

January 18, 2011

Sent Via Email and Courier

Environmental Management Branch
Ministry of Environment
PO Box 9342 Stn. Prov. Govt.
Victoria BC V8W9M1

Jim.Hofweber@gov.bc.ca

Attn: Jim Hofweber, Director of Waste Management

Dear Mr. Hofweber,

Re: Request for determination of contaminated site near Quinsam Coal Mine

We write, on behalf of the Campbell River Environmental Committee, the Campbell River Estuary Protection Group, the Haig-Brown Institute, and the Greenways Land Trust, in requesting you to follow the process under section 44 of the BC *Environmental Management Act* to determine Long Lake, nearby Quinsam Coal Mine approximately 30 km west of Campbell River, BC, on Vancouver Island,¹ as a contaminated site. Alternatively, we request that you exercise your authority to order a site investigation of Long Lake in accordance with section 41 of the Act.

As described below, an April 2010 study commissioned by the Canadian Water Network (“CWN”) found arsenic levels in the sediments of Long Lake to range up to 630 ppm and well above local background levels. The BC *Contaminated Sites Regulation* specifies that arsenic levels in sediments exceeding 11 ppm (for sensitive sites) and 20 ppm (for typical sites) could qualify a site to be a contaminated site. Given the CWN study found levels to range to over thirty times the levels in the Regulation, and given the comprehensiveness of that study, there is strong evidence indicating that Long Lake is a contaminated site. The CWN study also concluded that the evidence points to the Quinsam coal mine as the source of the contamination.

This contamination is especially disturbing given that the April 2010 study and an associated study by the University of Aberdeen in Scotland found the arsenic in Long Lake sediments may be in an acutely toxic form that can be taken up by biota.

¹ See pages 2-3 of the attached report, *An Environmental Investigation of the Quinsam Watershed*, for maps of Long Lake and its surrounding watershed.

This could potentially have significant adverse biological effects on the aquatic ecosystems downstream as the arsenic is released from the sediments into the water column over time.

Please treat our request to you as urgent, given that an application to expand the Quinsam Coal mine is currently under consideration by government authorities. We consider it crucial that the full severity and extent of the contaminated site potentially already created by Quinsam Coal mine be determined, to allow for consideration of appropriate remediation if applicable and to allow for a more informed decision on the expansion application.

Legal regime for contaminated sites in BC

‘Contaminated site’ is defined in section 39(1) of the British Columbia *Environmental Management Act* (“EMA”)² as follows:

39(1) “contaminated site” means an area of the land in which the soil or any groundwater lying beneath it, or the water or the underlying sediment, contains

- (a) a hazardous waste, or
- (b) another prescribed substance

in quantities or concentrations exceeding prescribed risk based or numerical criteria or standards or conditions.

The *Contaminated Sites Regulation* (“CSR”)³ prescribes those numerical criteria. Sections 1, 11 and 15 of the CSR state that if the concentration of any substance in sediment at a site is greater than the applicable generic numerical sediment criteria in CSR Schedule 9 and greater than the local background concentration, then it is a “contaminated site” for the purposes of section 39 of the Act.⁴

Schedule 9 of the CSR distinguishes between freshwater sediments and marine sediments, and for each distinguishes between ‘sensitive sediments’ and ‘typical

² *Environmental Management Act*, S.B.C. 2003 c. 53 (“EMA”). Available at http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/03053_00.

³ *Contaminated Sites Regulation*, BC Reg. 375/96, passed pursuant to the EMA (e.g. see EMA s.63(1)(n)). Available at http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/375_96_00.

⁴ See in particular, CSR section 1 definition of “generic numerical sediment criterion,” CSR section 11(1)(c), CSR section 11(3), and CSR section 15(1).

sediments.⁵ The Schedule sets arsenic levels at 11 parts per million (ppm) for sensitive freshwater sediments, and 20 ppm for typical freshwater sediments.⁶

Section 44 of the EMA authorizes you, as a Director appointed under that Act, to officially determine that a site is a contaminated site.⁷ We respectfully request that you do so, based on the information below, which we submit is sufficient to make a preliminary determination that Long Lake is a contaminated site. Alternatively, section 41 of the EMA authorizes you to order a site investigation if you reasonably suspect that the site may be a contaminated site. We respectfully request that you at least order such an investigation, again based on the information below, which we submit is sufficient to create such a reasonable suspicion.

The purposes of the contaminated sites provisions in the EMA and its regulations are to protect the public and the environment from the risks associated with contaminated sites, and to protect the public from the financial burden of having to pay for the clean-up of such contamination. Contaminated sites are recognized as a significant environmental and financial concern, and therefore these provisions are an integral and important part of British Columbia's environmental protection regime.

Section 45 of the EMA specifies who is responsible for remediation of a contaminated site. This includes operators and persons who produced or disposed of a substance that caused the site to become a contaminated site, whether directly or via migration of the substance.⁸ This would likely include the operators of Quinsam Coal mine.

Section 47 of the EMA sets out the general principles of liability for remediation. Section 47(4) explicitly notes that liability applies "even though the introduction of a substance into the environment is or was not prohibited by any legislation," and "despite the terms of any ... permit or approval or waste management plan and its associated operational certificate that authorizes the discharge of waste into the environment." Thus any approvals held in relation to the Quinsam Coal mine would not operate as a shield for responsibility if it turns out (as it apparently has) that the mine is harming the environment by causing contamination of sediment.

⁵ Whether the numerical criteria for 'sensitive sediments' or 'typical sediments' applies is based on the use of the sediment at the site or neighbouring sites, and "the potential for the sediment to cause pollution" (see section 12(2.1) of the CSR). Thus the 'typical sediment use' criteria in CSR Schedule 9 is higher than the 'sensitive sediment use' criteria, reflecting an acceptance of higher contamination where the sensitivity of the use of the sediment, or the potential for pollution, is lower.

⁶ As noted in *An Environmental Investigation of the Quinsam Watershed*, page vii, ppm is equivalent to µg/g.

⁷ Note EMA section 44(4) states: "The lack of a determination under subsection (2) or (3) does not mean that a site is not a contaminated site." However, such a determination facilitates posting on the public contaminated sites registry, remediation orders and cost recovery.

⁸ EMA s.45(1) and (2).

Arsenic contamination levels in Long Lake

The Canadian Water Network (“CWN”) commissioned a study in 2008 to investigate in part whether Quinsam Coal mine was introducing arsenic into the watershed, and if so what effect it was having. The Canadian Water Network is a network of independent researchers and engineers established by the federally-funded Networks of Centres of Excellence Program to “mobilize multidisciplinary research excellence, catalyzing innovation that provides practical, implementable solutions to complex water resource management issues.”⁹ The CWN study report (attached to this letter) was released to the public in April 2010 and is entitled: *An Environmental Investigation of the Quinsam Watershed*. The study was the first to include “a comprehensive and systematic sampling of lake sediments in the Quinsam watershed.”¹⁰ Quinsam Coal mine made no direct financial contribution toward the study.

The study sampled eight locations in Long Lake and found highly elevated levels of arsenic, iron and manganese. The arsenic concentration is of particular concern since it rises well above levels in the *Contaminated Sites Regulation*. Sediments from three of the Long Lake samples ranged from 26 to 36 ppm in arsenic, while the other five locations contained arsenic ranging from 110 to 630 ppm.¹¹ In contrast, other lakes in the watershed unimpacted by the mine had significantly lower arsenic levels in the sediments.¹² For example, arsenic levels in the Upper Quinsam Lake ranged from 3.9 to 45 ppm.¹³ Thus arsenic concentration in Long Lake sediments appears to be much higher than local background levels.

Arsenic concentrations in Long Lake sediments also appear to have increased over time. A 1992 study by Rieberger, for example, included a single sediment sample from Long Lake with an arsenic concentration of 197 ppm,¹⁴ significantly lower than the highest level reported in CWN’s April 2010 study, which is 630 ppm.¹⁵ It thus appears that arsenic levels in Long Lake sediment are not only elevated compared to other surrounding lakes but may have also increased over time.

⁹ For details on the Canadian Water Network, see their website at <http://www.cwn-rce.ca/about>.

¹⁰ *An Environmental Investigation of the Quinsam Watershed*, page 5.

¹¹ *An Environmental Investigation of the Quinsam Watershed*, page 19.

¹² *An Environmental Investigation of the Quinsam Watershed*, page 21.

¹³ *An Environmental Investigation of the Quinsam Watershed*, page 20.

¹⁴ See K. Rieberger, *Metal Concentrations in Bottom Sediments from Uncontaminated BC Lakes* (Victoria: BC Ministry of Environment, Land and Parks, 1992) [“Rieberger report”].

¹⁵ When the CWN samples are analyzed using the same digestive process as that used by Rieberger, the highest arsenic concentration in the CWN samples is 671 ppm. See slide 6 in the attached Dr. William Cullen’s presentation to Campbell River City Council.

Likely Sources of Arsenic

CWN's April 2010 report concluded: "The larger data set firmly establishes that Long Lake sediments are significantly higher than surrounding lakes for both arsenic and manganese concentrations, and points to the mine as the source. In other words, the high arsenic concentrations are not a consequence of naturally elevated arsenic in the lake sediments in the region."¹⁶

With regard to the source of the arsenic contamination in Long Lake, the study found that "arsenic concentrations are elevated in Long Lake as a result of acid rock drainage and other chemical process[es] associated with mine waste."¹⁷ The study noted a number of potential sources, each related to the mine.¹⁸ For example, particularly high levels of sediment contamination were found northeast of the discharging point of a seep that "includes groundwater from the vicinity of the 2 South pit and 3 South pit which stores high sulphur coal wastes,"¹⁹ and flooded underground mine workings are also thought to contribute to this seep flow into the lake.

CWN released an update to their April report in September 2010, which is attached to this letter and entitled *Update on Three Studies: Long Lake Seep Sampling, Long-term Mussel Monitoring Program and Cage Mussel Experiment*. The September 2010 update confirmed that the seep flowing from 2 South and 3 South pits contained 425 ppm of arsenic in sediment-solid form.²⁰ The update report concluded that this result "strongly indicates that the seep is a major contributor to the arsenic burden in Long Lake sediments and points to the possibility that there may [be] other sources in the same area, possibly below the lake surface."²¹

Furthermore, Principal Component Analysis (PCA) reported in the April 2010 study suggests through a statistical analysis of 41 elements that sediments from Long Lake differ in elemental profiles from those of nearby unimpacted lakes.²² Long Lake sediments analyzed in the CWN study also differ in chemical composition from the sample taken by Rieberger in the 1980s.²³ These two results suggest that

¹⁶ *An Environmental Investigation of the Quinsam Watershed*, page 33.

¹⁷ *An Environmental Investigation of the Quinsam Watershed*, page ii.

¹⁸ *An Environmental Investigation of the Quinsam Watershed*, page 22.

¹⁹ *An Environmental Investigation of the Quinsam Watershed*, page 22.

²⁰ *Update on Three Studies: Long Lake Seep Sampling, Long-term Mussel Monitoring Program and Cage Mussel Experiment*, Table 1.

²¹ *Update on Three Studies: Long Lake Seep Sampling, Long-term Mussel Monitoring Program and Cage Mussel Experiment*, page 2.

²² *An Environmental Investigation of the Quinsam Watershed*, pages 21 to 23. See Figure IV-1 on page 23 for a comparison of Long Lake sediments to other surrounding lakes.

²³ See slide 6 in the attached Dr. William Cullen's presentation to Campbell River City Council.

contaminants in Long Lake sediments may come from sources unique to Long Lake that were not present prior to the 1980s.

X-ray analysis of Long Lake samples further supports the conclusion that arsenic in Long Lake sediments comes from minerals that have been subject to some form of physical disturbance, such as mining.²⁴

The results of these analyses combined present strong evidence that arsenic and other chemicals in Long Lake sediments are not naturally occurring, but come from sources related to Quinsam Coal mine.

Danger of High Arsenic Contamination in Long Lake Sediments

Sediments are recognized as an essential element of the aquatic ecosystem, as explained by a 2003 report to government on the development of the CSR sediment criteria:

The role that sediments play in supporting primary productivity (both autotrophic and heterotrophic) is essential because green plants and bacteria represent the foundation of food webs upon which all other aquatic organisms depend (i.e. they are consumed by many other aquatic species).

In addition to their role in supporting primary productivity, sediments also provide essential habitats for many sediment-dwelling invertebrates and benthic fish.

...

Contaminated sediments represent an important environmental concern for several reasons. First, contaminated sediments have been demonstrated to be toxic to sediment-dwelling organisms and fish. As such, exposure to contaminated sediments can result in decreased survival, reduced growth and/or impaired reproduction in benthic invertebrates and fish. Additionally, some contaminants in the sediments are taken up by benthic organisms through a process called bioaccumulation. When larger animals feed on these contaminated prey species, the pollutants are taken into their bodies and are passed along to other animals in the food web in a process called biomagnification. As a result of the effects of toxic and bioaccumulative substances, benthic organisms, fish, birds, and mammals can be adversely affected by contaminated sediments.²⁵

²⁴ *An Environmental Investigation of the Quinsam Watershed*, pages 23-27. X-ray Absorption Near Edge Structure (XANES) Analysis found that arsenic in Long Lake sediments are bound to oxygen compounds, which signals that the arsenic was released due to a physical disturbance of the rocks. Undisturbed coal generally contains pyritic arsenic, which are bound to sulphur compounds.

²⁵ D. MacDonald et al., *Development and Application of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia* (Nov 2003, MacDonald Environmental Sciences, Nanaimo, BC), at pages 2-4 (references omitted). This document was prepared for the Ministry of

As discussed below, arsenic levels reported in CWN's April 2010 study are over 30 times above BC's CSR sediment criteria. Further, tests show that the arsenic in Long Lake sediments is toxic and can be taken up by aquatic life such as mussels. Moreover, arsenic currently stored in the sediments will be released into the water column over time and could adversely affect important aquatic ecosystems downstream from Long Lake, if it hasn't already done so.

Comparison to Contaminated Sites Regulation

As previously explained, Schedule 9 of the B.C. *Contaminated Sites Regulations* ("CSR") states that arsenic levels over 11 ppm (for sensitive site sediments) or over 20 ppm (for typical site sediments) qualify a site to be determined as a contaminated site. Even using the 'typical sediment' criteria for Long Lake, arsenic contamination of the sediment, which reaches up to 630 ppm, is over thirty times this criteria and is well above natural background levels as found in the Canadian Water Network report of April 2010.

The criteria in Schedule 9 were set after an extensive analysis of literature and toxicity test data,²⁶ and were set to be 20% higher than the national 'probable effects level' (PEL).²⁷ PELs were set by the Council of Canadian Ministers of the Environment (CCME) at a level above which adverse biological effects are likely to occur frequently. The Schedule 9 criteria were further evaluated to determine their reliability in predicting toxicity to selected organisms. Specifically, the sediment arsenic level of 20 ppm was found to have 'high' reliability in predicting toxicity.²⁸

Therefore, the substances found at levels exceeding the PELs are by their very nature a threat to the environment. Nevertheless, the CWN and the University of Aberdeen studies, as discussed below, established additional evidence that arsenic in Long Lake sediments is indeed toxic, and can be absorbed and accumulated in biota.

Toxicity and Uptake by Biota

The Long Lake sediments were analysed in an associated study at the University of Aberdeen in Scotland to assess their toxicity to organisms, using mud shrimp as an

Environment in November 2003 to provide context for the development of and guidance on the application of the sediment quality criteria included in the *Contaminated Sites Regulation*.

²⁶ D. Macdonald, *supra*.

²⁷ D. Macdonald, *supra* at page 34, 49. The Canadian Council of Ministers of the Environment (CCME) interim sediment quality guideline (ISQG) for arsenic is 5.9 ppm, while the CCME probable effect level is 17 ppm. The 20 ppm arsenic concentration in the CSR Schedule 9 criteria for typical freshwater sediments is derived by multiplying 17 ppm by 1.2 (i.e. 20% higher).

²⁸ D. Macdonald, *supra* at pages 38-40, and Table 9 on page 80.

indicator species.²⁹ The Aberdeen study found that, unless there is some other toxic substance in Long Lake sediment, the arsenic in Long Lake is much more bioavailable and acutely toxic to mud shrimp than other forms of arsenic commonly found in sediments of lakes unimpacted by disturbances such as mining.³⁰

The Canadian Water Network's long-term field experiment on fresh water mussels confirmed that the arsenic in Long Lake is bioavailable. The CWN's April 2010 study found that, "total arsenic analysis for the mussels transplanted to Long Lake did change significantly over time ... with a significant increase observed by week 26 ... This coincides with significantly higher arsenic concentrations in sediments from Long Lake."³¹ The study concluded that "more arsenic is being taken up in mussels in Long Lake than in nearby unaffected lakes,"³² and thus "the arsenic is available to bivalves, and presumably other biota."³³ Extractions using methods that simulated human gastrointestinal processes further confirms that arsenic in Long Lake sediment samples is bioaccessible.³⁴

Potential Impact on Downstream Rivers

CWN's April 2010 report incorporated data from a 13-year mussel monitoring experiment in the Quinsam Watershed. The data suggest that mussels from Quinsam River, downstream from Long Lake, have elevated arsenic concentrations compared with mussels from Simms Creek, a nearby creek unimpacted by the mine.³⁵ CWN's September 2010 update report analyzed archived mussel samples from this 13-year study, which indicated that arsenic concentration in Quinsam River mussels increased around the year 2000, and that before the increase, arsenic

²⁹ Dr. Jorg Feldmann *et al*, "Assessing the toxicity of arsenic-bearing sulfide minerals with the bio-indicator *Corophium volutator*," *Enviro Chem* [in press]. See the attached November 10, 2010 email from Dr. Feldmann for a summary of his findings.

³⁰ As explained in the Email from Dr. Jorg Feldmann of the University of Aberdeen to Dr. William Cullen of UBC (November 10, 2010), the LD50 values (Lethal Dose for 50% of organisms) for three common forms of arsenic found in undisturbed rocks – realgar, orpiment and arsenopyrite – are 224 to 1329 ppm. The Long Lake sediment seems much more toxic, however – the LD50 varies between 45-52mg arsenic. This means that it normally requires between 224 and 1329 ppm of arsenic to kill 50% of the organisms exposed to it, whereas only 45 to 52 ppm of the form of arsenic found in Long Lake sediments is killing the same number (unless there is something else toxic in Long Lake sediments).

³¹ *An Environmental Investigation of the Quinsam Watershed*, page 31.

³² *An Environmental Investigation of the Quinsam Watershed*, page 34.

³³ *An Environmental Investigation of the Quinsam Watershed*, page ii.

³⁴ *An Environmental Investigation of the Quinsam Watershed*, page 27. Physiologically Based Extraction Test (PBET) found that Long Lake sediments had arsenic that ranged from 7.9 to 35 percent bioaccessibility.

³⁵ *An Environmental Investigation of the Quinsam Watershed*, page 32-33.

in mussels from Quinsam River and Simms Creek were at similar levels.³⁶ This increase in mussel arsenic levels in Quinsam River occurred around the same time as a peak in sulphate levels in the waters of Long Lake.³⁷ Given that high sulphate levels can be associated with high concentration of arsenic,³⁸ the increasing level of arsenic in mussels downstream may correspond to an increase in arsenic levels in Long Lake sediments at about the same time.

Arsenic in Long Lake sediments will become increasingly mobile as it is released into the water columns over time. A 2004 study by Martin and Pederson found that arsenic in mining-impacted lakes, which is usually bound to oxygen compounds as explained before, is released into the water column as organic matter in the lake decomposes and extracts oxygen from the sediments.³⁹ As Dr. Cullen (one of the authors of the Canadian Water Network reports) explained to the Campbell River City Council, “Over time, when [Long Lake] is filled in by organic matter, as it will, as all lakes do, the arsenic is going to be released into the flux in water.”⁴⁰

Therefore, arsenic currently stored in Long Lake sediments could impact rivers downstream and the long-term mussel monitoring experiment shows that it may have already done so. Long Lake flows into Quinsam River, one of the main tributaries to Campbell River. Campbell River is a heritage river designated by British Columbia.⁴¹ It supports a rich environment of wild and hatchery-raised fish species, including all five species of salmon (chinook, coho, pink, chum and sockeye) as well as sea-run trout (steelhead and cutthroat). Arsenic in Long Lake sediments could potentially affect all these species downstream.

Urgency due to proposed mine expansion

Attached to this letter is another report from April 2010 entitled: *Report to the Quinsam Coal Environmental Technical Review Committee: Mine Permit (C-172)*

³⁶ *Update on Three Studies: Long Lake Seep Sampling, Long-term Mussel Monitoring Program and Cage Mussel Experiment*, page 3.

³⁷ *Report to the Quinsam Coal Environmental Technical Review Committee: Mine Permit (C-172) Amendment, Coarse Coal Rejects Management, and 7-South Mine*, page 11, figure III-2 shows a sharp increase in sulphate concentration in Long Lake water around the year 1998 to 2000. The data comes from regular sampling and testing of Long Lake water by Quinsam Coal Corporation (QCC).

³⁸ *An Environmental Investigation of the Quinsam Watershed*, page ii; and *Report to the Quinsam Coal Environmental Technical Review Committee: Mine Permit (C-172) Amendment, Coarse Coal Rejects Management, and 7-South Mine*, page 12. Acid rock drainage and other chemical processes associated with mine waste produce both arsenic and sulphate at the same time. Therefore, increase in sulphate level in water can be an indication that there is also more arsenic being introduced.

³⁹ Alan Martin & Thomas Pederson, “Alteration to lake trophic status as a means to control arsenic mobility in a mine-impacted lake” (2004) 38 *Water Research* 4415-4423.

⁴⁰ Presentation by Dr. William Cullen to Campbell River City Council (23 November 2010).

⁴¹ See http://www.env.gov.bc.ca/bcparks/heritage_rivers_program/bc_rivers/campbell_river.html

Amendment, Coarse Coal Rejects Management, and 7-South Mine. This Mine Permit report is in response to an application from Quinsam Coal Corporation (QCC) to develop, amongst other things, a new underground mine in what is called the 7-South area, and use of the 2-South pit area for subaqueous disposal of potentially acid generating coarse coal reject (PAG-CCR).⁴²

QCC's application is being processed by government authorities. But it emphasizes the importance of conclusively determining the full extent and severity of contamination in Long Lake and whether it is already a contaminated site as a result of the mine, so as to inform that application process and to help avoid the further creation of contaminated sites.

In that regard, it is noteworthy that the proposed 2-South pit tailings pond will have a capacity of about ten times that of the 3-South pit,⁴³ the latter having been identified as a potential source for the arsenic contamination of Long Lake sediments as mentioned above. Further, the proposed 7-South mine will remove coal from the No. 4 coal seam, and it has been noted that "sulphur concentrations, mainly pyritic sulphur, are much higher – above 2 ppm – than encountered in any previously mined sections and elements that are consistently enriched in the No. 4 seam include the metalloids arsenic, bismuth and selenium."⁴⁴

The Mine Permit report cautioned that "the proposal involves major construction in the 1/2/3 South area that is probably one of the sources of the high concentrations of sulphate and arsenic found in Long Lake. This surface disturbance can only increase the release of oxidation products from the area to the environment."⁴⁵

Conclusion

We respectfully submit that this letter, together with its attachments, provide compelling evidence for you to determine that Long Lake is a contaminated site as a result of activities related to Quinsam Coal mine. At the very least, we submit this letter and its attachments provide you with sufficient information to order an investigation to determine if Long Lake is a contaminated site. We reiterate the urgency of our request given the ongoing contamination, the potential for it to increase if the mine expansion application is approved, and the need to start working on appropriate remediation. We submit such remediation should focus first and foremost on eliminating the source of further contamination.

⁴² *Report to the Quinsam Coal Environmental Technical Review Committee: Mine Permit (C-172) Amendment, Coarse Coal Rejects Management, and 7-South Mine*, page 4.

⁴³ *Report to the Quinsam Coal Environmental Technical Review Committee: Mine Permit (C-172) Amendment, Coarse Coal Rejects Management, and 7-South Mine*, page 5.

⁴⁴ *Report to the Quinsam Coal Environmental Technical Review Committee: Mine Permit (C-172) Amendment, Coarse Coal Rejects Management, and 7-South Mine*, page 8.

⁴⁵ *Report to the Quinsam Coal Environmental Technical Review Committee: Mine Permit (C-172) Amendment, Coarse Coal Rejects Management, and 7-South Mine*, page 18.

Thank you for considering this letter and its attachments. We look forward to your response, and request you notify us of any comment periods in relation to determining if the site is a contaminated site.⁴⁶ Please do not hesitate to contact me should you have any questions.

Sincerely,



Keith Ferguson
Staff lawyer

Attachments: *An Environmental Investigation of the Quinsam Watershed.* Prepared by Environmental Sciences Group (ESG), Royal Military College, Kingston, Ontario; and University of British Columbia (UBC) for the Canadian Water Network. April 2010. Report written by Dr. William Cullen (UBC) and Vivian Lai (UBC), with assistance from Dr. Iris Koch (ESG), Dr. Ken Reimer (ESG), Maeve Moriarty (ESG), and Jane Bailey (ESG). Available at <http://www.greenwaystrust.ca/images/Environmental%20Investigation%20of%20the%20Quinsam%20Watershed.pdf>.

Report to the Quinsam Coal Environmental Technical Review Committee: Mine Permit (C-172) Amendment, Coarse Coal Rejects Management, and 7-South Mine. Dr. William Cullen, University of British Columbia. April 2010. Available at <http://www.greenwaystrust.ca/docs/7-South%20expansion%20comment.pdf>.

Update on Three Studies: Long Lake Seep Sampling, Long-term Mussel Monitoring Program and Caged Mussel Experiment. Prepared for the Canadian Water Network. September 2010 Report written by Dr. William Cullen and Dr. Ken Reimer.

Presentation by Dr. William Cullen to Campbell River City Council (November 23, 2010)

Email from Dr. Jorg Feldmann of the University of Aberdeen to Dr. William Cullen of UBC (November 10, 2010)

D. MacDonald et al., *Development and Application of Sediment Quality Criteria for Managing Contaminated Sediment in British*

⁴⁶ Such as may be required by, for example, EMA section 44(2)(c) or CSR section 15(3).

Columbia (Nov 2003, MacDonald Environmental Sciences, Nanaimo, BC).

CC: David Ranson, Director of Waste Management, Environmental Quality Branch, Ministry of Environment (MoE). David.Ranson@gov.bc.ca

The Honourable Murray Coell, BC Minister of Environment.
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