Incorporating Local Experiential Knowledge and Societal Values in Source Water Protection through a Broader Risk Analysis

H.C. Simpson
Ontario Ministry of Agriculture, Food and Rural Affairs, Guelph, Ontario, Canada
Department of Geography & Environmental Management, University of Waterloo, Waterloo, Ontario, Canada
R.C. de Löe
Department of Environment & Resource Studies, University of Waterloo, Waterloo, Ontario, Canada
D.L. Rudolph
Department of Earth & Environmental Sciences, University of Waterloo, Waterloo, Ontario, Canada

ABSTRACT
Source water protection (SWP) is a form of decision-making designed to ensure that land and water management practices do not degrade drinking water supplies. Environmental decision-making has traditionally been supported by risk analysis using scientific information. The literature indicates that a broader risk analysis approach is needed to involve members of affected communities so that local experiential knowledge and societal values can be more effectively incorporated. The purpose of this paper is two-fold: (1) to describe the elements of such a broader risk analysis approach, and (2) to present a case study that illustrates how such an approach could be implemented.

RÉSUMÉ
La protection de l'eau à la source (PES) est une forme de prise de décisions qui vise à s'assurer que les pratiques de gestion des terres et des eaux ne dégradent pas les réserves d'eau potable. Traditionnellement, le processus décisionnel en matière d'environnement a reposé sur l'analyse des risques à l'aide de données scientifiques. La documentation révèle qu'une approche plus globale de l'analyse des risques est nécessaire pour encourager la participation des membres des collectivités touchées en vue d'une intégration plus efficace du savoir expérientiel et des valeurs de la société. La présente communication vise deux objectifs : 1) décrire les éléments d'une analyse plus globale des risques et 2) présenter une étude de cas qui illustre la façon dont une telle approche pourrait être mise en œuvre.

1 INTRODUCTION

Source water protection (SWP) has been defined as a process for ensuring that the quality and quantity of sources for human water supplies are not diminished by land use activities (Peckingham *et al.*, 2005; Ivey *et al.*, 2006; Patrick *et al.*, 2008). Fundamentally, SWP is a form of decision-making where alternative courses of action are evaluated (Johnston *et al.*, 2000), with a specific focus on land and water management practices.

Experience has shown that the benefits of avoiding the contamination of a drinking water supply far outweigh the (financial and social) costs of implementing protective measures (Simpson and Myslik, 2005). For instance, the US EPA (1996) determined through seven community case studies that remediating a groundwater supply may be 30 to 40 times more expensive than preventing contamination. For one small rural community, the costs of remediating groundwater contamination were 700 times greater than implementing a basic wellhead protection plan. Similarly, the costs of replacing a water supply may be much higher than the costs of protection. Further, it may be difficult or impossible in some situations to replace a water supply if the groundwater source becomes contaminated and there is no alternate source.

Challenges associated with SWP are complex because of the high degree of indeterminacy that exists (i.e., ambiguity, complexity, uncertainty), and because source water protection has no clear end-point, which requires ongoing societal involvement. Turner (2004) states that decision-making involving such complex problems is 'quasi-scientific' because more than scientific knowledge needs to be considered in their solution. For instance, decision-making involving complex problems, such as those involving risk and the environment, needs to incorporate knowledge about societal values, such as equity and fairness of the distribution of the benefits and adverse effects in society (Kasperson, 2005; Renn, 2008), in addition to scientific information. Examples of these values include.

This is problematic, because traditional risk analysis is not suited for decision-making involving complex environmental problems (Functowitz & Ravetz, 1993; Wynne, 2002; Jasanoff, 2003; Turner, 2004). Traditional risk analysis assumes that humans behave as objective 'rational actors', a concept that has waned in the social sciences in favour of the view that humans (including risk experts) are subjective, and thus are influenced by risk perception and behaviour. This has resulted in a situation where risk analysis and communication efforts have been counterproductive. Consequently, a growing rift between risk experts and society is forming (Slovic, 2000; Smith, 2004). This means that risk analysis that is based only on technical knowledge, and which interacts with the public using risk communication, will likely exclude concerns that may be important to the broader community (Kasperson, 2005; Jasanoff, 1998; Rees, 2002).The majority of SWP efforts in North America are structured around a traditional risk analysis format, employing risk communication during interactions with the community. As a consequence, community involvement is usually limited to providing comments on technical work once the scope of the project has been determined. However, experience with watershed management suggests that land owners who have been involved more fully in the development and implementation of a local watershed management plan will value and take action to protect the quality and quantity of water proactively (NRC, 2000; Conservation Ontario 2001). This latter approach provides an opportunity to share their risk perceptions, to incorporate them into the scope of the SWP process, and to participate in the implementation of the resulting source water protection plan.

This paper contains two parts. The first part summarizes insight from the theoretical and empirical literature concerning decision-making involving complex problems, and includes an overview of related risk analysis processes and concerns. The different types of SWP approaches are also discussed, including ways that SWP can be improved by democratizing the risk analysis process. The second part presents a case study that provides an example of how state and non-state actors can work collaboratively to develop and implement a SWP program.

1.1 Different SWP Approaches

The importance of the wellhead concept was recognized formally in 1854 when John Snow correctly identified the Broad Street pump as the source of cholera, and ended an outbreak by convincing the local water commission to remove the pump handle. It was later confirmed that a cesspool leaking raw human wastewater into the underlying groundwater, which provided the source of water for the pump, was the source of the contamination (Hrudey and Hrudey, 2004; Turner, 2004). The theory and practice of SWP has evolved considerably since that time, following two complementary processes – wellhead protection and watershed management. These two different interpretations of SWP are discussed below.

Wellhead protection planning is a process for preventing contamination of the recharge area and groundwater for a water supply well or wellfield. In a municipal setting, a wellhead protection plan (WHPP) can include forming a stakeholder team or committee, delineating the protection area of the local well(s), identifying potential contaminant sources, and developing and implementing a local management plan (US EPA, 1993). This helps the community to identify the land area that provides groundwater recharge to the well(s), potential contaminant sources within the recharge area(s), and options for minimizing potential impacts on the well(s) such as pollution prevention, monitoring, and treatment where necessary (Simpson and Myslik, 2004).

However, the WHPP approach has limitations that were noted by Skinner (1985, 136) in a review of European groundwater protection efforts:

- It is difficult to modify WHPA zones to incorporate new technical information;
- It is 'source [or supply] orientated', focusing attention on the municipal well and 'does not protect the resource as a whole';
- It assumes that municipal use of groundwater takes priority over other 'social and economic interests';
- It requires technical effort to delineate WHPA zones whether or not there is any 'actual or potential quality threat', which could lead to the misdirection of public resources and placing unwarranted restrictions on lands; and
- It places a burden on technical staff to determine the appropriate scope of a groundwater investigation, which can be difficult where 'the problem is complex or the results ambiguous'.

Skinner's observations are understandable because the WHPP process is largely inward-looking, focused on protecting the groundwater resource, and usually dominated by technical staff; typically, opportunities for public input are limited. As a result, there is little awareness, let alone opportunity, for the community to help establish the scope and process for developing a WHPP, and as a consequence there is little understanding of the need for action among community members. Similarly, there is limited opportunity for the community to share experiential knowledge that may improve the WHPP process, such as identifying the location of historical industrial sites that may pose a threat to groundwater supplies.

Watershed management is a process that considers environmental, social and economic needs within the context of the hydrologic cycle at the watershed and subwatershed scale (WPI, 1995). Watershed management arose formally during the latter half of the 20th century when the environmental and social impacts of ongoing river engineering efforts began to be widely observed (White, 1998). The current conceptualization of watershed management is integrated watershed resource management (IWRM). IWRM has been defined as a process which 'promotes the coordinated development and management of water, land and related resources in an equitable manner without compromising the sustainability of vital ecosystems' (GWP, 2000).

Despite the apparent benefits of an integrated approach, IWRM has come under scrutiny for the following reasons (Biswas, 2004; Blomquist and Schlager, 2005):

- Failure to progress from 'single-component' to an integrated approach that considers both biophysical and social factors;
- Difficulty being recognized as the highest priority by other sectors (e.g., industry, agriculture);
- Concern that the increased involvement of stakeholders (with potential conflicting goals) will undermine integration; and
- Inherent political nature of watershed management (*e.g.*, boundaries, decision-making, and accountability).

These observations suggest that current SWP approaches are well positioned to deal with technical concerns, but need modification to deal with broader economic and social concerns.

1.2 The Need for an Alternative Approach

Risk analysis has been and largely continues to be the foundation for environmental decision-making (Jasanoff, 1998). Risk analysis is a process that has traditionally included three components: risk assessment, where the risk associated with some potentially hazardous event is evaluated; risk management, where guidance for the development of options for mitigating this risk is developed; and, risk communication, where potential options for decision-making purposes is shared with the public.

Smith (2004) observes that risk communication and risk perception should both concern the interaction and exchange of objective and subjective positions. Rather than incorporating the risk perception concerns of society, risk experts have used risk communication employing advertising techniques to get the message out simply and without creating a sensation (U.S. EPA 1990; U.S. EPA 2002). This approach has been critiqued by social scientists as 'message engineering' (Kasperson, 2005, 8), and has led to an ongoing distrust between risk experts and the public (Jasanoff 1998; Smith 2004).

Subjective risk 'helps humans to understand and cope with the dangers and uncertainties of life' (Slovic 1998, 74), and we have evolved an instinctive ability to manage perceived hazards through 'risk avoidance' and 'risk compensation' behaviour (Adams 2000; Slovic 2000). Also, white males appear to perceive risk differently than women and non-white males (Slovic 2000). As a result, (predominantly white-male) risk experts routinely dismissed lay persons as irrational, and labelled their concerns as subjective and inferior to their objective analysis (Jasanoff 1998; Slovic 1998), or even as invalid (Smith 2004). These social values and subjective risk behaviour are not considered to be 'rational', lying outside of what risk experts would normally include in the psychometric model, and is typically excluded from risk analyses.

There are also concerns with the apparent inability of risk analysis to adequately address sources and implications of indeterminacy (*i.e.*, ambiguity, complexity, and uncertainty), which is an inherent aspect of complex problems. Risk analysis has also been either unable or unwilling to consider tolerability of risk, which is related to social values such as equity and fairness of the distribution of the benefits and adverse effects in society (Kasperson, 1983; Kasperson, 2005; Renn, 2008). These concerns challenge public trust in risk analysis, and undermine their use for addressing complex problems.

The International Risk Governance Council (IRGC) has noted the importance of expanding risk analysis to integrate societal and technical considerations and link risk analysis and governance processes. Societal involvement becomes more important as risk problems become increasingly challenging [*i.e.*, simple *versus* indeterminate (ambiguous, complex, or uncertain)] (Renn, 2008). It is anticipated that an inclusive risk governance process will maximize public trust in and lead to optimal risk-related, decision-making (Renn, 2007) by integrating objectivity and subjectivity, acknowledging indeterminacy, and accounting for social values such as equity and fairness.

2 THE ROLE OF MORE SUBSTANTIVE COMMUNITY INVOLVEMENT

Good environmental decision-making has been linked with governance. It improves the 'regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes' (World Resources Institute, 2004; Lemos and Agrawal, 2006, 298). Water governance, a subset of governance that deals with water management challenges, helps secure life-support system goods and services (*e.g.*, water security), avoid difficulties (water pollution abatement), and helps anticipate unavoidable conflicts and difficulties (*e.g.*, competition for multiple functions of water) (Falkenmark, 2007).

Decentralized governance is particularly well suited to tackle questions that are local in scale and practical in scope because it can involve local stakeholders and incorporate their knowledge into the decision-making process (de Loë and Kreutzwiser, 2006). Lemos and Agrawal (2006, 303) provide several points in support of decentralized environmental governance:

- 'It can bring decision making closer to those affected by governance, thereby promoting higher participation and accountability;
- It can help decision makers take advantage of more precise time- and place-specific knowledge about natural resources;'
- It can stimulate communication between decision-makers at different scales, and with their constituents; and
- It can influence the 'relationships of people with each other and the environment.'

Supporting this argument, the literature notes that land owners who have been involved more fully in the development and implementation of local water protection efforts will value and take action to protect the quality and quantity of water proactively (NRC, 2000). The literature also notes that the process of involving landowners is not a simple one. A series of factors that are important contributors for stakeholder involvement in the development and implementation of initiatives such as SWP were identified through a review of the theoretical and empirical literature and a review of available documents and preliminary discussions with state and non-state actors involved in the SWP process in Ontario.

One factor is the building of partnerships within a stakeholder committee involved with the development and implementation of source water protection plans, and with the broader networks that committee members may represent. Partnering with stakeholders, particularly with industry, has been a critical factor for facilitating water management efforts and, where absent, was perceived as a significant constraint (NRC, 2000; Carr, 2004; Lach et al., 2005; Ferreyra and Kreutzwiser, 2007; van Wyk *et al.*, 2007; Patrick *et al.*, 2008). An important function of the stakeholder committees will be to encourage stakeholders to share and integrate scientific and experiential information from their different perspectives (Bellamy *et al.*, 1999; Lach *et al.*, 2005), and discuss value-based issues (Carr, 2004; Turner, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007). This co-production of knowledge will promote greater rigour in the project outcomes (Carr, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007), and help stakeholders reach decisions that might otherwise appear to compromise their perspectives and expectations (Lach *et al.*, 2005).

A second factor concerns the leadership and technical capacity of non-state actors to participate in decision-making processes (Carr, 2004; van Wyk *et al.*, 2007). Ivey *et al.* (2006) indicate that capacity and capacity building can take two potentially opposed forms. The first is 'capacity for action', where individuals or groups work to meet externally imposed objectives (*e.g.*, regulatory compliance). The second is 'capacity for self-determination', where individuals or groups seek to 'establish and achieve their own goals and agendas' (Ivey *et al.,* 2006, 946). This is not to say that non-state actors concerned with the latter do not support the overall goals of SWP, but rather that they may not completely agree with the SWP process as envisioned by the state. Through the SWP process different state and non-state actors can share perspectives and work together to achieve a balance between their own and external motivations, and provide a forum to make necessary concessions.

A third factor concerns the importance of developing social capital by stakeholder committee members, which will facilitate collaboration and co-production of knowledge. This will be important for the development of social capital, whereby stakeholders need to discuss and develop an understanding of each other's positions. Social capital involves building relationships that promote connectedness, common rules, equity, mutual empowerment, shared values and trust, and reciprocity (Carr, 2004; Turner, 2004; Cash *et. al.*, 2006; Mitchell and Breen, 2007; van Wyk et. al., 2007). Social capital is important because it will enhance the sort of collaborative thinking that is needed to achieve the broader good that will be a necessary part of source water protection that produces tangible results (Falkenmark, 2007; Mitchell and Breen, 2007; van Wyk et. al., 2007).

A fourth factor concerns building and applying 'vernacular' knowledge. Promoting the development of a vernacular knowledge that incorporates the sharing of scientific and experiential knowledge will encourage reasoned debate, promote social learning, and build capacity to better deal with value-based problems (Carr, 2004; Lach *et al.*, 2005; van Wyk *et al.*, 2007). Governance research has demonstrated that the process of creating vernacular science can help eliminate power differentials between actors, promote the discussion of value-based issues, and build social capital (*e.g.*, trust, connectedness) (Mitchell and Breen, 2007; van Wyk *et al.*, 2007). This also helps address the challenges of indeterminacy (Jasanoff, 2003), and ensure that both societal and technical aspects of risk are considered (Rees, 2002);

A final factor concerns promoting agency of local stakeholder committees, and the active and substantial involvement of non-state actors, in determining the nature and extent of local source protection efforts. The deficiencies of risk analysis may be addressed by involving non-state actors at the outset environmental initiatives, and encouraging a front-end questioning of what the process should achieve and how it should be structured (Wynne, 2002; Jasanoff, 2003). This will be important for the development of social capital, whereby stakeholders need to discuss and develop an understanding of each other's positions. This is consistent with the greater involvement of stakeholders in decentralized governance, and could lead to an outcome that is less divisive, and more likely to be accepted by the broader community (Renn, 2007).

3 A CASE STUDY

A number of locally based rural water quality programs have been developed by watershed-based conservation authorities across Ontario. One notable example is the Rural Water Quality Program (RWQP) that recently celebrated its tenth anniversary in 2008. The RWQP is a municipally-funded cost-share program, the first of its kind in Ontario and possibly Canada, which has had the objective of improving and protecting groundwater and surface water quality (Ryan, 1998). The RWQP is widely seen as a success, and has received approval for a third round of funding by the Regional Municipality of Waterloo (RMOW 2008). In the first ten years of operation it has provided grants totaling $3,131,187 for the implementation of 845 projects (Ryan, 2009). The RWQP has also been deemed a success in popular and technical publications at a local, provincial and national scale (*e.g.*, Romahn, 1998), and attracted positive coverage from the farm press (*e.g.*, Lammer-Helps, 2004).

The RWQP the model has since been expanded by the Grand River Conservation Authority across the Grand River watershed to include the neighbouring Wellington and Brant Counties, and the City of Brantford. The RWQP has also been used as a model in other parts of the province, such as the Clean Water Program for Oxford, Middlesex and Perth Counties, the Cities of London and Stratford, and the Town of St. Marys, which includes portions of eight watersheds.

The purpose of the remaining part of this paper is to present a case study of RWQP that was developed using the principles of a democratized risk analysis process, and provide some lessons that can be employed in the development and implementation of similar programs elsewhere.

3.1 Background

The Grand River Conservation Authority (GRCA), one of Ontario's largest and best-resourced authorities, has jurisdiction over the Grand River watershed, which covers parts of 34 municipalities and the Regional Municipality of Waterloo (the Region) in its entirety (see Figure 1). The GRCA manages surface water flows, monitors surface waters and groundwater, implements local rural water quality programs (providing financial incentives for adopting agricultural best management practices), facilitates local drought management, and engages in modeling, planning, and research within the Grand River watershed (Ivey *et al.*, 2006).

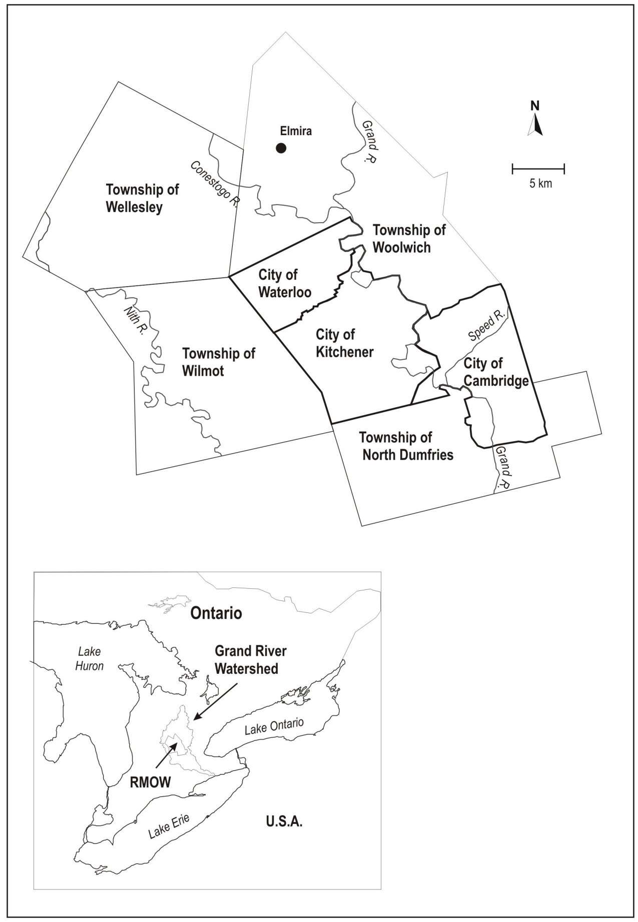

Figure 1. The Regional Municipality of Waterloo in the Grand River watershed, Ontario, Canada. (From Ivey *et al.*, 2006)

The Region is an ''upper-tier'' municipality whose jurisdiction applies to 7 ''lower-tier'', or area, municipalities: the largely rural townships of North Dumfries, Wellesley, Wilmot, and Woolwich; and the cities of Kitchener, Waterloo, and Cambridge. The Region is the tenth largest urban area in Canada, the 4^{th} largest urban area in Ontario, and its population is expected to swell to 558,000 by 2016 (RMOW, 2004a). The Region, through its Water Services Division (WSD), operates a system of 125 of municipal water wells in rural and urban areas and a surface water intake drawing from the Grand River, from which water is sold wholesale to 7 municipalities which distribute the water to retail customers. Municipal wastewater is collected and treated at seven wastewater treatment plants (WWTPs) that discharge treated effluent at a number of locations to the Grand River.

The Region had learned first-hand that the benefits of avoiding the contamination of a drinking water supply far outweigh the financial and social costs of implementing protective measures. This awareness came in part through having experienced significant contamination of its Elmira wells by the chemical N-nitroso demethylamine (Sanderson *et al.*, 1995), and having undergone a waterborne contamination event involving Cryptosporidium at its Mannheim Water Treatment plant (Hrudey and Hrudey, 2004).

The impetus for developing the RWQP was related to six factors concerning WSD operations at the Region, including:

- Motivation to fully implement the Region's Water Resource Protection Strategy, an initiative that identifies various contamination threats to municipal groundwater and surface water supplies including rural non-point sources (RMOW, 1994; Ryan, 1998).
- Recognition that the long-term ability to expand the capacity of its WWTPs might be limited by water quality in several reaches of the Grand River into which treated effluent discharges (RMOW, 1997).
- Knowledge that there was a considerable increase in surface water loadings of microorganisms, phosphorous and sediment in rural reaches of the Grand River that could not be attributed to WWTP effluent discharges (Draper and Weatherbe, 1994; Ryan, 1998).
- Awareness that a previous federal-provincial program entitled CURB (Clean Up Rural Beaches) had resulted in surface water quality improvements by funding improved rural land-use management practices (RMOW, 1997).
- Knowledge that the cost of removing one kilogram of phosphorous using a very advanced wastewater treatment process would be 17 times more costly than removing one kilogram of phosphorous through improved agricultural management practices, and save an anticipated $1 Million in capital upgrade costs at each of two WWTPs (RMOW, 1997).
- Broader interest in improving surface water and groundwater quality throughout the Region for health, recreational and ecological reasons.

In 1997, WSD staff sought and received approval in principle from Regional Council to develop and fund the RWQP in cooperation with relevant agencies and organizations. WSD staff then invited representatives from local land provincial agricultural and commodity organizations, the Grand River Conservation Authority (GRCA), provincial ministries (Agricultural Food and Rural Affairs; Environment and Energy) and a federal department (Agricultural and Agri-Food) staff to form a Liaison Committee that would provide advice on program development and implementation. It was realized by WSD staff at the outset that 'the success of the [forthcoming] program depends on the support and participation of farm organizations and local farmers… [and] it was essential that these groups be given an active role to play in guiding the program direction, structure, and implementation' (RMOW, 1997, 7). A larger steering committee was then formed that included representatives from more than 20 local and provincial agricultural and commodity organizations, four levels of government (upper and lower tier municipal, provincial and federal), and the local watershed conservation authority (Ryan, 1998).

3.2 Role of Factors in the Development and Implementation of the RWQP

The RWQP was evaluated for the contribution and significance of the factors identified above. This evaluation included observations by the lead author, who was involved with the RWQP during its development and initial implementation phase (from early 1997 through to the one-year anniversary of the RWQP launch in mid-1999), and a review of available documentation (*e.g.*, RWQP Steering Committee minutes, Region Engineering reports, and other available materials). The manner in which each factor contributed to the development and implementation of the RWQP is discussed below.

3.2.1 Partnerships

The formation of the RWQP benefited from a number of pre-existing partnerships involving the provincial and local agricultural community, such as the Ontario Farm Environmental Coalition and Waterloo Federation of Agriculture, and different agencies and organizations including the Grand River Conservation Authority (GRCA), the Ontario Ministry of Agriculture, Food and Rural Affairs, and the Ontario Soil and Crop Improvement Association. The Region had also built on these partnerships previously through initiatives such as the Rural Non-Point Source Working Group, which had developed a Rural Groundwater Awareness Program for farm and non-farm landowners (Simpson and Hodgins, 2002).

The Steering Committee benefitted from these partnerships, both during the development and implementation of the RWQP. For instance, a GRCA staff member hosted a kitchen table meeting with eight farm organization representatives at her family farm to get comments on a draft terms of reference for the RWQP, and gain insight from the agricultural community on the following associated issues (Loeffler, 1997):

- What BMPs should be funded by the RWQP, and what options should be considered for compensation;
- How should the RWQP be linked with the Environmental Farm Plan; and
- What other items should be included in the RWQP.
- This meeting provided an opportunity for farm organization representatives to speak candidly amongst themselves, and generated useful insight to the Steering Committee which was incorporated into subsequent discussions concerning the development of the RWQP.

3.2.2 Stakeholder Capacity

The development and implementation of the RWQP benefited from widespread leadership and technical capacity. From a leadership perspective, the Region used an approach that balanced its goal to address groundwater and surface water quality concerns with incorporating the concerns and needs of the agricultural community. The agricultural community also provided leadership through the many members of the Steering Committee who were elected representatives from local and provincial agricultural associations. For instance, agricultural leaders demonstrated that they were familiar with the workings of a program committee, and worked to ensure a clear definition of its role and a process for its operation (*e.g.*, terms of reference, application review process, appeals procedures) were formally accepted and documented.

Technical capacity was also represented throughout the Steering Committee. Technical information concerning groundwater and surface water was presented in or translated into a format that was understandable to the farmers by a conservation specialist from the GRCA, a hydrogeologist from the Ontario Federation of Agriculture and a water engineer from the Ontario Ministry of Agriculture, Food and Rural Affairs. For instance, Region staff generated a watershed-based map that outlined the groundwater and surface water priority areas (see Figure 2). Conversely, farmers went to great length to ensure that WSD staff understood the relationship between the BMPs being discussed and their connection to farming. At one point, the GRCA conservation specialist produced a guide entitled "Agriculture for Dummies" (Loeffler, undated) to educate Region staff about typical agricultural concepts and practices.

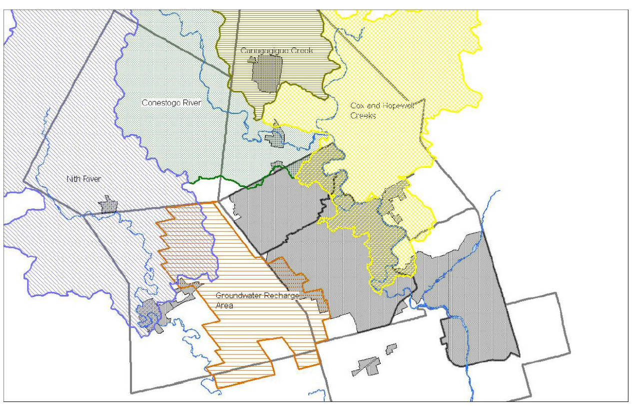

Figure 2. Groundwater and Surface Water Priority Areas

Efforts were also made to increase technical capacity in the broader farm community, to ensure that they were able to take advantage of financial incentives and implement BMPs associated with the RWQP. For instance, special EFP workshops were organized to ensure that the maximum number of farmers had a deemed appropriate EFP, and were therefore eligible to apply for RWQP incentives. It was also decided that nutrient management plan (NMP) workshops would be organized by the GRCA for farmers who did not have a consultant prepare their NMP. The Steering Committee were aware that farmers who prepared their own NMP, or were involved in the preparation of it, benefited most from the nutrient management planning process.

3.2.3 Social Capital

As with partnerships, the Region benefitted from substantial social capital that had been built up between the provincial and local agricultural organizations and different agencies and organizations. Two key examples of how this pre-existing social capital was employed strategically include the program model that was used to structure the RWQP, namely the Clean Up Rural Beaches (CURB) program, and the use of the Environmental Farm Plan (EFP) as an eligibility requirement for applicants to access incentives offered under the RWQP.

The use of the CURB model was a strategic use of social capital from two perspectives. First, the CURB model had been funded by the Ministry of the Environment and delivered in the Grand River Basin by the GRCA. As a consequence, in negotiating a new program to provide a reduction in phosphorous loadings from WSD WWTPs, the MOE would be familiar with the CURB model and its contribution to reducing agricultural non-point phosphorous loadings to surface water. Second, by proposing a model based on the CURB program, the GRCA would be in an excellent position draw on social capital shared with the farm community in offering a new but similar program.

Adopting the EFP program as an eligibility requirement for access to incentives under the RWQP drew on, and reinforced, social capital that had been generated between the farm community and the agencies and organizations responsible for its development and delivery. The EFP program had been developed by the Ontario Farm Environmental Coalition, an umbrella group of approximately 80 separate farm organizations in Ontario, with financial, logistical and technical support from Agriculture and Agri-Food Canada, the Ontario Ministry of Agriculture, Food and Rural Affairs, and the Ontario Soil and Water Conservation Association. Adopting the EFP as an eligibility requirement created a transfer of social capital from these organizations, and the six-year successful implementation of this program in Ontario, and led to recognition of the RWQP among farmers in the program area who had participated in the EFP program.

The Region was then able to build further on the social capital provided by using the CURB model and adopting the EFP program. This came in part from the collaborative environment that was established with the Steering Committee (SC) from the outset, which provided an open forum for farm community representatives to work actively with WSD and GRCA program staff to help develop the RWQP, and feel comfortable endorsing it to the members of the farm organizations that it represented (Lammers-Helps, 2004).

3.2.4 Vernacular Knowledge

The RWQP program benefited from the integration of experiential and scientific input to create a vernacular knowledge. One example of a source of vernacular knowledge was the Review Committee (RC). The RC was chaired by a Region WSD staff member. It consisted of two farmers and an alternate, and one representative each from the Ontario Farm Environment Coalition and the Province of Ontario (OMAFRA) staff. Funding applications were presented by GRCA staff anonymously to preserve the applicant identity; however, the farmer representatives often played a game of guess the applicant using their considerable knowledge of the local farming community.

The members of the Review Committee routinely combined scientific and experiential knowledge during the assessment of each funding application. On many occasions, this vernacular knowledge was shared with program applicants through GRCA staff to help improve the applications, and to help them to qualify for support. The RC also referred matters to the SC for clarification of issues that arose during the review of applications. One example involved a request that had been deferred because the RC realized that the existing activity related to the proposed BMP violated provincial legislation. The SC agreed that applications should not be approved where a violation exists that relates to a BMP for which funding was sought. The GRCA staff were encouraged by the RC to explain the circumstances to the applicant, and take the opportunity to work with the farmer to submit an expanded application that would bring the farm operation into compliance with legislation.

3.2.5 Agency of Stakeholders

As noted, the SC provided a working environment that facilitated collaboration. Agricultural leaders actively participated in the SC and worked to ensure that the forthcoming RWQP complemented programs that had been developed, or were under development, involving the farm community. A number of these initiatives, such as the CURB and EFP programs, have been discussed above. However, agricultural representatives demonstrated agency by bringing forth a number of changes during the development of the RWQP, either directly at the SC or indirectly by requests through the RC.

One example involved a request from the RC to the SC committee to change the geographic extent of the eligibility for a cost-share for costs associated with wellhead protection. Initially, wellhead protection BMPs such as extending the height of well casing, or decommissioning (plugging and sealing) abandoned or improperly maintained water wells was restricted to a groundwater priority area stipulated in the RWQP terms of reference.

GRCA program staff supported this proposal because they had been having difficulty promoting wellhead protection measures in only one priority area, and had been receiving requests from farmers located in others. Interestingly, this proposal from the RC was opposed by Region WSD staff because it was believed that implementing BMPs to protect groundwater supplies in areas that were not sensitive to contamination was not a prudent use of funds. However, the RC members argued that although the broader groundwater resource might not be under threat outside a sensitive groundwater area, the presence of an abandoned or poorly maintained well could act as a conduit for the contamination of an individual farm's water supply and the broader aquifer. This request was discussed at length by the SC and it was decided that it made sense to expand the geographic extent of the eligibility for a cost-share for costs associated with wellhead protection. Although a minor point from the broader perspective of the goals of the RWQP, it was a very important point from the perspective of the farm representatives, and was acknowledged by the broader SC.

4 SUMMARY

Traditional risk analysis is not adequate in itself for decision-making involving complex environmental problems. Complex environmental problems are quasi-scientific, and solving them requires a broader vernacular knowledge and the consideration of societal values. This deficiency with risk analysis can be addressed through a more substantial involvement of the community through decentralized governance. Five factors were identified as important contributors to environmental decision-making processes such as source water protection – partnerships, capacity, social capital, vernacular knowledge, and agency of stakeholders.

The Rural Water Quality Program, initiated by the Regional Municipality of Waterloo, was evaluated to determine the importance of the five contributing factors for its success. It was observed that the state and non-state actors exhibited each of these five factors in their efforts to participate and work collaboratively in developing and implementing a program. Further, the case study indicates that non-state actors, once substantively involved, can enhance the development and implementation of an environmental decision-making process.

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