheds.

### Private Prosecutions

Any citizen has the right to lay charges against a company, individual or government for alleged violations of the law. A citizen may take these charges through to trial and conduct a prosecution. Such prosecutions, termed "private prosecutions", are similar in most respects to Crown, or public, prosecutions, in which lawyers representing the Crown proceed with charges.<sup>114</sup>



*Bucked logs and logging debris in a stream channel in the proposed Stoltmann Wilderness Area north of Vancouver, April 1997.*

# FOREST WATCH of BRITISH COLUMBIA

## A project of the Sierra Legal Defence Fund

Forest Watch of British Columbia was started in 1997 in response to the provincial government's repeated failure to provide consistently good stewardship of publicly-owned forest lands.

Forest Watch aims to unite citizens concerned about forestry issues in a provincial network. Forest Watch BC members and workshop participants are educated about the laws that apply to the stewardship of public lands, and receive on-the-ground training which enables them to determine whether relevant laws and regulations are adhered to.

For example, in the summer of 1999 a Forest Watch BC training workshop was held at the Silver Lake Forestry Centre near the Okanagan community of Peachland. Forty participants from around the province attended. Among the things they learned was what is required of forest companies operating in and around watershed riparian areas.

People received formal training in monitoring forestry activities and in determining whether on-the-ground forest practices were in compliance with relevant provincial and federal laws, including BC's Forest Practices Code and the federal Fisheries Act. Workshop participants later conducted field investigations in the local Community Watershed. A Department of Fisheries and Oceans staff person attended and taught participants about the Department's work and responsibilities in riparian zones.

Forest Watch believes that improvements in forestry practices can best be achieved by providing quality information on the state of British Columbia's forests to assist decision-makers, and by assisting citizen's participation in decisions regarding public forest resources.



GREG DOUCETTE

*Forest Watch workshop participants doing field work near Peachland, 1999*

The Forest Watch BC network includes local citizens, local and provincial environmental groups, First Nations and the Sierra Legal Defence Fund.

SLDF administers the efforts of Forest Watch regional coordinators in several communities around the province. Annual training sessions like those at Silver Lake are helping the Forest Watch BC network expand across the province. The BC network is allied with a growing coalition called Global Forest Watch Canada.

The World Resources Institute in Washington, DC, is currently collaborating with organizations across the country in building Global Forest Watch Canada, an affiliate of Global Forest Watch. Global Forest Watch aims to build a global network of organizations to form a world-wide independent, decentralized non-

governmental forest development-monitoring network.

For more information on Forest Watch BC, contact the B.C. Coordinator, Aran O'Carroll at: [forestwatch@sierralegal.org](mailto:forestwatch@sierralegal.org) or at the address for Sierra Legal Defence Fund found on the back cover.



**Pros:** A successful prosecution can result in a guilty party being fined and/or imprisoned. A conviction also carries a stigma: the justice system is saying the actions of the offending party are morally wrong. A successful prosecution thereby acts as a deterrent to others, who may then be less inclined to cause environmental damage and run the risk of being charged and convicted. Finally, a private prosecution, even one that is stayed (see Cons, below), can prompt government or industry to make investments to clean up the environment.

**Cons:** In British Columbia, the Attorney General's current policy is to intervene in all private prosecutions regardless of merit.<sup>115</sup> This means that the citizen who launched the prosecution is prevented from proceeding with the case. At this stage, the Crown could decide to continue with the prosecution and let the court determine whether the defendant is guilty or not guilty. However, in almost all private prosecutions regarding environmental offences, where the Crown intervenes, the prosecution is stayed, meaning that the charges are dropped.<sup>116</sup> The other drawback of private prosecutions is that they are brought "after the fact". The damage is already done, and in many cases can never be repaired. They can also be expensive and time-consuming.

## Civil Actions

If the acts or omissions of another party cause you to suffer damages, you can often sue for compensation. This is known as a civil action. A civil action might be launched, for example, after a water-user finds that her or his water line and/or water supply has been damaged by logging activity.

There are four main categories of civil actions that may be useful in protecting water. In each case, you may be able to sue to recover your losses. The categories are:

- Trespass - if a person (individual, corporation or government) touches or causes something else to touch your property;
- Nuisance - if a person causes a loss of your use and enjoyment of your property;
- Negligence - if a person causes you damages in a way that they ought to have foreseen and been able to avoid; and,
- Strict liability - if a person undertakes very hazardous activities on their land, and causes damages to you, even if they weren't negligent.<sup>117</sup>

**Pros:** The awards from lawsuits can be quite high. Also, in the course of a civil action, you can seek an injunction to stop or prevent a proposed activity that you believe will cause you to suffer losses.

**Cons:** Civil actions are expensive and time consuming. Going through court is often a painful process. So if you can be proactive and get the relevant government agency to prevent the damage before the proposed activity takes place, you are better off.

## Environmental Assessments

Certain proposed activities may be required to go through provincial and/or federal environmental assessment reviews prior to being carried out. Such reviews can result in some activities being ruled out for environmental reasons (although this is extremely rare) or in modifications being made to proposed projects to make them less damaging to the environment.

In British Columbia, the criteria that determine whether a project goes through an environmental assessment are listed in the Reviewable Project Regulation.<sup>118</sup> For example, a proposed dam may or may not be subject to a review depending on its height and/or the volume of water it will impound. However, forestry activities are excluded from consideration under the British Columbia Environmental Assessment Act.

The circumstances under which a federal environmental assessment is triggered are similar but a little more complex. Proposed projects that may be reviewed are inventoried in three lists of regulations under the Canadian Environmental Assessment Act. Like the provincial environmental assessment regulations, pro-

posed projects may have to be of a certain magnitude before they are required to undergo a federal assessment. Also the issuance of certain permits may first require an environmental assessment. For example, under the Fisheries Act permission can be granted for a project that will alter fish habitat. But before such a permit is signed off, an assessment would have to be done.

**Pros:** Such review processes are proactive and sometimes preventive. They also allow for public input or participation at various stages.

**Cons:** Reviews are often discretionary. In addition, environmental assessment statutes exclude some important activities such as logging, which can have devastating impacts on the environment. They are often ineffective at actually preventing developments that cause harm to the environment.

## Government Intervention

There are a number of ways that governments may take action against corporations or individuals that have damaged, or may in the future cause damage to, water supplies. They include the previously mentioned powers vested in public health officials (See Elevating Water's Status) They also include:

- Crown prosecutions of companies or individuals that have violated laws or regulations;
- Orders requiring companies or individuals to cease certain damaging activities or to clean up after damaging activities have occurred (these may include orders before a proposed activity has taken place); and,
- Other court actions, including civil actions, in which the government sues a company or individuals on behalf of the public.

Governments also have a broad range of powers at their disposal to influence the outcome of events in watersheds by licensing or permitting activities. A license, permit or approval can have terms or conditions attached to it. For example, a timber-cutting permit may set out what can occur within riparian zones in proximity to watercourses. If the riparian zone is damaged, some of the actions at government's disposal (see those listed above) may be used to remedy the situation.

Citizens may have the opportunity to influence government agencies in conducting litigation, issuing orders, or setting the terms and conditions of licenses and permits. They may also be able to lobby effectively for cancellation of a license or permit if terms and conditions aren't met. However, government representatives often have broad discretionary powers when it comes to determining what will or will not be allowed in a license or permit. And they often do not rigorously enforce existing laws. For example, despite repeated violations, few municipalities are held to account for the damage their sewage does to fish habitat, even though the Fisheries Act says clearly that it is an offence to damage such habitat.

**Pros:** Crown prosecutions and other court actions are a lot cheaper to the complainant than private prosecutions or civil actions, and they more frequently proceed through the courts once successfully initiated.

Government orders can stop an activity from proceeding, halt further activity, or require cleanup.

**Cons:** The commencement of Crown prosecutions and other court actions, and the issuance of orders are highly discretionary decisions of government.

## Judicial Review

When a government awards a license, approves a project, issues an order, or makes any other decision under a statute, it is sometimes possible to have the decision reviewed by the courts. Usually a judicial review application is made on procedural grounds, with lawyers acting for the applicant arguing that the statutory decision-maker failed to take the proper steps in making his or her decision. Arguments may also be put forward that relevant information was not considered in reaching the decision, or that the decision-maker exhibited bias.

The courts are generally reluctant to overturn a decision only because it was demonstrably bad. A decision must usually have been unreasonable, or patently unreasonable, to be successfully overturned.

**Pros:** Judicial reviews can be proactive and preventive. In other words, they can occur before the disputed decision is acted on. As such, they sometimes enable prevention of harmful activities. Applicants may also have the opportunity to seek an injunction pending the outcome of a judicial review.

**Cons:** Judicial reviews can be expensive and time-consuming. They are limited to government decisions, not those of the private sector. And if successful, the outcome is usually an order that the initial decision be reconsidered, often by the same person or body that made the initial decision. See, for example, the *Friends of the West Country Association v. the Minister of Fisheries and Oceans, and the Attorney General of Canada*.<sup>119</sup>

## Statutory Appeals

Certain approvals of licenses or permits and other government decisions may be challenged through statutory appeals. Such appeals are heard either by a court or a special decision-making body listed in the relevant statute. Under B.C.'s Health Act, for instance, a statutory appeal is made to the Supreme Court. Under B.C.'s Forest Act, an appeal may be made to the Forest Appeals Commission in certain circumstances.

Standing, or the legal right, to bring an appeal, is generally set out under the specific legislation. Normally, people who are directly affected by the decision will have standing. In certain cases, a court or tribunal may grant so-called "public interest standing" which allows a person or group of people not directly affected but with an interest in the issue to have standing. Issues surrounding standing in judicial reviews are similar to those for statutory appeals.

**Pros:** Statutory appeals may be preventive if the government decision has not been acted on. The range of results possible under a statutory appeal is usually much broader than under a judicial review. It is sometimes possible, for example, to have a decision reversed or changed.

**Cons:** Like judicial reviews, statutory appeals can be time consuming and expensive. Subject as they are to the discretion of the courts or relevant decision-making bodies, not all appeals are allowed to proceed. As well, many statutes do not have a statutory appeal process built into them, or their appeal process doesn't allow ordinary citizens to appeal.

## Relevant Statutes

There are several relevant Acts, both provincial and federal, which give recourse to the various legal tools described above.<sup>120</sup> Following is a brief description of each.

### **The B.C. Fish Protection Act** <sup>121</sup>

This enabling legislation allows municipalities to enact by-laws and take other steps to control activities in proximity to streams and rivers within their municipal boundaries. By using the powers vested in them in the Act, municipal governments can dramatically restrict logging on private lands or on Crown lands within the district or municipality.

### **The Federal Fisheries Act** <sup>122</sup>

Several sections of the federal Fisheries Act apply to water-quality and fish habitat issues.

Section 36 - Prohibits the deposition into water of substances that are deleterious to fish. This includes materials from logging-related landslides, wood waste, chemicals, sewage, and any other substances with a deleterious effect. Crown or private prosecutions can be brought if this section of the Act is violated.



WILL HORTER

*Forest Watch workshop participants receive training in identifying fish-bearing streams during workshop in the Nahatlatch Valley near Boston Bar, August 1998.*

Section 35 - Prohibits the alteration of fish habitat, for example the damaging of stream banks or stream beds. Again, private or Crown prosecutions can be brought if this section is violated.

Section 37 - Allows the government to require plans or specifications from a company or individual that proposes an activity that may impact fish habitat. It also allows the government to restrict activities, require modifications in the proposed activity, or order a halt to work already underway.

Section 41(4) - Allows the government to seek a court-ordered injunction to stop work that violates the Act. This application might be prompted by the request of a member of the public.

Sections 42(1) and 42(3) - Allows the Crown and/or fishermen, in some circumstances, the right to launch civil actions against parties who violate the Act.

### **The Federal *Navigable Waters Protection Act*** <sup>123</sup>

The Act requires a federal permit for activities in, over, upon or beneath navigable waters. For example, the building of a bridge over a navigable river would require such a permit. Under the Act, the Department of Fisheries and Oceans can set out terms and conditions that must be adhered to, and it can revoke a permit when those terms and conditions are not met. In addition, the Navigable Waters Protection Act is on the Canadian Environmental Assessment Act's law list (see below), meaning such a bridge would also require an environmental assessment.

### **The Canadian *Environmental Assessment Act*** <sup>124</sup>

The Act applies to a wide range of projects and activities; those that may require an assessment are set out in federal regulations. This Act will only be invoked where some federal authority has to issue a permit, provide funding, holds land, or is the actual body proposing a project or activity. Citizens may contact the Environmental Assessment Agency to find out whether an assessment is planned for a particular project or to request that one be done.<sup>125</sup> Assessments can range in complexity from a cursory screening to a full-scale panel review.

Public participation is an integral component of a full environmental assessment, and the Act provides opportunities for public input and participation at various stages of the process. In some cases, funding is made available to assist public participants. It may be, but is often not the case, that linked activities become subject to review. For example, if a bridge is being assessed, it may follow that the road connecting to that bridge becomes part of the assessment.

### **The B.C. *Water Act*** <sup>126</sup>

Under this Act, government has the power to require companies to clean up water bodies that they have polluted. Government can also restrict changes in and about streams using the power vested in it in the Act. The Act's relevant sections are:

Section 9 - Restricts changes in and about streams. However, changes may be made without approval if they are allowed under various statutes including the Forest Practices Code. Under these circumstances, the party must comply with the Code's provisions. If those provisions are violated, the party requires an approval under the Water Act.

Section 39.1(j) - Allows a government representative such as a water engineer to order a company or individual to cease putting or to not put certain substances into water, remove what it has already placed in the water and to restore or rehabilitate the water course to its original condition.

Section 41.1(l) - Under this section, government can require that debris be kept out of a stream.

### **The B.C. *Waste Management Act*** <sup>127</sup>

This is the main provincial anti-pollution Act and applies to air, land and water. However, it has limited application to forestry, affecting only ancillary matters such as fuel leaks or dumps associated with forest industry activity. The Act has much more significant application to the forest industry when it comes to the issuance of permits for discharge of wastes into receiving waters, for example pulp mill effluent.

### **The B.C. *Environmental Assessment Act*** <sup>128</sup>

This Act sets up a planning regime similar in many respects to that under the Canadian Environmental

Assessment Act. Its aim is to have projects assessed at an early stage with a view to reducing or eliminating their adverse effects. Unfortunately, the Act does not apply to forestry. Consequently, one of the most serious threats to watersheds and streams in B.C. does not get the comprehensive style of environmental review that other lesser threats do.

**The B.C. Health Act** <sup>129</sup>

Sections 61 and 63 of this Act allows local health officials to conduct inspections and issue orders. These orders can require, among other things, the vacating and closure of a place, the carrying out of specified work, and the removal of things that cause a health hazard. In addition, sections 59 and 60 empower local boards of health to issue orders to remedy health hazards.

These provisions enable local officials to restrict how, where and whether logging takes place in a watershed. Citizens can press these officials to exercise their statutory powers to protect them from health hazards.

**The B.C. Forest Practices Code Act** <sup>130</sup>

There are a number of provisions in the Code that offer some protection to water supplies. Furthermore, the Code is a baseline that can be modified by “higher level” plans, which supersede the Code and may offer further safeguards to forests and watercourses. For example, landscape unit planning processes may identify “old-growth management areas” within certain watersheds. This may further protect streams and hydrological functioning by placing some forested areas off-limits to commercial logging.

Similarly, planning processes may identify “wildlife habitat areas” which are to be conserved to protect wildlife. These may include riparian areas. Under the Code, wildlife habitat areas are not able to reduce the provincial Allowable Annual Cut by more than one percent. The Code also offers some protection to, streamside forests depending on whether or not they are fish-bearing and how wide they are.

Under the regulatory provisions of the Code, watershed assessments are supposed to be conducted. Such assessments may yet prove to be a significant factor in reducing logging rates in many watersheds. However, the government has repeatedly extended the deadline for completing these assessments, allowing logging to continue unabated. Watershed assessments are to be done for all designated Community Watersheds under the Code, as well as all watersheds with significant downstream fisheries or domestic water uses, or in any area where a Ministry of Forests district manager says an assessment should be done.

Watershed assessments look at the hydrology of the watershed, and based on what’s already happened in it (either naturally or through historic development), establish logging rates which will not diminish water supply; in other words which will sustain or improve the watershed’s hydrology.

The Code also has provisions in it that allow the Ministry of Environment to designate certain water courses as “temperature sensitive.” Such a ruling could have dramatic consequences for land-use activities in proximity to streams. However, few if any designations have taken place.



GARTH LENZ

*Old-growth trees in the Hasty Creek Watershed, site of a protracted dispute between water users and industrial forestry interests.*

# APPENDIX 2

## Running Hot and Cold:

### An Overview of Community Experiences in Treating and Protecting Local Water Supplies

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While municipal governments in British Columbia are required by provincial statute to provide safe drinking water to their residents, very few have control over activities on lands draining into their surface water supplies. Elsewhere in this report we saw how elected officials in the City of Kimberley, along with

health authorities in the East Kootenay region, viewed this as a problem. How, they asked, could cities be legally required to make substantial investments to treat their drinking water, yet have no control over land-based activities such as logging and road-building that can degrade water supplies, forcing further expenditures?

In a rare number of cases, the Province has publicly linked its decision to grant “protected” status to certain watersheds with maintenance of municipal drinking water supplies. But this is the exception to the rule. In the vast majority of cases, small and large water purveyors are told that they have no control over land use activities in their watersheds. Consequently, important decisions relating to practices such as logging and road building remain the responsibility of the Ministry of Forests. One of the chief mandates of that ministry is to ensure a steady supply of wood fibre to the forest industry. To maintain fibre flow, Ministry of Forests officials say, requires the logging of commercially accessible forests in lands falling outside protected areas, including the lands around community water supplies.

Acknowledging the sensitivities surrounding development of lands in proximity to drinking water supplies, B.C.’s Forest Practices Code creates a special category of lands known as Community Watersheds. Under the Code, these lands are supposed to be subject to stringent planning before development takes place, something the Province says will safeguard the quality of surface water supplies. At the end of the day, however, it is the Ministry of Forests, not water users or water providers, that decides where and when logging in community watersheds takes place. The Ministry also decides on applications by water users for “community watershed status.” As we’ve already seen, this sometimes results in applications for community watershed status being rejected. If an application is rejected, however, other provisions of the Forest Practices Code would still remain in effect. In other cases where community watershed status is in place, water users may believe that this results in de facto protection of their water. Such beliefs may be unfounded.

In the following pages, the experiences of 10 different communities are described.

These brief profiles, as well as the community experiences outlined elsewhere in the report, show that in the eyes of the provincial government not all communities are equal. An enviable few communities find their watershed lands protected from potentially destructive land-based developments, while others find themselves in the murky position of not yet having the lands surrounding their water supplies developed but being told that logging is imminent. Still others have experienced development and are wrestling with how to pay to clean up muddied waters.

SLOF



*When it comes to clearcut logging around drinking water supplies, most communities feel powerless to stop it.*

## NELSON

**Location:** West Kootenay

**Water Source:** Five Mile Creek, from which 90 per cent of the city's water is drawn. The remainder comes from Anderson and Selous Creeks.

**Source Type:** Surface.

**Watershed Status:** A designated Community Watershed, Five Mile Creek received protected areas status under the B.C. government's Kootenay-Boundary Land Use Plan. The two other creeks do not have protected areas status, but are minor water supplies.

**Water Users:** Approximately 9,700 residents.

**Water Treatment:** Water is drawn from an intake pipe four kilometres up Five Mile Creek and is diverted to a six-million gallon reservoir. The reservoir acts as a settling pond, with sediments in the water column sinking to the bottom. The water is then treated with chlorine as it enters the distribution system from the reservoir. The city aims to maintain a chlorine residual in its distribution line of one part per million.

**Overview:** In July of 1997, the provincial government announced the Kootenay-Boundary Land-Use Plan, which granted a number of areas in the region protected area status. One such place was the West Arm Wilderness. Its 25,700 hectares include Five Mile Creek. In its reasons for declaring the area protected, the provincial government stated: "creeks within this area serve as a natural water source for the city (of Nelson)." <sup>131</sup> Bob Adams, Nelson's Director of Works and Services, says the Ministry of Forests was preparing plans to log the watershed prior to its being declared protected. Today, he says, there's "no development at all. We control the only road into the area, and it's gated and locked." <sup>132</sup>



PROVINCE OF BRITISH COLUMBIA

*Part of the protected West Arm Wilderness area, home to Nelson's drinking water supply.*

## SMITHERS

**Location:** Bulkley Valley.

**Water Source:** An aquifer accessed by three 83-metre-deep wells.

**Source Type:** Groundwater.

**Watershed Status:** Developed.

**Water Users:** Approximately 5,700 residents.

**Water Treatment:** Groundwater is accessed by deep wells within the city limits of Smithers, near the Bulkley River. The water receives almost no chemical treatment.

**Overview:** Unlike communities that rely on surface water supplies, Smithers and other groundwater users do not face the same pressures that surface water users do to maintain a chlorine presence in their water distribution systems. "We do not chlorinate except for about six weeks during the year when we run our main flushing program," says Don Gare, superintendent of public works for Smithers.<sup>133</sup> (Public works departments often flush their water distribution systems to rid pipes of bacterial and sediment buildup. During such times, chlorine is commonly used as a precautionary measure.) Gare says his office has received no request by provincial health authorities to chlorinate year round. A decision to discontinue fluoridation was reached by referendum in the 1999 municipal election.

## VALEMOUNT

**Location:** Robson Valley.

**Water Source:** Swift Creek.

**Source Type:** Surface.

**Watershed Status:** This largely undeveloped and designated Community Watershed is listed in the provincial government's Robson Valley Land and Resource Management Plan (LRMP) as part of a "special" resource management zone. This status is bestowed, the LRMP says, because Swift Creek is a "community watershed."<sup>134</sup> As a designated community watershed, Swift Creek is subject to certain Forest Practices Code provisions that are intended to offer some protection to community water supplies. There is no indication in current five-year forestry development plans of proposed logging in the watershed.

**Water Users:** There are approximately 1,300 residents in Valemount who drink water from Swift Creek.

**Water Treatment:** Water from Swift Creek is drawn into an intake within the Village of Valemount's boundary. There is a coarse filter at the intake. The Village has chlorinated its water for several years, and increased the use of chlorine in 1997 following a giardia outbreak. At that point, a baffle system was put into the 250,000-gallon reservoir to increase chlorine's contact time with the water. The Village aims to maintain a 0.6 parts per million chlorine content in the water distribution system.

**Overview:** Dennis Goddard, village administrator for Valemount, says the water coming out of household taps is "very clear." It does not need to be subject to fine filtration, something that the Village cannot afford.<sup>135</sup> Goddard went on to say that a lack of development in the Swift Creek watershed explains why the Village's water is so clear. "There's nothing above the water intake, nothing in the watershed itself. There's no roads, nor will there ever be," Goddard says, adding that the watershed is "designated on all our maps, including MOFs, as a community watershed. It won't be developed. They wouldn't dream of it." But Jeff Beale, district manager at the Ministry of Forests' office in nearby McBride, disagrees. Beale says that one per cent of the "allowable annual cut" in the Robson Valley is slated to come from community watersheds, including Swift Creek. "We have to operate in these areas. We have to start making some headway in pulling fibre out."<sup>136</sup> He says the status of development in Swift Creek is "low" at this point, and that any future logging would occur under the Ministry of Forests administered Small Business Forest Enterprise Program.

## REVELSTOKE

**Location:** Columbia River - Revelstoke.

**Water Source:** Greeley Creek.

**Source Type:** Surface.

**Watershed Status:** Designated Community Watershed (no immediate development pressure).

**Water Users:** The water system serves about 7,000 people.

**Water Treatment:** Chlorine; soon to be chlorine and membrane microfiltration.

**Overview:** In the fall of 1995, several people in the Revelstoke area became sick after drinking water contaminated with pathogens including giardia, cryptosporidium and campylobacterium. Following the outbreak, the city was ordered to disinfect its water by provincial Ministry of Health officials. Chlorine treatment was put in place the following summer. Bryant Yeomans, Revelstoke's superintendent of public works, says the city is now completing a \$6-million water treatment project that includes improvements at the water intake and settling ponds, and construction of a new water treatment plant that includes microfilters. The filters will help deal with periodically high turbidity levels in the water supply, particularly during heavy rains and the spring runoff period. Yeomans says it will also allow the city to reduce its chlorine use from 3 parts per million to 0.5 parts per million. Aside from some heli-skiing in Greeley Creek's upper reaches, there is very little human activity in the watershed. "We don't have any logging in that area," Yeomans says, "the Ministry (of Forests) understands we don't want logging."<sup>137</sup> Kurt Huettmeyer, operations manager at the Ministry of



Forest's Columbia Forest District office, says the logging of the Greeley Creek watershed is "a non-issue for us."<sup>138</sup> "There are a lot of unstable areas at the mouth of the creek. And the value of the timber is relatively lower than other areas that that licensee (Downie St. Sawmills) is operating in," Huettmeyer says.

## GOLDEN

**Location:** Columbia River - Revelstoke

**Water Source:** Four wells, with a fifth well house being developed.

**Source Type:** Groundwater aquifer, replenished from snow melt and precipitation on the western slopes of the Rockies.

**Watershed Status:** Developed.

**Water Users:** Approximately 4,000 people.

**Water Treatment:** Fluoride.

**Overview:** Golden's water supply is drawn from a well inside town limits. Water could be drawn from the nearby Kicking Horse River, says Ron Buss, Golden's public works operations manager. But the river water "requires more treatment. We'd have to chlorinate and remove solids."<sup>139</sup> The well water is low in iron content and of medium hardness (water is rated soft or hard depending on the amount of minerals present, particularly calcium and magnesium). The use of groundwater, Buss says, has eliminated waterborne disease outbreaks that other cities in the province using surface water supplies have confronted. He says the Ministry of Health has not yet asked Golden to chlorinate its water. "They're not after us," Buss says, "and we're not excited to (chlorinate) even if they ask us."

## McBRIDE

**Location:** Robson Valley.

**Water Source:** Dominion Creek.

**Source Type:** Surface.

**Watershed Status:** Like Valemount, the other large community in the Robson Valley, McBride's designated Community Watershed lands were examined during the local Land and Resource Management Planning or LRMP process. The Dominion Creek watershed did not receive "protected area" status during that process. Nevertheless, it has a designation as a Community Watershed, under the provisions of B.C.'s Forest Practices Code. This means that the watershed can be developed, but enhanced planning protection is required.

**Water Users:** About 760 village residents are serviced by McBride's water supply.

**Water Treatment:** Chlorine is used as the water enters into the distribution system.

**Overview:** McBride's water is drawn from the Butterfly Canyon area in the Dominion Creek watershed at the foot of Lucille Mountain. From a reservoir at the first bench in the canyon, the water flows by a pipe downhill into a one million-gallon holding tank. After going through a series of settling tanks, the water is chlorinated before entering the main water distribution system. Village administrator, Laird Irvine, says the large watershed has steep slopes and cannot be developed "without a lot of trouble... there's no mining, no logging, with the exception of some experimental logging by the Ministry of Forests up high."<sup>140</sup> Irvine went on to say that there is no logging permitted in the watershed and that the area's visibility to the highway precludes future logging to protect the "viewscape." Irvine's opinion is not shared by Jeff Beale, district manager at the Ministry of Forests office in McBride. Beale said that McBride's watershed does contain forest that is considered available for logging. While the total amount of land to be logged in this and other community watersheds in the Robson Valley is small, representing about 1 percent of the total Allowable Annual Cut for the region, it is nonetheless significant. "Every percent counts when the timber supply is falling," Beale says.<sup>141</sup>

## INVERMERE

**Location:** East Kootenay.

**Water Source:** Goldie Creek watershed.

**Source Type:** Surface.

**Watershed Status:** Partially developed, Goldie Creek is part of the larger Abel Creek watershed, a designated Community Watershed.

**Water Users:** About 2800 residents.

**Water Treatment:** Coarse filtration and chlorine.

**Overview:** Invermere's water is drawn from an intake pipe in the Goldie Creek watershed, about 15 km southwest of town. The water then travels about 2 kilometres by pipe into the Paddy Ryan Lakes, a series of small lakes, the last of which is about 3 metres deep and 300 metres across. The lakes act as natural settling ponds, meaning there is no need to treat the drinking water with fine filters, says John Rosenburg, Invermere's director of municipal works.<sup>142</sup> A coarse filter covers the water intake as the water goes into the water distribution system itself. The water is chlorinated at that point. Rosenburg says there is a small road network for a handful of farmers who have cattle ranging in the area. People also hike in the area. There's no active logging in the watershed, and none planned, Rosenburg says. Local Ministry of Forests officials say, however, that a small amount of logging in the watershed is planned. Steve Jablanczy, a timber officer with the Invermere Forest District, says a "minor salvage" operation to recover 200 cubic metres of blowdown tree tops is being organized through the ministry's Small Business Forest Enterprise Program. He added that the watershed "is considered a part of the chart area of the SBFEP, but not much of a contributor (to the district's Allowable Annual Cut)."<sup>143</sup> Most of the Goldie Creek watershed will never be logged because its forested slopes are "very steep and inoperable," Jablanczy says.

## QUEEN CHARLOTTE CITY - SKIDEGATE LANDING

**Location:** South end of Graham Island, Haida Gwaii (The Queen Charlotte Islands).

**Water Source:** One large well, various smaller wells and creek intakes.

**Source Type:** Mixed: groundwater and surface water.

**Watershed Status:** An undeveloped and designated Community Watershed.

**Water Users:** Approximately 600 residents.

**Water Treatment:** Well water is chlorinated and treated to remove iron and manganese. Individual households from the ferry landing west toward town have their own wells or draw water from various small creeks. In some cases, residents have both their own water supply and are hooked up to the new system.

**Overview:** A new water treatment and delivery service came into service in Queen Charlotte City in mid 1999. The new service supplies water to residents from the eastern edge of the community through to a well at Tarundl Creek, west of town. The new system replaced older, insufficient wells on the slopes above Queen Charlotte City. The land above Queen Charlotte City and Skidegate Landing, where the ferries land, is in a designated community watershed. Most of it is Crown land. Some of it falls within a timber licence issued to TimberWest. TimberWest, like its predecessors Fletcher Challenge Canada Ltd. and Crown Zellerbach, submitted forest development plans showing its intention to log in the community watershed. Those plans met with stiff local opposition. Residents worried that the logging would destabilize uphill slopes and encourage the entry of beavers into the watershed. Forest company attempts to "trade" logging rights to those lands for rights elsewhere on Haida Gwaii have failed.

## MERRITT

**Location:** Nicola Valley.

**Water Source:** Five deep wells within city limits, replenished by the Coldwater River.

**Source Type:** Groundwater.

**Watershed Status:** Developed.

**Water Users:** Approximately 8,000 residents.

**Water Treatment:** None.

**Overview:** The City of Merritt draws its water from five deep wells within city limits. The wells range in depth from 26 metres to 40 metres. Wellwater is replenished by groundwater that originates from the nearby Coldwater River. City engineer, Dale McTaggart, says the city is under no pressure from Ministry of Health officials to chlorinate the water.<sup>144</sup> He says the reason for this probably stems from the fact that groundwater generally has extremely low or non-existent bacterial counts, therefore there is little possibility of bacterial regrowth in the water distribution system itself. He says Merritt's water delivery system is flushed annually to clear out any unwanted materials. Beginning in the year 2000, a small amount of chlorine will be introduced into the water during annual flushing.

## NEW HAZELTON

**Location:** Skeena.

**Water Source:** Station Creek.

**Source Type:** Surface.

**Watershed Status:** A designated Community Watershed, Station Creek is undeveloped except for a road leading to the water intake, and an old logging road that continues on into other watersheds.

**Water Users:** Approximately 850 residents in the District of New Hazelton and 230 in the nearby Gitksan community of Hagwilget, which is on reserve lands.

**Water Treatment:** A chlorine residual of between .2 parts per million and .6 parts per million is maintained in the water line. A \$3.5-million slow sand filter is being installed to deal with periodic high turbidity counts.

**Overview:** Station Creek occasionally has sediments washed into it. Regional health officials have recorded waterborne disease cases. These may be the result of pathogens occasionally washing into Station Creek. Installation of a slow sand filter should remove virtually all pathogens and sediments in the water supply. A Department of Indian and Northern Affairs grant covers Hagwilget's share of the filters cost. The District's share will come from a provincial infrastructure grant and increased water-user fees. Chris Kingston, an engineer assisting Hagwilget with the filtration project, says sand filters are effective in removing sediment from water, but only up to a certain point. If they're loaded too heavily, he says, they'll shut down and water won't get through at all.<sup>145</sup> That is what happened when a slow sand filter in nearby Moricetown shut down after water in the partially logged Corya Creek watershed became extremely cloudy. The Moricetown band spent upwards of \$10,000 to temporarily divert untreated water into the delivery system when the filter shut down. Now, new engineering work at the site is necessary to eliminate future problems. The added cost of that work is at least \$1 million. Events like this have raised concerns about the costs to communities of logging in local watersheds. Ron Cotton, tenure administration officer with the Kispiox Forest District, says there is no proposed logging at Station Creek at this time, nor is their likely to be.<sup>146</sup> He says that of nine community watersheds in the Kispiox Forest District, only four are in areas projected to be logged. "Most of our CWs (community watersheds) have a very high level of inoperable ground so the timber that is there is often isolated by terrain or economic constraints," Cotton said. He added that local forest companies also have requirements to have certain portions of their chart areas in unlogged landscape level reserves. Companies have often chosen to place those reserves in community watersheds. "CWs have become a natural fit with this category," Cotton says.

## FOOTNOTES

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- 8 From "*Cow Pies and Dirty Water: Cattle in watershed clearcuts might be exposing us to a potentially lethal parasite*", Ben Parfitt, The Georgia Straight, December 12-19, 1996.
- 9 *Seeing the Forest Among the Trees: The Case for Wholistic Forest Use*. Herb Hammond. Polestar Press Ltd., 1992. Page 118.
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- 11 Ibid. page 122.
- 12 Blair-Whitehead and Husby. op cit. Page 19.
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- 14 *Long-Term Changes in Streamflow Following Logging in Western Oregon and Associated Fisheries Implications*. Water Resources Bulletin, American Water Users Association, Vol. 27, No. 2, April, 1991. By Brendan J. Hicks, Robert L. Beschta, and R. Dennis Harr. Pages 218 and 225.
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- 18 Ibid.
- 19 *Forest Follies: Adventures and Misadventures in the Great Canadian Forest*. Ben Parfitt. Harbour Publishing, 1998. Page 100.
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- 26 Ibid. Pages 50-51.
- 27 Ibid. Pages 51-52.
- 28 *Forest Follies*, Harbour Publishing, 1998. By Ben Parfitt. Page 153.
- 29 Office of the Auditor General of British Columbia, op. cit. - Page 53-54.
- 30 Ibid. Page 116.
- 31 Linda Williams, personal communication, June 10, 1999.
- 32 Barry Miller, personal communication, June 7, 1999.
- 33 Sieg Lehmann, personal communication, June 16, 1999.
- 34 Peter Gigliotti, personal communication, June 4, 1999.
- 35 Mark Martin, personal communication, June 9, 1999.
- 36 Office of the Auditor General of British Columbia, op. cit. Page 33.
- 37 Bob Thompson, personal communication, June 11, 1999.
- 38 Brian Wesleyson, personal communication, June 11, 1999.
- 39 *Kimberley Pushes for Water Protection*, The Georgia Straight, Sept. 24-Oct. 1, 1998. By Ben Parfitt.
- 40 Letter to the Minister of Health, Minister of Forests and Minister of Environment, by Tom Beardsley, chair East Kootenay Community Health Services Society, April 27, 1998.
- 41 Office of the Auditor General, op. Cit. Page 115.
- 42 Ibid. Page 119.
- 43 Jim Vincent, personal communication, June 8, 1999.
- 44 Louise Egan, personal communication, June 15, 1999
- 45 Paul Gibbons, personal communication, June 8, 1999.
- 46 Ibid.
  - \* The Forest Practices Board was set up under the Forest Practices Code to monitor compliance with the Code's various provisions.
- 47 Karen Rothe, Watershed Planner, Ministry of Environment Habitat Branch, personal communication, January 31, 2000.
- 48 Forest Practices Code of British Columbia Act, section 41(10) (b).
- 49 Ministry of Forests/Ministry of Environment, "Memorandum of Understanding on Designation of Community Watersheds in the Nelson Forest Region (10/20/98).
- 50 Office of the Auditor General, op. Cit. Page 13.
  - \* The Auditor General often circulates draft recommendations to government prior to publishing a report. The response of the government to the recommendations is included in the Auditor General's report itself.
- 51 Ibid. Page 132.
- 52 Letter to Ralph Robbins, B.C. Assistant Chief Forester, from J.D. Watts, Chairman of the Task Force on Multiple Use of Watersheds of Community Water Supplies, June 15, 1976.
- 53 Letter to Ben Marr, Environment and Land Use Technical Committee, from J.D. Watts, Chairman, Task Force on Multiple Use of Watersheds of Community Water Supplies, September 23, 1976.
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- 55 See Sections 61 to 63 of the Health Act. These sections spell out a health officer's or medical health officer's powers to inspect public or private places and to make orders to halt activities deemed to be a "health hazard." These powers include orders "requiring the removal from the place or from the vicinity of the place of anything that the order states causes a health hazard. The Health Act's website is [http://www.qp.gov.bc.ca/bcstats/96179\\_01.htm](http://www.qp.gov.bc.ca/bcstats/96179_01.htm).
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- 60 Ibid.
- 61 Ibid. Page 6.
- 62 Bjornn and Reiser, op. cit., Page 84.
- 63 Marcus et al., op. cit., Page 7.
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- 69 Marcus et al., op. cit., Page 5.
- 70 See Marcus et al. description of the "River Continuum Concept," Page 9-10.
- 71 Ibid.
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- 73 See Bjornn and Reiser, op.cit., Pages 121-131
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- 81 Chamberlin, et al. Page 187.
- 82 *Establishing Fisheries Management and Reserve Zones in Settlement Areas of Coastal British Columbia*. Department of Fisheries and Oceans, Canada. 1997. Page 1.
- 83 Ibid. Pages 9-10.
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- 93 The Use and Effectiveness of the Coastal Fisheries Forestry Guidelines in Selected Forest Districts of Coastal British Columbia. By D. Tripp. For Ministry of Forests Integrated Resources Branch. January, 1994. Page ii
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- 95 From Carnation Creek and Queen Charlotte Islands Fish/Forestry Workshop: Applying 20 Years of Coastal Research to Management Solutions. British Columbia Ministry of Forests Research Program, 1998. *Focus on Forestry -fisheries Problems: Lessons Learned from Reviewing Applications of the Coastal Fisheries-Forestry Guidelines*. By Derek Tripp and Dan Hogan. Page 31.
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- 132 Bob Adams, personal communication, October 7, 1999.
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- 134 Robson Valley LRMP, BC Ministry of Environment, Lands and Parks, Page 107.
- 135 Dennis Goddard, personal communication, October 4, 1999.
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GARTH LENZ

**Muddied Waters** was prepared by the **Sierra Legal Defence Fund** for a number of groups involved in water-quality and watershed management issues around British Columbia. A brief description of the SLDF and the groups supporting this document follows.

The **B.C. Tap Water Alliance** is a coalition of water-user groups that is actively involved in promoting the protection of municipal water supplies, in particular catchment lands around surface water bodies. For more on the BCTWA see its web site at [www.alternatives.com/bctwa](http://www.alternatives.com/bctwa).

A non-profit society comprised of members from approximately 40 community watershed groups, **The B.C. Watershed Stewardship Alliance** promotes responsible community watershed planning, grounded in consensus-based decisions. The Alliance is preparing a series of reports to communities and government agencies. Informed by consultations with communities, the reports will look at the present state of watershed management as well as proposed changes to the present system. For more information on the Alliance visit its web site at [www.bcwsa.bc.ca](http://www.bcwsa.bc.ca).

**The Red Mountain Residents Association** is a group of residents and property owners living in the Hasty/Vevey/Aylwin watershed in the Slocan Valley south of Silverton. The Association formed to more effectively respond to issues of common concern to area residents, including fire control and water protection. In recent years, the Association has been principally focussed on responding to the threats posed to drinking water supplies by proposed industrial logging and road-building activities. [www.watertalk.org/SVWA/redmountain/](http://www.watertalk.org/SVWA/redmountain/).

**The Sierra Club of B.C.** is a grassroots-based conservation group with a long history of campaigning to protect wilderness in British Columbia. It promotes the responsible use of the earth's ecosystems and resources as well as the restoration of natural and human environments. For more information visit [www.sierraclub.ca/bc](http://www.sierraclub.ca/bc).

Founded in 1990, **The Sierra Legal Defence Fund** is a non-profit environmental law organization that provides free legal services to the environmental community in Canada. Its goals are to: level the playing field for groups that simply cannot afford to go to court against large institutions when important environmental values are at stake; bring carefully selected cases with the ultimate goal of establishing a body of strong legal precedents that recognize the vital importance of environmental values; and provide professional advice on the development of environmental legislation. For more information on the SLDF visit its web site at [www.sierralegal.org](http://www.sierralegal.org).

**The Tuwanek Ratepayers Association** is a non-profit society that formed in 1970 to protect a local water supply threatened by logging. The water supply, known as Irving Creek, was subsequently protected from development. Since then, the Association has taken on a role as an environmental watchdog, monitoring the effects of logging on the region's main water supply and attempting to halt further logging-related damages. For more information, write to RR3, Cowley Site, C-20, Sechelt, B.C., V0N 3A0.

