

**A Proposal for Law Reform:
Addressing Aggregate Industry Landfill Practices that Threaten
Clean Drinking Water**

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1) Introduction

Executive summary

This report proposes reform of BC law to address significant environmental concerns related to the aggregate industry. In particular, this report examines how sand and gravel mining and quarrying has the ability to contaminate groundwater and sensitive aquifers when pits are reclaimed as landfills. The report will offer background information on the aggregate industry, as well as case studies where reclamation of pits has caused groundwater and drinking water contamination. Finally, this report will offer a series of recommendations for law reform based on the best practices of other jurisdictions. The laws in other jurisdictions demonstrate that BC has fallen behind in environmental protection -- and this report urges the government to take remedial action now.

The aggregate industry

The aggregate industry refers to the process of extracting sand, gravel, and stone. These materials are then refined and used in many different construction activities such as making concrete; building roads, dams and other structures; mixing with asphalt; and contributing to the production of materials such as blocks, bricks, and pipes.

Currently in BC, about 2,600 aggregate pits are in operation employing about 4 000 – 5 000 people and producing 50 million tons of sand and gravel annually.¹ The government of BC acknowledges that many communities face aggregate shortages, particularly in BC's Northeast where increased oil and gas exploration has demanded the construction of many new roads. Government also acknowledges that effective management of the aggregate resource represents a considerable challenge to both planners and the industry.²

The cost of hauling or transporting aggregate can lead to significant costs – which may double when transporting beyond 30km stretches.³ For that reason, sand and gravel pits and rock

¹Government of BC: Ministry of Energy, Mines, and Petroleum Resources:
<http://www.empr.gov.bc.ca/Mining/Geoscience/SurficialGeology/AggregateProject/Pages/default.aspx>

² Government of BC: Ministry of Energy, Mines, and Petroleum Resources:
<http://www.empr.gov.bc.ca/Mining/Geoscience/SurficialGeology/AggregateProject/Pages/default.aspx>

³Baker, Douglas; Slanz, Christine; Summerville, Tracy, An Evolving Policy Network in Action: The case of Construction and Aggregate Policy in Ontario. (2001) *Canadian Public Administration*, v.44 i.4 pg 464

quarries are typically developed as close to the demand source as possible. This often results in sand and gravel operations being located in the rural-urban fringe -- where proximity to local drinking water supplies is not uncommon.⁴ Unfortunately, the eventual landfilling of such aggregate sites can easily contaminate water supplies. While recognizing the importance and social utility of the aggregate industry, this report documents the pressing need for proper regulation to ensure groundwater is adequately protected.

The aggregate mining process

The extraction of aggregates can take place in a number of ways. The process typically begins with exploration, where a broad range of field search and measurement activities are used to gather information about the potential sand and gravel deposit.⁵ Once a site is chosen and the proper approvals are issued, the top of the site is cleared of vegetation and soil so that a pit can be dug. The extraction process typically involves backhoes, front-end loaders, and bulldozers digging out sand and gravel directly from the working face of the pit. The process of extracting sand and gravel is often referred to as open-pit mining. Regulation of sand and gravel mines as well as their pits falls under the *Mines Act* as well as the *Environmental Management Act*.^{6,7}

The environmental concern

The process of quarrying or open pit mining for sand and gravel leaves large holes in the landscape that are often refilled with other material. This report is being written due to concerns that when industry is authorized to fill these holes with waste (i.e. they become landfills), the groundwater is at risk of contamination from substances in the fill, or from substances produced in the breakdown of fill materials. This concern arises partially due to the high hydraulic conductivity of sand and gravel pits.

Hydraulic conductivity, also known as permeability, is the ability of the earth to transmit water. Such conductivity is affected by the porosity of rocks and fracturing and separation of rock layers.⁸ Hydraulic conductivity can be used to estimate the velocity at which water will flow

⁴ Baker, Douglas; Slanz, Christine; Summerville, Tracy, An Evolving Policy Network in Action: The case of Construction and Aggregate Policy in Ontario. (2001) *Canadian Public Administration*, v.44 i.4 pg 464

⁵Understanding the Sand and Gravel Business, Collections Canada (undated)
http://www.collectionscanada.gc.ca/eppp-archive/100/200/301/inac-ainc/building_future-e/snd/sgb_e.html

⁶ *Mines Act*, RSBC 1996 c293, *Environmental Management Act* SBC 2003 c53

⁷ Under the *Mines Act* a mine includes "a place where mechanical disturbance of the ground or any excavation is made to explore for or to produce coal, mineral bearing substances, placer minerals, rock, limestone, earth, clay, sand or gravel". *Mines Act*, RSBC 1996 c 293, s.1

⁸Malaspina University College (Vancouver Island University) <https://web.viu.ca/earle/geol304/geol-304-b.pdf>

through rock or sediment. Sand and gravel aquifers typically have quite high hydraulic conductivity – which leaves such aquifers particularly susceptible to contamination.⁹

Further, due to thin and permeable vadose zones (the area between the top of the earth and groundwater) as well as the potential fracturing of nearby bedrock during operations, the groundwater near these sites is described as “the most vulnerable to contamination” and therefore typically not suitable for waste disposal.¹⁰

An *Environment Canada* report summarizes the concern for groundwater contamination in the context of landfills as follows:

“The main threat to water quality due to the disposal of wastes focuses on the groundwater environment. Surface water contamination also occurs as a result of direct runoff from waste sites to streams, lakes and wetlands, and indirectly as contaminated groundwater discharges to surface waters. The contamination of groundwater has many factors which makes it very different from surface water contamination. Because we cannot observe groundwater, we typically discover that the groundwater is contaminated once a well or surface water body becomes contaminated. Surface water contamination occurs quickly and can be stopped at the source. However, groundwater contamination may commence years after the waste source is in place. The slow release rate causes it to take years to thousands of years to move through the groundwater flow regime, and groundwater can be difficult, if not impossible to remediate, and prohibitively costly to remediate. Ultimately all contaminated groundwater will discharge to surface water. Thus, should serious groundwater contamination occur, the destruction of drinking water supplies and aquatic ecosystems occurs for decades to hundreds of years (emphasis added).”¹¹

The same report recognizes that while setbacks are often in place to prevent the uptake of bacteria in drinking water supplies, coarse-grained sand, gravel, and fractured bedrock aquifers are particularly susceptible to widespread transport of viruses and other pathogenic organisms.¹²

⁹ Conductivity may vary, depending on the sorting of aquifer materials and the amount of silt and clay present. US Geological Survey, *Aquifer Basics* <https://water.usgs.gov/ogw/aquiferbasics/uncon.html>

¹⁰ Twardowska, Irena; Allen, Herbert E.; Kettrup, Antoius A.F.; Lacy, William J. “Solid Waste: Assessment Monitoring and Remediation” *Waste management series*, (April 22, 2004), Gulf Professional Publishing, page 553 https://books.google.ca/books?id=KcqeppzFewC&source=gbs_navlinks_s

¹¹ Allan S. Crowe et al., “Threats to Sources of Drinking Water and Aquatic Ecosystem Health in Canada: Landfills and Waste Disposal” (2008) at page 51.

¹² Allan S. Crowe et al., “Threats to Sources of Drinking Water and Aquatic Ecosystem Health in Canada: Landfills and Waste Disposal” (2008) at page 54.

In BC, the inadvisability of using sand and gravel sites as a landfill has been clearly recognized in internal government policy documents. For example, the *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (1995) states:

“Due to the porous nature of sand and gravel deposits, the use of pits and quarries as disposal sites is generally not permitted, since wastes can easily contaminate groundwater sources, surface water and soil”¹³

Unfortunately, BC officials have dismissed the Handbook as a mere unenforceable guideline, not law (see discussion in Part 4, below).

In the following section, examples of sand and gravel sites that led to groundwater contamination highlight the fact that such sites are uniquely unsuitable for landfilling.

2) Examples of sand and gravel contaminated sites

The science is clear that allowing landfills over sand and gravel aquifers raises significant risks for groundwater. The following documented examples of where contamination has occurred highlights the risk.

In the US, the Environmental Protection Agency has developed a “Superfund” to manage contaminated sites that exist due to hazardous waste being dumped, left behind, or mismanaged.¹⁴ The Superfund has been used in various circumstances where sand and gravel sites led to groundwater contamination.

For example, between 1968 and 1976 the 27-acre Delaware Sand & Gravel Landfill in New Castle, Delaware accepted municipal and industrial wastes, including drums containing organic and inorganic chemicals. Waste and leachate from the landfill migrated into the underlying groundwater of the Columbia Aquifer and the Upper Potomac Aquifer which is used as a drinking water source for the residents of New Castle. This contamination led to the need for

¹³ *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (1995) British Columbia Ministry of Energy, Mines and Petroleum Resources; Ministry of Transportation and Highways, and Natural Resources Canada. pg. 77 https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/contracting-with-the-province/documents/16699-2017/t3 - 6 - _reclamation_and_environmental_protection_handbook_for_sand_gravel_and_quarry_operations_in_british_columbia - 1995.pdf

¹⁴ “What is Superfund?”, United States Environmental Protection Agency, <https://www.epa.gov/superfund/what-superfund>

nearby residents to be put on a public water supply from the Artesian Water Company. Although several cleanup actions have taken place, additional cleanup actions are still planned.

In another example, the 60-acre Wauconda Sand and Gravel site located in Lake County, Illinois was used as a municipal landfill operation from around 1955 until 1978. After the site had been closed and covered with a layer of clay, soil, and vegetation, sampling found that groundwater was contaminated with heavy metals, volatile organic compounds (VOCs) and pesticides.¹⁵ In 2003, nearly 400 homes of affected residents using local wells were given bottled water.¹⁶ Although traces of vinyl chloride in the water could not be directly linked to the well, a civil suit was filed by local residents asking that the costs be covered for them to hook up to a clean water supply.¹⁷

In Canada, we have had similar occurrences of contamination. In Ville Mercier, Quebec, two abandoned sand and gravel pits became landfill sites for the dumping of organic industrial wastes. Between 1968 and 1972 approximately 40 000m³ of hazardous wastes were dumped. This resulted in the contamination of the groundwater where the contaminated plume was estimated to cover an area of about 10-15km². By 1992, only 5% of total contaminants had been removed.¹⁸ Although little information is available on the status of this site, a 2011 Montreal Gazette article details the work of environmental toxicologist Daniel Green and his attempt to lift the veil on the discussion of the environmental impacts the contamination of this site has had.¹⁹

The above examples are worst case scenarios for drinking water. However, they show the wisdom of the BC policy document that states: “Due to the porous nature of sand and gravel deposits, the use of pits and quarries as disposal sites is generally not permitted, since wastes can easily contaminate groundwater sources, surface water and soil”.²⁰

¹⁵ “Wauconda Sand & Gravel, Wauconda, IL”, Environmental Protection Agency,

<https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0500332#bkground>

¹⁶ “Wauconda Sand & Gravel, Wauconda, IL”, Environmental Protection Agency,

<https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0500332#bkground>

¹⁷ “Neighbors hit timing of lawsuit over water” (March 16, 2005), Chicago Tribune,

http://articles.chicagotribune.com/2005-03-16/news/0503160282_1_landfill-owners-vinyl-chloride-drinking-water

¹⁸ Lesage, Suzanne. Groundwater Contamination and analysis at Hazardous Waste Sites. CRC Press AUG 13, 1992.

Page 382

https://books.google.ca/books?id=kVEvsB1QwIAC&pg=PA511&lpg=PA511&dq=gloucester+landfill+sand+and+gravel&source=bl&ots=K5oXFSY_MS&sig=7cpBvj_PYUNOOYKoaY2coiPfa1s&hl=en&sa=X&ved=0ahUKEwj85_nQ4dXXAhUJiVQKHcbdC6oQ6AEIjAB#v=onepage&q=gravel&f=false

¹⁹ Lalonde, Michelle. “Archive: Mercier’s hidden poison, Montreal Gazette” (August, 2011)

<http://www.montrealgazette.com/health/Archive+Mercier+hidden+poison/5223693/story.html>

²⁰ *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (1995) British Columbia Ministry of Energy, Mines and Petroleum Resources; Ministry of Transportation and Highways, and Natural Resources Canada. pg. 77 https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/contracting-with-the-province/documents/16699-2017/t3_-_6_-

As you will see below, BC needs more than such non-enforceable policy statements that Government seems to be ignoring in practice. BC needs a strict and mandatory regulatory process to instill trust in the public that their groundwater and sensitive aquifers will be protected from an ever-expanding aggregate industry.

3) BC residents are concerned about what landfilling old mines can do to drinking water

The following two examples of landfilling old mines – one an old quarry and one a gravel extraction pit – are the most recent situations where BC residents have expressed mounting concern that BC’s laws aren’t strong enough to protect their valuable drinking water.

Shawnigan Lake: Cobble Hill Holdings Ltd.

Litigation about a project to landfill contaminated soils in an old quarry raised questions about whether BC laws adequately protect drinking water from landfilling of old mines. In 2013 South Island Aggregates (later to be Cobble Hill Holdings Ltd.) obtained a 50-year permit from the Ministry of Environment to accept and store up to 100,000 tonnes of contaminated soil annually at their quarry site subject to “requiring complete containment of the soils to be introduced into the quarry”.²¹ The quarry site is located within the Shawnigan Lake Watershed, just minutes from Shawnigan lake, the local residents’ drinking water source.

The issuance of this permit was met with resistance by local residents and environmentalists concerned about the potential contamination of their drinking water source from these contaminated soils entering surface and groundwater. A report by local MLA and scientist Andrew Weaver found evidence that runoff from the permitted site failed drinking water standards at the point of entry with Shawnigan Creek.²² Shawnigan Creek drains into Shawnigan Lake, a drinking water source for several thousand people. Dr. Weaver also made the following comments:

[reclamation and environmental protection handbook for sand gravel and quarry operations in british columbia - 1995.pdf](#)

²¹ Government of BC: “South Island Aggregates - Cobble Hill Holdings”,

<https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-permitting-compliance/sia>

²²Weaver, Andrew. “On the Wisdom of Dumping Contaminated soils in the Shawnigan Lake Watershed” (April 2015)

<http://www.andrewweavermla.ca/2015/04/18/shawnigan-watershed/>

“There is conflicting evidence between the expert opinion provided as part of SIA’s application for a permit and that obtained by Shawnigan Resident’s Association. Herein lies the critical problem with the entire permitting process. The Professional Reliance model for project permitting in use in British Columbia is inherently flawed. No matter what project is seeking approval, when the government bases its decision on the professional advice provided by a project proponent, there will always be public concern. In fact, basing approval decisions on the Professional Reliance Model makes it difficult, if not impossible, for a project to earn a social license to proceed.”²³

Conflict over the Cobble Hill approval lead to both tribunal and court proceedings over whether the permits were rightfully issued and whether the acceptance of contaminated soils was a reclamation practice or technically a landfill.

The District of Cowichan was unsuccessful in its court challenge to the project based on local zoning laws. However, In January 2017, the Residents in Shawnigan Lake were successful in their judicial review at the BC Supreme Court. The court found that the Environmental Appeal Board, in confirming the approvals, did not act fairly in its procedures with respect to the admission of opinion evidence. The court found evidence that the conduct of Cobble Hill Holdings and the Qualified Professionals compromised the integrity of the approval process under the *Environmental Management Act*.²⁴ The result of the case was that the permit allowing shipments of contaminated soil was stayed until more evidence could be properly considered.

In February of 2017, the BC government cancelled the waste discharge permit due to the inability of Cobble Hill holdings to provide financial security in the form of an irrevocable letter of credit.²⁵ Although this was received well by the residents of Shawnigan Lake, concerns continue as to how the contaminated site will now be cleaned up. Further, Cobble Hill Holdings Ltd. continues with a civil suit seeking damages against the province and former Minister of Environment for incurred financial losses.²⁶

²³ Weaver, Andrew. “On the Wisdom of Dumping Contaminated soils in the Shawnigan Lake Watershed” (April 2015)

<http://www.andrewweavermla.ca/2015/04/18/shawnigan-watershed/>

²⁴ *Shawnigan Residents Assn. v. BC (Director, Environmental Management Act)* 2017 BCS 107 at para 9.

²⁵ Government of BC: “South Island Aggregates - Cobble Hill Holdings”,

<https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-permitting-compliance/sia>

²⁶ Vancouver Sun: “BC former environment minister sued over Shawnigan Lake soil site decision” (August, 2017)

<http://vancouversun.com/news/local-news/b-c-former-environment-minister-sued-over-shawnigan-lake-soil-site-decision>

Campbell River: Uplands Excavating Ltd. – Landfilling a Gravel Pit

Upland Excavating Ltd. (Upland) currently operates a landfill and gravel extraction pit in Campbell River. In 1992 the site was issued a permit under the *Waste Management Act* to operate a landfill on site which would accept “inert municipal” refuse. In October 2013, Upland applied to the Ministry of Environment for an Operational Certificate (section 28 of the *Environmental Management Act*) that would authorize the landfill to:

“receive construction and demolition waste, land clearing debris, and non-hazardous waste soil for discharge into a lined, engineered landfill cell. The landfill will include a leachate collection and treatment system to protect the environment. Progressive final close and an environmental monitoring program will be implemented. The landfill will be designed constructed, and operated in accordance with the Ministry of Environment Draft Second Edition Landfill Criteria for Municipal Solid Waste, dated September 2015.”

If authorized, the landfill will receive 32 890 tonnes of waste a year. Materials that have been authorized to go into the waste system include demolition waste, land debris, non-hazardous waste soil, and waste asbestos. These materials will produce leachate that will contain sulphate, arsenic, iron, manganese, Total Dissolved Solids, calcium, sulphate, chromium, copper, metals, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs) and petroleum hydrocarbons (PHCs). Although a leachate collection and liner system will be implemented, most engineers acknowledge that all liners leak. Further, the *Design Operations and Closure Plan* prepared by Uplands Excavating Ltd. anticipates that 0.121m³/year of leachate will leak through the landfill base and enter the mixing zone beneath the landfill footprint.²⁷

The inappropriate location of the Uplands site is what has local residents concerned. The location of the landfill abuts Rico Lake, which drains to McIvor Lake, Campbell River’s drinking water source. If contamination of the aquifers beneath the landfill takes place and water flows west, there is a possibility that groundwater may contaminate the local residents’ drinking water. In the alternative, if contamination were to occur and move east, it is possible that it may come in contact with Cold Creek, which is the operational water for the major Quinsam

²⁷ GHD (Feb 2016) *2016 Design, Operations, and Closure Plan – Upland Landfill, Draft for Review* Available 8 March 2016 online: https://issuu.com/esolutionsgroup/docs/088877-rpt-01-draft_docp_-_wm (“Upland Landfill DOC Plan”) at pg. 61 as cited in: Matt Hulse: “Municipal Zoning Regulation of the Proposed Upland Excavating Landfill” *Environmental Law Centre*, University of Victoria, (2016): <https://crecwebcom.files.wordpress.com/2016/05/crec-submission-to-campbell-river-final-submitted.pdf>

River Salmon Hatchery facility and the Quinsam River.²⁸

Although the proponents were required to prepare a Technical Assessment Report and a Hydrogeology and Hydrology Characterization report pertaining to the Upland Excavating Landfill Application, an independent report prepared by GW Solutions on behalf of the Campbell River Environmental Committee made the following observations about the site:

- 1) There is insufficient characterization of the groundwater regime across and near the site. In particular, more information is needed on the western half of the site, because if a groundwater divide is confirmed, it would indicate that groundwater may move directly from the site to Rico Lake.²⁹
- 2) There is insufficient characterization of both the lithology and the groundwater regime at and beyond the property boundary and no discussion of the future contaminant transport from the site. There is also insufficient information on the vertical and horizontal hydraulic gradients, and what may happen should contaminants be released by the proposed landfill.³⁰
- 3) The GHD Reports provide no discussion of the change in Rico Lake hydrology, including the water level regime during project construction and operation, and the potential impact of the landfill.³¹
- 4) The recommended groundwater quality monitoring wells may be inadequate in number and locations to intercept a plume emanating from the site.³²
- 5) The potential for groundwater mounding underneath a developing landfill waste deposit has not been examined.³³

²⁸ GW Solutions (October 17, 2016): Review of Upland Excavating Landfill Application Technical Assessment Reporting <https://crecwebcom.files.wordpress.com/2016/05/gws-review-of-upland.pdf> at pg. 7

²⁹ GW Solutions (October 17, 2016): Review of Upland Excavating Landfill Application Technical Assessment Reporting <https://crecwebcom.files.wordpress.com/2016/05/gws-review-of-upland.pdf> at pg. 2

³⁰ GW Solutions (October 17, 2016): Review of Upland Excavating Landfill Application Technical Assessment Reporting <https://crecwebcom.files.wordpress.com/2016/05/gws-review-of-upland.pdf> at pg. 5

³¹ GW Solutions (October 17, 2016): Review of Upland Excavating Landfill Application Technical Assessment Reporting <https://crecwebcom.files.wordpress.com/2016/05/gws-review-of-upland.pdf> at pg. 7

³² GW Solutions (October 17, 2016): Review of Upland Excavating Landfill Application Technical Assessment Reporting <https://crecwebcom.files.wordpress.com/2016/05/gws-review-of-upland.pdf> at pg. 8

³³ GW Solutions (October 17, 2016): Review of Upland Excavating Landfill Application Technical Assessment Reporting <https://crecwebcom.files.wordpress.com/2016/05/gws-review-of-upland.pdf> at pg. 9

Clearly, important questions remain about whether or not Campbell River’s groundwater is at risk. Campbell River Environmental Committee has put pressure on government to review evidence that points to the possibility of contamination and to ensure that their groundwater is protected. To date, the Operational Certificate has yet to be issued.

4) Law reform: best practices & recommendations

BC’s regime is broken

In 2016 the Auditor General released her report: *An Audit of Compliance and Enforcement of the Mining Sector*. In this report, she found that the greatest environmental risk from mining is water contamination.³⁴ She also stated, “regardless of whether the mining industry is experiencing growth or slow-down, protection of the environment needs to be ensured. This is only possible with strong regulatory oversight”. Although her report was focused on compliance and enforcement in the industry, she made various relevant findings about the current regime including:

- both ministries (Ministry of Mines & Ministry of Environment) lack sufficient resources and tools to manage environmental risks from mining activities;³⁵
- neither ministry uses a permitting approach that reduces the likelihood taxpayers will have to pay costs associated with the environmental impacts of mining activities;³⁶
- neither MEM nor MoE are conducting adequate monitoring and site inspections and neither have assessed how this is impacting risks;³⁷and
- neither MEM nor MoE have adequately evaluated the effectiveness of their regulatory programs. Both ministries are aware that deficiencies in their regulatory activities are resulting in risks to the environment. In at least two instances—the tailings breach at Mount Polley mine and the degradation of water quality in the Elk Valley—these risks have manifested into real environmental impacts.³⁸

³⁴ Office of the Auditor General of BC, *An Audit of Compliance and Enforcement of the Mining Sector*. (May 3, 2016) at pg. 31

³⁵ Office of the Auditor General of BC, *An Audit of Compliance and Enforcement of the Mining Sector*. (May 3, 2016) at pg. 6

³⁶ Office of the Auditor General of BC, *An Audit of Compliance and Enforcement of the Mining Sector*. (May 3, 2016) at pg. 6

³⁷ Office of the Auditor General of BC, *An Audit of Compliance and Enforcement of the Mining Sector*. (May 3, 2016) at pg. 7

³⁸ Office of the Auditor General of BC, *An Audit of Compliance and Enforcement of the Mining Sector*. (May 3, 2016) at pg. 7

As the auditor general report highlights, for many years the province of BC has done a strikingly inadequate job of enforcing and ensuring compliance with mining rules. However, not only has government failed to ensure that existing rules are followed – but there are substantial gaps in the rules themselves. Gaps in legislation mean that proper environmental protection measures are not being implemented by the mining industry – an assertion that is documented thoroughly in *Fair Mining Practices: A New Mining Code for BC*.³⁹

Recommendations:

Although there are many areas for improvement, this section will focus on recommendations for law reform to prevent groundwater contamination from occurring over or near sand and gravel sites. These recommendations highlight how BC has fallen short compared to other jurisdictions. However, the recommendations also demonstrate how a few simple legal amendments could enhance protection of BC's groundwater.

Landfill site restrictions

The location of a landfill is one of the most significant factors in determining whether it will be environmentally safe. When you locate a landfill in or near a sand and gravel mine site, you are simply asking for trouble.

This principle is clearly recognized in a BC Government policy document. The *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (1995) states:

“Due to the porous nature of sand and gravel deposits, the use of pits and quarries as disposal sites is generally not permitted, since wastes can easily contaminate groundwater sources, surface water and soil”⁴⁰

³⁹ Maya Stano and Emma Lehrer, *Fair Mining Practices: A New Mining Code for BC*, Fair Mining Collaborative, Vancouver (2013) <http://www.fairmining.ca/fair-mining-code/>.

⁴⁰ *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (1995) British Columbia Ministry of Energy, Mines and Petroleum Resources; Ministry of Transportation and Highways, and Natural Resources Canada. pg. 77 https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/contracting-with-the-province/documents/16699-2017/t3 - 6 - _reclamation_and_environmental_protection_handbook_for_sand_gravel_and_quarry_operations_in_british_columbia - 1995.pdf

However, this Handbook seems to carry little weight with Government, and landfilling of the Uplands gravel pit appears to have occurred in spite of the Handbook provision. The Office of the Chief Inspector of Mines has recently dismissed the importance of this Handbook, stating that it is not legally enforceable and out of date. A letter sent on behalf of the Chief Inspector claimed:

“The Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia (the handbook) is a guideline publication only. It was last updated over 20 years ago.”⁴¹

Clearly, there is a need to update the *Handbook* and formally legislate the principle recognized in the *Handbook* as an **enforceable legal provision**.

Note that the BC Government’s *Landfill Criteria for Municipal Solid Waste*⁴² sets out various siting requirements, identifying that siting “is one of the most important aspects of environmental protection.”⁴³ Certain requirements include:

- landfills may not be constructed within 500 m of an existing or planned “sensitive land use” which may include schools, hotels, or parks.
- the landfill footprint shall be a minimum distance of 300 m from a water supply well or water supply intake and a minimum 500 m from municipal or other high capacity water supply wells.
- landfill shall be a minimum 1.5 m above “groundwater” at all times.
- current and planned future uses of groundwater and surface water shall be identified within 1km of landfill footprint.
- After considering uses, Qualified Professionals must recommend the appropriate water quality criteria, compliance locations, and provide related rationale and justification for applications.⁴⁴

Although the criteria related to siting does offer a certain degree of environmental protection in relation to groundwater, again the policy document is not legally binding. The Criteria may become legally enforceable if incorporated into solid waste management plans, or operational

⁴¹ Letter from Kate Musgrove on behalf of Al Hoffman, Chief Inspector of Mines addressed to Leona Adams, April 11, 2017.

⁴² Government of BC, *Landfill Criteria for Municipal Solid Waste 2nd Edition*, (June 2016)
https://www2.gov.bc.ca/assets/gov/environment/waste-management/garbage/landfill_criteria.pdf

⁴³ Government of BC, *Landfill Criteria for Municipal Solid Waste 2nd Edition*, (June 2016) pg. 9
https://www2.gov.bc.ca/assets/gov/environment/waste-management/garbage/landfill_criteria.pdf

⁴⁴ Government of BC, *Landfill Criteria for Municipal Solid Waste 2nd Edition*, (June 2016) pg. 9
https://www2.gov.bc.ca/assets/gov/environment/waste-management/garbage/landfill_criteria.pdf pg. 9

certificates and permits.⁴⁵ However, this leaves the ministry with the discretion of choosing not to enforce the criteria and therefore does not offer the same level of protection that occurs in some jurisdictions. **Crucially important, the BC requirements allow for landfills in sensitive areas (like sand and gravel pits) where other jurisdictions simply ban them.** Examples below include jurisdictions with “best practice” legislation that comprehensively protects sand and gravel aquifers from the risks created by establishing landfills in such sensitive places.

United States

In 1991, the US Environmental Protection Agency (EPA) introduced new federal waste disposal criteria for Municipal Solid Waste Landfills as a response to what was being characterized at the time as a "waste disposal crisis" in the US.⁴⁶ Part of instituting the new federal criteria was to improve the safety of municipal solid waste landfills through location restrictions that either prohibit or strictly regulate landfills proposed in the following regions: near airports, flood plains, wetlands, fault areas, and seismic impact zones.⁴⁷

In developing the criteria, the EPA noted the need to protect vulnerable groundwater areas, but decided with a lack of adequate data to leave this to local state laws.⁴⁸ Today, various states are expanding upon this siting criteria requirement to prevent landfills from being constructed on past sand and gravel sites.

Ohio

In Ohio, siting requirements prevent all solid waste landfills within sand and gravel pits. Their legislation is comprehensive and exemplifies a best practice for groundwater protection. The legislation incorporates the following:

- prohibits solid waste landfills within sand and gravel pits or limestone or sandstone quarries or over sole source aquifers or sand and gravel aquifers that yield more than 100 gallons per minute
- protects groundwater drinking resources by prohibiting landfills within a 5-year time-of-travel for groundwater flow to a public water supply well or within a designated drinking water source protection area
- requires landfills to be located at least 1000 feet from residential water supply wells and developed springs

⁴⁵ Government of BC, *Landfill Criteria for Municipal Solid Waste 2nd Edition*, (June 2016) pg. 9
https://www2.gov.bc.ca/assets/gov/environment/waste-management/garbage/landfill_criteria.pdf pg. vi

⁴⁶ FR- 1991-10-09 page 50980

⁴⁷ 40 CFR §258.10-258.16 <https://www.gpo.gov/fdsys/pkg/CFR-2012-title40-vol26/xml/CFR-2012-title40-vol26-part258.xml#seqnum258.10>

⁴⁸ FR- 1991-10-09 page 51048

- requires landfills to be located outside of areas where collapse of underground mines may potentially cause ground subsidence⁴⁹

Maine

Maine is another example of a jurisdiction which expressly prohibits landfills in locations overtop of a significant sand and gravel aquifer. Their relevant provision reads:

2-A. Aquifer protection:

The department may not issue a license for a solid waste disposal facility when it finds that the proposed facility overlies a significant sand and gravel aquifer or when the department finds that the proposed facility poses an unreasonable threat to the quality of a significant sand and gravel aquifer it does not overlie, or to an underlying fractured bedrock aquifer.⁵⁰⁵¹

⁴⁹Ohio Code 3745-29-07(H)(2), <http://codes.ohio.gov/oac/3745-29-07> Ohio Code Guidance Document: http://epa.ohio.gov/portals/34/document/guidance/gd_690.pdf

⁵⁰ MRS § Maine title 38 chapter 13 subchapter 1-A: Solid Waste Article 3: Solid Waste Facility <http://legislature.maine.gov/legis/statutes/38/title38sec1310-N.html>

⁵¹ The rest of the provision reads:

A. "Significant sand and gravel aquifer" is defined as a porous formation of ice-contact and glacial outwash sand and gravel that contains significant recoverable quantities of water likely to provide drinking water supplies. [1993, c. 680, Pt. A, §37 (RPR).]

B. "Fractured bedrock aquifer" is defined as a consolidated rock formation that is fractured and that is saturated and recharged by precipitation percolating through overlying sediments to a degree that will permit wells drilled into the rock to produce a sufficient water supply for domestic use. [1993, c. 680, Pt. A, §37 (RPR).]

C. In determining whether or not the proposed facility poses an unreasonable threat to the quality of a significant sand and gravel aquifer or to an underlying fractured bedrock aquifer, the department shall require the applicant to provide:

(1) A thorough hydrogeological assessment of the proposed site and the contiguous area including any classified surface waters, significant sand and gravel aquifers and fractured bedrock aquifers that could be affected by the proposed facility during normal operation or in the event of unforeseen circumstances including the failure of any engineered barriers to ground water flow. The assessment must include a description of ground water flow rates, the direction of ground water flow in both the horizontal and vertical directions, and the degree of dilution or attenuation of any contaminants that may be released from the proposed site and flow toward any classified surface water, significant sand and gravel aquifer or fractured bedrock aquifer.

California

California state law bans permitting a new landfill or expanding an existing landfill for the disposal of nonhazardous solid waste if the land has been primarily used at any time for the mining and excavation of gravel or sand.⁵²

Oregon

Oregon state law places restrictions on establishing a municipal solid waste landfill in sensitive hydrogeological environments. The law states that no person shall establish or expand a landfill in a gravel pit excavated into or above a water table aquifer or other sensitive or sole source aquifer where the department has determined that groundwater must be protected from pollution and the existing natural protection is insufficient or inadequate to minimize the risk of such pollution.⁵³⁵⁴

New Mexico

In, New Mexico no municipal solid waste landfills are approved where the top of the uppermost aquifer will be closer than 100 feet to the bottom of the fill, or for construction and demolition landfills that do not accept more than 25 tons per day annual average, where the top of the uppermost aquifer will be closer than 50 feet to the bottom of the fill.⁵⁵

Alberta

In Alberta, the *Waste Control Regulation* requires landfills to meet the siting requirements prescribed by the *Code of Practice for Landfills*.⁵⁶ This code of practice forms a part of the regulation and has siting requirements that require a professional geologist or engineer to

⁵² See PRC § 40060, including PRC § 40060 (a), which reads: “Notwithstanding any other provision of law, a regional water board shall not issue a waste discharge permit for a new landfill, or a lateral expansion of an existing landfill which is used for the disposal of nonhazardous solid waste if the land has been primarily used at any time for the mining or excavation of gravel or sand.”

⁵³ The provision reads: no person shall establish or expand a landfill in a gravel pit excavated into or above a water table aquifer or other sensitive or sole source aquifer, or in a wellhead protection area, where the Department has determined that:

- (a) Groundwater must be protected from pollution because it has existing or potential beneficial uses (OAR 340-040-0020); and
- (b) Existing natural protection is insufficient or inadequate to minimize the risk of polluting groundwater

⁵⁴ OAR 340-095-0010 <https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=71255>

⁵⁵ 20.9.4.9 NMAC <https://www.env.nm.gov/swb/documents/1.24.12SolidWasteRuleswPharmacyFinal.pdf>

⁵⁶ *Waste Control Regulation*, Alta Reg 192 1996 s. 24(1)

assess the geological and hydrogeological conditions specific to the landfill and its surrounding area prior to the construction or expansion of a landfill.⁵⁷

Mining sites – Getting the mine location right in the first place

Clearly, banning landfills in sand and gravel sites is doable – and would be a step forward. However, this should likely be done along with other measures that recognize that providing proactive environmental protection is much simpler than backtracking to achieve environmental restoration after damage occurs. Many long-term problems can be avoided by barring mining from sensitive areas with poor environmental restoration capability -- and by establishing adequate buffers around areas of ecological significance. Under BC's current legislative scheme, mining activities are allowed most places – and only prohibited on 13% of the land base.⁵⁸ Progress can be made by limiting mines to safe locations, and ensuring protective reclamation plans are done at the beginning.

Work needs to be done on restricting mining in areas where the mining – or subsequent reclamation activity – could do significant environmental harm. This reform requires research beyond the central scope of this paper. However, some examples of jurisdictions that restrict the location of mines in environmentally sensitive areas are found below:

The *Fair Mining Practices Code* publication cites the following:

“...in Alaska citizens can petition to have certain lands designated as unsuitable for surface coal mining: lands will be designated as such if the regulatory authority determines that reclamation is not feasible. In Minnesota, the regulatory authority must develop procedures to identify areas, or types of areas, that cannot be reclaimed from mining activities with existing techniques. In such cases, permits will not be issued in these areas until such time that the authority determines technology is available to satisfy reclamation laws...”⁵⁹

A number of jurisdictions bar mining activity in areas that have been designated as no-go mining zones in land use plans – often for environmental reasons. For example, in the Yukon, Northwest Territories, Ontario and Sweden, sites for mines cannot be established in areas

⁵⁷ Alberta *Code of Practice for Landfills*, s. 6(1) <http://www.gp.alberta.ca/documents/codes/LANDFILL.PDF>

⁵⁸ Judah Harrison, “Too Much at Stake: The Need for Mineral Tenure in BC” (Vancouver: Ecojustice, June 2010) at 5

⁵⁹ Maya Stano and Emma Lehrer, *Fair Mining Practices: A New Mining Code for BC*, Fair Mining Collaborative, Vancouver (2013) <http://www.fairmining.ca/fair-mining-code/> at p. 111.

where land use plans bar mining for environmental reasons.⁶⁰ In addition to the information that can be found in the *Fair Mining Practices Code*, the following jurisdictions have legislation of interest for mine siting.

South Dakota

In South Dakota, mining permits are not issued on “unsuitable land”. Land is considered unsuitable if the following conditions cannot be satisfactorily mitigated:

- reclamation of the affected land pursuant to the requirements of this chapter is not physically or economically feasible;
- substantial disposition of sediment in stream or lake beds, landslides, or water pollution cannot feasibly be prevented;
- the land to be affected by a proposed mining operation includes land that is special, exceptional, critical, or unique as defined in the legislation and satisfactory mitigation is not possible;⁶¹
- the proposed mining operation will result in the loss or reduction of long-range productivity of aquifer, public and domestic water wells, watershed lands, aquifer recharge areas, or significant agricultural areas;
- the biological productivity of the land is such that the loss would jeopardize threatened or endangered species of wildlife indigenous to the area; or
- the board finds that any probable adverse socioeconomic impacts of the proposed mining operation outweigh the probable beneficial impacts of the operation.⁶²

Montana

In Montana, a person engaged in the mining of rock products can obtain a permit for multiple sites if the sites do not:

⁶⁰ Maya Stano and Emma Lehrer, *Fair Mining Practices: A New Mining Code for BC*, Fair Mining Collaborative, Vancouver (2013) <http://www.fairmining.ca/fair-mining-code/> at pp. 97-98.

⁶¹ 45-6B-33.3. Special, exceptional, critical, or unique land defined. For the purposes of § 45-6B-33, land is special, exceptional, critical, or unique if it possesses one or more of the following characteristics:

(1) The land is so ecologically fragile that, once it is adversely affected, it could not return to its former ecological role in the reasonably foreseeable future;

(2) The land has such a strong influence on the total ecosystem of which it is a part that even temporary effects felt by it could precipitate a system-wide ecological reaction of unpredictable scope or dimension; or

(3) The land has scenic, historic, archaeological, topographic, geologic, ethnologic, scientific, cultural, or recreational significance.

⁶² [SL 45-6B-33](http://sdlegislature.gov/Statutes/Codified_Laws/DisplayStatute.aspx?Type=Statute&Statute=45-6B-33) http://sdlegislature.gov/Statutes/Codified_Laws/DisplayStatute.aspx?Type=Statute&Statute=45-6B-33

- operate within 100 feet of surface water or in ground water or impact any wetland, surface water, or ground water;
- have any water impounding structures other than for storm water control;
- have the potential to produce acid, toxic, or otherwise pollutive solutions;
- adversely impact a member of or the critical habitat of a member of a wildlife species that is listed as threatened or endangered under the Endangered Species Act of 1973; or
- impact significant historic or archaeological features.⁶³

Nova Scotia

In Nova Scotia, exploration activities cannot take place in municipal water supply watershed lands unless the proponent has first obtained the necessary approvals from the provincial environment ministry.⁶⁴

Additionally, the Nova Scotia *Water Act* allows a minister to designate an area surrounding any source of waters supply for a water works as a Protected Water Area.⁶⁵ For example, in 1992, the council of the Town of Amherst requested that the Minister of Environment designate the North Tyndal water recharge area as a protected water area.⁶⁶ A regulation regarding activities in the area has now been enacted which states that no person shall authorize or commence an operation to extract peat, gravel, rock or mineral in the Protected Water Area.⁶⁷

Conclusion

The purpose of this report has been to give background on the aggregate industry and explain how contamination of groundwater may occur where pits are reclaimed as landfills. Case studies show that water contamination has the possibility to be drastic, and that residents in BC are concerned that their government is not doing enough to protect their drinking water.

The examination of legislation in other jurisdictions illustrates many possible ways that BC could reform its aggregate mining and reclamation rules to better protect drinking water sources.

In order of significance, this report recommends that the Government of BC consider all of the following actions:

⁶³ MCA 82-4-335 <http://leg.mt.gov/bills/mca/82/4/82-4-335.htm>

⁶⁴ *Mineral Resources Regulations*, NS Reg 222/2004, s 73(3).

⁶⁵ *Water Act* RSNS 1989 c 500, 16(1) -(2)

⁶⁶ *North Tyndal Protected Water Area Designation and Regulations*, NS Reg. 200/92, s I

⁶⁷ *North Tyndal Protected Water Area Designation and Regulations*, NS Reg. 200/92, s 12

- 1) Legislate enforceable and mandatory landfill siting restrictions in the *Environmental Management Act* so that no waste permit, approval, or Operational Certificate can be issued for filling a mine pit over a sand and gravel aquifer with waste. Such restrictions apply in places like Ohio, Maine, and California and were already recommended in the BC policy document, *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (1995).
- 2) Legislate mine siting restrictions that prevent sand and gravel operations from commencing on land where there is a long-term potential to contaminate sensitive aquifers or drinking water sources.
- 3) Refine the legislative regime in a way that makes standards legally enforceable, accessible, and intelligible for the public.

While the recommendations in this report have provided best practices and examples of statutory language being used in other jurisdictions, the province of BC may consider working with its internal experts and legislative drafters to prepare statutory provisions that best suit the province. Appendix A offers preliminary language for how a specific landfill siting provision might be drafted.

By taking the above steps, we can begin to reform the laws of BC to ensure that regulatory decisions adequately protect the Province's invaluable resource of clean water.

Appendix A: Draft Landfill Siting Provision

- 1) No permit, approval, plan, certificate or any other authorization under this Act shall permit a new landfill, or expansion of an existing landfill, if the land has been primarily used at any time for the mining of gravel or sand.

Or,

- 2) The director shall not approve any permit, approval, plan, certificate or any other authorization for a solid waste landfill unless the director determines that all of the following criteria are met:
 - a) The solid waste landfill facility is not located in a sand or gravel pit where the sand or gravel deposit has not been completely removed;
 - b) The solid waste landfill facility is not located in a limestone quarry or sandstone quarry; and
 - c) The solid waste landfill facility is not located above a highly sensitive aquifer.