Bottled water and groundwater in Ontario: Can free market environmentalism resolve the emerging conflicts?

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Abstract

Nestlé Waters's recent purchase of a well and water-taking rights in the Township of Centre Wellington, Ontario, has garnered national and international attention, raising concerns about how groundwater resources should be managed. In this paper, we explore free market environmentalism as a way to resolve groundwater management and water-takings issues in Ontario. Controversy over groundwater resources and their use, as illustrated by the recent case in Ontario, has become more prevalent globally as concerns about groundwater quality and scarcity develop. Our results suggest that, in theory, the incorporation of private property rights and the common law principle of riparian rights into provincial groundwater allocation mechanisms has the potential to resolve the emerging conflicts in Ontario. However, our analysis reveals that the current level of politicization in Ontario's water allocation and pricing systems, combined with the current lack of adequate monitoring and documentation of groundwater use, are significant barriers to implementing a resource allocation mechanism for groundwater based on the principles of private ownership and riparian rights. We address these limitations to gain a deeper understanding the implications of the current water-takings system in Ontario, and conclude that these limitations deserve greater social and political attention if these controversies are to be resolved. While free market environmentalism has solutions to offer to Ontario's groundwater management issue, the current political and institutional approaches to groundwater allocation and pricing in Ontario do not allow for them to be fully applied.

Keywords: Groundwater extraction; Ontario, Canada; Nestlé; free market environmentalism; riparian rights; water permits.

Introduction

Conflicts and controversies can arise over the use and management of resources (Bate 2002), and groundwater is no exception. One such example which has recently garnered national and international attention is the controversy that emerged when Nestlé Waters outbid the Township of Centre Wellington to purchase water-taking rights to a well owned by Middlebrook Water Company near Elora, Ontario. The essence of the controversy lay in the fact that although clean and accessible groundwater is an important resource for many Canadian citizens, corporations can outbid local townships to purchase water-taking rights from the government and proceed to extract at minimal cost large volumes to bottle and sell.

The purpose of this paper is to explore the emerging controversies surrounding groundwater use in Ontario,

specifically regarding Nestlé Waters's successful outbidding of the Township of Centre Wellington, and to suggest potential ways of resolving these types of controversies. This is achieved by examining the structure of property rights and the institutions related to water resources and groundwater usage policies in Ontario. The nature of water-permitting and pricing in Ontario is given particular attention. The role that free market environmentalism can play in remedying the conflicts around Ontario groundwater is then investigated by asking whether it is feasible for municipal and provincial laws and institutions to be altered so as to strengthen property rights and promote responsible and efficient groundwater use in the future.

Trends in Groundwater Levels, Price, and Usage

Groundwater usage

Approximately 30.3% of the Canadian population depends principally on groundwater for municipal, domestic, and rural use (Environment Canada 2013; Statistics Canada 1996). As reported by the Program on Water Governance (2010) and shown in **Table 1**, Ontario has the largest population reliant on groundwater of all Canadian provinces and territories, although not the largest percentage of population. This reliance on groundwater, however, is not uniform throughout Ontario. Many smaller municipalities rely on groundwater as their primary—and sometimes sole—source of water (Environment Canada 2011). This is illustrated in **Figure 1**, which shows that small municipalities draw a greater percentage of their water supply from groundwater sources than do larger ones.

In Ontario, groundwater is extracted for purposes that include manufacturing, agriculture, and public waterworks. Compared to these uses, extraction for water bottling comprises less than 1% of total groundwater withdrawals (Rutherford 2004). However, a main reason why water-extraction for bottling has become a concern is that bottled water is entirely consumptive. Bottled water, unlike water used for other purposes, does not in any way return to the local ecosystem from which it was taken (Rutherford 2004). Once the water is bottled, it is not discharged back into the aquifer. Rutherford (2004) suggests that this may interfere with aquifer rechargeability to emerge and negatively impact local ecosystems, especially in areas that are sensitive to aquifer water supply reductions.

Groundwater levels

Due to the lack of available data, it is difficult to find high-quality information about overall trends in groundwater levels in Ontario (Rutherford 2004). Although documented instances in which groundwater quantity and quality have suffered as a result of overexploitation are few, there is no systematic inventory of the country's groundwater resources, and information about Canada's groundwater resources and their sustainability is often incomplete or inadequate (Nowlan 2005; Rivera 2008).

There are, however, observable trends elsewhere in Canada which are of particular interest to the question of groundwater use. The Council of Canadian Academies (2009) used data from the British Columbia Ministry of Environment's Observation Well Network to create a hydrograph of the water levels in one of the wells (Municipal Well No. 7) in the Township of Langley, a rapidly urbanizing agricultural community. This hydrograph (**Figure 2**), shows a negative trend in aquifer levels over 40 years, which is attributable to groundwater overuse as a result of increased population growth and residential, commercial, and industrial development (Council of Canadian Academies

2009). Since many other rural communities are also currently experiencing increased urbanization, it is possible that greater withdrawals of groundwater will negatively impact groundwater recharge rates elsewhere (Council of Canadian Academies 2009).

Water prices

The Council of Canadian Academies (2009) compared per capita daily water use figures with the price of water in various developed countries. As shown in **Figure 3**, countries with lower water prices generally consume more water. Compared to countries in Europe, the price of water in Canada is low and its per capita use is very high. **Table 2** shows how provincial groundwater prices in Canada, which are determined by the provincial governments, vary from \$0 to 500 per million litres (in 2017 CAD) (Environment Canada 2011). The Ontario price of \$3.71 per million litres for industrial and commercial ground water uses has been fixed for the last 10 years.

Institutional and Policy Framework

Bottled water production fits into a complex policy context which spans several jurisdictions. The original laws governing Canadian water resource allocation originated in English common law, whereby holders of riparian rights were legally entitled to access water on their property for domestic purposes, and to do so without interference. The majority of these legal doctrines, however, were eventually superseded by statutory rulings (Nowlan 2005). Currently, groundwater use and management responsibilities are shared between federal, provincial, and municipal governments. Under the Constitution Act (1867), legislative power over the use of water in Canada was distributed across federal and provincial governments. Federal water policies, however, are limited in their scope and have not been fully utilized or acted upon (Nowlan 2005). As such, provincial governments ultimately maintain legislative jurisdiction over the use and management of groundwater in Canada. Federal water policies and the various levels of legislation over water use and management in Canada and Ontario are discussed below.

Canada Water Act (1985) and Federal Water Policy (1987)

The Canada Water Act (Government of Canada 1985) authorizes regulations regarding the planning and implementation of water conservation programs and water management regimes. The Act, though, is limited in its breadth. It serves to mandate which governmental bodies are responsible for these measures, and establishes broad objectives for water use. The Federal Water Policy (Environment Canada 1987) responded to the findings of the Canada-wide Inquiry on Federal Water Policy (1984-1985), detailing federal departments' responsibilities while also including environmental and sustainability considerations.

These are illustrated in the Federal Water Policy's purpose statement (Environment Canada 1987):

The overall objective of the federal water policy is to encourage the use of freshwater in an efficient and equitable manner consistent with the social, economic and environmental needs of present and future generations.

In a substatement, the Federal Water Policy underlines the importance of usage and management rules that respect the real value of water, and suggests that the realistic pricing and valuation of groundwater would be preferable (Environment Canada 1987). This policy is founded on the notion that water is a resource that Canadians take for granted and overexploit, as citizens have become accustomed to subsidized water rates (Federal Water Policy 1987). Moreover, Nowlan (2005) attributes the misuse of water resources to a general lack of knowledge regarding the quantity of the resource, price information, patterns of surface water and groundwater use, and the environmental impacts of such use. The Federal Water Policy (1987) proposes five strategies to guide the improvement of water use and management in the country: water pricing, scientific leadership, integrated planning, legislation, and public awareness.

Ontario Water Resources Act (1990)

The 1990 Ontario Water Resources Act establishes the province's responsibilities regarding surface water and groundwater allocation. Most importantly, it governs the licensing regimes for water-takings and transfers within the Province of Ontario. Under most conditions, any person can use up to 50,000 litres of water per day without having to obtain a permit. Apart from household, livestock, or firefighting purposes, any per diem rate above 50,000 litres requires a permit from the provincial government (Ontario Water Resources Act, Section 34). These permits are subject to conditions such as set expiry dates, water return policies, and mandatory conservation measures, and are not transferable without written consent from the Minister of Environment and Climate Change. Section 34.2 of the Act establishes rules that limit the ability for persons to use water in a way that transfers large amounts of water between or out of Ontario water basins. Exceptions are made for transfer of water within containers less than 20 litres in volume, or for products manufactured with basin water.

In 2004, Regulation 387/04: Water Taking and Transfer under the Ontario Water Resources Act established restrictions over the ability of beverage manufacturers to take water in high-use watersheds, and improved user transparency by requiring any holder of a permit to collect and record daily and annual data on their water-takings. The stated objective of this regulation is to mitigate negative impacts of water-takings on hydrological and ecological conditions at water sources (Government of Ontario 2004).

In 2003, under Regulation 434/03, the province declared a one-year moratorium on the use of surface water or groundwater for water bottling, among other industrial and commercial uses. Nowlan (2005) notes that this moratorium marked the Province's reconsideration of the bottled water industry as a distinct user of groundwater resources. During this time, the provincial government reviewed water-taking policies, and subsequently enacted Regulation 387/04 in 2004 and Regulation 450/07 in 2007. These regulations set a fee of \$3.71 per million litres of water for any facility classified as a Phase 1 Industrial/Commercial user (which includes bottled water and beverage producers). The Ministry of the Environment and Climate Change (MOECC) is obliged to review the appropriateness of this \$3.71 charge every five years.

In response to the issues surrounding Nestlé Waters's water-takings and growing public awareness of the low water-taking prices, a regulation has been proposed by the Government of Ontario to charge water bottlers an additional CAD \$500 per million litres (Ministry of the Environment and Climate Change 2016). Furthermore, through Regulation 463/16 (Government of Ontario 2016a), the province authorized yet another moratorium which prohibits new water-taking permits and renewals for surface and groundwater permits for bottling purposes. However, prior permit holders can continue extraction if their permit was issued or renewed prior to December 16, 2016.

Controversies and Conflicts surrounding Groundwater Extraction

There many aspects of groundwater management in Ontario with regard to bottled water that present social and economic conflicts. In this section we summarize the most prominent of these concerns, chiefly discussing the recent controversies in southwestern Ontario surrounding Nestlé Waters's successful bid for the well and water-taking rights in the Township of Centre Wellington, as well as the challenges of managing groundwater resources across the province in the future.

Social controversies and conflicts

In the summer of 2016, the Township of Centre Wellington, then looking to expand its water resource-base to increase urban development, was outbid by Nestlé Waters for water-taking rights to a well owned by the Middlebrook Water Company (Jones 2017). Because the large corporation's win coincided with the province's difficulties in maintaining water supply during a severe drought, the event garnered international attention (Sutherland 2016). The small township soon became the focal point for environmentalists and policy makers who were seeking to change provincial water-taking laws. As a result of the issue, Ontario premier Kathleen Wynne concluded that the water permit allocation system was "outdated" (Jones 2017).

Some Canadians believe that this shows the inability of the MOECC to protect municipalities' access to potable water from multinational companies. The Council of Canadians, for example, a social justice organization, created a petition and a movement to boycott Nestlé in response to their outbidding of the Township of Centre Wellington (Council of Canadians 2016; Ferreras 2016). Other members of the public do not place the blame solely on Nestlé. According to Bueckert (2017), SaveOurWater.ca and Wellington Water Watchers have accused the township and Nestlé Waters of working together in an attempt to privatize the local water resources. The mayor of Centre Wellington responded with a statement that the township did not engage in any background deals with Nestlé (Bueckert 2017).

A statement by Andreanne Simard, a manager at Nestlé Waters, outlined Nestlé's commitment to working with the community and stressed the importance of local residents' needs. Nestlé, Simard (2017) notes, has expressed a strong interest in ensuring sustainability of the groundwater resource quality and quantity for the future.

In addition to opposition to Nestlé Waters's purchase of the well and water-taking rights in the Township of Centre Wellington, there are groups that oppose all privatization of water resources, one of those being Water for Future Generations. The group states private water service providers do not act in the interest of the community they serve, and that those who want to commodify water are motivated solely by profit. In their opinion, water should only be controlled by local communities (Water for Future Generations 2017).

Groundwater resource management

Significant gaps exist within groundwater monitoring data (Rutherford 2004; Rivera 2008). Some Canadian provinces monitor the allocation of groundwater permits but do not have record of the actual quantities of groundwater extracted or used. Additionally, usage categories are very general and there are few details about specific uses of groundwater extracted. Ontario, moreover, does not have readily available data on groundwater extraction and use. Rutherford (2004) has noted that there is no available data for non-municipal uses, and she and others highlight the importance of quality data for policy decisions (Rivera 2008).

Available data about the quantity of publicly owned versus privately owned water-taking permits, water uses across ownership types over time, and groundwater level trends across the province, are very limited. For example, the Government of Ontario maintains a database of all active water taking permits in the province. However, this database records neither how much water was actually extracted and used by each permit holder nor whether this amount varied over time. According to this database, the Corporation of the City of Guelph (near to the Township of Centre Wellington) itself currently holds 107 water-taking permits which in total allow for a maximum extraction rate of 762,413,639 litres

per day. Though certain permits limit water-taking with seasonal restrictions, 73 of these permits allow unrestricted, year-round access (Government of Ontario 2017). In contrast, Nestlé Canada Incorporated and Nestlé Waters Canada maintain 11 water-taking permits in Wellington County (which includes the City of Guelph, Township of Centre Wellington, and the Town of Elora) for bottled water purposes. These permits allow for a maximum total extraction rate of 25,067,000 litres per day, with nine of the permits allowing for year-round access (Government of Ontario 2016b). As noted previously, the database does not record actual water usage or water usage trends.

How groundwater needs might change in future years poses another important challenge for groundwater management (Rivera 2008). The Council of Canadian Academies (2009) states concern that the impact of climate changes, urbanization, and intensification of use will increase future groundwater demand. In addition, there are concerns that the current price of groundwater resources is too low because it does not include future use and option value. These concerns are among those raised by various groundwater reports (Rutherford 2004; Nowlan 2005; Council of Canadian Academies 2009). Glenn Murray, the Ontario Minister of the Environment and Climate Change, has also suggested that the current price of water is too low (Butler 2016). Disagreement over current water pricing raises questions about what the price should be and how it should be determined.

The Free Market Environmentalist Approach

The common perception that environmental and resource management issues require political intervention in order to be remedied is a view known as political environmentalism, and one which has recently come under increasing scrutiny (Anderson and Leal 2015). This view, moreover, is particularly common in the resource-abundant country of Canada. As Pearse (1988) argues, Canada suffers from an exceedingly diverse system of resource ownership rights which largely favours government ownership. Anderson and Leal (2015) propose free market environmentalism as an alternative to political environmentalism, namely free market environmentalism. In the free market environmentalist approach, defined and enforceable private property rights, in conjunction with English common law principles, are promoted as a viable solution to resource management controversies such as those discussed in this study.

Free market environmentalism is premised on the ideas of Friedrich Hayek (1945), who suggested that the principal economic problem is how to best coordinate the knowledge of individuals to achieve an effective allocation of scarce resources. Central planners, for example, are demonstrably ineffective in this achieving this effective allocation (Steele 1981). On the free market environmentalist view, when there

are fully defined, enforceable, and transferable private property rights, the interest of a resource owner will be aligned with the common good of resource preservation, thereby forcing the individual to internalize the social costs of resource exploitation.

Barnett (1992) expands upon this notion by explaining that in a decentralized social order wherein individuals have defined and enforceable private property rights, individuals' ability to engage in consensual transfers of property gives rise to the true values of resources. Barnett (1992) suggests that in consensual transfers of property, property owners only seek a transfer of property if they see a value in the other party's rights to that property that is greater than their own valuation of that property. Only this occurrence, Barnett (1992) notes, will demonstrate the true value of a resource in which the parties are interested. The result is a market-based price mechanism which reflects the involved individuals' knowledge of the resource, and which is critical for environmental stewardship. As Pasour (1982) notes, the problem of knowledge plagues political environmentalism in the sense that no central planning system can account for all factors that affect the true value of a given resource. The following discussion will demonstrate that this problem is only one of several that restrict the performance of political environmentalism as a means of resolving the conflicts surrounding groundwater extraction and use in Ontario.

Theory of nonmarket failure and public interest theory

The theory of nonmarket failure set forth by Wolf (1979), or the failure of governmental intervention, holds that both market and nonmarket action can lead to outcomes divergent from what is socially preferable. Wolf (1979) proposes that nonmarket intervention suffers largely from the lack of a competition in the provision of public goods and the lack of an internal feedback system. A system wherein public goods are provided by a monopolistic supplier solely motivated by short-term growth and the pressures of private interest groups, with no reference to the true social costs of their actions, may lead to rising costs, derived externalities, and distributional inequities (Wolf 1979). Wolf (1979) calls for the development of a set of countermeasures against nonmarket failures.

Public choice theorists seek to address one branch of these nonmarket failures. Yandle (1999) states that the influence of special interest groups, both rent-seeking and bureaucratic, frequently and negatively conditions the outcomes of the political process. The environmental revolution that began in the 1960s called upon government bodies to impose regulations to mitigate what were growing public concerns over environmental externalities and deficiencies in the provision of public goods caused by the private sector (Yandle 1999). These practices have since been codified in Canadian environmental legislation. As Yandle (1999) suggests, in the current paradigm of political environmentalism, it has been assumed that politicians act

solely in the interest of the public. However, public choice theorists suggest that politicians act self-interestedly, and thus are motivated to act in ways that increase votes. This often means that special interest groups have an incentive to engage in rent-seeking behaviour and to lobby politicians, which can lead to distributional inequalities in the political economy (Yandle 1999). As Morris (2009) points out, the natural environment is assumed by many to be a public good, but under the lens of public choice theory, the definition of a public good is misconstrued in the sense that goods which can be provided privately (such as natural resources) are treated as public. Free market environmentalism strives to resolve this ambiguity by proposing an alternative system based upon private property rights and principles found originally in English common law.

Riparian rights

In the absence of private property rights, individuals are limited in the decisions they make with respect to ownership (De Alessi 1998). As Coase (1960) theorized, where private property rights are well defined and enforceable and there are no transaction costs, bargaining between parties will lead to an efficient allocation of resources regardless of the initial allocation of rights. In other words, under the right institutional conditions, environmental and resource-related issues can be seen as a private matter which involves contractual agreements between users, rather than a matter to be resolved administratively through government regulation (Yandle 1999). De Alessi (1998) acknowledges that in practice, transaction costs are generally positive and substantial, and are therefore key determinants of the system of property rights, as they impact the value of the net benefits of privatization.

Rothbard (1979) suggests that individuals are free to act as they wish, provided that they are not committing an overt act of aggression against others or their property. In a scenario in which private property rights are fully defined and strict causality can be observed, the application of common law principles could facilitate a mutually beneficial process of conflict resolution between the involved parties. Under the current system in Canada, property rights are less than fully defined and are subject to regulations and land use restrictions. This entails, as Epstein (1998) describes, that environmental amenities are treated as liabilities. We argue that under a common law-based system with defined, enforceable, and transferable private property rights, rights-holders would come to treat their property as an asset for which there are opportunity costs and incentives to maximize value, confident that their rights are guaranteed and would be enforced. That is to say, well-defined ownership promotes stewardship. Under threat of imposed regulations and land-use restrictions within the framework of political environmentalism, the rights-holder will not act rationally according to their knowledge of their property or resources, but instead will abuse their property in order to extract from

it as much value as legally possible while their rights to it are still enforced (Hayek 1945).

Riparian water rights, which originate in English common law, are a tool available to those who own property that is in direct contact with a water source. Although riparian rights are codified in Canadian government policy, governmental regulations and statutory rulings have gradually diminished their strength.

Historically, a distinction has been drawn between ground and surface waters, and this has begun to change only recently. In Ontario, it was only in 1961 that surface water licensing conditions were applied to groundwater resources (Nowlan 2005). The contemporary hydrological consensus, moreover, is that ground and surface waters are not separate entities and must not be treated as such (Rivera 2008). Nevertheless, riparian rights still apply principally to surface water and not to groundwater.

As Hopley and Ross (2009) make clear, riparian rights are not full private property rights over the water. Rather, they include only the rights of access and drainage, rights relating to flow, rights to undiminished quality, and rights to water use. A significant feature of riparian rights systems is that rights-holders must not impede the rights of others who use the water. Accordingly, rights-holder have access to the water but cannot diminish its quantity or quality to the detriment of other rights-holders.

This bundle of property rights has proved in some cases to be an effective means of environmental protection. In the United Kingdom, where riparian rights are stronger than in Canada, the case of the Anglers Conservation Association (ACA) of the UK, exemplifies the power of this common law principle applied to water resources (Bate 2001). The ACA, through a private interest cooperative, sought to protect the water resources accessible to riparian rights-holders by ensuring that those liable for nuisances such as pollution or water supply reduction were made to compensate other riparian rights-holders for lost revenue or pleasure, and to undertake restoration and rehabilitation of the riparian zone (Bate 2001). The ACA pooled their resources to protect the water resources to which they were entitled use (Bate 2001).

Canada has a history of environmental degradation caused by non-market intervention where riparian rights were overridden. Brubaker (1995) explores the case of KVP Company, which operated a pulp and paper plant in Espanola, Ontario. Riparian plaintiffs on the Spanish River found themselves bereft of their original rights to access clean and unpolluted water due to pollution by the KVP plant. Initially, KVP was served with a legal injunction to halt their water pollution. However, through a number of changes to federal and provincial legislation in response to the appeal of KVP, the company was permitted to continue its previous operations. Brubaker (1995) highlights here that government intervention might encourage pollution or other environmental damages in the name of a public good (in this case, employment). This brings us back to the question raised by public choice theorists of whether natural resources and environmental amenities should be treated as public goods.

The following analysis will focus on the applying the free market environmentalist approach as a means of resolving controversies over groundwater resources, which we believe have been in part caused in by a political environmentalist approach to groundwater management and allocation.

An Evaluation of the Free Market Environmentalist Approach

This analysis begins by acknowledging that current groundwater allocation mechanisms in Ontario do not constitute a paradigm of private property rights and liability law. The recently proposed increase of the per unit price for industrial and commercial water-takings in Ontario is evidence that the administratively set price is artificially low and out of step with the market price and with the true value of groundwater resources. This political price mechanism has been labelled by Wagner (1998) as a parasitic process, for any political pricing system depends on the existence of a market pricing system, however far removed from market values political pricing may be. Indeed, as Anderson and Leal (2015) describe, public sector control over water resources has been justified by the commonly-held notion that water holds such a high value that its allocation cannot be left to the vices of the market system.

An explanation for the proposed increases in water-taking prices may be the restricted feedback mechanisms inherent in nonmarket intervention, as Wolf (1979) described, which suggests that the five-year mandatory price review has been inadequate. The fact that the government, in response to public pressure, has increased the price might reflect its efforts to set a price more commensurate with the true social cost of commercial groundwater extraction. Even with the proposed increase in price, the current groundwater allocation mechanisms still operate within the existing institutional framework and therefore perpetuate whatever conflicts may be attributable to the current political-economic paradigm of political environmentalism.

Canadian federal and provincial policies have acknowledged the need to confront environmental and social concerns over water use, but current water-pricing in Ontario may be threatening these objectives. The data on groundwater permitting in Wellington County suggest that the bottled water industry, particularly Nestlé Canada Inc. and Nestlé Waters Canada, is not well-endowed with takings rights, at least in comparison with the nearby City of Guelph. The available data on groundwater hydrology weakly suggest that current extraction rates are environmentally sustainable; however, the limited quantity of such data does not allow for firm conclusions to be made (Nowlan 2005; Rivera 2008), especially when we consider the example of the decreasing levels observed in Langley, B.C., municipal well no. 7 (Figure 2, Canadian Council of Academies 2009). Under the free market environmentalist approach, in contrast to the prevailing political environmentalism and the current systems of permitting and pricing, an individual property

owner would be better incentivized to understand the local implications of commercial groundwater extraction, its advantages and consequent potential harms to water quantity or quality (De Alessi 1998). This market-based approach would encourage more efficient resource allocation and create opportunity costs and incentives which are not present in the current, politically-determined system.

If this is true, then reinforcing and strengthening riparian water rights, namely by taking into account the contemporary hydrological consensus that ground and surface waters cannot be treated as separate resources, may hold some merit as a protection against possible environmental consequences of groundwater extraction.

All Canadian provinces, with the exception of Quebec, have legal foundations in English common law (Glenn 2010). In theory, as discussed by Rothbard (1979), individuals who hold riparian rights could establish direct causality and take legal action against a tortfeasor who diminishes their rights to access or natural flow of water. The tortfeasor would be held accountable and made to compensate those upon whose riparian rights they have infringed.

There are a few concerns regarding the viability of this course of action in controversies surrounding groundwater usage. Beyond the fact that riparian rights currently pertain to surface rather than groundwater, Canadian natural resource management has moved away from common law and private ownership of water resources and toward crown ownership (Pearse 1988), a transition which served to reduce the power of those who hold riparian rights. Even if riparian rights pertained to groundwater resources as they have to surface waters, a system increasingly based upon the licensing and permitting of crown-owned water would, in any case, continue to diminish the power of those who hold riparian rights. The case of KVP in Northern Ontario demonstrates the possible negative implications which can arise from the governmental override of riparian rights.

The second concern is the difficulty of establishing strict causality, especially given the limitations of the data on how extraction impacts groundwater hydrology in Ontario. Notwithstanding these concerns, a major criticism of common law principles (such as riparian rights) is that they are costly to exercise in legal action, and that the personal risk to an individual plaintiff is high if suit is lost (Bate 2001). Bate (2001) highlights that harm to water resources may be alleviated if riparian holders can cooperate and pool resources to achieve a common goal, as in the case of the ACA in England.

It is concerning that the Province of Ontario has shifted away from a common law-influenced system, which favoured riparian rights, to the current water permitting system. Perhaps more concerning is that there is an imbalance between the reliance on groundwater regulation and the reliance on the incentives created by private property rights. As Morriss (2009) points out, the legal institutions chosen for natural resource governance must be capable of providing incentives for knowledge production. The deficit

in the understanding of groundwater extraction and its hydrological and ecological impacts may serve as evidence that the water-takings permit system and the low price of groundwater do not incentivize users to account for or fully appreciate the true social value their resources or the true costs of extraction. Furthermore, Morriss (2009) maintains that when natural resource allocation is governed by the principles of common law and private property rights, the opportunity for rent-seeking behaviour and lobbying from special interest groups is diminished. Although this could be an added benefit of a the free market environmentalist approach, our research did not find these rent-seeking behaviours to be in evidence in Ontario's water policy.

Groundwater extraction in Canada is at a critical juncture. The institutions that have historically governed the use of groundwater have been satisfactory largely because the resource was in abundance. Governmental control of groundwater resources, however, instead of private ownership, may preclude their integration into the market (Smith 2004), thereby disincentivizing the gathering of information about the resources' potentials and possible associated risks. In other words, groundwater users have never had the chance to realize the full value of their resources in the way that they would have were groundwater privatized in the same manner and at the same point in time, for instance, as oil (Smith, 2004). Consequently, groundwater resources in Ontario, and the impacts of their extraction, remain inadequately understood and set at an artificially low price. In theory, a transition to water resource allocation based on private ownership and protected by common law principles would be beneficial. Since private ownership and market pricing incentivize information-gathering about a given resource, a system of riparian rights which recognizes the connectedness of surface and groundwater would be complementary, and would incentivize the exploration of potential ecological and hydrological impacts of groundwater extraction. Elevating riparian rights, therefore, could have profound effects in environmental and resource management.

In practice, however, the transition from crown ownership to a system of private ownership buttressed by the common law principle of riparian rights, would certainly face some or all of the challenges detailed above. Moreover, the question remains as to how this transition would occur. Due to the nature of groundwater resources, delineation of full private ownership may be unfeasible, as Anderson and Leal (1995) suggest. Since water is a fugitive resource, with the consequence that large-scale extraction in one area may affect groundwater reserves elsewhere, an effort to delineate enforceable and transferable private property rights over individual groundwater aquifers may be prove difficult (Morriss 2009). Alternatively, allocating property rights to over a collection of groundwater aquifers based on their geographical, ecological, and hydrological properties within a watershed to a single owner might create incentives for effective resource use which are similar to those normally created by private property rights.

Conclusions and Recommendations

This paper has provided evidence that Ontario's current permit-based system of groundwater allocation is neither economically nor socially preferable. The recently proposed increase in the per unit price of groundwater for industrial and commercial takings further demonstrates that the current pricing mechanism is dysfunctional, with the set price being artificially lower than market value and entirely out of step with the true social cost of groundwater extraction. Based on our analysis, we conclude that the current political environmentalist approach to managing groundwater use in Ontario has in large part led to the local disputes that have garnered international attention. In theory, a free market environmentalist approach in Ontario's groundwater policies may have significant benefits, but the reversal of what now resembles an allocation mechanism based on political environmentalism is a major impediment to its execution. Although riparian rights offer a prospective avenue with which to leverage common law principles for environmental protection, their effective exercise is limited. A system of riparian rights which recognizes the connectedness of surface and groundwater, though, would be preferable. Moreover, an effort to delineate the enforceable and transferable property rights over a collection of aquifers within a given geographical region according to hydrological and ecological factors may have some merit. Finally, more detailed documentation of groundwater use in Ontario (and the country as a whole) is needed if we are both to fully comprehend the array of social, environmental, and economic implications of the current water-takings system, and propose viable improvements or alternatives.

References

- Anderson T, Leal D. 2015. Free market environmentalism for the next generation. Revised ed. New York (NY): Palgrave Macmillan. 200 p.
- Barnett R. 1992. The function of several property and freedom of contract. *Social Philosophy and Policy*. 9(1): 62-94.
- Bate R. 2001. Saving our streams: the role of the Anglers' Conservation Association in protecting English and Welsh rivers. London (UK): Institute of Economic Affairs. 128 p.
- Bate R. 2002. Water - Can property rights and markets replace conflict? In: Morris J, editor. Sustainable development: promoting progress or perpetuating poverty? London (UK): Profile Books. p. 239-254.
- Brubaker E. 1995. Property rights in the defence of nature. Toronto (ON): Environment Probe. 328 p.
- Brueckert K. 2017 Jan 4. Groups accuse Nestlé, Centre Wellington of 'backroom deal' to privatize water. CBC News [Internet]. [cited 2017 Apr 6]. Available from: <http://www.cbc.ca/news/canada/kitchener-waterloo/nestle-centre-wellington-accused-deny-backroom-deals-1.3920539>
- Butler C. 2016 Oct 18. Ontario water isn't being priced fairly, says Environment Minister Glen Murray. CBC News [Internet]. [cited 2017 Apr 6]. Available from: <http://www.cbc.ca/news/canada/kitchener-waterloo/guelph-aberfoyle-new-rules-water-environment-glen-murray-1.3809763>
- Coase RH. 1960. The problem of social cost. *Journal of Law and Economics*. 3: 1-44.
- Council of Canadian Academies. 2009. The sustainable management of groundwater in Canada: report of the Expert Panel on Groundwater [Internet]. Ottawa (ON): Council of Canadian Academies; [cited 2017 Apr 6]. Available from: [http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/groundwater/\(2009-05-11\)%20gw%20report.pdf](http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/groundwater/(2009-05-11)%20gw%20report.pdf)
- De Alessi L. 1998. Private property rights as the basis for free market environmentalism. In: Hill PJ, Meiners R, editors. Who owns the environment? Lanham (MD): Rowman & Littlefield Publishers, Inc. p. 1-35.
- Epstein RA. 1998. Habitat preservation: a property rights perspective. In: Hill PJ, Meiners R, editors. Who owns the environment? Lanham (MD): Rowman & Littlefield Publishers, Inc. p. 223-258.
- Ferreras J. 2016 Sept 23. Boycott Nestlé, says petition after company outbids town for water. *Huffington Post Canada* [Internet]. [cited 2017 Apr 6]. Available from: http://www.huffingtonpost.ca/2016/09/23/boycott-nestle-water_n_12157042.html
- Glenn JM. 2010. Crown ownership of water in situ in common law Canada: public trusts, classical trusts and fiduciary duties. *Les Cahiers de droit*. 51(3-4): 493-519.
- Environment Canada. 1987. Federal Water Policy [Internet]. Ottawa (ON): Environment Canada; [cited 2017 Apr 6]. Available from: http://publications.gc.ca/collections/collection_2014/ec/En4-247-1987-eng.pdf
- Environment Canada. 2011. 2011 municipal water use report: municipal water use 2009 statistics [Internet]. Ottawa (ON): Environment Canada; [cited 2017 Apr 6]. Available from: https://www.ec.gc.ca/Publications/B77CE4D0-80D4-4FEB-AFFA-0201BE6FB37B/2011-Municipal-Water-Use-Report-2009-Stats_Eng.pdf

- Environment Canada. 2013. Water sources: groundwater [Internet]. Ottawa (ON): Environment Canada; [cited 2017 Apr 6]. Available from: <https://www.ec.gc.ca/eau-water/default.asp?lang=En&n=300688DC-1>
- Environment and Climate Change Canada. 2017. Water: federal policy and legislation [Internet]. Environment and Climate Change Canada. [cited 2017 Apr 6]. Available from: <https://www.ec.gc.ca/eau-water/default.asp?lang=En&n=E05A7F81-1>
- Government of Canada. 1985. Canada Water Act [Internet]. Ottawa (ON): Department of Justice; [cited 2017 Apr 6]. Available from: <http://laws-lois.justice.gc.ca/PDF/C-11.pdf>
- Government of Canada. 2017. Constitution Acts, 1867 to 1982 [Internet]. Ottawa (ON): Department of Justice; [cited 2017 Apr 6]. Available from: <http://laws-lois.justice.gc.ca/eng/const/FullText.html>
- Government of Nova Scotia. 2016. User fees and government charges, 2015-2016 [Internet]. Halifax (NS): Province of Nova Scotia; [cited 2017 Apr 6]. Available from: [https://www.novascotia.ca/finance/site-finance/media/finance/budget2015/2015-2016 User Fees and Government Charges.pdf](https://www.novascotia.ca/finance/site-finance/media/finance/budget2015/2015-2016%20User%20Fees%20and%20Government%20Charges.pdf)
- Government of Ontario. 1990. Ontario Water Resources Act R.S.O. 1990, c. O.40 [Internet]. Toronto (ON): Queen's Printer for Ontario; [cited 2017 Apr 6]. Available from: <https://www.ontario.ca/laws/statute/90o40>
- Government of Ontario. 2003. O. Reg. 434/03 (Ontario Water Resources Act, R.S.O. 1990, c. O.40 [regulation revoked 2004 31 Dec]): The taking and use of water [Internet]. Toronto (ON): Queen's Printer for Ontario; [cited 2017 Apr 6]. Available from: <https://www.ontario.ca/laws/regulation/030434>
- Government of Ontario. 2004. O.Reg. 387/04 (Ontario Water Resources Act, R.S.O. 1990, c. O.40): Water takings and transfer [Internet]. Toronto (ON): Queen's Printer for Ontario; [cited 2017 Apr 6]. Available from: <https://www.ontario.ca/laws/regulation/040387>
- Government of Ontario. 2007. O.Reg. 450/07 (Ontario Water Resources Act, R.S.O. 1990, c. O.40): Charges for industrial and commercial water users [Internet]. Toronto (ON): Queen's Printer for Ontario; [cited 2017 Apr 6]. Available from: <https://www.ontario.ca/laws/regulation/070450>
- Government of Ontario. 2016a. O.Reg. 463/16 (Ontario Water Resources Act, R.S.O. 1990, c. O.40): Taking ground water to produce bottled water [Internet]. Toronto (ON): Queen's Printer for Ontario; [cited 2017 Apr 6]. Available from: <https://www.ontario.ca/laws/regulation/r16463>
- Government of Ontario. 2016b. Map: permits to take water. Ontario Ministry of Environment and Climate Change. [Internet]; [cited 2017 Apr 6]. Available from: <https://www.ontario.ca/environment-and-energy/map-permits-take-water>.
- Hayek F. 1945. The use of knowledge in society. The American Economic Review. 35(4): 519-530.
- Hopley S, Ross S. 2009. Aboriginal claims to water rights grounded in the principle ad medium filum aquae, riparian rights and the Winters doctrine. Journal of Environmental Law and Practice. 19(3): 225-266.
- Jones A. 2017 Jan 18. Ontario proposes to boost water bottler fee by \$500 per million litres. The Globe and Mail. [Internet]. [cited 2017 Apr 6]. Available from: <http://www.cbc.ca/news/canada/toronto/water-bottle-fee-1.3940545>
- Ministry of the Environment and Climate Change (ON). 2016. A regulation establishing a moratorium on the issuance of new or increasing permits to take water for water bottling [Internet]. Ontario's Regulatory Registry; [cited 2017 Apr 6]. Available from: <http://www.ontariocanada.com/registry/view.do?postingId=22948>.
- Morris AP. 2009. Politics and property in natural resources. Social Philosophy and Policy. 26(2): 53-94
- Nestlé Waters Canada. 2017 Jan 27. Statement re: Centre Wellington response to Middlebrook Road property proposal [Internet]. Puslinch (ON): Nestlé Waters Canada; [cited 2017 Apr 6]. Available from: <http://www.nestle-waters.ca/en/media/pressreleases/statement-re-centre-wellington-response-to-middlebrook-road-property-proposal>
- Nowlan L. 2005. Buried treasure: groundwater permitting and pricing in Canada [Internet]. Toronto (ON): Walter and Duncan Gordon Foundation Canada; [cited 2017 Apr 6]. Available from: https://qspace.library.queensu.ca/bitstream/handle/1974/8509/Buried%20Treasure_Groundwater%20Permitting%20and%20Pricing%20In%20Canada.pdf?sequence=1.
- Pasour EC Jr. 1982. Agricultural land protection: is government intervention warranted? Cato Journal. 2(3): 739-758.
- Pearse P. 1988. Property rights and the development of natural resource policies in Canada. Canadian Public Policy/Analyse de Politiques. 14(3): 307-320.
- Program on Water Governance. 2010. Fact sheet: groundwater use regulation [Internet]. Vancouver (BC): Program on Water Governance; [cited 2017 Apr 6]. Available from:

http://watergovernance.sites.olt.ubc.ca/files/2010/04/FS_Groundwater_Regs.pdf

- Rivera A. 2008. International Year of Planet Earth 3. Groundwater sustainable development in Canada – emerging issues. *Geoscience Canada*. 35(2): 73-87.
- Rothbard MN. 1979. The myth of efficiency. In: Rizzo M, editor. *Time, uncertainty, and disequilibrium*. Lexington (MA): LexingtonBooks: DC Heath and Company. p. 91-96.
- Rutherford S. 2004. Groundwater use in Canada [Internet]. Vancouver (BC): West Coast Environmental Law; [cited 2017 Apr 6]. Available from: <https://www.wcel.org/sites/default/files/publications/Groundwater%20Use%20in%20Canada.pdf>
- Smith FL Jr. 2004. The Progressive Era's derailment of classical-liberal evolution. *The Freeman*. 54(5): 26-30.
- Statistics Canada. 1996. Quarterly estimates of the population of Canada, the provinces and the territories (11-3, Catalogue no. 91-001). Ottawa (ON): Statistics Canada.
- Steele DR. 1981. Posing the problem: the impossibility of economic calculation under socialism. *Journal of Libertarian Studies*. 5(1): 7-22.
- Sutherland S. 2016 Jul 29. Despite rain and flooding, Southern Ontario drought worsens. *The Weather Network*. [Internet]. [cited 2017 Apr 6]. Available from: <https://www.theweathernetwork.com/news/articles/drought-conditions-worsening-throughout-eastern-ontario/69534>
- Wagner RE. 1998. The constitutional protection of private property. In: Hill PJ, Meiners R, editors. *Who owns the environment?* Lanham (MD): Rowman & Littlefield Publishers, Inc. p. 315-336.
- Water for Future Generations. 2017. Threats to Our Water [Internet]. Vittoria (ON): Water for Future Generations; [cited 2017 Apr 6]. Available from: http://www.wffg.ca/take_action.php.
- Wolf C Jr. 1979. A theory of nonmarket failure: framework for implementation analysis. *Journal of Law and Economics*. 22(1): 107-139.
- Yandle B. 1999. Public choice at the intersection of law and economics. *European Journal of Law and Economics*. 8(1): 5-27.

Tables and Figures

Figure 1. Percentage of water obtained from surface and ground water sources, respectively, by municipal size group, across Canada (Environment Canada 2011).

Figure 2. Hydrograph displaying water level (in meters below ground level) in Langley municipal well no. 7, Langley, British Columbia, 1962-2003 (Council of Canadian Academies 2009). Kindly reproduced with permission from the Canadian Council of Academies.

Figure 3. Municipal water consumption (litres per day per person) and water pricing (purchasing power parity) by country (Canadian Council of Academies 2009). Kindly reproduced with permission from the Council of Canadian Academies.

Table 1. Dependence on groundwater for domestic, municipal, and rural use, by province or territory, as indicated by the number of residents dependent on groundwater, percentage of the population dependent on groundwater, and groundwater use as a percentage of Total Water Use. The number of residents dependent on groundwater, and the percentage of population dependent on groundwater, are based on Statistics Canada (1996), as discussed in Environment Canada (2013). (For this reason, Nunavut is not included.) Groundwater use as a percentage of Total Water Use is based on Nowlan (2005).

Province or Territory	Number of residents dependent on groundwater	Percentage of population dependent on groundwater	Groundwater use as percentage of Total Water Use
British Columbia	1,105,803	28.5%	10%
Alberta	641,350	23.1%	3%
Saskatchewan	435,941	42.8%	n/a
Manitoba	342,601	30.2%	n/a
Ontario	3,166,662	28.5%	2.5%
Quebec	2,013,340	27.7%	n/a
New Brunswick	501,075	66.5%	n/a
Nova Scotia	426,433	45.8%	n/a
Prince Edward Island	136,188	100%	n/a
Newfoundland and Labrador	189,921	33.9%	n/a
Yukon	15,294	47.9%	75.4%
Northwest Territories	18,971	28.1%	n/a
Total (first column); average percentage (second and third columns)	8,993,579	30.3%	n/a

Table 2. Water extraction permit prices in Canada in 2017, given as Canadian dollars (CAD) per million litres, by province or territory. (The prices given are solely for the water extraction permits; they do not include permit application fees or additional fees for extraction over a certain amount, both of which vary by province.)

Province or territory	Permit price (2017 CAD/Million Litres)
British Columbia	\$2.50
Alberta	\$0.00
Saskatchewan	unknown
Manitoba	unknown
Ontario	\$3.71
Quebec	\$70.00
New Brunswick	unknown
Nova Scotia	\$150.95
Prince Edward Island	\$0.00
Newfoundland and Labrador	\$500.00*
Yukon	unknown
Northwest Territories	unknown
Nunavut	unknown
*Newfoundland and Labrador charges \$500 per million litres for extraction for water bottling purposes and \$5 per million litres for other commercial purposes.	