

**From staples theory to new regionalism:
managing drinking water for regional resilience
in rural British Columbia**

by

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or

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Abstract

The Canadian infrastructure deficit presents challenges and opportunities, but also raises questions. Perhaps the most salient of these questions is not only how can we address these challenges, but how will what we do impact the future? Using a case study of drinking water systems in rural British Columbia, this research explores three unique aspects of the infrastructure deficit. **First** - the relationship between the infrastructure deficit and patterns of regional development is examined, paying particular attention to the legacy of staples dependent development. This research provides a historically and theoretically informed lens on the relationships between the two and how this influences the present day. The results present a more contextually-informed and regionally integrated framework and temper the presentism that often characterizes current discussions of the infrastructure deficit. **Second** - infrastructure management approaches are examined to see if there has been a shift in approach to ones more reflective of regional resilience. Current infrastructure conditions suggest renewal efforts must increase, making this investigation timely in order to better inform policy. While there is potential for drinking water systems to act as a catalyst to enhance regional resilience, this potential is largely untapped. **Third** - the potential for new regionalism as a platform for an alternate infrastructure management approach is studied. The proposed new regionalism based approach recognizes and accounts for the myriad of influencing factors and uses different mechanisms to support and encourage drinking water systems in fulfilling their potential role in supporting regional resilience. While the need for an alternate approach to managing drinking water systems is recognized and elements of the proposed approach are increasingly applied, substantive barriers remain. Collectively this research responds to a broader question of whether a new regionalist approach to infrastructure can positively impact future regional development and support rural regional resilience? Several important factors influence the ability of resilient regions to respond to change, of which drinking water systems are one. However, while it is possible that changes to the management of drinking water systems could have an influence on regional resilience, this is unlikely to occur in isolation or separate from larger, systemic change.

Key words: drinking water; infrastructure; staples theory; rural; regional development; drinking water systems; planning; new regionalism; regional resilience

Dedication

*Remember what they say
There's no shortcut to a dream
It's all blood and sweat
And life is what you manage in between*

- Broken Bells, October

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Table of Contents

Approval.....	ii
Ethics Statement.....	iii
Abstract.....	iv
Dedication.....	v
Acknowledgements.....	vi
Table of Contents.....	vii
List of Tables.....	x
List of Figures.....	xi
List of Acronyms.....	xii
Chapter 1. Introduction	1
1.1. Overview	1
1.2. Research Questions and Objectives.....	4
1.3. Conceptual Framework.....	5
1.4. Dissertation Structure	5
Chapter 2. Introduction to the Literature.....	6
2.1. Overview	6
2.2. Infrastructure	6
2.3. Drinking water systems.....	9
2.4. Rural regional development.....	13
2.5. Staples theory	15
2.6. New regionalism	16
2.7. Regional resilience	18
Chapter 3. Methods and Case Study Overview	22
3.1. Foundational research.....	22
3.2. Case study approach.....	23
3.3. Conceptual framework.....	24
3.4. Kootenay Development Region	24
3.5. Data collection and analysis	25
3.6. Limitations	27
Chapter 4. Paper #1: Unintentional Influence: Exploring the Relationship between Rural Regional Development and Drinking Water Systems in Rural British Columbia, Canada.....	28
Abstract:.....	28
4.1. Introduction.....	28
4.2. Literature Review.....	30
4.2.1. Staples Theory and Rural Regional Development	30
4.2.2. Rural Restructuring and the Regional Resurgence	32
4.2.3. Rural Regional Development, Infrastructure, and Drinking Water Systems.....	34

4.2.4. Literature Summary	36
4.3. Research Methods	37
4.4. Case Study: The Kootenay Development Region	40
4.5. Research Findings.....	42
4.5.1. Historical Regional Development and Drinking Water Systems	42
4.5.2. Drinking water system challenges in context	45
4.6. Discussion	48
4.7. Conclusions.....	51
Acknowledgements	53

Chapter 5. Paper #2: Half-empty: drinking water systems and regional resilience in rural Canada 54

Abstract.....	54
5.1. Introduction.....	54
5.2. Literature review	56
5.2.1. Regional resilience	56
5.2.2. New regionalism	57
5.2.3. Resilience, regionalism, and drinking water systems	58
5.3. Research methods	60
5.3.1. Case study overview	62
5.4. Findings.....	63
5.4.1. Overview	63
5.4.2. Support for regional integration.....	64
5.4.3. Barriers to regional integration.....	67
5.5. Discussion	69
5.6. Conclusions.....	72

Chapter 6. Paper #3: Exploring a new regionalism based approach to managing drinking water systems in rural regions..... 74

Abstract.....	74
6.1. Introduction.....	74
6.2. Literature Review.....	76
6.2.1. Drinking water	76
6.2.2. New regionalism	78
6.2.3. Regional resilience	80
6.3. Methods	81
6.3.1. The case study approach	81
6.3.2. Data collection and analysis	82
6.3.3. A new regionalism approach to drinking water systems.....	83
6.4. Results	85
6.4.1. Overview	85
6.4.2. Exploring dominant themes	89
6.5. Discussion	93
6.6. Conclusions.....	96

Chapter 7. Discussion and Conclusions	98
7.1. Introduction.....	98
7.2. Paper 1: the staples legacy	99
7.3. Paper 2: the fractured present	101
7.4. Paper 3: future in question.....	103
7.5. Research evolution and lessons for future research	105
7.6. Recommendations and Conclusions.....	106
References	111
Appendix A. Co-authorship Statement	130
Appendix B. Paper 1: Semi-Structured Interview Topic Guide	131
Appendix C. Paper 2: Resilience Indicators	134
Appendix D. Paper 3: Framework Guide and Questionnaire	138

List of Tables

Table 1.	Interviewee details	39
Table 2:	Categories of regional resilience indicators	61
Table 3:	Links between drinking water systems and the surrounding region	64
Table 4:	New regionalism and drinking water management	80
Table 5:	Dominant responses	86

List of Figures

Figure 1:	Conceptual framework	5
Figure 2:	The Kootenay Development Region.....	25
Figure 3:	The Kootenay Development Region.....	41
Figure 4:	The Kootenay Development Region.....	62
Figure 5:	New regionalism based approach to managing drinking water systems for regional resilience	85

List of Acronyms

BC	British Columbia
CAO	Chief Administrative Officer
CBT	Columbia Basin Trust
IHA	Interior Health Authority
OCP	Official Community Plan
WWII	World War II

Chapter 1. Introduction

1.1. Overview

Infrastructure systems serve as the physical foundation of modern society. The two are closely linked, “[w]here humans go, so eventually do walking trails, trade routes, highways, and communications networks. In turn, the distribution of infrastructure, whether embodied in ports, rail lines, or grain-handling facilities, steers the subsequent distribution of people and their economic activities” (Vining & Richards, 2001). Infrastructure provides the foundation for, and influences, how our communities and regions function – including quality of life, economic development, and environmental quality. The importance of infrastructure systems is recognized in the academic literature (see Chapter 2) as well as by citizens, with survey data suggesting that Canadians view infrastructure alongside health care as important to protect from spending cuts (Gregg, Kelly, Sullivan, & Woolstencroft, 2010; Stiff & Smetanin, 2010). But what role could infrastructure play in the future viability of rural places?

In Canada critical infrastructure systems currently face many challenges, not the least of which is the infrastructure deficit – the gap between what is needed and what is available to meet maintenance requirements, bring existing infrastructure to acceptable levels, or replace existing infrastructure (Burlington & Caranci, 2004; Kennedy, Roseland, Markey, & Connelly, 2008; Mackenzie, 2013; Mirza, 2007a; Ploeg, 2003). Awareness of the neglect of infrastructure assets has grown in the last decades, in Canada and globally (Harchaoui, Tarkhani, & Warren, 2003; Langelier, 2002; Stiff & Smetanin, 2010). For rural Canada the infrastructure deficit exists within a particular setting. Factors such as low population density, lack of economies of scale, large spatial areas, and capacity limitations create unique challenges (Breen & Minnes, 2015; Minnes & Vodden, 2014). However, despite the challenges, the infrastructure deficit also presents an opportunity for change.

As noted above, infrastructure systems and development go hand in hand. Indeed, the initial development of rural British Columbia (BC), and rural Canada, was followed or paralleled

by large-scale, top-down infrastructure projects – from the building of the national railroad, to BC Premier W.A.C. Bennet’s ‘Province Building’ efforts to Prime Minister Diefenbaker’s ‘Roads to Resources’ program. However, beginning in the 1980s, a period of rural restructuring reshaped the rural landscape, changing investment patterns, governance structures, policies, and programs (Beaumier, 1996; Fairbairn, 1998; Savoie, 2003). During this period, the context (e.g., investment, governance) surrounding the infrastructure established in the post-World War II (WWII) changed (Beaumier, 1996, 1998; Polèse, 1999; Savoie, 2003). One example of this changed landscape is the decreased investment in infrastructure. These changes are thought to have contributed to the aforementioned infrastructure deficit (Burlington & Caranci, 2004; Coad, 2009; Connelly, Markey, & Roseland, 2009; Ploeg & Holden, 2013).

Considering both the challenges and opportunities, the current state of infrastructure raises questions. Perhaps the most salient of these questions are i) how can we address these challenges, and ii) how will our response(s) impact the future, particularly the viability of rural regions? Beyond the obvious challenges, the infrastructure deficit presents an opportunity for change – change in how infrastructure systems are planned, designed, operated, and managed. Opportunities for change are particularly relevant when considering rural regional resilience - the ability of rural regions to resist and adapt to change (Boschma, 2014). While much of the discourse of regional resilience focuses on the economic dimensions of development, a need to broaden the exploration of the concept in other areas has been identified (Martin & Sunley, 2014). Given the relationship between development and infrastructure a closer examination of the current and potential influence of infrastructure systems on regional resilience seems a natural next step.

Drinking water systems, the infrastructure related to the treatment and distribution of drinking water, provide a critical service for quality of life and the economy, as well as providing a direct, physical link (i.e., diversions, pumps, pipes) to the surrounding environment (i.e., the watershed). Unsurprisingly, drinking water systems are among the critical infrastructure systems comprising Canada’s infrastructure deficit (American Water Works Association, 2001; Federation of Canadian Municipalities, 2012a; Kennedy et al., 2008; Meligrana, 2003; Mirza, 2007b; Roy, 2008). Despite targeted (re)investment from federal and provincial infrastructure programs, drinking water systems remain a pervasive challenge for rural places, including rural BC (Interior Health Authority, 2013, 2014a, 2014b, 2014c), suggesting that the challenge goes beyond financing and engineering.

In order to explore the above question of how our approach to infrastructure may impact the future of rural regions, it is important to understand:

- i) The factors contributing to and influencing the current state of infrastructure;**
- ii) The role of current management approaches; and**
- iii) The potential for an alternate, regionally-based, approach to support regional resilience.**

In the past, regional development has played a key role in the development of rural BC, as with other parts of rural Canada. Specific to drinking water, the resource itself is regional in nature. For both development and water management and governance the regional scale has recently seen a resurgence in academic and policy discussions, including discussion of the potential for regionalism within the rural context to help address issues attributed to the above period of restructuring. Within regional development this resurgence, or 'new regionalism', differs from past regional approaches in terms of changes in context (e.g., globalization), as well as a change in governance (e.g., co-construction, horizontal governance), inclusion of a wide range of characteristics (e.g., place, innovation, integration), and an emphasis on competitive advantage (Allen & Cochrane, 2007; Amin, 1999; Ethier, 2001; Hettne, Inotai, & Sunkel, 2000; Macleod, 2001; Ortiz-Guerrero, 2013; Peterson, Walker, Maher, Hoverman, & Eberhard, 2010; Rainnie & Grobbelaar, 2005; Savitch & Vogel, 2000; Wheeler, 2002; Zimmerbauer & Paasi, 2013). Regional action offers the potential to counter limitations faced by individual communities through collective action, offering potential improvements to drinking water systems specifically, as well as how these systems support regional resilience.

This research examines the confluence of infrastructure, rural restructuring, and regional development by exploring the three questions above specific to drinking water infrastructure in the Kootenay Development Region of rural south-eastern BC. Drinking water systems are used as a specific lens through which to examine the past (how did we get here?), the present (what are we doing?), and the future (should we do it differently?). By specifically examining the rural context, this research addresses gaps within the literature about infrastructure, drinking water systems, and regional development – all of which are often dominated by an urban perspective or obscured by the mixing of urban and rural data. The following sections outline the research questions and objectives, the conceptual framework guiding this research, and the overall structure of this dissertation.

1.2. Research Questions and Objectives

Below is an overview of the three papers that make up this dissertation, and the core research question and purpose of each paper. This research contributes to academic discourse relating to staples theory, new regionalism, regional resilience, and drinking water management, as well as informing policy and management.

Paper 1¹ (chapter 4) - *What is the legacy of staples theory and what does this mean for the future in the context of regional resilience?* This paper examines whether the factors contributing to or influencing the current state of rural drinking water systems extend beyond those typically captured by the concept of the 'infrastructure deficit'. The objective of paper 1 is to examine the relationship between past regional development and the evolution of drinking water systems in order to provide a historically and theoretically informed lens on the relationships between development and drinking water systems in rural BC and how these relationships influence current challenges.

Paper 2² (chapter 5) - *Do current approaches to the planning and management of drinking water systems reflect a transition toward regional resilience?* This paper explores the extent to which regionalism, as applied to drinking water systems, may serve to foster greater regional resilience and to what extent regional resilience exists under current management approaches. The objective of paper 2 is to explore the dynamics of rural regional resilience through an investigation of drinking water infrastructure in rural BC, Canada and what the current contribution of drinking water infrastructure is to regional resilience.

Paper 3³ (chapter 6) - *Could a new regional approach be applied to the management of drinking water systems in rural BC?* This paper explores the potential for new regionalism to serve as a foundation for a new management approach for rural drinking water systems. The objective of paper 3 is to first identify the potential contribution drinking water systems could make to regional resilience, then develop and explore the applicability and feasibility of an alternative management approach based on new regionalism that could assist drinking water systems to meet this potential.

¹ Paper 1 has been published in the Journal of Rural and Community Development (2015, Vol 10, No 3).

² A modified version of Paper 2 was submitted to Planning Practice & Research and is in review.

³ A modified version of Paper 3 was submitted to Society & Natural Resources and is in review.

1.3. Conceptual Framework

The conceptual framework for this research combines staples theory, new regionalism, and regional resilience (see Figure 1). The model used for this research is descriptive, as opposed to predictive. Each of the three papers provide the specific details that relate that paper to the conceptual framework, as well as the theoretical framework specific to each paper.

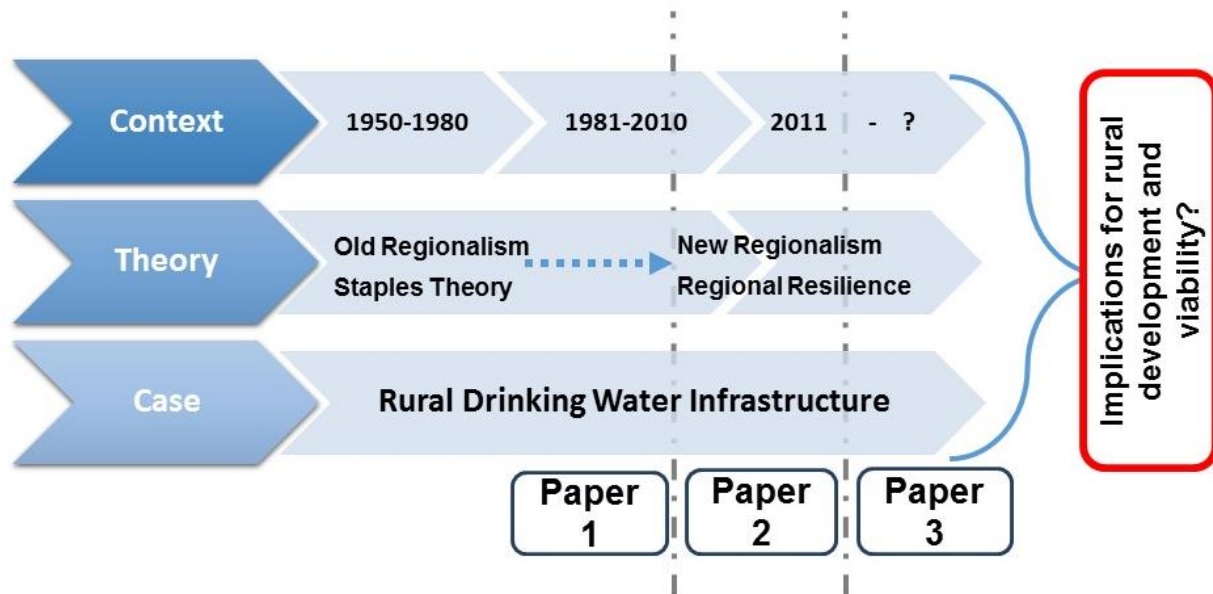


Figure 1: Conceptual framework

1.4. Dissertation Structure

This document begins with an introduction to the core literature that informed this research. This is followed by a discussion of the case study approach and methods used. The three papers make up Chapters 4, 5, and 6. Chapter 7 follows with an overarching discussion, conclusions, and recommendations.

As a fundamental aspect of life, water cuts across disciplines. The literature reviewed in Chapter 2, as well as the individual papers, details the interdisciplinary nature of the topics contained within this research. The case study approach taken (Chapter 3 and the individual papers) illustrates a detailed investigation of a complex socio-economic and ecological system.

Chapter 2. Introduction to the Literature

2.1. Overview

This research draws on several bodies of literature about infrastructure, water, and rural development. As discussed in Chapter 1, the challenges facing infrastructure systems are increasingly prominent. Infrastructure issues (e.g., the infrastructure deficit) are typically examined through a narrow lens, focused on financing (e.g., investment) and engineering (e.g., structure design, age). However, the recognized relationship between infrastructure and development suggests that infrastructure exists within the broader story of development, not only in the past, but in the present and future as well. Focusing on drinking water systems in rural BC, this research uses a broad lens, examining the relationship between infrastructure systems and regional development, the influences of past staples-based development, what management approaches exist at present, and the potential for a new approach (new regionalism) to support future resilient regions.

This chapter provides an overview of the literature reviewed for this dissertation, including sources related to: infrastructure, drinking water systems, regional development, staples theory, new regionalism, and regional resilience. Within this chapter, each body of literature is defined and discussed within the context of this research. Additionally, each of the three papers contains a specific literature review (see Chapters 4-6).

2.2. Infrastructure

There is no single agreed upon definition of infrastructure. This broad term can be defined by myriad characterizations (e.g., scale, purpose, governing body). While the term 'infrastructure' often conjures images of large, long lasting physical structures like bridges and buildings (i.e., hard infrastructure), infrastructure can also include non-tangible, service related systems and organizations such as education and health services (i.e., soft infrastructure) (CBCL Limited, 2012; Edwards, Bowker, Jackson, & Williams, 2009; Fulmer, 2009). Furthermore, infrastructure is an evolving term, demonstrated by electronic and cultural infrastructure being added to traditional infrastructure, such as roads, railways, and seaports (Dang & Duxbury, 2007; Ploeg, 2003; Vining & Richards, 2001).

For the purposes of this research infrastructure is defined as the built systems that connect communities to the goods and services needed to function and maintain or improve quality of life (CBCL Limited, 2012; Edwards et al., 2009; Pollalis, Georgoulas, Ramos, & Schodek, 2012). Specifically, this research focuses on drinking water systems in rural BC, further discussed in Section 2.3.

The rural context presents both unique challenges and opportunities for infrastructure. For example, the establishment of infrastructure is an initial hurdle to development in rural areas. A certain amount of infrastructure must be in place prior to development (e.g., transportation) (Ploeg & Holden, 2013). This is demonstrated by the 'Province Building' initiative that occurred under Premier W.A.C. Bennett (premier of BC from 1952 to 1972) and the federal 'Roads to Resources' program under Prime Minister Diefenbaker (prime minister from 1957 to 1963) – both focused on access to and development of natural resources, leading to development of rural areas (Breen, Markey, Daniels, & Vodden, 2015; Tomblin, 1990).

While urban issues and rural-urban interdependencies are important, rural specific challenges need to be understood and addressed (Federation of Canadian Municipalities, 2012a). How rural is defined varies across the literature, depending on the author and the subject (e.g., policy, demographics, culture), resulting in a continuum with 'rural' at one end and 'urban' at the other, allowing for different degrees of rurality (Markey, Halseth, & Manson, 2009). The rural context typically includes small populations spread over large spatial areas. As a result, the infrastructure challenges that exist in urban areas tend to be magnified in remote and rural communities because there is the need to build and maintain a full range of infrastructure, regardless of the supporting population size (Government of Canada, 2007; Locke, 2011). While urban and rural areas face infrastructure challenges, there are inherent limitations in rural areas that affect infrastructure differently. These include limited human and financial capacity, lack of economies of scale, physical geography (e.g., mountains), rising expectations for services, and shrinking tax bases (Breen, 2013; Dobbs et al., 2013; Federation of Canadian Municipalities, 2013a, 2013b; Minnes & Vodden, 2014; Robinson et al., 2008). These limitations can act as obstacles for development, adding costs as well as decreasing quality of life, impacting the ability of rural areas to attract and retain people (Burleton & Caranci, 2004; Federation of Canadian Municipalities, 2006; Government of Canada, 2007; Markey, Halseth, & Manson, 2012). These limitations, in particular those related to capacity, make the collection, and accuracy, of infrastructure data difficult, resulting in a poor understanding of the rural situation (Dobbs et al.,

2013; Federation of Canadian Municipalities, 2012c, 2013a). Despite these rural-specific considerations many reports generalize between rural and urban, resulting in a representation that is not an accurate reflection of either setting (External Advisory Committee on Cities and Communities, 2006; Ploeg, 2003). My research focuses specifically on the rural context.

Infrastructure links directly to the surrounding economy, environment, and quality of life. Development is accompanied and supported by critical infrastructure, which facilitates the production and movement of goods and people (Baldwin & Dixon, 2008; Fulmer, 2009; Swimmer, 2001; Vining & Richards, 2001). Without the necessary infrastructure systems in place economies would not grow to their full potential, nor would economies be competitive (Brodhead, Darling, & Mullin, 2014; Cautillo, Zon, & Mendelsohn, 2014; Kitson, Martin, & Tyler, 2004). Indeed there is much existing research that focuses specifically on infrastructure and economic productivity (e.g., Harchaoui, Tarkhani, & Warren, 2003; Ploeg & Holden, 2013; Vining & Weimer, 2001). Quality of life and standard of living are dependent on infrastructure through the contributions infrastructure makes to health, safety, security, and well-being of individuals and communities (Baldwin & Dixon, 2008; Coad, 2009; Dale & Hamilton, 2007; Kitchen, 2006; Pollalis et al., 2012). Infrastructure also has effects on environmental quality, in part because of the negative impacts infrastructure can have on the environment through poor design and neglect (Dale & Hamilton, 2007; Ploeg, 2004). For example, a life cycle analysis of water infrastructure shows how system energy use can produce greenhouse gas emissions, contributing to climate change (Karney & Dziedzic, 2015). While research exists exploring the relationships between infrastructure and the economy, quality of life, and environment, these aspects are typically examined separately. This research offers a holistic perspective, including all three.

Infrastructure in Canada has been characterized as a dire problem “of the same order as the accumulated federal debt” (The Canadian Council for Public-Private Partnerships & Mirza, 2009). Currently, the primary challenge is the infrastructure deficit (Burleton & Caranci, 2004; Connelly, Markey, & Roseland, 2009; Kennedy, Roseland, Markey, & Connelly, 2008; Mackenzie, 2013; Mirza, 2007a; Ploeg & Holden, 2013; Ploeg, 2003, 2004). Factors commonly cited as causal or related to the infrastructure deficit include: infrastructure age, institutional restructuring and policy change, lack of planning and asset management, financial issues (e.g., lack of investment, inadequate financial tools), contextual changes, and a growing disconnect between people and infrastructure systems (Burleton & Caranci, 2004; CBCL Limited, 2012; Coad, 2009; Connelly et al., 2009; Dale & Hamilton, 2007; Kennedy et al., 2008; Mackenzie, 2013; Maxwell, 2008; Mirza,

2007a; Mirza & Haider, 2003; Pollalis et al., 2012). While infrastructure is a foundation of society (Vanegas, 2003) there is a risk that infrastructure can lock communities and regions on to a specific, potentially unsustainable path (Connelly et al., 2009; Dale & Hamilton, 2007). However, within the challenge presented by the infrastructure deficit there is also opportunity. If reinvestment and rehabilitation must occur, there is an opportunity to reimagine infrastructure. This research frames the challenge of the infrastructure deficit as an opportunity to change the way infrastructure is approached in order to support future regional resilience.

Improving infrastructure (e.g., through technology, design, operations, management) can help preserve or improve environmental quality and facilitate behavioural change, as well as having the potential to enhance regional resilience (see Section 2.7) (Berkes & Ross, 2013; Mirza, 2007b; Robinson et al., 2008). **For the purposes of this research, sustainable infrastructure is the design, construction, and operation of infrastructure in ways that, at a minimum, do not diminish social, economic, and ecological functions presently and in the future, and enhance these functions where possible** (Dale & Hamilton, 2007; Pollalis et al., 2012). Additionally, beyond the infrastructure itself being sustainable, the design, operation, and management of infrastructure can act as a catalyst, strategy, or tool to reduce environmental impacts, aid in climate change mitigation and adaptation, and facilitate sustainability (Berkes & Ross, 2013; Choguill, 1996; Connelly et al., 2009; Kennedy et al., 2008; Robinson et al., 2008). While the importance of building resilience into infrastructure design is recognized as having the potential to facilitate the ability of a region to adjust and adapt (Berkes & Ross, 2013; Christopherson, Michie, & Tyler, 2010; Magis, 2010; Robinson et al., 2008), the largely unexplored links between regional resilience and drinking water systems are the focus of this research.

2.3. Drinking water systems

Access to water is a basic human right and is recognized in Canada as a basic service (Vining & Richards, 2001). Drinking water systems are among those infrastructure systems that provide a critical public service (American Water Works Association, 2001; Baldwin & Dixon, 2008; Government of British Columbia, 2001). As discussed above, drinking water systems play a role in to the economy (e.g., development), the environment (e.g., water quality), as well as to quality of life (e.g., health) (Bunch et al., 2014). The rationale for selecting drinking water systems

as the specific lens for this research arose from the findings of previous work in the case study region which identified drinking water as an important and timely topic (see Chapter 3).

Drinking water systems are comprised of multiple, interconnected hard and soft infrastructure elements, whose individual or collective failure can disrupt this critical service (Yazdani, Otoo, & Jeffrey, 2011). **For the purposes of this research, drinking water systems go beyond the treatment and distribution infrastructure to include the planning, operation, and management of these systems.**

From a jurisdictional standpoint the standards and regulations relevant to drinking water in Canadian provinces are largely set at the provincial level (Bakker, 2007). Prior to 1992 the *BC Health Act* regulated water quality in BC, but without explicitly addressing infrastructure (Office of the Provincial Health Officer, 2007). New standards and regulations were brought into effect in BC with the 2001 *Drinking Water Protection Act*, the *Action Plan for Safe Drinking Water* (2000), and the *Drinking Water Protection Regulation* (2003) – each contributing to regulations, standards, monitoring, and critical features of drinking water provision (Government of British Columbia, 2003; Office of the Provincial Health Officer, 2007). In BC there are required and discretionary standards for drinking water systems (British Columbia Ministry of Health, 2012), but there are few universally applied standards related to design, construction, materials, treatment methods, or additives (Christensen, 2011). The province is divided into five health authority regions, each of which acts as a regulatory body for drinking water systems (e.g., issuing permits, stipulating conditions) (Health Protection Branch, 2013; Interior Health Authority, 2006). The Kootenay Development Region, used as the case study for this research (see Chapter 3), is part of the Interior Health Authority (IHA) region.

Other provincial ministries (e.g., Community, Sport, and Cultural Development and Forests, Lands, and Natural Resource Operations) also play roles related to drinking water systems, either directly (e.g., funding) or indirectly (e.g., environmental regulation). For example, on February 29, 2016 Bill 18, BC's new *Water Sustainability Act* came into effect, bringing in new regulations related to environmental health and water quantity, such as stream health and aquatic environment and ground water regulation (Government of British Columbia, 2016b). At the provincial level it is important to note the split in regulation concerning water quality (primarily the responsibility of the health authorities) and quantity (primarily the responsibility of Forests, Lands, and Natural Resource Operations). Operators of drinking water systems are required to meet the regulations of both, however between, and even within, these branches of government there is a

lack of integration resulting in disjointed and conflicting regulations. It is also important to note that neither the IHA region, nor the regions covered by the other provincial ministries, align with the Kootenay Development Region or the other political or physical regions (e.g., watersheds). This is illustrative of the fragmented jurisdiction facing water management across Canada (Bakker & Cook, 2011; Pahl-Wostl, Gupta, & Petry, 2008) (see Chapter 3 for why the Kootenay Development Region was selected).

While regulation comes from the provincial level, the planning, operation, and management of drinking water systems takes place at the local level (Bish & Clemens, 2008). In BC local level drinking water governance can be complex. For example, systems are divided and regulated differently according to size (Government of British Columbia, 2003). One example of this difference is that that large systems, those serving over 500 people, require certified water operators, while small systems, those serving less than 500 people, do not (Government of British Columbia, 2003). Additionally, discretionary regulations mean that certain permits (e.g., construction permits) can be waived for small systems (Government of British Columbia, 2003). Within rural areas small systems are particularly common (Office of the Provincial Health Officer, 2000). Drinking water systems also vary in terms of who manages them. Systems can be managed by local governments (e.g., municipalities or regional districts), single service providers (e.g., water users communities), First Nations, or private systems (Government of British Columbia, 2003; Regional District of Central Kootenay, 2010). **For this dissertation I include both small and large systems regardless of source or design, but focus on those owned and operated by local governments.** There are also phantom systems that were initially intended to serve one or two consumers, but grew over time with little regulation or oversight (Regional District of Central Kootenay, 2010). Conditions and required permits vary by size and governance structure, as well as by source, design, and other factors at the discretion of provincial Drinking Water Officers (Regional District of Central Kootenay, 2010). Again fragmented governance, in this case between levels and branches of government, is considered a major challenge to the ability to manage water (Bakker, 2007; Bakker & Cook, 2011).

Increased municipal responsibility (see Section 2.4) resulted in an increased financial burden with decreased revenue, impacting all local infrastructure, including water systems (Bakker, 2007; Kennedy et al., 2008). In terms of funding support, local government systems are presently the only drinking water systems in BC that can access provincial and federal funding (Regional District of Central Kootenay, 2010). Additionally, there are concerns that service prices

are not always reflective of the true cost of service provision which, combined with reduced funding, contributes to past and present failures in infrastructure system maintenance (Butt, 2009; Roseland, 2012).

As noted above, sustainable communities are characterized by sustainable infrastructure. This includes water, with sustainable water systems contributing to the objectives of society while maintaining environmental quality (British Columbia Water and Waste Association, 2014; Heare, 2007; Pollalis et al., 2012; Robinson et al., 2008; Santora & Wilson, 2008). However, much of Canada's water infrastructure was constructed in the 20th century with economic development as the main focus and the only consideration given to water was that its abundance was a requirement for growth (Karney & Dziedzic, 2015). Given this history it is little surprise that infrastructure system design is now outdated, as are the perspectives and expectations created by this history (e.g., water shortages viewed as an impediment to growth as opposed to a natural limit) (Karney & Dziedzic, 2015). Beyond this there are many other challenges specific to rural drinking water systems, including, but not limited to, issues of decreased, or lack of, re-investment, adequate maintenance, and age (American Water Works Association, 2001; Karney & Dziedzic, 2015; Maxwell, 2008). Additionally, the provincial government in BC is perceived by some in rural areas as not being equipped to operate rural water systems, potentially putting rural users at a greater risk (Regional District of Central Kootenay, 2010).

This research explores the factors, past and present, which have contributed to the challenges presently facing rural drinking water systems (see Chapters 4 and 5). Additionally, this research also presents and explores an alternative management approach designed to help address these challenges while taking advantage of the opportunity the infrastructure deficit presents (see Chapter 6). The design of a new approach for water management has been attempted by others within the literature. For example, integrated water resource management emerged in the 1990s offering a widely recognized coordinated management approach (Mitchell, 2005). There are also examples of new and innovated approaches (e.g., the watershed governance prism) (Bunch et al., 2014). However, the combination of new regionalism (see Section 2.6) and regional resilience (see Section 2.7) and application to rural drinking water systems is novel.

2.4. Rural regional development

Regional development in rural Canada has been studied in detail. **Within this research regional development is defined as taking a territorial approach to planning and development, where development is understood in a comprehensive sense, including economic, social and environmental dimensions** (Markey, 2011b). Presently, the regional scale is experiencing a resurgence of interest in academic and policy discourses (Storper, 1999; Ward & Jonas, 2004). This resurgence is tied to the potential for regionalism to address issues of scale and capacity resulting from rural restructuring. Where rural communities face unique challenges related to factors like distance, economies of scale, and capacity to deal with the impacts of political or economic restructuring, regional development offers a potential counter to these limitations through collective action (Ivey, de Loë, & Kreutzwiser, 2006; Robins, 2007). Within this research the term **'region' is understood to operate at multiple scales, being both open and connected** (Christopherson et al., 2010; Pendall, Foster, & Cowell, 2009).

Canadian rural regional development is intertwined with staples theory (see Section 2.5). For example, prior to WWII there was no explicit, comprehensive regional development policy in Canada. In the absence of an explicit policy, rural exploration, development, and settlement were directed largely by the discovery and availability of natural resources (Barman, 1996; Conway, 2006; Innis, 1930). For thirty years following WWII regional development became an explicit priority in Canada as attempts were made to address regional disparities across the country (Beaumier, 1996; Polèse, 1999; Savoie, 2003; Weaver & Gunton, 1982). Both the federal and the BC provincial governments developed top down, centralized regional development approaches focused on natural resource extraction (Beaumier, 1996; Polèse, 1999; Savoie, 2003; Tomblin, 1990; Weaver & Gunton, 1982). As noted previously, the federal government under Prime Minister Diefenbaker and the provincial government under Premier W.A.C. Bennet targeted rural areas, with natural resource development providing funding for ongoing development building efforts, creating strong links between rural communities and resource development (Markey, Halseth, & Manson, 2006b, 2008a; Pringle, 2011; Tomblin, 1990). In the 1960s there were attempts at the federal level to diversify and develop secondary production, described by some as a rejection of the staples model (Douglas, 2013; Fairbairn, 1998; Polèse, 1999; Weaver & Gunton, 1982). While successful in some parts of the country, despite these efforts, natural resource reliance remained the economic foundation of rural BC.

Beginning in the 1970s, in response to the apparent failures of the top down, centralized approach to regional development, a new era of sector based development arose (Beaumier, 1996; Markey, Halseth, & Manson, 2007; Savoie, 2003). This shift, combined with the recession of the 1980s, brought about a thirty year period of rural restructuring (Beaumier, 1996; Polèse, 1999; Savoie, 2003). This period of restructuring reshaped the rural landscape through changes in investment patterns, governance, policies, and programs (Beaumier, 1996; Fairbairn, 1998; Savoie, 2003). During this period there were numerous changes in development approaches, as well as continued attempts to shift away from staples reliance (Howlett & Brownsey, 2007; Nelson, 2004; Pomfret, 1993). Downloading of responsibilities from upper to lower levels of government brought the dismantling of senior government and industry supports, a transition from top down to bottom up development resulting in communities being increasingly on their own in terms of development (Barrett, 2004; Beaumier, 1996; Bish & Clemens, 2008; Fairbairn, 1998; Polèse, 1999; Savoie, 2003). This isolation was underscored by the culture of competitiveness that had developed between communities following WWII (Markey, Halseth, & Manson, 2006a). Development programs and policies could now be seen coming from multiple levels (Markey, 2011a). Changes in context, such as globalization, decentralization, and free trade influenced development (Macleod, 2001), as did the rise and evolution of concepts such as resilience (see Section 2.7).

As discussed above, regional development has recently seen a resurgence of interest in academic and policy discourses – raising the question of what the next era in Canadian regional development will look like. In rural areas regional development offers the potential to counter some of the aforementioned challenges and limitations through collaboration between multiple, different actors (e.g., local government, community groups) (British Columbia Water and Waste Association, 2014; Ivey et al., 2006; Markey & Heisler, 2011; Robins, 2007). What is next for regional development is an interesting question, with the continued prominence of staples theory (see Section 2.5), but also the rise of new regionalism (see Section 2.6).

As noted above, infrastructure provides a foundation for society, including providing a foundation for regional development. The overlap between the two bodies of literature (infrastructure and regional development) includes the obvious and deliberate (e.g., investment spending targeting infrastructure to spur development) and the implicit (e.g., impacts to development as a result of new infrastructure and impacts to infrastructure from rural restructuring). Specific to drinking water, in addition to the role of drinking water as an essential

service and the other links between infrastructure and regional development, regional scale collaboration has the potential to help address water specific challenges. For example, collaborative regional-scale efforts are critical for addressing the identified challenge of fragmented governance stemming from, “the allocation of responsibility for governance among multiple actors and/or agencies, with relatively little or no coordination” (Hill, Furlong, Bakker, & Cohen, 2008: 316). Additionally, the use of regions, such as the watershed, as the basis for water management is noted within the literature as a best practice (McKinney & Johnson, 2009; Rothwell, 2006).

2.5. Staples theory

Natural resource extraction has been an important driver of regional development in BC and the rest of Canada, particularly in rural areas (Barman, 1996; Goldberg, 2004; Innis, 1930; Watkins, 2007). Innis’s staples theory offers an explanation of the pattern of development seen in rural Canada, describing the focus on natural resource exports as the leading economic driver, and recognizing the regional differences created by the varied spatial distribution of natural resources (Innis, 1930; Nelson, 2004; Pomfret, 1993; Watkins, 1963). Staples theory is described as both a framework for analyzing political, social, and economic history, as well as an explanation of economic growth (Watkins, 1963). Additionally, staples theory provides the rationale for the most common approach to Canadian economic development, beginning with its initial application to cod and the fur trade, and evolving to modern day application to timber, minerals, hydroelectricity, and oil and gas (Pomfret, 1993). Rurally, staples-led development describes an overreliance on a single industry, leading to ‘boom and bust’ cycles, as well as weak adaptive capacity, and overexploitation of resources (Clapp, 1998; Gunton, 2004; Markey, Pierce, Vodden, & Roseland, 2005). **Within this research staples theory provides a foundational explanation for how rural regions in BC developed, providing a common thread throughout periods of rural regional development, and identifying some of the challenges associated with staples-led development in terms of growth, infrastructure development, and renewal.**

During the post WWII boom, staples-led development resulted in regional development being closely tied with the resource industries. However, these ties were disrupted by rural restructuring, which saw the social contract that tied resource development to the social fabric of rural regions fragmented (Markey et al., 2008a). Additionally, as discussed in Section 2.4, evidence of past shifts in regional development has been used to challenge the application of

staples theory to the Canadian economy (Markey et al., 2005; Watkins, 1963; Weaver & Gunton, 1982). However, these shifts away from staples dominance were predominantly urban, whereas in rural areas staples reliance persisted (Drache, 2014; Howlett & Brownsey, 2007; Nelson, 2004; Storey, 2010; Weaver & Gunton, 1982). Staples theory remains an important economic explanation, one that helps us clearly understand the role of natural resources in rural regional development.

Staples-led development has been both an implicit and an explicit driver of rural regional development in rural BC and Canada. Periods of explicit staples development created a close tie between economic and social development, as well as a tight relationship between rural regions and resource development (Markey et al., 2008a). While a period of rural restructuring saw deliberate and unintentional attempts to shift away from staples reliance (Howlett & Brownsey, 2007; Markey et al., 2005; Nelson, 2004; Pomfret, 1993), even as the federal development approach shifted from a regional to sector-based perspective, the importance of staples continued (Beaumier, 1996; Weaver & Gunton, 1982). Arguably, a continued focus on staples-led development continues in BC today. However, despite the persistence of staples-led development, changes (i.e., rural restructuring) mean that the rural economic landscape has evolved. These differences are demonstrated in the changed relationships between rural communities with government and industry, as well as between communities themselves. As noted above, this raises questions around what is next for rural regional development in Canada.

2.6. New regionalism

From the rural restructuring of the 1980s, the rise of proactive local actions, and a changing political and economic context there came a reconceptualization of regional development that emerged in the late 1980 and early 1990s (Buzdugan, 2006; Hettne et al., 2000; Kitson et al., 2004; Macleod, 2001; Markey, 2011a; Perrin, 2012; Wheeler, 2002). This resurgence, or 'new regionalism', differs from past regional development approaches in terms of an overall change in governance approach from top down or bottom up to a collaborative, co-constructed model, as well as the inclusion of new factors (e.g., place), and an emphasis on flexibility and competitive advantage (Buzdugan, 2006; Ethier, 1998; Jonas, 2011; Perrin, 2012). While new regionalism focuses on the region as the preferred unit of planning, analysis, and action, 'the region' is not one static unit, but rather multiple, different, potentially overlapping regions (Amin, 1999; Fawcett, 2004; Heisler, 2012; Hettne & Inotai, 1994; Rainnie & Grobbelaar,

2005; Tomaney & Ward, 2000). **Within this research, new regionalism provides a foundation for employing the regional scale, as well as providing an integrating framework linking water and regional resilience. For the purposes of this research, new regionalism is defined as a collaborative, integrated approach to development taking place at a sub-national regional scale.** As this research builds on the existing *Canadian Regional Development* project (see Chapter 3), their parameters for defining new regionalism were used – essentially focusing on five key themes: collaborative governance, innovation and learning, integration, place, and rural/urban relationships (Vodden, Markey, Douglas, & Reimer, 2015).

Many of the challenges related to infrastructure are reflective of the need for attention to the themes of new regionalism, such as the need for innovation, partnerships, collaboration, and links with economic competitiveness (Markey et al., 2012; Ward & Jonas, 2004). Beyond infrastructure, new regionalism is noted as having potential relevance for source water protection, as well as for management of drinking water (Minnes, 2012).

Other alternative approaches, such as integrated water resource management, take a regional scale approach, as well as using elements similar to new regionalism, such as coordination, multi-level decision-making, and integration (Cohen, 2012; Vinke-de Kruiff & Ozerol, 2013). However, new regionalism provides a more inclusive scope. Past research has noted that new regionalism offers an evolution of regionalism towards a regional development approach where management institutions cooperate in multiple matters (e.g., economic growth, environmental protection) (Peterson, Mcalpine, Ward, & Rayner, 2007).

The application of new regionalism to water is not new. For example, in Australia new regionalism was applied to planning for water quality improvement (Peterson et al., 2010). However, the application of new regionalism specifically to rural drinking water infrastructure, as seen in this research, is novel, particularly given the gap in new regionalism literature related to rural applications. The aforementioned five themes of new regionalism identified by the *Canadian Regional Development* project relate to drinking water. For example, there is the need for drinking water systems to be place specific (Pollalis et al., 2012; Robinson et al., 2008), as well as a need for place specific water governance structures and legislation (Hirokawa, 2011). The literature also notes the need for alternative governance frameworks for drinking water systems that differ from existing approaches which lack integration (Nowlan & Bakker, 2007; Sarte, 2010), the need for a comprehensive, integrated approach to water (Dang & Duxbury, 2007; Pollalis et al., 2012), the need to identify interdependencies between rural and urban areas (e.g., shared watersheds),

and the need for innovation within drinking water systems to create solutions, technical and otherwise (Bakker, 2007; Bakker & Cook, 2011; Breen & Minnes, 2015; CBCL Limited, 2012; Maxwell, 2008).

As described in Section 2.4 and illustrated in Figure 1, the first thirty year period post WWII may be defined in terms of staples-led regional development (Hayter, 2000; Weaver & Gunton, 1982). Following a roughly thirty year period of rural restructuring, which dismantled or weakened many of the institutional frameworks developed during the post-war period, new regionalism may now offer an alternative approach to rural regional development (Savitch & Vogel, 2000). Staples theory, as described in Section 2.5, remains an important and relevant characterization of rural economic development. New regionalism, as a new approach to development, is compatible with the tenets of staples theory, building on a clear understanding to the past. This is, for example, particularly relevant to new regionalism's inclusion of place-based development, wherein interventions seek to reveal, utilize, and enhance the unique endowments of a location (e.g., natural resources) (Markey, 2011b).

2.7. Regional resilience

Resilience is a term that has evolved to be used by multiple disciplines with different definitions, and applied in various ways, offering potential for addressing complex issues, particularly where there is overlap between socio-economic and ecological systems (Davoudi et al., 2012). The variance in definition has allowed for different conceptions of resilience to be applied to different circumstances (Martin, 2012). This research focuses on a social science use and application of resilience, specifically at the regional scale – rural regions and environmental resources (Adger, 2000). **For the purposes of this research regional resilience includes the ability of a rural region to successfully cope with or resist (short term) and adapt (long term) to change. In this use, the pursuit of regional resilience is an ongoing process as opposed to a specific outcome** (Boschma, 2014; Christopherson et al., 2010; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008; Pendall et al., 2009; Skerratt, 2013). Under this definition regional resilience is less about 'bouncing back' to a particular point in order to stay the same, but rather it is focused on 'bouncing forward' through a process that includes recovery and re-orientation existing paths and the development of new paths (Boschma, 2014; Bristow & Healy, 2013; Scott, 2013). Resilient regions are not only economically successful, but are able to maintain success over time (Christopherson et al., 2010).

Path dependence and lock in are two elements critical to regional economic adaptation (Hassink, 2010). Path dependence is where outcomes evolve as a consequence of existing process or history, while lock in is where a combination of history and self-reinforcing effects steer an economy down one path as opposed to another (Hassink, 2010). Both path dependency and lock in are common within rural regions. To be considered resilient, regional economies must have the capacity to withstand or recover from disturbances to their developmental growth path, undergoing changes as necessary to their economic and other structures and institutions in order to either maintain their previous development path or transition to a new path (Martin & Sunley, 2014). It is this path creation, or ability to transform, that allows rural regions the ability to respond to disturbances (Scott, 2013).

It is noted in the literature that resilience offers a useful lens for rural studies (Scott, 2013), providing an opportunity to reframe rural development, policy, and practice. This research also reinforces the need to integrate the concept of resilience into the study of regional development identified by Martin and Sunley (2014). Additionally, resilience management seeks to identify potential stresses, as well as points of intervention where it is possible to increase resilience (Milman & Short, 2008). For this research the focus is on drinking water systems as a point of stress. Specifically, **this research examines regional resilience as it relates to drinking water systems at the regional scale.**

Resilience is a conceptual tool that assists in dealing with change (Berkes & Ross, 2013). Resilient regions must be able to recognize and address internal and external links, particularly as globalization has made regions more permeable to outside effects (Christopherson et al., 2010; Martin & Sunley, 2014; Maybery, Pope, Hodgins, Hitchenor, & Shepherd, 2009). Inclusion of the social or human element in resilience means there is a role for consideration of place and context - that resilience comes from not only structural conditions, but from the decisions of people (Bristow & Healy, 2013). From this perspective drinking water systems are not only pipes and pumps, but the human element as well – the planning, operation, management, and use. Additionally, traditional management approaches often assume things are static and unchanging (Resilience Alliance, n.d.). By incorporating regional resilience, this research builds in an assumption of future change.

Modern infrastructure is one factor that can enable a region to adjust, respond, and adapt over time (Berkes & Ross, 2013; Christopherson et al., 2010; Magis, 2010; Pollalis et al., 2012). Given this link, it is reasonable to consider infrastructure as one factor that influences regional

resilience (Bradford & Wolfe, 2010). It is possible that a regional approach could result in more sustainable infrastructure and environmental protection while providing services (Zumpano, 2008). The need for infrastructure to evolve toward resilience has been identified (Santora & Wilson, 2008). However, infrastructure and resilience are also linked negatively through the infrastructure deficit, which is currently an impediment to resilience (External Advisory Committee on Cities and Communities, 2006; Hamilton & Dale, 2007; Robinson et al., 2008). For example, a deficient drinking water system may not support new economic development opportunities, or may fail to protect a community from a natural disaster (e.g., wildfire). Additionally, because of the long life span of infrastructure, it can contribute to path dependence and lock in, hindering economic restructuring.

While much of the regional resilience research focuses on economic dimensions, there is a need to explore the concept in other domains (Martin & Sunley, 2014), particularly in rural areas where dependence on natural resources provides a link between social and ecological resilience as social systems remain reliant on ecological systems (Adger, 2000). Water is a critical resource and drinking water systems are subject to short term shocks as well as the long term need to adapt to changes. Water infrastructure strongly affects many components of communities – such as system layout and firefighting capacity - although municipalities often underestimate this broader perspective and related data are sparse (Karney & Dziedzic, 2015). Drinking water systems can impact not only the community, but also the surrounding region (e.g., through watershed dynamics or impacts on regional economies). Linking resilience and water management is not new, as many watershed based management approaches recognize the need to understand relationships within a system (Hager et al., 2013). Drinking water systems provide a point of interaction between different scales and elements in a region. As noted above, water systems may also be a limiting factor for regional resilience. However, there are examples of how good water governance can enhance resilience (Booher & Innes, 2010) and where resilient watershed approaches understand and account for links between ecological and social systems (Hager et al., 2013).

While new regionalism is noted by some as providing an opportunity for a more holistic perspective on regional development, the emphasis is often on the socio-cultural and economic dimensions of development (Perrin, 2012; Rainnie & Grobbelaar, 2005; Rast, 2006). Resilience, as a concept stemming from ecology that recognizes connections between socio-economic and environmental systems, offers a more robust inclusion of environmental considerations (Bristow,

2010). New regionalism and resilience are complementary, sharing common characteristics while also addressing gaps and reinforcing each other. By combining the two, this research offers the strengths of both. New regionalism and resilience share commonalities such as the importance of place and innovation. New regionalism provides structure in terms of approach as well as a focus on the regional scale. Resilience dovetails with this, while further emphasizing environmental dimensions. By combining regional resilience and new regionalism I hope to offer a more balanced perspective than what is offered by more typical approaches to drinking water systems management.

Chapter 3. Methods and Case Study Overview

3.1. Foundational research

This research builds on the work of a collaborative research project called *Canadian Regional Development: A Critical Review of Theory, Practice and Potentials (Canadian Regional Development)*, which the author of this dissertation worked on as a research assistant and contributing author. The *Canadian Regional Development* project was an investigation of how Canadian regional development has evolved over the past two decades, and the degree to which Canadian regional development has incorporated new regionalism into policy and practice (Vodden et al., 2015). The *Canadian Regional Development* project used a mixed methods case study approach, selecting four case study regions based on criteria characteristic of rural Canada in order to increase the likelihood that findings would be transferable to other areas in rural Canada. Case study regions were selected based on the following characteristics:

- i. Clearly delineated region with overlapping jurisdictions and sub-regions (in order to reflect rural regional complexity);
- ii. Remote relative to major decision-making centres and major urban influences;
- iii. Connected via ground transportation networks;
- iv. Historically natural resource based economy;
- v. Low density; and
- vi. Sparse population.

Initial findings from the *Canadian Regional Development* project identified drinking water systems as an important topic within the Kootenay Development Region - one of the four case study regions (Breen, 2012). This finding is in line with the findings from other research within the region that cites drinking water as an issue of importance (Hamstead, 2014).

In addition to the *Canadian Regional Development* project, Papers 2 and 3 build on the work of the *Newfoundland & Labrador and British Columbia Comparative Water Study (NLBC)*, which the author of this dissertation also worked on as a research assistant and contributing author. The *NLBC* project also built on the *Canadian Regions* project, using two of the four case study regions, the Kootenay Development Region and the Kittiwake Region of Newfoundland and Labrador. The *NLBC* project had two objectives, i) to complete a comparative study examining the role of local government in drinking water management, and ii) to explore the potential for a regional approach to drinking water management (Breen & Minnes, 2015). The literature review

from the *NLBC* project contributed to the resilience indicator list used for Paper 2 in this dissertation, and the lessons learned from the *NLBC*'s exploration into regional approaches were used as the foundation for the proposed new regionalism approach to drinking water management examined in Paper 3.

3.2. Case study approach

As the research questions asked in this dissertation are exploratory, a flexible research method was required. Case studies are recognized as being well-suited to situations where researchers are seeking to learn the how and why of events, where the researchers have little control over the events in question (Yin, 2009). Case studies are also well suited to complex situations, as well as studying dynamic phenomena in real time in a real life setting (Berg, 2009; Yin, 2003). The above description of a somewhat unknown, complex situation over which the researcher has little control applies well to this research on the connections between rural drinking water systems, regional development, and regional resilience.

While case studies can be qualitative, quantitative, or both (Eisenhardt, 1989; Eisenhardt, 1991; Yin, 1981), qualitative research is well suited to discovery, description, and understanding (Quimby, 2012). Using a case study approach allows for the identification of key players and relationships within a particular situation and can generate narrative based descriptive data (Martin & Sunley, 2014). This type of exploratory research sets the stage for future research that is more predictive or based on hypothesis testing (Trochim, 2006). Again, as noted above, the unknowns of the situation on the ground with respect to drinking water systems lend themselves to this type of exploratory, narrative approach.

In an exploratory, qualitative case study, smaller, targeted samples are used, as opposed to larger, distributed, statistically significant samples (Quimby, 2012). Case studies typically combine data collection methods, such as interviews and observations, which may be qualitative or quantitative, or both (Eisenhardt, 1989; Eisenhardt, 1991; Yin, 1981). As this research builds on existing research (see Section 3.1) the decision was made to continue using a case study approach for this dissertation, focusing on one of the existing case study regions (the Kootenay Development Region – see Section 3.3) and continuing the mixed-method case study approach. This allows for this research to build on the knowledge and lessons learned from past research, and also to benefit from a multi-year, long term research project offering in-depth knowledge of

the region. Additionally, using a case study region that meets criteria characteristic of rural Canada increases the likelihood that findings will be generalizable and transferable to other places, at least to some extent, recognizing that context matters.

3.3. Conceptual framework

The conceptual framework for this research combines three major theoretical approaches: staples theory, new regionalism, and regional resilience (see Chapter 1, Figure 1). Each paper uses a different element of this conceptual framework as its theoretical base. Each of the three papers provides the specific details that relate that paper to the conceptual framework, and describes the specific theoretical framework used in the paper (see Chapters 4-6).

As noted in Section 3.2, this research is descriptive and exploratory, as opposed to predictive. While the fact that the case study region is reflective of characteristics typical of rural Canada allows for the potential of generalization and transferability, the context-specific nature of case study research is indicative that this framework is not meant to be a reproducible experiment, but rather to provide a repeatable framework and process that could be applied elsewhere, modifying for local conditions as required.

3.4. Kootenay Development Region

The Kootenay Development Region (the Kootenays) is the case study chosen for this research, building on the *Canadian Regional Development* project. The Kootenay Development Region is a provincially identified economic development region in south-eastern BC comprised of three regional districts – a form of local government (see Figure 2). The region is 57,786.6 km², or approximately 6% of British Columbia's land mass, with a dispersed rural population of approximately 146,000 (3% of the provincial population) (BC Stats, 2012a). The region is mountainous, with varied terrain and ecosystems. The Kootenays are water rich, with the region being home to the Canadian portion of the Columbia River Basin. Economically, the region has a long history of reliance on staples (i.e., natural resource) products, from mining to forestry to hydroelectricity.

Within the Kootenays, drinking water systems range in terms of size, system service area, governance structure, and other factors. The exact number of drinking water systems in the region

is unknown and there is no exhaustive inventory. The provincial regulatory body for drinking water in the Kootenays and adjacent areas is the Interior Health Authority (IHA). IHA lists 123 large water systems and 1,800 known small water systems in their region (see small versus large water systems in Section 2.3) (Norlin, 2014). However, IHA also recognizes that there are an unknown number of additional systems within the Kootenays (Norlin, 2014).

This research includes both small and large systems, but predominantly focuses on those systems that are owned and operated by local governments (i.e., municipalities and regional districts). While there are First Nations communities within the region, these systems are considered outside the scope of this research as a result of differences in management and jurisdiction, as are single user systems (e.g., individual wells). Further regional details specific to each paper are discussed in Chapters 4-6.

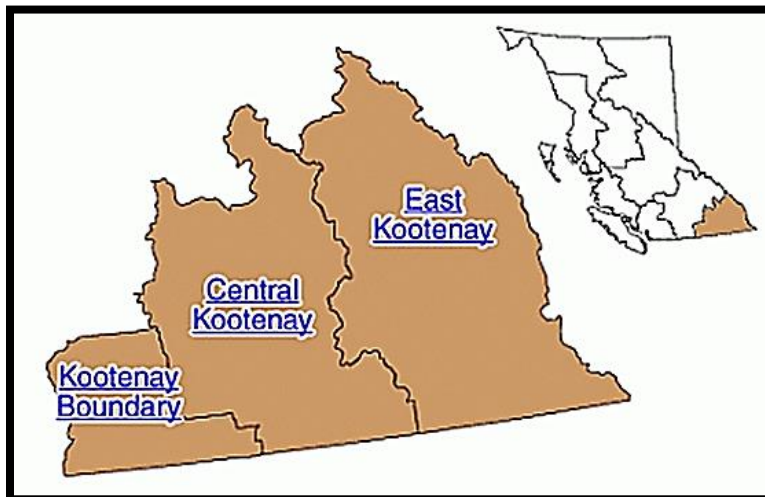


Figure 2: The Kootenay Development Region (Government of British Columbia, n.d.)

3.5. Data collection and analysis

Several data collection methods were used in this research. A major review of several different bodies of literature (see Chapter 2) provided the background and contextual information used to frame this research. Additionally, multiple research visits to the case study area between 2011 and 2015 allowed the researcher to become familiar with the nuances of the region.

Each of the three papers has a specific data collection method: semi-structured interviews (Paper 1), document content analysis (Paper 2), and interviews/questionnaires (Paper 3). All data

were examined qualitatively using NVivo qualitative analysis software, providing a narrative of how several complex subjects interrelate (Morse & Richards, 2002). The specific analysis methods used in each paper are discussed in detail in Chapters 4-6, with an overview provided below.

Paper 1 analysis is based on interviews with individuals related to the planning and management of small and large drinking water systems in the region, including local governments, as well as regional, provincial, and federal organizations involved with drinking water infrastructure. Semi-structured interviews were conducted using an open-ended question guide (see Appendix B) (Berg, 2007; Eisenhardt, 1989; Spradley, 1979). Between 2011 and 2014, 44 semi-structured interviews were conducted with 49 people, representing different branches of 32 different organizations. Interviewees were identified through a targeted internet search of relevant organizations. Interviews were requested via phone and/or email and the majority of interviews were conducted in person, with the remainder conducted over the phone.

Paper 2 used a content analysis approach to analyze planning documents related to drinking water systems (Berg, 2007). Documents selected related to the organizations represented in the interviews conducted for Paper 1. At this stage, due to the large number of small, non-governmental, drinking water systems and the lack of information about these systems, as well as the fact that the governance structures for these systems were different than those of the larger systems, the decision was made to focus the remainder of the research on only those drinking water systems under the purview of local governments (i.e., municipal and regional districts). Planning documents, relevant legislation and regulations, and other documents were analysed using indicators of regional resilience compiled based on the *NLBC* project literature review (see Appendix C). These indicators were reviewed by the *NLBC* team. In total, 27 publically accessible documents were collected and analysed.

Paper 3 analysis is based on interviews with individuals associated with local government drinking water systems and supporting regional, provincial, and federal organizations. A questionnaire comprised of closed and open ended questions was used in an interview style conversation either in person or over the phone with interested individuals (see Appendix D) (Dillman, Smyth, & Christian, 2009; Eisenhardt, 1991; Gregory, Johnston, Pratt, Watts, & Whatmore, 2009). A combination of the results from Papers 1 and 2, as well as the lessons from the *NLBC* project, were used to propose an alternative, regional management approach for drinking water systems. To maintain consistency with Papers 1 and 2, the target individuals were

from organizations included in Paper 1 and Paper 2, where possible. A list of potential respondents was drawn up from those who had participated in interviews from Paper 1 and organizations responsible for the documents included in the content analysis in Paper 2. Requests were made via phone or email, and the majority of the interviews were completed in person. In 2015 a total of 20 interviews were conducted with 22 people, representing 15 organizations.

3.6. Limitations

One of the major challenges and potential limitations of this research is data access (e.g., planning documents that are made publicly available and easily accessible versus those that are not). There are also communities within the region that were not included, either because the targeted representatives declined to participate or as a result of constraints (e.g., time and finances). In terms of generalizability, the Kootenay region has some unique characteristics, both cultural and physical (e.g., sheer number of water systems). As a result, while there are transferable lessons to other rural areas, there are many elements that are likely to be unique to the Kootenays. The limitations specific to each paper are discussed within the individual chapters (Chapters 4-6).

Chapter 4. Paper #1: Unintentional Influence: Exploring the Relationship between Rural Regional Development and Drinking Water Systems in Rural British Columbia, Canada

Abstract:

Rural drinking water systems face a number of challenges, not the least of which is a growing infrastructure deficit. While age and investment are typically highlighted as key factors influencing the infrastructure deficit, other pervasive challenges remain for rural drinking water systems in British Columbia, Canada. This raises the question of whether factors influencing the infrastructure deficit extend beyond those typically captured in the literature. The purpose of this paper is to examine the relationship between rural regional development and drinking water systems in order to provide a historically and theoretically informed lens on the relationships between the two and how these links influence present day challenges. The authors aim to temper the presentism that often characterizes current debates surrounding the infrastructure deficit and to frame current drinking water system challenges within a more contextually-informed and regionally integrated framework.

Keywords: drinking water; infrastructure; staples theory; rural; regional development

4.1. Introduction

Drinking water systems are critical infrastructure, providing a service that impacts the economy, the environment, and quality of life. However, drinking water systems in British Columbia (BC), Canada, face a range of challenges, including aging infrastructure, inadequate treatment infrastructure, difficulty retaining certified operators, and a lack of financial resources (Health Protection Branch, 2013; Ministry of Health Planning & Ministry of Health Services, 2002; Office of the Provincial Health Officer, 2011). These challenges are recognized as being particularly problematic in rural areas in BC, as well as across rural Canada and North America (American Water Works Association, 2001; Maxwell, 2008; Minnes & Vodden, 2014).

Unsurprisingly, drinking water systems are recognized as part of Canada's 'infrastructure deficit', defined as the gap between current investment levels and what is needed to maintain and

upgrade existing infrastructure assets, excluding any additional investment necessary to address new infrastructure requirements (American Water Works Association, 2001; Coad, 2009; Federation of Canadian Municipalities, 2012a, 2012b; Kennedy et al., 2008; Markey, Connelly, & Roseland, 2010; Meligrana, 2003; Mirza, 2007b; Roy, 2008; Ryser, Markey, & Halseth, 2014). Literature discussing the 'infrastructure deficit' typically highlights influencing factors like infrastructure age and decreased investment (Burleton & Caranci, 2004; Federation of Canadian Municipalities, 2012a, 2012b; Kennedy et al., 2008; Mirza, 2007b; Roy, 2008). Despite targeted federal and provincial (re)investments in infrastructure, problematic drinking water systems remain a pervasive issue in rural BC, exemplified by ongoing water advisories (Interior Health Authority, 2013, 2014a, 2014b, 2014c). This raises the question of whether the factors influencing the present challenges faced by rural drinking water systems extend beyond those typically captured by the 'infrastructure deficit'.

The purpose of this paper is to examine the relationship between regional development and drinking water systems in order to apply a historically and theoretically informed lens to the development of rural drinking water systems in rural BC. By offering this perspective we aim to make two contributions to the current discourse: a) to temper the presentism that often characterizes current debates surrounding the infrastructure deficit; and b) to frame current drinking water system challenges within a more contextually-informed and regionally integrated framework. Through this approach we offer a perspective that is informed by the past, with a better understanding of where infrastructure challenges come from, how they developed, and how this contextually and historically informed perspective might assist with solutions.

Our theoretical framework focuses on rural regional development and staples theory. We apply this framework for two reasons. First, drinking water systems do not exist in isolation from the communities they serve, raising questions about the relationship between drinking water systems and regional development. And second, staples theory provides a robust theoretical foundation that encompasses the development trajectory of rural resource-based communities in BC and across Canada. We apply this framework to a case study of drinking water systems in rural BC, specifically the Kootenay Development Region, which exemplifies both the aforementioned challenges surrounding drinking water systems, as well as characteristics typical of other rural regions across the country. The paper begins by providing an overview of the literature framing this research: staples theory, regional development, the infrastructure deficit, and drinking water systems. This is followed by a presentation of the research methods and case

study region. Next we present our findings, followed by our conclusions and implications for future research. The research upon which this paper is based is part of a larger cross-Canada investigation into rural regional development entitled *Canadian Regional Development: A Critical Review of Theory, Practice and Potentials*.

4.2. Literature Review

4.2.1. Staples Theory and Rural Regional Development

Within the context of our research, staples theory provides a foundational explanation for understanding how rural regions in BC developed. Staples theory provides a common thread throughout different periods of rural regional development⁴, and helps to identify some of the challenges associated with staples-led development including infrastructure development and renewal.

In BC, as with the rest of Canada, the underlying driver of regional development has been natural resource (i.e., staple) extraction and exploitation (Barman, 1996; Drache, 2014; Goldberg, 2004; Innis, 1930; Watkins, 2007). Innis' staples theory offers an explanation of this pattern of development, describing the focus on natural resource exports as the leading economic driver, and recognizing the regional differences created by the varied spatial distribution of natural resources (Innis, 1930; Nelson, 2004; Pomfret, 1993; Watkins, 1963). Staples theory is described as both a framework for analyzing political, social, and economic history, as well as an explanation of economic growth (Watkins, 1963). Staples theory is noted as the most common, albeit not the only, approach to Canadian economic development, beginning with its initial application to cod and fur, and evolving in application to timber, wheat, minerals, hydroelectricity, and oil and gas (Pomfret, 1993). From a rural perspective, the staples-led development described by staples theory resulted in overreliance on single industries, providing periods of growth but eventually leading to economic instability, weak adaptive capacity, and overexploitation of resources (Clapp, 1998; Gunton, 2004; Markey, Pierce, Vodden, & Roseland, 2005).

⁴ For the purposes of this paper, regional development is defined as taking a territorial approach to planning and development, and while the focus is often driven by an economic imperative, development is understood to take a comprehensive perspective, including social and environmental dimensions.

From confederation to World War II (WWII) there was no explicit regional development policy in BC or Canada. In the absence of a regional development policy, exploration and settlement in rural BC was ad hoc, directed by the availability of natural resources as explained by Innis' staples theory (1930). As a result of the lack of explicit and coordinated development approaches, combined with other factors (e.g., small population), initial rural regional development in BC was minimal (Barman, 1996; Conway, 2006). Disparities between regions were initially noticed during the depression of the 1930s, however explicit attempts to address these disparities did not begin until after WWII (Polèse, 1999).

Explicit regional development became a priority in the post WWII period, as attention turned to the previously identified regional disparities, highlighting a need to address gaps in income and unemployment, as well as identifying opportunities for growth (Beaumier, 1996, 1998; Savoie, 2003; Weaver & Gunton, 1982). Consequently, the federal government adopted a centralized, top down regional development approach, establishing government bodies like the federal Department of Regional Economic Expansion (Beaumier, 1996; Polèse, 1999; Savoie, 2003; Weaver & Gunton, 1982). As these top down approaches to development arose, both the federal and the provincial governments deliberately and explicitly focused on staples-led development.

The BC provincial government, under the W.A.C. Bennett government, also took a largely centralized, top down approach to addressing disparities within the province, in particular the targeted opening up and development of rural BC (British Columbia Ministry of Community Sport and Cultural Development, n.d.-a; Markey et al., 2006b, 2008a; Pringle, 2011; Tomblin, 1990). While the Province used resource development in rural areas to fund ongoing province building, they also invested in rural areas, creating strong links between staples-led economic development and social development, resulting in tight relationships between rural regions and resource development (Markey et al., 2008a).

In the 1960s federal advisors attempted to reject the staples model in favour of pursuing a more diversified economy (Fairbairn, 1998; Weaver & Gunton, 1982). To some degree there was a shift to secondary production in Canada, as new regional development programs and policy instruments were instituted and certain parts of the country (e.g., Ontario) focused increasingly on the manufacturing sector (Douglas, 2013; Fairbairn, 1998; Polèse, 1999; Weaver & Gunton, 1982).

Regional development also changed, having remained a priority into the 1970s with continued belief that regional disparities could be addressed through centralized, top down approaches (Beaumier, 1996; Polèse, 1999). However, toward the end of the 1970s it became apparent that the federal government could not solve the issue of regional disparities. This perceived failure, combined with other factors such as the 1980s recession, resulted in the dismantling of the centralized, top down federal approaches to regional development (Beaumier, 1996; Markey, Manson, & Halseth, 2007; Polèse, 1999; Savoie, 2003). Similarly in BC, the end of the Bennett era and the beginning of a new political era in the 1970s indicated a transition to a new approach to development. However, regardless of efforts to shift the economy and changes in development approach, natural resource extraction remained the economic foundation of BC, a continuation of staples-led development.

4.2.2. Rural Restructuring and the Regional Resurgence

The post WWII 'long boom' was a thirty year, relatively stable period of deliberate staples-led regional development (Hayter, 2000; Weaver & Gunton, 1982). However, beginning with the recession of the early 1980s, there is reasonable consensus surrounding a thirty year period of restructuring where development shifted away from regional approaches and much of the established hard and soft regional development infrastructure from the long boom was dismantled (Beaumier, 1996, 1998; Polèse, 1999; Savoie, 2003). This restructuring reshaped the rural landscape through changes in investment patterns, governance, policies, and programs (Beaumier, 1996; Fairbairn, 1998; Savoie, 2003).

During this period of restructuring there is evidence of continued changes in development approaches, as well as both deliberate and unintentional attempts to shift away from staples reliance (Howlett & Brownsey, 2007; Markey et al., 2005; Nelson, 2004; Pomfret, 1993). This shift has been used to challenge the use of staples theory to describe the Canadian economy (Markey et al., 2005; Weaver, 1982; Watkins, 1963). However, even as the federal development approach shifted from a regional to sector-based perspective, the emphasis on natural resources continued (Beaumier, 1996; Weaver & Gunton, 1982). Any shifts away from staples products were primarily through urban diversification, as opposed to in rural areas where there remained a persistent reliance on a staples-based economy (Howlett & Brownsey, 2007; Nelson, 2004; Weaver & Gunton, 1982). Arguably, a continued focus on staples-led development continues today in BC.

However, a clear change has been the shift away from strong, top down government leadership (Drache, 2014; Storey, 2010).

Tighter fiscal policies prompted the downloading of responsibilities from upper to lower levels of government. Responsibilities traditionally held by senior governments increasingly shifted to local governments, who struggled with the dismantling of senior government and industry-oriented supports that had closely linked rural communities to resource development (Bish & Clemens, 2008; Polèse, 1999). As communities increasingly found themselves 'on their own' in terms of development there was a transition toward more decentralized, bottom up, context driven development approaches (e.g., Community Economic Development) (Barrett, 2004; Beaumier, 1996; Fairbairn, 1998; Polèse, 1999; Savoie, 2003).

Development programs and policies, once directed from the upper levels of government, could now be seen coming from multiple levels (Markey, 2011). Globalization, decentralization, deregulation, privatization, establishment of free trade agreements, improvements in technology, and many other factors resulted in changes to regional development approaches (Macleod, 2001). This period also saw the rise of concepts such as sustainable development⁵ and resilience⁶, inviting the inclusion of environmental and social values into what had been traditionally economic development (Folke, 2006; Roseland, 2000). During this period there was a broadening of the term development, to extend beyond economic and to focus on change as opposed to strictly focusing on growth (Roseland, 2012).

Despite these changes, the restructuring era in BC was largely characterized by deregulation and multiple, short-term, failed development projects (Markey et al., 2005). This period of restructuring saw government cutbacks, downloading, and overall changes in governance structure. However, staples theory remains important as an economic explanation, albeit differently than in the past. Restructuring brought a disruption of past regional development approaches, as well as changes to the relationships between rural regions and natural resource industries where despite its continued importance, the social contract that tied resource

⁵ For the purposes of this paper sustainable development is understood broadly as meeting the needs of the present without compromising the ability of future generations to do so (World Commission on Environment and Development, 1987).

⁶ For the purposes of this paper resilience is defined as the "capacity of a regional or local economy to withstand or recover from market, competitive and environmental shocks to its developmental growth path, if necessary by undergoing adaptive changes to its economic structures and its social and institutional arrangements, so as to maintain or restore its previous developmental path, or transit to a new sustainable path characterized by a fuller and more productive use of its physical, human and environmental resources" (Martin & Sunley, 2014, p13).

development to social development fragmented (Markey et al., 2008a). During the long boom staples-led development closely linked regional and community development to the resource industry. Under restructuring, without a strong federal or provincial rural development plan guiding the process, the dominance of natural resources favoured private wealth accumulation (Drache, 2014).

Recently regional development has seen somewhat of a resurgence of interest in academic and policy discourses given the potential for regionalism to address issues of scale and capacity associated with processes of rural restructuring. Where rural communities face unique challenges related to factors like distance, economies of scale, and capacity (e.g., financial or human ability) in dealing with the impacts of political (e.g., senior government withdrawal of services and support) or economic (e.g., industrial flexibility) restructuring, regional development offers a potential counter to some of these limitations through collective action (British Columbia Water and Waste Association, 2014; Ivey et al., 2006; Robins, 2007). Collaboration within a region can improve the ability to meet challenges and, conversely, a lack of collaboration is linked to disparities between communities, as well as acting as a barrier to development (Markey & Heisler, 2011; Reimer, 2009). Regional-scale efforts are also critical for addressing the challenges of fragmented governance stemming from, “the allocation of responsibility for governance among multiple actors and/or organizations, with relatively little or no coordination” (Hill, Furlong, Bakker, & Cohen, 2008: 316). The negative impacts of fragmented governance on our ability to manage water has been well documented (Bakker, 2007; Bakker & Cook, 2011).

While this research focuses specifically on the relationship between regional development and infrastructure, it is important to acknowledge that the shifts in regional development are linked to overarching changes in governance and the economy (Bish & Clemens, 2008; Pomfret, 1993), which is captured within the literature on rural restructuring (Markey et al., 2008a; Ryser et al., 2014).

4.2.3. Rural Regional Development, Infrastructure, and Drinking Water Systems

Infrastructure can be broadly defined as the built systems that connect communities to the goods and services needed to function and maintain or improve quality of life (Edwards et al., 2009; Pollalis et al., 2012). Any development is accompanied and supported by critical infrastructure (Baldwin & Dixon, 2008; Vining & Richards, 2001). The design and quality of

infrastructure can impact the economy, the environment, and quality of life (Baldwin & Dixon, 2008; Markey et al., 2010, 2012; Meligrana, 2003; Mirza, 2007b). The direct links between regional development and infrastructure explain the specific focus of this research on changes in rural regional development, as opposed to changes in governance or the economy.

Within the context of the above discussion of regional development, there is a clear role played by infrastructure. For example, during the minimal pre-WWII development, infrastructure (e.g., transportation infrastructure) was a factor limiting the development that occurred (Barman, 1996). Following WWII during the long boom, regional development was supported by aggressive infrastructure building campaigns, such as Prime Minister Diefenbaker's 'Roads to Resources' campaign and, at the provincial level, Premier W.A.C. Bennett's 'Province Building' (Markey et al., 2006b; Tomblin, 1990). These infrastructure investments closely linked with staples theory, as infrastructure systems were designed to facilitate natural resource extraction, as well as closely tie regions to resource industries (Weaver & Gunton, 1982). With the period of restructuring that followed the context surrounding this infrastructure changed, with decreased investment impacting the hard infrastructure itself (Beaumier, 1996, 1998; Polèse, 1999; Savoie, 2003). This change exposes the temporary nature of infrastructure that was put in place during the post-war period. Despite these changes, staple products remain important economically in rural regions, but without the social link between rural regions, upper levels of government, and industry.

This period of restructuring saw a decline in infrastructure investment as well as the aforementioned downloading of responsibilities to local levels of government which, combined with factors like infrastructure age, resulted in the rise of the 'infrastructure deficit' (Mirza, 2007b). This gap between current investment levels and what is needed to maintain and upgrade existing infrastructure assets is a critical challenge across Canada, rural and urban alike, although rural areas face a different set of barriers as a result of factors like demographics, as well as financial capacity and economies of scale (Coad, 2009; Federation of Canadian Municipalities, 2013a; Kennedy et al., 2008; Markey et al., 2010; Meligrana, 2003; Mirza, 2007b; Roy, 2008; Ryser et al., 2014).

While the above discusses infrastructure generally, drinking water systems are often left out of this discussion. Within this research drinking water systems were selected as a vehicle to further explore how the historical trajectory of staples-led rural regional development has linked with infrastructure, and how this link has helped shape the present conditions and contributed to current challenges (e.g., the infrastructure deficit). Drinking water systems are among the

infrastructure systems providing a critical service to society (American Water Works Association, 2001; Government of British Columbia, 2001).

For much of this history British Columbia's Department of Municipal Affairs was responsible for assisting local governments with service provision, including drinking water provision (Bish & Clemens, 2008; British Columbia Ministry of Community Sport and Cultural Development, n.d.-b, n.d.-c, n.d.-d). Municipalities and regional districts were largely in charge of services such as drinking water, with some Provincial controls in place in terms of licensing and quality standards (Bish & Clemens, 2008). Prior to 1992 water quality was regulated under the *BC Health Act* as part of sanitary regulation, which addressed water quality but not infrastructure (Office of the Provincial Health Officer, 2007). BC brought in new standards and regulations with a new *Drinking Water Protection Act* in 2001, the *Action Plan for Safe Drinking Water* (2002), and the *Drinking Water Protection Regulation* (2003) (Office of the Provincial Health Officer, 2007). These established regulations, standards, monitoring, and other critical features of drinking water provision. However, the application of standards and regulations is often at the discretion of Drinking Water Officers, and can differ based on size and governance, as well as other factors (e.g., source).

Presently, the governance and regulation of drinking water system in BC is complex. In terms of system size, water systems are divided into large (serves over 500 people in a 24 hour period) and small (serving up to 500 people in a 24 hour period) (Government of British Columbia, 2003). Small systems are particularly common in rural areas (Office of the Provincial Health Officer, 2000). In terms of governance, drinking water systems can be managed by local governments (e.g., municipalities or regional districts), single service providers (e.g., improvement districts or water users' communities), First Nations, or individuals (Government of British Columbia, 2003).

4.2.4. Literature Summary

This paper pulls together multiple bodies of literature and both areas of overlap and gaps are used to help identify our findings. Several key themes are critical. Staples theory allows us to understand the important and continuous role of natural resources in rural areas. Initially this was uncoordinated, but during the long boom staples-led rural regional development was deliberate and economic and social development was tightly linked. However, restructuring resulted in changes, including a severing of ties between natural resource industries and communities, as

well as decreasing investment in infrastructure systems – all of which created weakness at the local level. Weakened individual communities were ill prepared for restructuring and its repercussions, particularly given their staples dependency and concordant weakness in other areas of their economy. The timing also coincides with the ageing and degradation of much of the original infrastructure, presenting additional fiscal challenges. Regionalism has resurfaced in the literature as a way to potentially construct redefined relationships within a region and with senior levels of government in an attempt to collectively address these weaknesses. Its integrated perspective moves beyond a traditional dichotomy of top down, or bottom up to seek new co-constructed relationships to address development needs and opportunities. Drinking water systems, despite their importance, are largely absent from much of this narrative, prompting further investigation.

4.3. Research Methods

As noted in the introduction, our research builds on the work of a four-year cross-country project, *Canadian Regional Development: A Critical Review of Theory, Practice and Potentials (Canadian Regional Development)*, investigating how Canadian rural regional development has evolved over the past two decades and the degree to which Canadian regional development systems have incorporated new regionalism into their policy and practice (Vodden, Markey, Douglas, & Reimer, 2015). This project used a mixed methods case study approach in order to study the complexity of regional development efforts in practice (Berg, 2009; Gregory et al., 2009; Yin, 2003). For this overarching project four case study regions from across the country were chosen based on a set of characteristics typical of rural Canada:

- clearly delineated region with overlapping jurisdictions and sub-regions to reflect rural regional complexity;
- remoteness relative to major decision-making centres and major urban influences;
- accessible via ground transportation networks;
- historically natural resource based economy;
- low population density; and
- sparse population.

By using characteristics reflective of rural Canada, the case study findings are more likely to be generalizable and transferable to other locations that share similar characteristics.

Of these four overarching case study regions our research is a more in-depth exploration of an identified topic within one region, the Kootenay Development Region (the Kootenays - see

Section 4). Findings from the *Canadian Regional Development* project identified water and drinking water systems as a prevalent topic in the Kootenays (Breen, 2012). As our research builds on these findings, the same case study area and approach were maintained. Various data sources were used to ensure a complete, well-rounded picture, as well as allowing for the cross referencing of data (Eisenhardt, 1989; Morse & Richards, 2002; Yin, 2003). Data sources included: a literature review of academic and government documents (e.g., historic documents, regulation, legislation, policy, plans); field observations; and targeted semi-structured interviews. Data sources were examined qualitatively, providing a narrative of the linkages between several complex subjects (Morse & Richards, 2002).

Over a four year period (2011-2014), we conducted 44 semi-structured interviews with 49 people⁷, representing different branches of 32 organizations⁸ (see Table 1). Interviewees were identified through a targeted internet search of relevant regional organizations (e.g., local and regional governments, provincial policy and regulatory bodies, supporting organizations). Interviews were requested via phone and email, and the majority of the resulting interviews were in person. Organizations were contacted until there was representation across the region, both geographically and in terms of organization type. Interviews followed a pre-determined question and topic guide, informed by relevant literature. Questions were open ended and the semi-structured interview process allowed for questions to reflect the specific context of each organization.

⁷ Two interviews included multiple interviewees.

⁸ Multiple interviews were conducted within single organizations. For example, within a regional district interviews could include planning, engineering, environment, elected officials, or others.

Table 1. Interviewee details

Organization Level	Organization Type⁹	Interviewee Type	Interviewee Count
Federal	Funding	Director	1
Provincial Government	Regulatory Policy Support (funding, program)	Resource officer Director	9
Provincial Non-Government	Economic Development Support (funding, program)	President CEO Project Manager	3
Regional Non-Government	Development Support (funding, program) Facilitation	Manager Executive Director CEO	2
Local Elected Officials	Municipality Regional District Electoral Area	Mayor Regional Board Member Council	13
Local Government	Public Works Economic Development Utility Services Development Services Environmental Services Engineering Services Recreation Planning & Development Services	Foreman Director EDO Supervisor Manager	15
Local Non-Government	Economic Development Support (funding, program)	Team leader Manager Coordinator CEO	5

Of these interviews, 32 were focused on regional development broadly and 12 were drinking water system specific. Regional development interviews broadly explored themes of regional development as defined by the *Canadian Regional Development project*. These interviews identified drinking water and drinking water systems as prominent issues, highlighting various challenges, as well as providing regional context. Water specific questions focused on themes of a) history, b) jurisdiction, c) policies and programs, and d) governance. The interviews focused on drinking water systems were intended to fill gaps within the initial interviews, as well

⁹ Interviewees were assured confidentiality and due to the rural nature of the study area the names of organizations cannot be listed as interviewees would be easily identifiable given the limited number of such positions.

as in the literature, providing a better understanding of the drinking water systems in the Kootenays and exploring the links with development.

Interviews were recorded and transcribed for analysis. Qualitative content analysis of the interviews combined detailed coding based on existing theory and structural codes determined by specific knowledge gaps in the existing literature (DeCuir-Gunby, Marshall, & McCulloch, 2010). NVivo qualitative analysis software was used to code and analyze interviews. An explanation building technique was used (Yin, 2003) to explain the links between development and drinking water systems. As this research stems from a larger project, discussion and review of the analysis occurred with other team members. Due to the in-depth exploratory nature of the interviews our intention is to provide an explanation that serves as a basis to inform policy, as well as serve as a foundation for future investigation

4.4. Case Study: The Kootenay Development Region

The Kootenay Development Region is 57,786.6 km² (6.2% of BC) (BC Stats, 2012a) (see Figure 3). Western exploration and settlement of the region began in the 1800s and was natural resource (staples) focused, predominantly mining and forestry, but also including recreation based on natural amenities (Parks Canada, 2009; Stevenson et al., 2011). Presently, the region is characterized by small, rural settlements and a dispersed, but stable population (~146,264 or 3% of the provincial population) (Statistics Canada, 2012). The closest major population centres (e.g., Calgary AB, Vancouver BC, Kelowna BC, and Spokane WA) are outside the region. Unemployment in the region is higher than the provincial average and employment in manufacturing and trade is dominant, particularly related to natural resource extraction, which remains economically important to the region (Baxter, Berlin, & Ramlo, 2005; BC Stats, 2012b, 2013).

Beyond the findings of the *Canadian Regional Development* project, the Columbia Basin Trust's Water Smart program also identified infrastructure as a key challenge (Hamstead, 2014). Drinking water systems vary within the region. In terms of size, the case study region includes both small and large water systems. In terms of governance, the region includes drinking water systems governed by local governments (e.g., municipalities or regional districts), single service providers (e.g., improvement districts or water users' communities), First Nations, and individuals (e.g., wells). Additionally, systems vary based on water source, treatment type, and other factors.

A formal public inventory of Kootenay drinking water systems does not exist. The regional health authority, Interior Health Authority (IHA), estimates that there are 123 large water systems (serving 80% of the population) and 1,800 known small water systems (which service 20% of the population) in the IHA region, which includes, but extends beyond the Kootenays (Norlin, 2014).

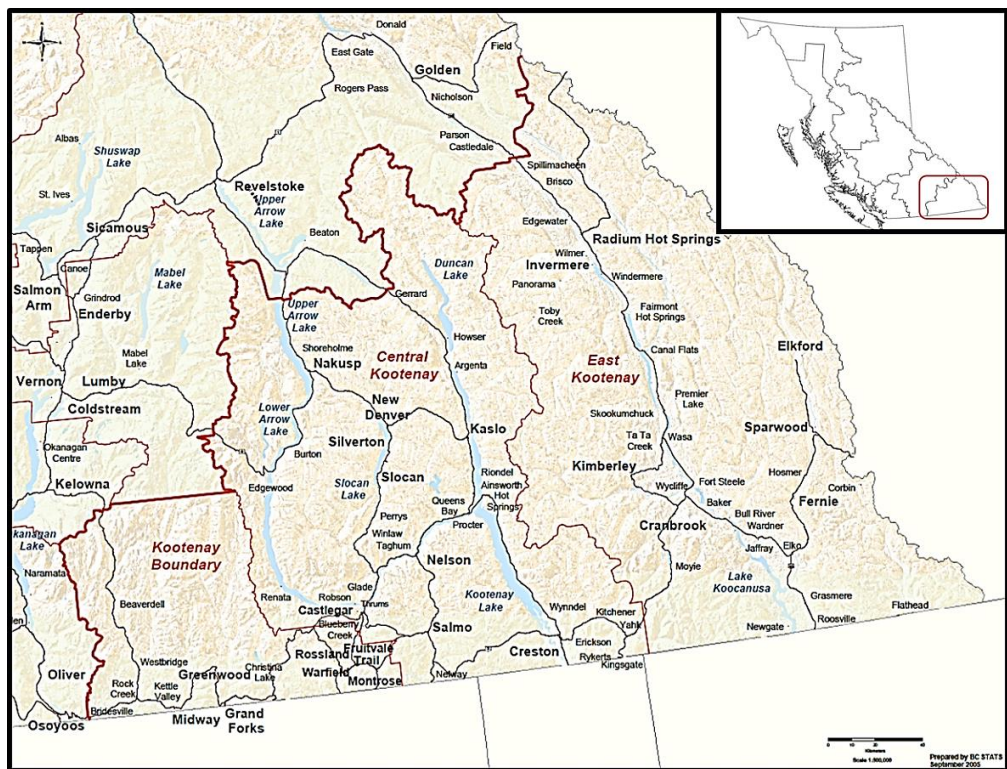


Figure 3. The Kootenay Development Region (BC Stats, n.d.)

The scope of this research includes both small and large drinking water systems governed predominantly by local government, but including single service providers. The focus on local government drinking water systems is a result of these systems being easily identified, as well as corresponding with the government organizations identified through the initial *Canadian Regional Development* project. In the absence of an inventory, small, single service providers are difficult to identify, however, several interviews discuss single service drinking water systems, necessitating their inclusion. This research includes drinking water systems with both surface and ground water sources, although surface water systems are more prevalent. While there are First Nations communities within the region, as a result of differences in management and jurisdiction these systems are considered outside the scope of this research as are single users (e.g., individual wells).

4.5. Research Findings

The above literature review details the changes in regional development in rural areas. We see the continued importance of staples theory, but a distinct shift in terms of how staples-led development is related to community and regional development – from a tightly-knit relationship following the war to the disconnection we see today. As part of this we see the rise and fall of infrastructure, from an integral part of the post war development period to today's infrastructure deficit. Our research explored this narrative through the specific lens of drinking water systems. The following section presents the results of this research, identifying and exploring the relationship between the regional development that shaped the region and drinking water systems, as informed by staples theory and regional development. We provide our findings in two sections: i) the historical narrative surrounding drinking water infrastructure, and ii) related challenges and complicating factors.

4.5.1. Historical Regional Development and Drinking Water Systems

In the Kootenay region drinking water systems corresponded to the period of regional development discussed in the literature review. Interviewees provided case study specifics to the otherwise generalized story of rural BC found in the literature (see below).

Early regional development and initial water system establishment. Much of rural BC was explored and settled prior to WWII, including the case study region. Initial development (e.g., settlement) is difficult to separate from infrastructure (Vining & Richards, 2001). As noted above, development during this period was largely ad hoc and lacking an explicit development policy. The minimal development that occurred was, in part, due to the limiting role of infrastructure. Regardless of the limitations surrounding other infrastructure systems (e.g., transportation) one ubiquitous necessity is a source of drinking water. One local interviewee noted that:

One of the standard comments that I've oft used is that nobody forms a community so that they can have a finance department. Not gonna happen. So usually a community is formed as a result of either a legal issue – somebody shooting up somebody. Or B – we got no water or the water is poisoning us and people are dying. Or C – the one that is almost as common in BC is our waste water / septic pits are contaminating the potable water and making people sick. So when you understand that as a basic core for forming local governments then you can see where some of the legislation has come from.

While development policy lacked direction, drinking water was the most frequent service requested of local governments (Bish & Clemens, 2008). BC's Department of Municipal Affairs was established to assist local governments, including local level responsibilities such as drinking water provision (Bish & Clemens, 2008; British Columbia Ministry of Community Sport and Cultural Development, n.d.-b, n.d.-c, n.d.-d). While individual systems (e.g., wells) were common at the time, multi-user water systems were also established, some of which remain today. Two interviewees were able to trace their municipal water system to this era, and parts of this original system remain in use today. For example, one local interviewee indicated that:

... I had the [water system] documents from roughly 1925. There have probably been 3 water systems that the city has operated with, starting in 1895 or so... The majority of the pipes in town... the large majority of them were well over 50 years old. And some of them up to 80, 90, and some of them up to 100.

It was the physical geography of the Kootenays that drew development, however the physical geography also played a role in the pattern of drinking water systems. The region is remote and mountainous, with multiple, small settlements strategically dispersed across the region, each of which required drinking water. As a result, the Kootenays are anecdotally said to have thousands of water systems, mostly small systems, likely more than any other part of the province. Interviewees indicated that these systems were built independently by community members and maintained/expanded by volunteers as needed.

During the resource boom that followed WWII the deliberate, top down, approach to regional development included strategic planning of and investment in critical infrastructure systems (Beaumier, 1996; Savoie, 2003). WWII to the 1960s was referred to as the 'Golden Age' of infrastructure investment in Canada (Federation of Canadian Municipalities, 2012a; Harchaoui et al., 2003; Infrastructure Canada, 2011). During this era roads were built, railways expanded, and company towns established, with many of these efforts focused on opening rural regions for large scale resource extraction (Markey et al., 2006b; Pringle, 2011; Tomblin, 1990). These investments created strong ties between communities and natural resource industries.

As rural regions developed further, so too did drinking water systems. In the Kootenays interviewees pointed to this as the dominant time period for the construction of drinking water systems in the region, largely as a result of investment from the province as well as industry. New systems were driven by the creation of new communities, the relocation of existing communities (e.g., the building of the Columbia River dams and subsequent flooding resulted in the relocation

and construction of several new community water systems in compensation), and the arrival of new industry to communities requiring system upgrades to supply industry needs (e.g., mills). Connections between communities and industry, at least in terms of the physical infrastructure systems, remain today, as described by one local interviewee:

What we are working with right now is kind of a unique system. We don't own the pumps, the pulp mill owns the pumps. They provide us pressure to our water treatment centre. We share an intake with the pulp mill.

Restructuring and afterward. With the period of restructuring in the 1980s, the decline in top down regional development was accompanied by a decline in investment to critical infrastructure (Federation of Canadian Municipalities, 2012a; Mirza, 2007b; Roy, 2008). This change in approach to regional development is indicative of an overarching change in governance, with greater levels of responsibility, surrounding both development and infrastructure, being shifted to local government (Bish & Clemens, 2008). It was during this time that, “there was a long period where infrastructure was let go” (Local Interviewee). This was mirrored in the response of a provincial interviewee who noted that:

[In the] building boom post WWII and through the 60s and 70s we built a whole lot of infrastructure and assumed it had a long lifespan, which it does. But didn't manage it for the long lifespan. Didn't start setting aside funding to replace it when its life cycle comes up.

This era of restructuring appears to have contributed greatly to present day infrastructure challenges, not only in terms of decreased investment, but also in the transfer of responsibilities without supporting local level capacity—local communities could no longer rely on the province or resource industries for critical investments.

Since 2000 provincial and federal governments have increased infrastructure capital through efforts such as the original and new Building Canada Plan, although within the literature the level of (re)investment is recognized as not being at the needed rate (Burleton & Caranci, 2004; Federation of Canadian Municipalities, 2014; Government of Canada, 2007; Roy, 2008). In addition to a continued need for infrastructure (re)investment, in 2000 the contaminated water tragedy of Walkerton Ontario launched drinking water quality, or at least liability, on to the agenda of the provincial government. In the years that followed, BC developed new drinking water legislation and regulations (Office of the Provincial Health Officer, 2007). These regulatory changes influenced a new wave of drinking water system construction, attempting to bring existing systems in line with new standards, as described by one local interviewee: “there is a push from

the one side from on health organizations to become fully compliant with standard treatment methods.”

Present day: regional development and drinking water systems. Interviewees were asked about current links between drinking water systems and regional development. It was clear that largely only those interviewees specifically tied to water systems saw a strong link. For example, a local interviewee pointed to the example that it is not possible to subdivide a lot for development without providing potable water, requiring the existing drinking water system to meet current standards and regulations. Without water allocation, source security, and a compliant drinking water system, development of any sort is a non-starter. Capacity of an existing drinking water system for expansion can limit development, including not only capacity in terms of available water, but also capacity for service (e.g., firefighting). Drinking water systems can present liability issues, increase development costs (e.g., system upgrades required prior to development), and impact the surrounding environment. One local interviewee summed up the relationship simply: “you can’t have development without water”.

However, while many interviewees identified various relationships between development and drinking water systems, some noted that these links are not always immediately apparent and that the role of drinking water systems in development can go unacknowledged. Additionally, while some interviewees found it hard to separate drinking water systems from development, one regional interviewee pointed out that on a broad scale the recognition of explicit connections between regional development, drinking water infrastructure, and community resiliency have not happened because of the complexity of this challenge,

I think it is really hard to separate [water from development]. We’re talking about infrastructure deficit, there’s the community infrastructure piece, but then there’s also the human infrastructure piece that goes along with that. And then there is the succession planning and knowledge management... I think it is really hard to separate them out but at the same time I think it is really hard when you say regional development it is just this huge behemoth.

4.5.2. Drinking water system challenges in context

Our research confirms that drinking water systems within the case study region are consistently facing a range of challenges, with varying degrees of severity. As discussed in the introduction, the prevalence of challenges with drinking water systems suggests issues beyond

age and investment in infrastructure. Through our data analysis we identified several factors related to present challenges that illustrate the complexity of the situation: changing context, changing standards and regulation, technology, and mismanagement. This section discusses these challenges, as well as demonstrating the influence of the legacy of past drinking water systems.

Drinking water systems are long lived (Baldwin & Dixon, 2008). Once constructed these systems remain in place for a long time. As highlighted above interviewees identified that infrastructure dating from the late 1800s to the 1960s and 1970s remains in the ground and in use today. While this raises the obvious challenge of system age, a related challenge is change in context, where present needs differ from past. Drinking water systems were closely associated with past development needs (e.g., resource extraction or agriculture). The closure of industry, change in relationships between industry and communities, growth of new development opportunities, and change in community population, equate to a change in context surrounding water systems. Such changes create present day challenges as a result of a mismatch between the needs and expectations of the past and present. For example, a provincial interviewee explains that some small systems shifted from a system primarily designed for irrigation to that supporting a residential community: “So [these water systems] were never really designed to be a community water system. Just over time that’s what they grew to, pragmatically the pipes are in the ground, the water is there, we’ll just hook up to that.”

There have been changes to the regulatory context surrounding drinking water, raising the standards that must be met in order for water to be considered potable. Required upgrades can be costly, particularly in rural areas where economies of scale are lacking. This is particularly relevant for small systems where residents end up on a boil water advisory because, as one local interviewee points out, they need:

...to upgrade [their] water [system] because Interior Health says you have to upgrade. There are guys that have been on boil water for seven or eight years. You should never be on boil water! You need a process but there is no money. So what do you do? You boil water.

Interviewees pointed to new, alternative, and improved treatment technology (e.g., Ultraviolet treatment) as offering many potential options for meeting new standards. And while technological solutions were noted as a source of conflict (e.g., differences in perspective on the use of point of entry/point of use treatment), overall interviewees agreed that technology is not a

limiting factor. Rather, the limiting factors are the cost of the technology, as well as the cost and capacity required for operation and maintenance. Relative to technology, it was capacity issues, both financial and human (e.g., certified water operators), that were widely cited as critical challenges.

A focus on treatment, in addition to the expense, can also take away from other system challenges. Distribution systems tend to be the older parts of drinking water systems. Within the study region many distribution systems are near, if not at the end of their natural lifespan. Deteriorating distribution increase system risk and costs (e.g., the loss of treated water), highlighted by a local interviewee:

Because in our communities the loss in our municipal water systems is horrendous. It is unbelievable, it really is...A lot of them recognize this, they knew going in and for them they didn't want to go out to the public and ask them to turn off the tap when they're brushing their teeth because they knew that they were losing so much water that asking people to do that is not really going to make a difference.

Several interviewees pointed to local-level mismanagement as an issue that has contributed to today's challenges. There are some proactive examples where managers are building detailed asset management plans, including upgrading assets to reflect the current and future context. However, this is not the norm, particularly among the smaller systems. Overall, when it comes to system management the historical and present absence of full cost accounting is acknowledged, in particular the failure to adequately charge customers. As a result, the present combination of both replacing and upgrading infrastructure is causing potentially unaffordable increases in price for customers. One local interviewee indicated that:

Some of our fees have actually doubled...it was \$11 up until a year ago per user per month... So this is the same system where our challenge is introducing water treatment and renewing those assets that are failing. So obviously we have mismanaged the system over years. If we would have been at \$25 [per user per month] even 10 years ago we would have some money at least to offset some borrowing costs.

Adding to the above failure to adequately charge for services are past failures to establish reserve funds to address future replacement and upgrades, as identified by another local interviewee:

...our roads, water and recreation systems, in particular roads and water, we're not putting any money aside because we want to keep taxes low because we don't have any industrial tax base. And those assets are wearing out faster than what we can increase taxes to cover. So it is a little scary.

Interviews also indicated that mismanagement was an issue at higher levels of government, particularly at the provincial level. This included the aforementioned lack of reinvestment in infrastructure, changing regulations, downloading of responsibility, as well as issues with relationships and communication between levels of government. Infrastructure funding, while available, is uncertain, short term, and often restricted in a variety of ways (e.g., available to municipal governments and regional districts, but not water users' communities). Additionally, the majority of interviews discussed issues of jurisdiction, responsibility, and liability. Positively, provincial level organizations indicated willingness and effort to consider place and context when it comes to funding as well as water quality regulations, as exemplified by this quote from a provincial interviewee:

The flexibility then becomes, ok we're looking for multiple barriers, what is reasonable for you? And we have put in some standards. A set of conditions of permits. Generally you should have source protection. You should have basic treatment requirements. And then it is a matter of step by step progress. The flexibility is some flexibility in technology there. But for the most part it is flexibility in timelines for compliance.

While this effort was acknowledged at the local level to some degree, a continued lack of understanding and consideration of place on the part of upper level institutions was noted by local interviewees. One local interviewee described this as:

There is quite a disconnect with the governing body. They have never done this job, actually having to work in the field where you have to make something work. They just get to create these rules and regulations that are not really practical sometimes.

While few interviewees explicitly discussed the lack of integration within and between institutions, this was a consistent undertone in many interviews. Collaboration, or a lack of, as well as siloed planning and management at the local and provincial levels, appears to exacerbate issues. For example, in BC the current institutional system ties drinking water infrastructure to health in terms of regulation and is almost exclusively under the jurisdiction of the provincially designated regional health authority. Infrastructure funding however comes from another ministry, as does environmental quality monitoring and regulation.

4.6. Discussion

Our findings identify and trace links between drinking water systems and the trajectory of rural regional development, highlighting the legacy of staples theory, early regional development,

and rural restructuring. It is our belief that understanding these legacies may provide valuable context surrounding the challenges rural drinking water systems face in the present. Three core themes are worth highlighting.

First, it is clear that regional development efforts influenced drinking water systems in terms of pattern and purpose. As rural settlement patterns mirrored the exploration and exploitation of natural resources the same staples-led development influenced the supporting infrastructure, including drinking water systems. The legacy of staples theory goes beyond economic development and can be seen in infrastructure systems. While some infrastructure systems (e.g., transportation) were deliberately planned to facilitate staples-led natural resource extraction, other infrastructure systems (e.g., drinking water) appear to be a more unintentional by-product of staples-led development.

Staples theory provides a common thread throughout the different periods of regional development, from its implicit role in the pre-WWII Canadian economy, to the explicit continuation of staples theory following WWII, and the continued emphasis on natural resource exploitation today. Although staples-led development policies were not intended to influence drinking water infrastructure, the reality is that these policies indirectly shaped the pattern and function of drinking water systems. Initial settlement patterns and economic activity are mirrored in drinking water systems today, not only illustrating the legacy of this past development, but demonstrating the link between resource-based activities and rural regional development (Wolfe, 2010). Just as a staples trap sees a lack of economic diversification and continued reliance on volatile staple products, common in rural BC (Ryser et al., 2014), the staples theory legacy on infrastructure poses issues of path dependency and constraints on future development. The challenge is how to re-shape infrastructure, like drinking water systems, to address changes in context and facilitate future development. This challenge is noted above where changes in context (e.g., land use, economic interests) surrounding drinking water systems have rendered existing infrastructure redundant, useless, or inadequate.

Second, the period of restructuring that began in the 1980s appears to have had unintended or unforeseen consequences on drinking water systems. As regional development shifted away from being top down and centralized, investments dropped and many responsibilities were passed to the local level without a corresponding transfer of additional capacity. As a result, we see a period where many drinking water systems begin to flounder. As infrastructure reaches the end of its life cycle there is not only a deficit in terms of what needs to be rebuilt, but little local

capacity, fiscal or human, to support addressing this deficit. During this period there is recognition of the limitations of both top down and bottom up approaches to regional development, highlighting a need for an approach that combines the two (Markey et al., 2008).

We also see changes in economic structure (e.g., recognition of the need for diversification) and values (e.g., recognition of sustainable development and resilience) requiring a reconsideration of what development means (e.g., economic growth versus a more holistic interpretation focused on progress and improvement) and what approaches are used (e.g., a shift from regional development to sector specific development and individual community efforts). Given that this period of restructuring took a toll on infrastructure systems, this raises the question of what approaches could offer potential for not only a more co-constructed (top down and bottom up) and integrated (able to look beyond silos) approach to managing infrastructure, but one that would incorporate concepts like sustainable development and resilience.

Finally, we found several present day challenges seemingly unrelated to development (e.g., changes in standards and regulation, technology, management). Within the context of the development legacies discussed above, we find that these present day challenges are exacerbated. For example, on its own, aging and degrading infrastructure would have posed a challenge in rural areas. However, changing regulation mean that not only were systems aging, but the systems were largely inadequate. These changes in water quality regulations alter the relationship between development and drinking water systems. As noted above, initially this relationship was one where development directed the pattern and purpose of drinking water systems. With changes in regulation, rather than drinking water systems simply supporting regional development, present and future development can now be limited by drinking water systems as existing infrastructure fails to meet new regulations (e.g., where lots cannot be subdivided and developed without providing potable water). Beyond that simple example, interviewees noted that new developments (e.g., a housing subdivision) face additional expenses, as well as lengthy and complex processes as a result of drinking water licensing and regulation. In addition to limitations to development dictated by drinking water system capacity, both new systems and systems that cannot provide potable water face additional hurdles. This is not to say that new regulations do not serve a purpose. However, in comparison to early regional development when there was little regulation surrounding the planning, establishment, and operation of drinking water infrastructure, present day regulation affords drinking water systems more influence over development than in the past.

New standards and regulations requiring expensive treatment technology also present rural communities with the choice of potentially debilitating costs or accepting a potentially damaging, economically and health wise, boil water advisory. As noted above, while technology is not a limitation, rural capacity – financial and human – is. These capacity challenges stem in part from the downloading of responsibilities without support from the provincial to local governments during the restructuring period. In short, the legacy of rural restructuring plays a role in present day challenges.

Additionally, we found challenges related to failures of management and the complexity of present institutional structures. The majority of interviews discussed issues of jurisdiction, responsibility, and liability – all institutional elements that became more complex during the period of restructuring. Operating a compliant drinking water system is not an easy task, particularly given the aforementioned rural capacity limitations. Addressing questions surrounding infrastructure systems that fit the present and future context, as well as incorporating sustainable development and resilience is a formidable challenge, one which is influenced by the past. It is a challenge further complicated when current institutions are not set up to address these links. This is highlighted when one considers the different, overlapping, and occasionally conflicting provincial ministries related to water. In order to manage drinking water systems in a co-constructed and integrated fashion local water system managers face the challenge of individually interacting separately with each ministry, and potentially departments within ministries, as well as interacting with other drinking water systems within their region, both physical (i.e., the watershed) and political. Current institutional structures are both siloed and tiered, which hinders an already difficult situation, and is unsupportive of concepts like sustainable development and resilience. Within this context it is little wonder that links between drinking water systems and development are not explicitly recognized and addressed through management and planning.

4.7. Conclusions

Drinking water systems have been deteriorating, leaving all levels of government to face a critical infrastructure deficit. The present as well as the future are shaped by events of the past. Viewing this current drinking water infrastructure deficit, as well as other present day water system challenges, through a historically and theoretically informed lens allows us to clarify why drinking water systems remain a challenge, despite (re)investment efforts. It is clear that links with development play a role and that infrastructure goes beyond the stereotypical role of supporting

development. Our findings suggest that rural regional development has influenced and impacted drinking water systems in the past and that this relationship has shifted with the growing influence of drinking water systems on development. The research also shows that the legacies of both staples theory and rural restructuring exacerbate present day challenges creating a situation more complex than one would assume if only infrastructure age and degradation were considered. Moving forward, the challenge of breaking with the past will be in how to manage drinking water systems, as well as other infrastructure, in order to address changes in context as well as facilitate sustainable development and resilient rural regions.

This research attempts to speak to what can be learned from the past. Interviewees noted that complexity is a key issue when it comes to proactively linking infrastructure to regional development. While some drinking water systems have managed to use the flexibility of the local governance system to create explicit linkages between the drinking water system and development, most drinking water systems face challenges in meeting basic requirements and despite all efforts drinking water systems remain a challenge. Presently, drinking water systems are deteriorating in many regions, and they may not be capable of meeting future needs given their pattern and purpose largely mirrors the past. Our research identifies and highlights factors beyond age and investment, highlighting that the legacy of the past combined with the challenges of the present will undoubtedly impact the future.

Infrastructure provides the foundation upon which society functions (Vanegas, 2003). Overall, the relationships we identify between drinking water systems and development are important and should be considered. These connections help to explain how we got to where we are presently, and where we are going in the future. How drinking water systems are planned and managed will impact future development (Connelly, Markey, & Roseland, 2009; Dale & Hamilton, 2007; Kennedy, Roseland, Markey, & Connelly, 2008; Mirza, 2007). Presently, there is a need for considerable (re)investment in drinking water systems. However, without careful consideration of factors beyond financial needs, such as past and present interrelationships with development, it is unlikely that we will see substantive changes to the current situation, which will exacerbate future conditions.

The infrastructure deficit presents a window of opportunity for renewal, to replace and rethink drinking water systems to support future development. A growing body of literature is exploring links between sustainability and resilience, including potential approaches to fostering these links (Connelly, Markey, & Roseland, 2009; Dale & Hamilton, 2007; Kennedy et al., 2008;

Pendall, Foster, & Cowell, 2009; Pollalis et al., 2012; Robinson et al., 2008). However drinking water systems continue to play catch up as opposed to proactively building resilience by integrating infrastructure into development (Pollalis et al., 2012). In order to best take advantage of this opportunity we require a better understanding of the factors that brought about this situation.

Rural regions need two key resources to support development: financial resources and appropriate infrastructure (Ryser & Halseth, 2010). At the moment, the case study region exemplifies that rural regions arguably have neither, and are suffering both from a lack of capacity, but also the degradation of infrastructure. Challenges surrounding capacity, collaboration, equity, and integration extend beyond drinking water systems and are found in many rural issues, suggesting larger systemic challenges. If factors like development are not considered alongside infrastructure systems when opportunities arise for re-investment, there is the potential for infrastructure to lock development onto an unsustainable path (Connelly et al., 2009; Dale & Hamilton, 2007; Markey et al., 2010). While the infrastructure deficit opens the door for the consideration of new approaches that would help integrate infrastructure with development, this opportunity is only temporary. Regions should address the infrastructure deficit with full knowledge of the past, building resilience as opposed to duplicating the past.

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Chapter 5. Paper #2: Half-empty: drinking water systems and regional resilience in rural Canada

Abstract

This paper explores the dynamics of rural regional resilience through an investigation of drinking water infrastructure in rural British Columbia, Canada. Specifically, the paper explores the extent to which regionalism, as applied to drinking water systems, may serve to foster greater regional resilience. Current infrastructure conditions suggest renewal efforts will increase over the coming years, making this investigation timely in order to better inform policy and decisions. Using the Kootenay Development Region of British Columbia as a case study, the paper explores whether current approaches to the planning and management of drinking water systems reflect a transition toward regional resilience. We found that while there is potential for drinking water systems to act as a catalyst to enhance regional resilience, this potential is largely untapped. Our case study indicates that a lack of regional cohesion and direction combined with barriers from existing institutional structures makes it difficult for regionalist approaches to realize their full potential.

Key Words: drinking water systems, infrastructure, regional resilience, planning, rural

5.1. Introduction

Drinking water systems are critical to communities and regions, providing a crucial service, as well as providing a physical link to watersheds. Despite their importance, drinking water systems in rural Canada face challenges, including aging infrastructure, inadequate water treatment, and difficulty attracting and retaining human resources (Federation of Canadian Municipalities, 2012a; Ministry of Health Planning & Ministry of Health Services, 2002). These challenges can result in water loss, high infrastructure costs, boil water advisories, and related problem, which can undermine and threaten local quality of life, economic stability, and environmental quality. Additionally, these challenges take place against the backdrop of rural restructuring that has been ongoing since the 1980s (Polèse, 1999; Savoie, 2003). Rural communities and regions have increasingly found themselves assuming a greater burden of

development related responsibility without concomitant resources (Ryser et al., 2014). Specific to water is the increasingly recognized challenge of dealing with fragmented water governance (Furlong & Bakker, 2011).

Regionally oriented approaches to development have seen a resurgence of interest in academic and policy discussions, including the potential for regionalism to address rural issues associated with restructuring. As rural communities face challenges related to factors like distance, economies of scale, and capacity, regional development offers the potential to counter some limitations through collective action (Ivey et al., 2006). Regional-scale efforts are said to be key to address the above challenge of fragmented water governance (Furlong & Bakker, 2011).

Complementing the discussion about regional change and restructuring, researchers are applying the concept of resilience within the study of regional development (Martin & Sunley, 2014), contributing to a growing discourse about regional resilience (Bristow, 2010; Pendall, Foster, & Cowell, 2009; Simmie & Martin, 2010; Yamamoto, 2011). Regions are a complex integration of factors, including economic, social, cultural and ecological factors, all of which are influenced by, and have the potential to influence regional resilience. Returning to the aforementioned challenges facing drinking water systems, infrastructure, as the physical foundation for society, serves as a point of interaction between the economy and the environment, as well as society and the environment. However, the specific relationship between drinking water systems and regional resilience, particularly *rural* regional resilience and how the planning and management of drinking water systems supports (or not) the region, is a gap within existing literature.

Unsurprisingly, drinking water systems are part of Canada's 'infrastructure deficit' - the gap between current investment levels and what is needed to maintain and upgrade existing infrastructure assets (American Water Works Association, 2001; Federation of Canadian Municipalities, 2012a; Kennedy et al., 2008; Markey et al., 2010; Mirza, 2007b). Infrastructure deficit literature typically highlights factors like deterioration due to age and decreased investment (Federation of Canadian Municipalities, 2012a; Kennedy et al., 2008; Mirza, 2007b). However, despite targeted federal and provincial (re)investments in infrastructure, drinking water systems remain a pervasive concern in rural British Columbia (BC), exemplified by ongoing water quality notifications and improvement programs (Interior Health Authority, 2013, 2014c). This suggests that the challenges associated with rural drinking water systems may extend beyond the issues of engineering and investment, as well as beyond pipes and pumps.

The purpose of this paper is to explore the dynamics of rural regional resilience through an investigation of drinking water systems in rural BC, Canada. The cross over between resilience and water is an established area for investigation, however the focus on drinking water systems is worth particular consideration given drinking water systems as an aforementioned point of interaction, allowing a link with recent integrated conceptualizations of regional development. There is potential for drinking water systems to enhance regional resilience, however the extent to which regionalism has been identified and used as a strategy to foster greater regional resilience is unclear, particularly relative to drinking water systems. Given that current conditions of drinking water infrastructure suggest renewal efforts will increase over the coming years (American Water Works Association, 2001; Mirza, 2007b), it is useful to explore the relationships between drinking water systems and regional resilience in order for policy makers and local governments to better understand the potential for addressing the infrastructure deficit, as well as how to enhance the contribution of systems to the overall viability of rural regions in the future.

Using the Kootenay Development Region of British Columbia as a case study, this paper explores the question of whether current approaches to the planning and management of drinking water systems reflect a transition toward regional resilience. By using drinking water systems as an example, this research adds further depth to the discourse surrounding the role of water in regional resilience. It also adds to the discourse around the management of infrastructure systems, helping to better understand the potential role for infrastructure in building regional resilience. We hope the research also contributes to work being done to address the rural dimensions and implications of regional resilience generally. We begin with a review of literature related to regional resilience, new regionalism, and water systems. This is followed by an explanation of our methods and information about our case region. We then present our findings and conclusions.

5.2. Literature review

5.2.1. Regional resilience

Resilience has evolved to have multiple meanings and applications. The 'resilience perspective' has been used as an approach to analyzing, understanding, and emphasizing integrated, interdependent ecological and human systems (Folke, 2006). A growing interest in, and application of, resilience within social science (Hill, Wial, & Wolman, 2008) has seen the term

broaden from its use to describe a community's ability to cope with external stresses and disturbances (Adger, 2000) to its use as a framework for explaining differences in regional economic adaptability (Hassink, 2010).

Within the discourse on regional resilience there are narrow and broad perspectives. Narrow perspectives refer to regional resilience as the response of regions to growing exogenous and endogenous shocks (Hill et al., 2008; Martin, 2012; Scott, 2013). Broader perspectives consider the degree of resistance a region has to shocks, as well as its adaptive capacity (Bailey & Berkeley, 2014). Research in this area has studied resilience as an explanation of differing economic responses (Hassink, 2010; Martin, 2012) and of regional performance (Christopherson et al., 2010). Resilience is also used as an analytical tool to understand regional differences, as well as how to build capacity and create policies that contribute to resilience (Martin 2012; Bailey & Berkeley 2014). Resilience can provide a lens for rural studies, affording an opportunity to reframe development, policy, and practice (Scott, 2013).

Drinking water systems are subject to direct and indirect short term shocks as well as the long term need to adapt. For the purposes of this paper regional resilience includes the ability of a region to resist (short term) and adapt (long term) to change. In this use, regional resilience is a process as opposed to an outcome (Norris et al., 2008). As resilience can be in response to both sudden shocks and slow change (Hassink, 2010), shocks can be accommodated and new paths can be developed (Boschma, 2014). As such resilience is less a bounce back, but a bounce forward through a process of recovery, resistance, re-orientation, and renewal (Bristow & Healy, 2013; Scott, 2013; Martin & Sunley, 2014).

This paper focuses on the role of drinking water systems in supporting resilient rural regions. While much of the regional resilience research focuses on economic dimensions, there is a need to explore other dimensions of the concept (Martin & Sunley, 2014), particularly in rural areas where dependence on natural resources provides a clear connection between social and ecological resilience (Adger, 2000).

5.2.2. New regionalism

Early regional development in Canada was motivated by the identification of regional disparities through the post-World War II growth period (Weaver & Gunton 1982; Polèse 1999). These efforts were characterized by a centralized top-down approach which extended into the

1970s, ultimately ending as a result of perceived inefficiency combined with fiscal constraints and the recession of the early 1980s (Weaver & Gunton 1982; Polèse 1999; Savoie 2003). Rather than being the end of regionalism, the restructuring of the 1980s, combined with the rise of local actions and a changing political and economic context, led to a reframing of regional development that began in the 1990s (Hettne et al., 2000; Wheeler, 2002).

New regionalism differs from past approaches in terms of the change in context as well as an alternate intervention approach resulting from changes in governance, the inclusion of a wide range of characteristics, and an emphasis on competitive advantage (Ortiz-Guerrero, 2013; Savitch & Vogel, 2000; Zimmerbauer & Paasi, 2013). While there is no universally accepted definition, new regionalism is a reconceptualization of what 'the region' is, favouring a territorial approach to development and incorporating governance, integration, place, innovation, and consideration of rural-urban relationships. The region is the preferred unit of action, however as no one region can serve all purposes, 'the region' may include multiple, different, potentially overlapping units (Hettne & Inotai, 1994; Jonas, 2011; Rainnie & Grobbelaar, 2005).

Within this paper new regionalism provides a foundation for employing the regional scale in management of drinking water systems, as well as providing a framework that links water and regional resilience. Old regional approaches lack flexibility and consideration for factors such as place and integration, and as such are inadequate when it comes to resilience (Jonas, 2011). New regionalism allows a more holistic approach to development (Markey et al., 2006b; Ortiz-Guerrero, 2013). The local and regional scale is noted as being critical for resilience, highlighting the need for multi-level governance – a core new regionalism theme (Berkes & Ross, 2013; Vodden et al., 2015). New regionalism and resilience overlap on other core themes, including recognition of place, and an emphasis on integration, knowledge, and innovation (Bristow, 2010; Berkes & Ross, 2013).

5.2.3. Resilience, regionalism, and drinking water systems

Linking resilience and water is not new and many existing watershed-based management approaches apply characteristics of resilience (e.g., Ferreyra et al. 2008). Water systems may also be a limiting factor in terms of regional resilience, such as the example provided by the infrastructure deficit (Robinson et al. 2008). There is potential for water systems to enhance resilience and reason to suggest that a regional approach could help facilitate this; however gaps remain surrounding resilience and water infrastructure (Santora & Wilson, 2008). The design,

management, and operation of infrastructure has been noted as one factor relating to regional resilience (Christopherson et al., 2010; Pollalis et al., 2012). While the importance of building resilience into infrastructure design is recognized as helping to facilitate the ability of a region to adjust and adapt (Robinson et al. 2008; Christopherson et al. 2010; Berkes & Ross 2013), other aspects of drinking water systems remain underexplored – such as the planning and management of drinking water systems, particularly in rural areas.

Also identified is a need for a change of scale when managing drinking water, as current water management jurisdictions often appear too constrained to address challenges and opportunities (McKinney & Johnson, 2009). Drinking water systems are typically governed at a community scale, creating challenges as a result of jurisdictional boundaries. Issues such as water pollution highlight the interdependence of drinking water systems within the same watershed (McKinney & Johnson, 2009). Conversely, addressing issues on a national scale can be challenging in terms of capacity and context (Hettne et al., 2000). When considering the challenges of small and large scale approaches it is little wonder that attention to the regional scale is increasing (Rothwell, 2006).

From a regional development perspective, water is important in terms of quality of life, economic development, and environmental quality. The need for integrated approaches to water management is acknowledged in the literature, particularly in light of failures of past approaches to address interrelationships and the complexities of shared jurisdictions (Rothwell 2006; Bakker 2007; Maxwell 2008). Theoretically new regionalism affords flexibility and integration not seen in past approaches to regional development. New regionalism is also noted for its ability to address complex, multi-scale problems such as water management (Markey, Halseth, & Manson, 2008b; Peterson et al., 2010).

However, while new regionalism is noted as providing an opportunity for a holistic perspective, the emphasis is largely economic (Rainnie & Grobbelaar, 2005). Although opportunities to connect new regionalism with the environment exist, this area of the literature is less developed. Resilience offers a more robust connection to the environment (Bristow, 2010). In this way, new regionalism and resilience are complementary, and well suited to an exploration of the role of drinking water systems in rural regions.

5.3. Research methods

This research builds on the work of the *Canadian Regional Development* project, a four year (2010-2014) cross-country project investigating how rural Canadian regional development has evolved and the degree to which these regional development systems have incorporated new regionalism into policy and practice (Vodden et al., 2015). Drinking water was identified as a topic of interest within one of *Canadian Regional Development* project's case study regions – the Kootenay Development Region of BC (the Kootenays) (Breen, 2012).

The results of the *Canadian Regional Development* project served as the foundation for an in-depth examination of rural drinking water systems. The *From staples theory to new regionalism: managing drinking water for regional resilience in rural British Columbia* project takes a mixed method case study approach, including 65 interviews and 4 years of field observations. This paper builds from this work, focusing specifically on an extensive content analysis of community and regional planning documents to assess the presence of new regionalist themes in drinking water management.

By examining specific documents the authors were able to view the case study region as a whole while investigating the individual component parts. Our content analysis explored a targeted selection of planning documents from within the region for, i) evidence of regional resilience, ii) the links between drinking water systems and the surrounding communities and region, and iii) how the current approach to managing drinking water systems differs from the potential offered by New Regionalism. A theoretical and analytical framework informed by regional resilience guides the overall investigation.

Not all planning documents from within the region were used. In part this is because a systematic review of all documents is not possible due to the lack of comprehensive inventory of water systems within the region. The exact number of systems in the region is unknown (Norlin, 2014). Additionally these systems can be operated by multiple organizations operating under different regulatory conditions. The *From staples theory to new regionalism: managing drinking water for regional resilience in rural British Columbia* project focuses specifically on drinking water systems owned and operated by local governments. As a result our content analysis focused on local government drinking water systems and on the supporting and regulating organizations at the regional, provincial, and federal level. The documents targeted for this paper included geographic representation from across the region, system size, and a range of community

capacity. Document selection was informed by the results of interviews conducted at an earlier stage of the project (Breen & Markey, 2015). All selected documents related to either the management of water systems, and/or links between water systems and the surrounding community or region. At least two documents from each organization were included.

We selected 27 publically accessible documents representing: the federal government, the provincial government, seven municipal governments, three regional districts, and one regional organization. The documents were primarily planning documents. Where a planning document was not available, the best available substitute was used (e.g., in the absence of a drinking water system plan or a water management plan the water bylaw was used).

We developed a list of regional resilience indicators, drawn from a review of relevant literature. We compiled and thematically sorted all noted characteristics and indicators of regional resilience within the literature to produce an analytical framework. The result was six categories of indicators (Table 2), with each indicator having specific criteria.

Table 2: Categories of regional resilience indicators

Institutional Structure	Policy and Planning	Implementation	Evaluation	Operations and Management	Sustainable Infrastructure
<ul style="list-style-type: none"> • Multi-level governance • Robust governance structure • Redundant governance structure • Alternative governance arrangement • Institutional integration • Innovative governance • Evaluation 	<ul style="list-style-type: none"> • Co-constructed • Integrated (institutional) • Place-based • Informed by peer review science and other information • Adaptive • Sustainability • Holistic (integration) 	<ul style="list-style-type: none"> • Policies and plans are enacted • Communication • Rapidity 	<ul style="list-style-type: none"> • Regular evaluation, education, monitoring • Broad definition of success • Sustainability rating system or certification • Contribution to overall quality of life • Strong environmental capital • Meets existing regulations / standards 	<ul style="list-style-type: none"> • Technical capacity • Effective management and customer engagement • Adaptive • Innovative • Collaboration • Knowledge and capacity building • Monitoring and evaluation 	<ul style="list-style-type: none"> • Multi-functionality • Innovative technology • Equity • Utility right sized • Sustainable and efficient design / resource use • Asset management and evaluation of infrastructure assets • Robust infrastructure system • Redundant infrastructure system

We used an open coding approach where document text was manually matched to indicators based on indicator criteria using NVivo qualitative analysis software. Text could be coded as: present, absent, indeterminate, or not applicable. To be ‘present’ or ‘absent’ the text must explicitly display or contradict one or more of the indicators. ‘Not included’ was where there was an absence of evidence for, but not necessarily a contradiction of indicators. Once initial open coding was completed axial coding was used to identify connections (DeCuir-Gunby et al., 2010).

5.3.1. Case study overview

The Kootenay region is in south-eastern BC, bordered on the east by Alberta and the south by the United States (Figure 4). The region is comprised of a number of jurisdictions, including three regional districts – a form of local government in BC. The entire region falls within the jurisdiction of the Interior Health Authority, a provincial body whose responsibilities include drinking water.

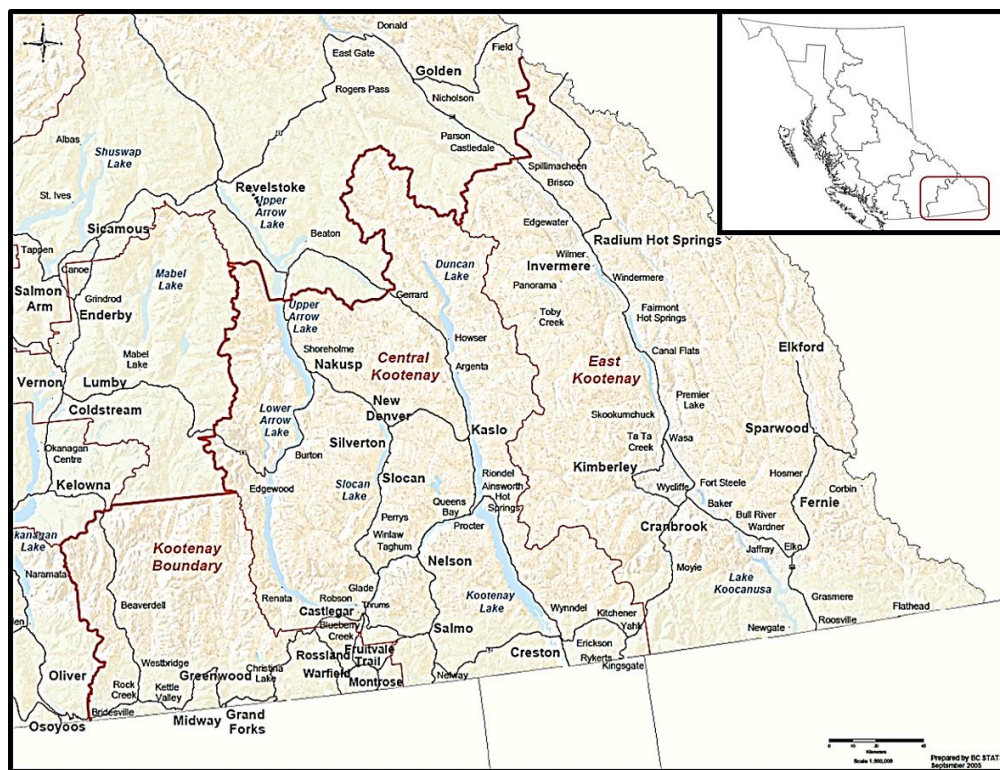


Figure 4: The Kootenay Development Region (BC Stats, n.d.)

The region is 57,787 km² and home to approximately 142 000 people (BC Stats, 2012a). The region is mountainous, biodiverse, and water rich. Relative to BC, the Kootenays has slower population growth, higher average age, lower average income, and higher unemployment (BC Stats, 2012a, 2012b). The majority of economic drivers are service related (e.g., trade, health care, tourism) (BC Stats, 2012a).

5.4. Findings

5.4.1. Overview

The documents demonstrate different degrees of support for, or challenge to, regional resilience. Additionally, different levels of support were found between the six categories. An overview of the presence of at least one indicator from each category would suggest that the **policy and planning** category is dominant, with 25/27 documents reflecting supporting characteristics of one or more indicators from this category, as well as the largest number of references coded¹⁰. Evidence of the **evaluation** (22/27) and **implementation** (23/27) categories appear less often and are fewer in overall numbers. Coding notes indicate that there was an absence of explicit discussion of these topics. The presence of indicators from the **institutional structure** (24/27), **sustainable infrastructure** (22/27), and **operations and management** (21/27) categories are similar in number, however coding notes suggest fewer details related to sustainable infrastructure. The content analysis identified many trends and themes across the documents, however what is perhaps most interesting and relevant to our research question is the relationships identified between the documents and the evidence of support for and barriers against regional integration.

Given our premise, in order for drinking water systems to support regional resilience, the documents analysed would have to reflect the characteristics of resilience and would also have to link to, and integrate with, the region. A detailed examination of these links offers insight into a potential transition toward regional resilience and the role of drinking water systems in regional resilience. Evidence specific to these relationships was found in six specific indicators from three categories (Table 3). From these six indicators we found two key findings relative to the current

¹⁰ From a quantitative standpoint this is neither statistically significant nor reproducible. However, the volume of sections coded to policy and planning makes this worth noting.

management of drinking water systems: i) support for regional integration and ii) barriers to regional integration.

Table 3: Links between drinking water systems and the surrounding region

Category	Institutional Structure	Institutional Structure	Institutional Structure	Operation & Management	Policy & Program	Policy & Planning
Indicator	Alternative Governance	Innovative Governance	Institutional Integration	Collaboration	Institutional Integration	Holistic Integration
# of documents found in (/27)	27	25	26	18	27	27
Present	9	10	22	15	23	20
Absent	21	8	9	-	4	9
Indeterminate	2	3	10	3	4	2
Not included	-	5	2	3	1	3

5.4.2. Support for regional integration

The coded documents demonstrate a clear **recognition of the need for regional integration** as it relates to drinking water management. There were examples of acknowledgement of how changing context necessitates changes in governance toward a more integrated approach, an openness to new governance ideas (e.g., new scales of organization and integration across different silos), and acknowledgement of the importance of best practices in governance (e.g., flexibility, attention to place and sustainability).

In terms of the need for changes in governance, there were many instances found within the documents. For example, the Water Management Plan for the Regional District of Central Kootenay states that:

The Regional District of Central Kootenay (RDCK) is one of only five regional districts in the province that have pro-actively assumed a greater role in the delivery of critical services to its residents by way of a defined, long range strategy. Leadership in the delivery

of a potable water service to rural residents (typically a provincial responsibility) demonstrates a clear understanding that existing governance models for stand-alone community water systems may be marginally successful and that local governments hold the key to successful and sustainable delivery of the most precious of all resources – safe and reliable drinking water (Regional District of Central Kootenay 2010, pg 1).

Similar recognition is found related to general regional management as well. For example, the Regional District of East Kootenay “encourage(s) the establishment of Local Community Commissions or alternative governance options to enhance participation in local decision making” in their Regional Growth Strategy (Regional District of East Kootenay, 2004).

Within the documents there were also instances of an openness to new governance ideas and acknowledgement of the importance of best practices in governance. For example, the village of Kaslo, a participant in Water Smart, a regional-scale initiative established by the Columbia Basin Trust (CBT), coordinated with other participating communities to develop individual water loss management plans. Kaslo’s Water Loss Management Plan reflects the village’s participation in the collaborative effort while retaining separately governed systems (Kerr Wood Leidal, 2013). Kaslo’s Official Community Plan (OCP) again recognizes the role of the regional scale, “in mutually beneficial, cost effective development of regional services for water, waste water, fire protection, emergency response, medical, planning, youth and planning” (Village of Kaslo 2011, pg 34). We also found an explicit recognition of the potential approaches to and benefits of integration. At the provincial level, integration was explicitly stated as a goal, “Many ministries and government agencies are involved in different aspects of drinking water protection. But until now, there has been no proper coordination and integration of these functions” (Ministry of Health Planning & Ministry of Health Services, 2002). Overall our content analysis found a widespread recognition of the need to change, reflecting a potential shift or transition towards integration and regional approaches. However, clarity and details as to how this would be achieved was lacking.

Within the analyzed documents there were also **supportive actions** demonstrating a shift toward regional approaches and enhanced regional resilience. For example, there was evidence of new institutions, or parts of institutions geared toward partnerships and collaborations. Again, using a provincial example, “Under the leadership of the Ministry of Health Services, an inter-ministry committee will be established to coordinate these drinking water protection measures, identify emerging issues and to ensure proper integration - from source to tap” (Ministry of Health Planning & Ministry of Health Services, 2002). Other supportive actions included examples of new sources of financing that allow or encourage a more regional approach. For example, from an

overarching perspective one regional district aims to “Develop an action plan that directs board and staff actions in advocating for our region's share of resource revenues” (Regional District of Kootenay Boundary 2015, pg 8). Existing actions that demonstrate integration in governance ranged from vague to detailed, and included integration of governance between or within organizations, as well as consultation and collaborative efforts. Examples include the aforementioned Water Smart program, as well as the acquisition procedure in place to address the voluntary turnover of small water systems to be managed collectively by a regional district (Regional District of Central Kootenay, 2010).

The evidence for collaboration within the operation and management of drinking water systems ranges from vague and generalized to detailed and specific. At the one end are plans that indicate organizations “will work closely with...” followed by a list of potential organizations or types of organizations. However, often no concrete examples are offered. On the other end are specified relationships naming specific participants. Coded text range between the two, although overall the generalized examples are dominant. Again, this is indicative of a growing recognition of the importance of new approaches and systems thinking, albeit with some confusion and uncertainty around the execution. There were examples of collaborative efforts within the traditional structure, but also new initiatives, including regional level initiatives using a different scale and a more lateral structure, again, such as the aforementioned Water Smart program.

We also found actions demonstrating recognition of the need to consider and recognize other plans where there may be interactions, as well as the need for integrated approaches, this time specific to policies, plans, and programs. For example, the Sustainable Community Plan for Grand Forks explicitly strives to ensure that “planning processes or plans reflect a coordinated approach to enhance community sustainability through linkages between different types of plans or planning activities” (Urban Systems Ltd. 2011, pg 2). This reinforces emerging governance ties through specific policy and planning examples, such as links between provincial ministries, between local government and non-government organizations, and municipalities and water stewardship efforts. Evidence was identified of links being made between subject specific silos through comprehensive or integrated planning, education and building understanding, and other actions. The Cranbrook OCP for example, ties residential, agricultural, and recreational activities within the watershed together as part of the plan (City of Cranbrook, 2006). However, overall the majority of direct action demonstrated in the documents remains contained within single organizations at the community scale.

Overall we identified a continuum in terms of not only the type of action (e.g., recognition versus creation of a new institution), but a range in terms of scale (e.g., from single organization upward) and scope (e.g., very narrow to broad). Within this continuum, one commonality is the growing realization that nothing occurs in isolation, and that new forms of governance and other action is required to address the multitude of interconnections.

5.4.3. Barriers to regional integration

The content analysis also found evidence of barriers within the current institutional structures that act as barriers to regional integration. These barriers were found within the planning and management of drinking water systems, as well as the surrounding governance structure. There are many examples of absence of resilience characteristics, primarily the dominance of a top-down hierarchical institutional structure that appears to undercut changes such as those noted above. This is exemplified through confinement within an existing top down system, the acknowledgement of the limitations of an organization's authority within the hierarchy, and illustration of strict top-down control. The BC *Drinking Water Protection Act* prescribes a strong top-down structure and most local government documents acknowledge this. This extends more generally as well. For example, the Nelson OCP recognizes jurisdictional limitations of local municipalities: "The OCP can only encourage senior levels of government to take action; it cannot force or require senior governments to act" (City of Nelson 2013, pg 4). While recognizing the responsibility inherent in the provincial government's position, it is worth noting that the current institutional structure appears focused on a top-down hierarchy, blocking – in reality or in perception – lateral co-constructed approaches to governance that would support regional resilience.

Other examples indicate that while some degree of contextual flexibility was built into the governance structure the balance of power surrounding this flexibility is largely held by those higher in the hierarchy, such as provincial officers or regulatory bodies. A general absence of institutional integration is seen within most documents, which fail to mention any institution or department save for themselves - evidence of silos both between and within organizations. The absence of integration is seen in the split between the human and environmental side of water governance, along with the separation between levels of government, as well as within and between local governments. We found contradiction and conflict between different objectives

within and between organizations. For example, Castlegar's OCP recognizes the surrounding system, while acknowledging inherent conflict as the city:

Is surrounded by a number of rural settlements which are unincorporated. The proximity to these communities presents synergistic opportunities for the City and the [RDCK]. Yet, like other communities, the contradicting land use objectives between the two authorities do not easily allow for cooperative and coherent planning (City of Castlegar 2011, pg 112).

It is not only the governance structure, but programs that appear to favour single institutions in a top-down hierarchy. Finally, and perhaps the most obvious barrier within the institutional structure category, is the continuation of business as usual – an overall absence of evidence of change despite an acknowledgement that change is needed.

Similarly, other coded text reveals that links appear to be well established within traditional structures, albeit not in all cases. This is exemplified by the linkages we found along traditional lines: within a single organization (e.g., within a community - the Nelson OCP and Water Master Plan), at the same scale (e.g., community to community), and along the traditional hierarchy (e.g., province→community) but few links between organizations within the case study region, excluding traditional top-down relationship between the provincial and local government. Additionally, many coded sections are focused on inclusion, participation, maintaining relationships, and engagement – all lower level forms of collaboration. From a regional resilience perspective, this indicates that a regional system is lacking and that a strong traditional hierarchy remains.

Absences of integration of policy and planning are found across the documents, with evidence primarily pointing to a traditional structure that perpetuates a hierarchical structure, as well as a single organization focus. Some municipalities lacked a formal, publically accessible water management plan, while others failed to recognize or integrate their water management plan into broader planning documents (e.g., OCP or regional growth strategy). This may partially be a result of factors such as the requirements around what must be included in certain plan types, which plans must exist, as well as community capacity. However, this also contradicts the above findings relating to the recognition of the need for integration. There was evidence of failure to prioritize this element of integration, and an overall failure to make links within and between organizations, something again exacerbated by the dominance of traditional institutional structures that continue to support silos.

Overall, a critical element connected to these structural barriers is scale. For water systems to be supportive of regional resilience linkages are required between the water system, the surrounding community, and the overarching region. The documents used in the content analysis indicate that top-down hierarchical structures remain dominant, limiting the execution and benefits from integration; and it is the local community, not the regional, scale that is dominant at the local level. Findings related to the collaboration indicator re-enforces that multi-scale examples continue to follow a more traditional top-down model, as opposed to examples of relationships at the same scale, or even a new (regional) scale, where there are some examples of truly collaborative efforts. Examples of collaboration beyond a single community are often at the informal or preliminary stage. In terms of links between silos, where there is evidence of attempts at holistic approaches, the majority are specific to a single organization, generally at the community scale. One exception is the CBT, whose documents recognized links institutionally and in terms of subject matter, and demonstrated attempts to construct an integrated and collaborative regional web.

The above barriers are not necessarily indicative of a failure of the documents, but of the failings of the current institutional structure and approaches to planning when evaluated against characteristics of regional resilience. A top-down, hierarchical institutional structure remains, which seemingly undercuts attempts to change, both generally and specific to drinking water.

5.5. Discussion

Our findings indicate that there are links between drinking water systems and regional resilience. Within these links there is the potential for drinking water systems to support regional resilience in two ways. First, identifying and strengthening connections between drinking water systems at a regional scale offers the potential to increase efficiency of operations and the capacity of organizations through collaboration. Second, drinking water systems can explicitly link the communities and the region, supporting the larger system and movements towards regional approaches to governance and service delivery. This can include directly supporting development through the provision of water-related infrastructure and services, as well as strengthening links between infrastructure and services and the environment. Additionally, this regional perspective can shed light on the infrastructure deficit, providing potential solutions beyond increased investment. However, this potential is far from reality.

We found evidence of resilience reflected within all of the documents. There are multiple examples of recognition of the need to consider a more holistic, multi-level systems perspective, as well as examples of direct action that indicate a willingness to change through short and long term efforts, as well as efforts at various scales. Specifically in terms of drinking water system management, several documents illustrate increasing recognition and action towards regional resilience. These examples indicate a growth in recognition of a systems perspective, as well as the potential role water systems can play. Overall, this is indicative of the potential for enhancing regional resilience through planning and management of drinking water systems. However, currently this appears to be emergent.

There are also clear barriers to regionalism from existing institutional structures at all scales, regulation, jurisdiction, and planning requirements. Despite examples of movements toward regional integration, the continuation of a traditional, siloed, top-down hierarchy is obvious, both generally and specific to water. This is seen in the focus and structure of the documents themselves, as well as the overarching regulation and jurisdiction. And while this is not to say that institutional structure is the only barrier, our findings suggest that the current institutional structure has a difficult time accommodating new ideas and change. The research identified three particular elements of structural difficulty, each raising unique questions regarding regional resilience. First, the majority of evidence was specific to the **scale** of the organization authoring the document. The focus of organizations appears to be first, and often entirely, on the local scale, followed by some consideration of other organizations at the same level. Local level organizations also demonstrate more consideration of upper level organizations than vice versa. Perhaps given the nature of the documents (e.g., requirements of OCPs) this is unsurprising. However, it is difficult to relate these to the overarching question of regional resilience because the region rarely makes an explicit appearance, leaving questions such as whether we can assume regional resilience can, to some degree, stem from the resilience of different singular components?

Second, there is the **dominance of traditional structures**. These structures appear to be resistant to change, whether a shift to a multi-disciplinary perspective (e.g., allowing different management perspectives), a lateral perspective (e.g., collaboration between communities), or a multi-level perspective. This raises the question of whether the existing institutional structure is capable of encouraging or supporting regional resilience.

Third, water systems are **complex**. Our literature review highlights the multitude of ways water is connected with different facets of day-to-day life. Recently it has been observed that

interlocking networks are increasing the overall numbers of plans (Burns & Grant, 2014). While this potentially serves to illustrate a growing understanding of interconnections, it also increases chances of conflict between planning documents and creates challenges for coordination (Burns & Grant, 2014). This is unsurprising as while comprehensive planning is related to resilience, its integrated nature makes it hard to implement (O'Hare & White, 2013).

Returning to the research question, is the current approach to managing drinking water systems supportive of regional resilience, based on our analysis the response is variable. Documents from the upper levels of government, while increasingly recognizing the need for flexibility, engagement, and coordination, continue to be top-down and hierarchical in nature. Within the region itself some larger communities demonstrate that the role of water within the community is being increasingly recognized and integrated with other aspects of community planning, working to support community resilience. However, the details surrounding smaller communities, as well as those small systems under the control of the regional districts, are difficult to access. At the regional scale, the CBT provides one example of a regional effort including multiple systems and communities, but overall there is little evidence within the Kootenays of regional or sub-regional planning and management. While drinking water systems clearly play a role within their communities, the scaling up - either of water systems to the watershed level or communities to the regional level more generally - is lacking. As noted above there is the potential, not only in terms of the role for water, but also more generally in terms of communities coming together as a region, to enhance regional resilience. But at this juncture this remains potential only.

Finally, results from the content analysis compared with interviews conducted in previous stages of the *From staples theory to new regionalism: managing drinking water for regional resilience in rural British Columbia* project identify a disconnect between paper and practice. Interviews reference stale or unused plans, informal or unrecorded plans, challenges surrounding access to plans, lack of capacity to implement plans, and plans that exist solely as a result of regulatory requirements (Breen & Markey, 2015). What is recorded in plans is not always indicative of what is happening, including plans referencing actions that are never implemented to plans that do not include actions taken.

5.6. Conclusions

There is much potential for drinking water systems to act as a catalyst to enhance regional resilience. Is this currently occurring in the Kootenay region? Overall the impression is that regional integration is emergent or occurring in isolated situations. There are no cohesive or integrated regional plans, although more recent examples are making progress in this direction, such as the Kettle River Management plan recently developed by the Regional District of Kootenay Boundary (Regional District of Kootenay Boundary, 2011). While water systems are recognized by overarching plans this is often in a nested and hierarchical way (water system→community→province), that excludes consideration of the surrounding region(s). There appears to be a lack of regional cohesion and direction that, in addition to the institutional structure barriers, makes it difficult for the planning and management of drinking water systems to take advantage of their potential links to regional resilience. While traditional approaches to water resource management are being replaced by more flexible, horizontal, multi-level approaches (Ferreira et al., 2008), our research indicates that this shift is not present specific to the planning and management of drinking water systems in rural BC.

What does that mean for the future? While certain pressures and requirements will continue, there is some flexibility within current institutional structures, particularly at the local level, as well as some evidence of an openness to change. Existing regional organizations offer potential links between organizations in order to work toward common goals, with the potential of enhancing regional resilience. The structure of BC's regional districts affords the flexibility to create and pursue new initiatives.

Regions can be locked into sub-optimal situations as a result of institutional structures (Boschma, 2014; Pendall et al., 2009). In the case of the potential role for water systems in supporting regional resilience in the Kootenays it appears as though existing institutional structures limit emerging change and that this is likely enhanced by a long history of competition and rivalry between communities and strong top-down structures (Author 2015). Pendall et al. suggest that a massive shock is needed to change the course of path dependence (2009). Perhaps the current infrastructure deficit offers such a shock. Infrastructure is a factor that can contribute to path dependence or that can facilitate adaptability and change, particularly as it is renewed (Christopherson et al., 2010; Pendall et al., 2009). Currently, both in the Kootenays and across Canada the infrastructure deficit is recognized as a critical challenge, providing opportunity for infrastructure, like drinking water systems, to be an agent of change. However, in addition to

new approaches, such as those reflective of new regionalism, new institutions and institutional structures will be required (Zimmerbauer & Paasi 2013). Given the gap between potential and practice, the role of drinking water systems in regional resilience warrants further exploration, particularly of the potential for alternative management approaches to drinking water systems aimed at enhancing regional resilience.

Chapter 6. Paper #3: Exploring a new regionalism based approach to managing drinking water systems in rural regions

Abstract

Rural regions face many challenges when managing drinking water systems. Current management approaches lack the ability to deal with the complexity that surrounds these infrastructure systems and the critical service they provide, as well as the links between these systems and the economy and environment. This research explores the potential for an alternative approach to managing drinking water systems. The proposed new regionalism based approach recognizes and accounts for the myriad of influencing factors, using different mechanisms to support and encourage drinking water systems in fulfilling their potential role in supporting regional resilience. Using a case study approach, data collected from targeted, semi-structured interviews indicate that elements of the proposed approach are already in use within the Kootenay Development Region, in British Columbia, Canada. Results indicate that while the need for an alternate approach to management of drinking water systems is recognized, and elements of the proposed approach are increasingly applied, substantive barriers remain, such as the existing institutional and jurisdictional structure.

Key Words: drinking water systems; new regionalism; regional resilience; rural

6.1. Introduction

Drinking water systems in rural Canada face challenges to being both functional and compliant with regulatory requirements. In terms of function, aging and degrading systems often struggle to serve residents in a way that is financially viable, and few systems are managed in a way that focuses on building a resilient future. Regulatory compliance poses an additional challenge, due to the associated costs and limited opportunity for context-specific approaches within provincial regulations. Infrastructure literature often focuses on infrastructure age, degradation, and past maintenance; engineering; and financial elements. However, for drinking water systems in rural British Columbia (BC) recent research has demonstrated how additional factors such as past regional development trends combine with more common rural challenges like human capacity and physical geography to further complicate the situation (Breen & Markey,

2015). As a result, drinking water systems in rural regions present a multi-faceted management challenge for which it is unlikely that there is a single solution. Rather, the complexity of the situation is viewed in this paper as indicating a need for a different approach to managing drinking water systems, one that is flexible and that recognizes and accounts for the myriad of influencing factors, and one that sees drinking water systems as supporting regional resilience - the continuous ability of a region to both resist and adapt to change (Boschma, 2014).

There are many alternative resource management approaches, including those dedicated specifically to water (e.g., integrated water resource management). However, as noted above, many of the factors affecting drinking water systems extend beyond the realm of water. Regional resilience is influenced, positively and negatively, by multiple factors, including infrastructure systems (Martin & Sunley, 2014). Having regional resilience as a key consideration in rural areas where dependence on natural resources provides a clear link between social and ecological aspects of regional resilience (Adger, 2000).

However, in order to work toward regional resilience, an alternate framework and approach to those used in the past is needed. 'new regionalism' offers one such alternate framework and approach. While there is no single, agreed upon definition of new regionalism, the common characteristics are that new regionalism is a reconceptualization of what 'the region' is, favouring an integrated, territorial approach to development and incorporating factors such as integration, governance, learning and innovation, and place-based development (see Section 5.2, Table 4). New regionalism is applied in different ways, including past application to natural resource management, water, and watersheds (Peterson et al., 2007, 2010). While not a panacea, new regionalism offers the potential to serve as a management platform for – an approach that has potential to manage drinking water systems deliberately to enhance and support regional resilience. This paper explores this potential, with an aim to add to the existing literature, as well as contribute to the broader discourse on rural viability by informing policy and decision-making.

Despite the potential of new regionalism to offer an alternative approach to managing rural drinking water systems, previous research suggests it is hindered by the current management reality. In BC, drinking water systems are typically managed at the local level, on a system by system basis and in silos, while simultaneously being subject to a traditional top-down regulatory and institutional hierarchical structure with multiple, overlapping jurisdictions. The result is both horizontal fragmentation between departments and local governments, and vertical fragmentation

of lower and higher levels of government (Brandes, Ferguson, M'Gonigle, & Sandborn, 2005). This fragmentation is noted as a hurdle to water management and to regional resilience (Bakker & Cook, 2011; Breen & Markey, under review). Given the challenges rural drinking water systems face and the shortcomings of existing management, this research explores the potential of new regionalism to serve as the foundation for an alternative management approach for rural drinking water systems. My objectives are to i) identify the potential contribution drinking water systems could make to regional resilience; ii) develop a new regionalism based approach to the management of rural drinking water systems aimed at supporting regional resilience, and iii) examine the applicability and feasibility of this approach for drinking water systems in rural BC.

Below, I first present an overview of literature reviewed, including an overview of literature related to drinking water systems (e.g., regulations and management) and their potential contribution to regional resilience, new regionalism, and regional resilience. This is followed by the methods used, findings, discussion, and conclusions. By focusing on rural drinking water systems, this research hopes to offer a new perspective, addressing gaps within the existing literatures related to rural infrastructure and new regionalism. Additionally, findings relating to the applicability and the feasibility of the proposed approach are intended to help inform local and provincial policy relative to management of drinking water systems.

6.2. Literature Review

6.2.1. Drinking water

6.2.1.1. Regulation and management

The need for changes to the management of drinking water systems is recognized in different ways within academic literature. For example, despite water being naturally regional (i.e., the watershed), drinking water systems are typically managed at the local government scale (McKinney & Johnson, 2009). However, the use of the watershed scale is now seen as a best practice for water management (Ferreyra et al., 2008; Rothwell, 2006). There is also a recognized need for an integrated approach to water management that addresses the interrelationships between water, people, and environment across jurisdictions (Bakker, 2007). Additional factors, such as building on existing capacity and place specific opportunities and constraints, should be considered in management approaches (de Loë & Kreutzwiser, 2007; Hirokawa, 2011).

However, contrary to this recognition of a need for integration, as noted in the introduction, the management of drinking water in Canada is fragmented and siloed, generally taking a more traditional top down hierarchical approach, particularly between the provinces and local governments. The role of the Canadian federal government in drinking water is limited outside of First Nations reserves (Bakker & Cook, 2011), excepting the funding role played by Infrastructure Canada (Infrastructure Canada, 2014) and the development of federal guidelines for drinking water quality. Drinking water systems are primarily regulated from the provincial level. In BC this predominantly involves the Regional Health Authorities (water quality) and the Ministry of Forests, Lands, and Natural Resource Operations (water quantity and environment), although other ministries (e.g., Community, Sport, and Cultural Development) play related roles in terms of facilitation and funding. Provincial regulation of drinking water systems vary according to size, source, design, and governance (Government of British Columbia, 2003; Regional District of Central Kootenay, 2010). The Province has mandatory and discretionary water quality standards, as well as licensing requirements (British Columbia Ministry of Health, 2012). Additionally, it is important to note that provincial regulation and management is fragmented between health and quality (*Drinking Water Protection Act*) and environment and quantity (*BC Water Sustainability Act*). While British Columbia's new *Water Sustainability Act* offers the potential for regional water plans, as well as other tools, such tools are managed and regulated separately from drinking water systems management. But regardless of the regulation, the bulk of the actual management of drinking water systems in BC is done at the local level (Bish & Clemens, 2008) by local governments (i.e., municipalities or regional districts), single service providers (e.g., water users communities), First Nations, or owners of private systems (Government of British Columbia, 2003).

6.2.1.2. Drinking Water System Potential

Infrastructure is the physical foundation of society, linking to social, economic, and environmental quality, development, and growth (Baldwin & Dixon, 2008; Pollalis et al., 2012). The design, function, condition, and management of infrastructure can lock regions on to a specific, often unsustainable, path (Brodhead et al., 2014; Connelly et al., 2009; Dale & Hamilton, 2007). Conversely, with deliberate design and management, infrastructure can act as a catalyst or tool to reduce environmental impact, aid in mitigation and adaptation, and facilitate sustainability (Berkes & Ross, 2013; Kennedy et al., 2008; Robinson et al., 2008). Infrastructure can be one factor that allows regions to adapt over time (Berkes & Ross, 2013; Christopherson

et al., 2010; Magis, 2010), enhancing regional resilience (e.g., through disaster preparation and recovery) (Berkes & Ross, 2013; Mirza, 2007b).

Drinking water systems are one example of infrastructure that provides a critical service (American Water Works Association, 2001). For example, drinking water systems consist of multiple, interconnected elements whose individual or simultaneous failure can disrupt services – requiring improvements to factors like reliability, recovery, robustness, and redundancy to contribute to resilience (Yazdani et al., 2011). Sustainable communities are generally characterized by sustainable water systems (Robinson et al., 2008). However, conditions for sustainability include appropriate and effective government and management, as well as physical infrastructure (Baldwin & Dixon, 2008).

There is a recognized need to change not only the way drinking water systems are designed, but to change how systems are managed in order to contribute to the broader objectives of society while maintaining environmental integrity (Federation of Canadian Municipalities & National Research Council, 2005). These systems need to be managed in a way that contributes to the broader objectives of society while maintaining environmental integrity (British Columbia Water and Waste Association, 2014; Heare, 2007; Pollalis et al., 2012; Santora & Wilson, 2008). However, presently the potential for drinking water systems to contribute to sustainability and regional resilience is hindered by management factors, such as increased responsibility placed on local governments and other local purveyors of drinking water (e.g., increased financial responsibility with decreased revenue) (Bakker, 2007; Kennedy et al., 2008) and the aforementioned issues of fragmentation (Brandes et al., 2005).

Alternative approaches to water management are not new. For example, integrated water resource management is a widely cited alternative approach (e.g., Mitchell, 2005). There are also lesser known approaches, such as the watershed governance prism (Bunch et al., 2014). The approach proposed in this paper attempts to address existing challenges while directing drinking water systems toward their potential of contributing to regional resilience. The theoretical foundation for this approach is built on new regionalism and regional resilience, discussed below.

6.2.2. New regionalism

The concept of new regionalism emerged in the late 1980 and early 1990s (Hettne & Inotai, 1994; Kitson et al., 2004). This ‘reconceptualization’ of regional development emerged in reaction

to the restructuring that followed the 1980s recession and the rise of proactive, local actions initiated by changing political and economic contexts (Buzdugan, 2006; Hettne & Inotai, 1994; Rainnie & Grobbelaar, 2005). New regionalism is characterized not only by the use of the regional scale, but by characteristics like place-based development, innovation, competitive advantage, and flexibility – all necessary for regions and communities to function in a changing world (Jonas, 2011; Perrin, 2012; Savitch & Vogel, 2000; Wheeler, 2002). Under new regionalism the region is not a static unit, but multiple, different, and potentially overlapping units, recognizing that no single region can serve all needs (Amin, 1999; Fawcett, 2004; Zimmerbauer & Paasi, 2013). New regionalism provides a foundation for employing the regional scale, as well as providing an integrated approach linking water and regional resilience.

While other alternative water management approaches use a regional scale and can employ similar characteristics, new regionalism is broad, allowing for consideration of multiple facets, including the links between drinking water and development. New regionalism has been applied to water (e.g., the application of new regionalism in planning for water quality improvement in Australia (Peterson et al., 2010)), however the application of new regionalism to both drinking water and the rural context is lacking in the literature.

There is a breadth of literature included under the umbrella of new regionalism. Five core themes, as identified by the *Canadian Regional Development* project (Vodden et al., 2015), can be seen across new regionalism literature: governance, integration, place, innovation, and rural-urban relationships. Each of these five themes can be directly related to drinking water (see Table 4). For the purposes of this research, new regionalism is used as an analytical framework, exploring a holistic and co-constructed approach to managing drinking water systems at a sub-provincial regional scale based on the previously identified five themes.

Table 4: New regionalism and drinking water management

New Regionalism Theme	Link to Drinking Water
Governance	Ability to support collective action and decision-making in multi-level and multi-sector networks is applicable to complex and multi-level governance situations as in Canadian drinking water governance and management.
Integration	Affords consideration and balance between ecosystem relationships, human activities (social and economic), values and governance actors at multiple scales. Facilitates sustainability and resilience.
Place	Ensures consideration of place and the associated biophysical, social, cultural and economic factors (e.g., within the watershed).
Innovation	Includes mobilizing knowledge through exchange, promoting water networks, and a focus on long term evaluations of new governance structures and legislation.
Rural-urban relationships	Identifies and builds on interdependencies. While the focus of regional development policy is often on urban areas, urban centres require rural resources – including water.

Source: (Breen & Minnes, 2015)

6.2.3. Regional resilience

The breadth of new regionalism affords an approach to development that extends beyond the management of drinking water. This research looks at regional resilience as it relates to rural drinking water systems. Resilience and water are commonly linked within the literature (e.g., Booher & Innes, 2010; Hager et al., 2013; Yazdani et al., 2011). Consideration of the human factor in resilience means that place and context are recognized as having important roles, with resilience emerging not only from structural conditions, technology, or institutions, but from the decisions and actions of people (Bristow & Healy, 2013). This speaks to why this research goes beyond the hard infrastructure (e.g., pipes, pumps) to include planning and management.

Resilience has evolved in its definition and application within multiple disciplines and scales. This research focuses on the social science perspective at the regional scale. Resilience provides a useful lens for rural studies and analysis (Pendall et al., 2009; Scott, 2013) and is noted as particularly relevant for resource dependent regions, given the link between their economies and environmental resources (Adger, 2000). The literature demonstrates different approaches to resilience, such as the short term capacity to absorb shock (Boschma, 2014) and successful adaptation over the long term (Christopherson et al., 2010; Pendall et al., 2009; Simmie & Martin, 2010) through a process of recovery, resistance, re-orientation and renewal

(Bristow & Healy, 2013; Scott, 2013). For the purposes of this research, regional resilience is the continuous ability of a region to both resist and adapt to change, allowing shocks to be accommodated, but also new paths to be developed as appropriate to the context (Boschma, 2014). In particular, this research is focused on the role of drinking water systems in supporting the ability of regions to be resilient. In this use, regional resilience is a process as opposed to a specific outcome (Norris et al., 2008; Skerratt, 2013).

Factors like globalization have made regions more susceptible to outside effects (Christopherson et al., 2010; Macleod, 2001), necessitating flexibility. Combining regional resilience and new regionalism affords a practical, flexible regional approach. New regionalism and resilience share common characteristics. However, while new regionalism offers some explicit direction in terms of an alternative development approach, it stems from an economic perspective – and remains poorly developed from an environmental perspective, whereas resilience grew from ecology and broadened to include the economic and socio-cultural perspectives (Folke et al., 2004). By combining the two, the intent is to balance the economic, socio-cultural, and, in particular, the environmental, all using the regional scale. This is key for drinking water services, as drinking water systems facilitate the use and consumption of water and link communities to the surrounding environment. Drinking water systems play a potentially important role in regional resilience – either supporting or detracting. In order to support regional resilience drinking water systems would have to link with and support the regional economy, quality of life, and surrounding environment.

6.3. Methods

6.3.1. The case study approach

This research builds on the foundation laid by the *Canadian Regional Development* project, which explored new regionalism in rural Canadian regions. Findings identified drinking water as a key topic (Breen, 2012). This spurred further exploration of drinking water systems management and rural resilience in rural BC (Breen & Markey, 2015; under review), as well as a comparative study of rural drinking water management that provided an initial exploration of the potential for a new regionalism based approach to water management (Breen & Minnes, 2015).

This research continues the case study approach adopted by the *Canadian Regional Development* project. Given the complexity that surrounds rural drinking water system management a case study approach is fitting. The Kootenay Development Region (the Kootenays) was selected as a case study region for a number of reasons. Past research afforded the author in-depth regional knowledge and a robust longitudinal study. Additionally, the Kootenays reflect characteristics shared by other rural regions, providing potential for wider applicability.

The Kootenays are comprised of three regional districts, 22 electoral areas, and 26 municipalities. The region covers 6.2% of the province of BC (BC Stats, 2012a), but with 3% of the population, ~146,000 people (Statistics Canada, 2012). The region has an unknown number of drinking water systems, with estimates upwards of 2000, ranging range in size, source, management, governance, compliance, and condition. These drinking water systems have a range of environmental, economic, and social impacts, and in many cases managers face challenges relating to deteriorating infrastructure, increasing regulatory requirements, and capacity and resource limitations (Breen & Markey, 2015). Only drinking water systems that are owned and operated by local governments are included in this research.

6.3.2. Data collection and analysis

In 2015, 20 interviews were conducted with 22 people representing 15 organizations. As this research builds on past research, there was a continuation of the organizations that were involved in previous stages of research – identified through targeted internet searches, discussions with organizations, and referrals. At the local level, two types of local government individuals were targeted: local government Chief Administrative Officer (CAO) or equivalent (5)¹¹ and water operations and management staff or equivalent (11). Additionally, related supporting and upper level government organizations were also targeted – i.e., those regional, provincial and

¹¹ For each local government 1 CAO (or equivalent) and 1 water operations/management person were contacted. 5 local governments had these two participate (8 people total). 4 local governments only had water management people participate (4 people total), with CAOs either not responding or declining in favour of their water person. Lastly, one local government included 2 water operations and management staff – one systems operations and one watershed management (2 people).

federal organizations that are not local governments, but have a direct governance, regulatory, program, or funding role (6)¹².

Interviewees were asked closed and open ended questions based on the four goals and six mechanisms of the proposed approach (see Figure 1). For each of the six mechanisms, examples were developed representing the core concepts found in the literature (see Table 2). Closed ended questions targeted the applicability or feasibility of a particular aspect of the approach, while the open ended questions allowed for elaboration and clarification on the initial response. All participants were asked questions about the applicability and feasibility of the proposed six mechanisms, although the supporting organizations provided general comments as opposed to specific details given the scope of their jurisdiction. Supporting organizations were also asked questions specific to their ability to support local implementation.

Initial closed ended responses noted during interviews were tabulated and responses were cross referenced with interview transcriptions. NVivo qualitative analysis software was then used to code and explore the qualitative responses, resulting in a final set of descriptive statistics and themes. An explanation building technique was used to explore the variables influencing question responses (Yin, 2003) - attempting to explain the contextual factors influencing the applicability and feasibility of the proposed approach.

6.3.3. A new regionalism approach to drinking water systems

The purpose of a new regionalism based approach to managing drinking water systems is to call for regional collaboration to guide drinking water system management in a way that facilitates and supports regional resilience. The approach is intended to be flexible, as opposed to being prescriptive, able to deal with different scales and capacities, and to work within the existing fragmented governance actors and processes. This flexibility allows for differences between places, providing a set of ideas that can be combined and enacted in different ways, allowing systems to maintain independence while encouraging collaboration.

The approach is broad and aspirational, focusing on what actions could be taken at the local level. This is appropriate given that any new management approach would have to work

¹² All supporting organizations contacted participated.

within the existing legislative and regulatory framework and there would be little point in pursuing legislative or regulatory changes if it such an approach was not applicable or feasible locally. The proposed approach challenges local managers to identify opportunities for management of drinking water infrastructure to better link with and support regional development, and the overall support of regional resilience.

The proposed approach was based on the literature reviewed above, and used the five new regionalism themes as explained above to identify indicators of regional resilience relating to water management, and more specifically water systems management (Breen & Minnes, 2015). These resilience indicators were further refined by the author in 2015 specific to drinking water systems in order to examine existing management approaches. (Breen & Markey - in review). For the Breen & Markey – in review paper a content analysis using both latent and manifest coding was applied to both sets of indicators, along with the accompanying literature to identify core goals and mechanisms for approaching those goals (Breen & Markey - in review). Building on the above, the following analytical framework was developed for this research:

The proposed new regionalism based approach for managing drinking water has four defined goals:

1. *Enhance operations* – ensure efficient and innovative use of existing capacity
2. *Support development* – ensure drinking water systems support regional development
3. *Environmental stewardship* – ensure attention to surrounding environment
4. *Adaptability* – avoid path dependence

Goals are to be achieved through actions in one or more of the following six mechanisms:

1. *Integrated planning* – inclusive planning process and the integration of plans
2. *Knowledge sharing* – sharing information, using multiple sources, collaborative efforts
3. *Water system design* – infrastructure is efficient, sustainable, and place appropriate
4. *Operations* – collaborative efforts and asset management
5. *Implement and evaluate* – ongoing assessment and adaptation
6. *Flexible institutional structure* – working at different scales and with different actors

Figure 5 is a visual interpretation of these goals and mechanisms, attempting to illustrate how drinking water systems are interconnected within a region. For example, a drinking water system must be integrated at a community and regional level in order to support development, just as it must consider the watershed scale in order to account for environmental stewardship.

Additional details of how this approach was presented can be found in the following section.

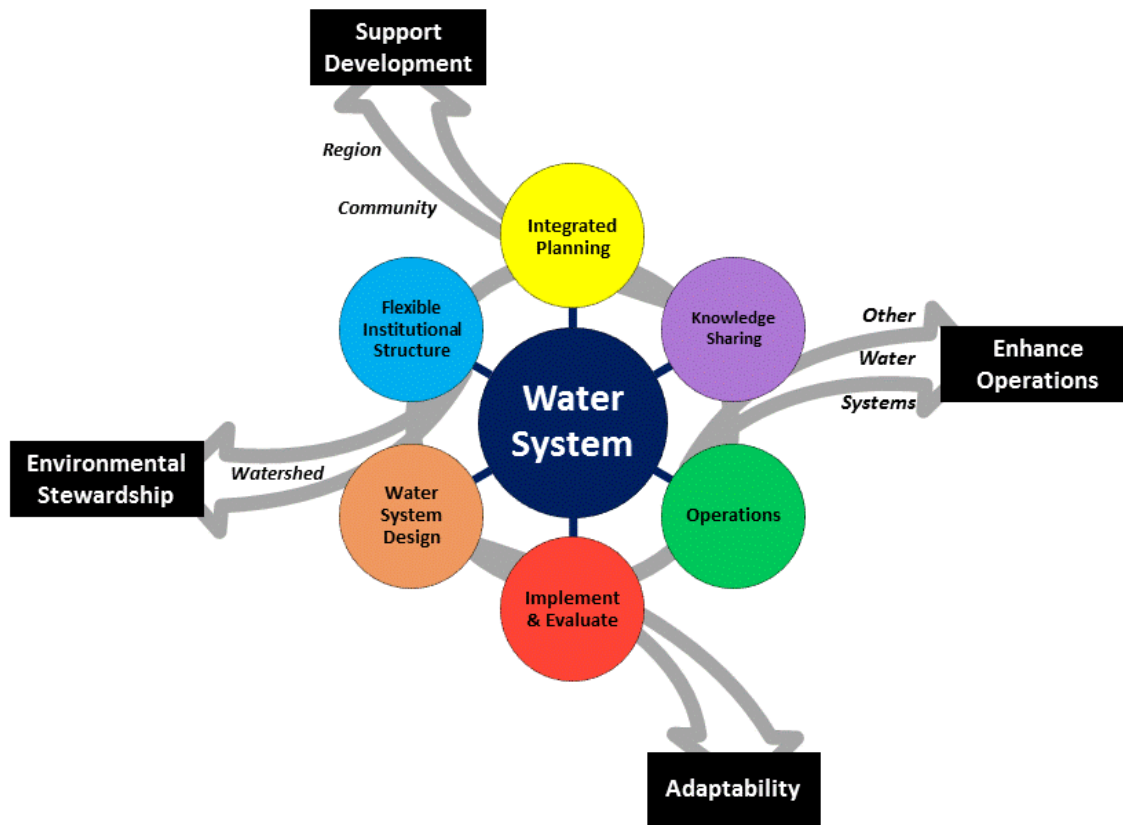


Figure 5: New regionalism based approach to managing drinking water systems for regional resilience

6.4. Results

6.4.1. Overview

Table 5 lays out each of the six mechanisms with examples of core concepts and provides an overview of the dominant response to each question, as well as the dominant qualifier(s).

Table 5: Dominant responses

	Applicable (/16)¹³	Feasible (/16)¹⁴	Support For (/6)¹⁵
1. Planning			
<i>Water-specific considerations beyond what is currently required</i>	Yes¹⁶ (16) – no dominant qualifier	Yes (12) – within the confines of existing jurisdiction/institutional structure and context dependent	Yes (4) – often only a specific element, with others noted as outside scope/mandate
<i>Non-water related considerations beyond what is currently required</i>	Yes (13) – predominantly unqualified	Yes (10) – range of qualifiers, including: resources, priorities, external pressure, and jurisdiction/institutional structure	Not sure (4) – lacking mandate or some conflict/lack of authority in jurisdiction/institutional structure
<i>Drinking water plans should integrate with other plans</i>	Yes (12) – recognition of need and existing examples	Yes (13) – range of qualifiers, including: resources, priorities, protectionism, and willingness/acceptability	Tie: yes/not sure/NA (2/2/2) – need is recognized, but challenged by conflict or lack of authority in jurisdiction/institutional structure
2. Knowledge Sharing			
<i>Large scale approach to knowledge sharing</i>	Yes¹⁶ (16) – recognition of need or no qualifier	Yes (15) – range of resources, context considerations, priorities and acceptability	Yes (4) – often only a specific element, with others noted as outside scope/mandate; some conflict or lack of authority in jurisdiction/institutional structure
<i>Consideration of a wide range of information when making decisions</i>	Yes (10) – predominantly not qualified, others are context related	Yes (9) – Resources, priorities, and willingness/acceptability	No¹⁷ (3) - generally outside mandate
<i>Larger scale, collaborative approaches to public education</i>	Yes (11) – recognition of need or no qualifier	Yes (11) –resources and priorities	Yes (4) - but often only a specific element (others outside scope/mandate)

¹³ Local government interviewees only

¹⁴ Local government interviewees only

¹⁵ Supporting organization interviewees only

¹⁶ ^ denotes 100% agreement

¹⁷ * denotes a weak majority – i.e., more than any other, but equal or less than the combined total of other responses

	Applicable (/16)¹³	Feasible (/16)¹⁴	Support For (/6)¹⁵
<i>Building human capacity at a scale larger than a single system or community</i>	Yes (14) – predominantly not qualified	Yes (14) – resources	Yes* (3) - often only a specific element, with others noted as outside scope/mandate
3. Water System Design			
<i>Physically linking infrastructure systems where practical</i>	Yes (9) – recognition of need and existing examples	Yes* (8) – jurisdiction/institutional structure, resources, and priorities	No* (3) - generally outside mandate
<i>Accounting for future needs that can change infrastructure design or the technology needed</i>	Yes^ (16) – not qualified or examples given	Yes (11) - largely unqualified, with some resource and context based qualifiers	Yes* (3) - often only a specific element, with others noted as outside scope/mandate
<i>Use of new, innovative, and sustainable technology</i>	Yes (13) – recognition of need and existing examples, but focused on specific aspects only	Yes (11) – resources are the dominant qualify, with some comments around jurisdiction/institutional structure	Yes (4) - often only a specific element, with others noted as outside scope/mandate; some conflict/lack of authority in jurisdiction/institutional structure
<i>Use of specific design characteristics and considerations</i>	Yes (14) – recognition of need and existing examples	Not sure* (6) - resources	Yes (4) - but often only a specific element (others outside scope/mandate), some conflict/lack of authority in jurisdiction or institutional structure
4. Water System Operations			
<i>Larger scale collaborative approaches to water system operations</i>	Yes (13) – predominantly not qualified	Yes (11) – qualified mostly by priorities, protectionism/isolation, and jurisdiction/institutional structure	Yes (5) - often only a specific element, with others noted as outside scope/mandate
<i>Various asset management considerations</i>	Yes^ (16) – predominantly not qualified	Yes (14) – resources and external pressure	Yes (4) – often only a specific element, with others noted as outside scope/mandate

	Applicable (/16)¹⁸	Feasible (/16)¹⁹	Support For (/6)²⁰
5. Implementation and Evaluation			
<i>Timely, supported, and accountable implementation</i>	NA	Yes (10) – priorities and resources	NA
<i>Evaluation criteria goes beyond existing regulations</i>	Yes (11) – not qualified and fits context	Not sure* (5) – priorities and resources	No* (3) - scale and context
<i>evaluation is ongoing and policies, programs, plans and/or processes can be adapted immediately</i>	Yes (10) – predominantly not qualified, but existing examples given	Yes* (8) – resources and existing examples	NA
6. Flexible Institutional Structure			
<i>Institutions should be flexible enough to allow governance or management of drinking water systems at a scale larger than a single organization and should have the flexibility to include multiple actors in drinking water governance or management</i>	Yes (10) – qualifiers focus on what exists, specific aspects, scale, and context	Yes* (8) – range of qualifiers including: jurisdiction/institutional structure, protectionism/isolation, willingness and acceptability, priorities, resources, context, and external pressure	Tie: yes/not sure (3/3) – flexibility exists, but politics, relationships, protectionism, and institutional structures

Responses, both in terms of the applicability and feasibility of the proposed approach, were typically positive (e.g., supportive, in favour). However, responses were also often qualified in some way, indicating complexity and the lack of a simple yes/no response. Generally questions relating to applicability of the proposed approach had a greater positive response than questions

¹⁸ Local government interviewees only
¹⁹ Local government interviewees only
²⁰ Supporting organization interviewees only

relating to feasibility. It appears that while many local government respondents found a mechanism, or an element of one, applicable to their system they were more likely to change or qualify their response relating to the feasibility of that tactic or element. Supporting organizations also responded positively, but indicated that they were often limited in their abilities to pursue these aspects of the proposed approach, most commonly due to restrictions, limitations, or conflicts in mandate, as well as constraints within jurisdiction and/or institutional structure. Of the mechanisms presented, water specific planning, knowledge sharing, water system design (i.e., systems that are efficient, sustainable, and place appropriate), and collaborative water system operation are the elements most likely to be, in part or in whole, applicable, feasible, and supportable. Conversely, implementation and evaluation and flexible institutional structure are least likely, the former most often due to constraints related to priorities and resources, while the latter being more complex with a range of qualifying factors including lack of pressure or requirements to change and challenges merging the proposed approach with existing institutional structures.

6.4.2. Exploring dominant themes

Within the range of responses five dominant, influential themes could be observed: resources, context, jurisdiction and institutional structure, perception and understanding, and external pressure.

First – resources. It is clear that resources are a challenge. Resource references most often referred to financial resources (e.g., lack of funding, inadequate or inappropriate funding tools and requirements²¹), human resources (e.g., qualified people, capacity, time), and information (e.g., access to information sources, place appropriate resources). Examples of this theme were found throughout the interviews, in quotes similar to the following from a Local Government Water Manager:

I think certainly for [us] and I think I'll speak for certainly most municipalities in the probably everywhere, certainly the interior of BC, is we're under resourced. There's just no, thinking outside the box takes effort and time and ... no I don't have time for that, I'm just, again doing the bare minimum, we're checking the checkboxes. And any time you want to step outside of that box man it's it takes a lot.

²¹ Local government restrictions to the use of property taxes as a method of funding is an example of an inadequate tool, as is the restrictions placed on those systems not under local government control that are unable to access funding. Expectations around the level of water quality treatment that should exist prior to infrastructure upgrades being funded is an example of an inappropriate requirement.

Further, the resource gap is ubiquitous – occurring at all levels. However, it is also recognized that simply ‘throwing money or people’ at the situation is not the solution. On one hand multiple examples provided by interviewees demonstrate successful innovation and collaboration resulting in the enhancement of existing resources or more efficient use. On the other, systemic issues (see below), including factors such as political willingness and acceptability, play a crucial role relating to the allocation of resources:

Nobody has put any money in the bank... So there's no money in the bank to replace all that stuff. So what happens is the politicians rather than raising the tax rates and incurring the wrath of the public tend to not run again. And then the new group comes in. They recognize the problem, but they have their particular interest groups that are supporting them. So the tax revenue tends to go towards building of new, I call them monuments. – Local Government CAO Interviewee.

Second – context. Not every element of each of the proposed mechanisms will work in each scenario and different places will approach things differently from a unique starting point. Take water meters for example. Generally accepted as a conservation tool, several interviewees made observations similar to the quote below from a Local Government CAO:

Metering doesn't make sense for every community in the Kootenays. It really depends on your treatment costs and your source and your capacity and your population. So a place like [town A] or [town B], maybe metering makes more sense. But for our population right now, metering would be way down the list for priorities.

The role of context was reflected in terms of the need account for scale, physical layout, local socio-economic realities, history (e.g., between communities, within organizations, between specific people), and physical infrastructure in water system design and management. Context differences were seen between small and large systems, and in the references to differences between government and non-government systems. When discussing potential for regional training opportunities, a Local Government Water Manager noted that,

There's only so much standard stuff that all municipalities do. Hydrant maintenance, valve maintenance, flushing, like those sorts of things, those are common across the municipalities. But when it comes to treatment around here everybody's different. Everybody has a different treatment system, a different treatment ... process.

This discussion of context underscores the importance of a flexible approach. Interviewees further highlighted the need for flexibility within current jurisdiction and institutional structures (e.g., BC's Regional District governance structure) that would allow for more regional collaboration as suggested by the proposed approach. However, similarly to the resource theme

above, this flexibility is influenced by other themes discussed below, particularly the role of external pressure.

Third – jurisdiction and institutional structure. Multiple comments from all interviewees point to larger systemic issues related to jurisdiction and institutional structure. Fragmented jurisdiction, clashing mandates, contextually inappropriate and uncertain regulations/standards, and where the balance of power is held (i.e., not with local government) all reflect this. For supporting organizations this can mean that they are limited in what they can do and what initiatives they can support. For example, when asked about changes to infrastructure design to support sustainability, one Supporting Organization Interviewee noted:

We don't actively look at that. Although we do tell water suppliers that 'hey, this is a great idea, you should be looking at this'... For instance, we're supportive of metering. We're supportive of leak detection. But we don't have anything on the books that we expect, that we've been telling water suppliers with regards to that. We don't make it a condition of permit, let's put it that way. That's not within our legislation.

For local governments this can mean that their best efforts are thwarted by lack of jurisdiction and power. When asked about planning within their watershed, one Local Government Water Manager identified other organizations within the watershed, noting, "we don't have jurisdiction over them at all...if they're going to be doing work in the area they have to come and see us first. For things like that. But we can't say no."

While existing flexibility in the *Community Charter* and *Local Government Act* could allow things to be done differently, jurisdictional structure can mean that local governments are fighting an uphill battle against factors outside of their control.

The lack of legislation around water related planning has the benefit of allowing communities to plan in a contextually appropriate fashion (e.g., demand management plans, watershed protection plans). However, it also appears as though too much flexibility can lead to defaulting to the status quo, particularly in cases where resources are lacking. To add to this responses were indicative of the challenge of changing how people view or approach things. Interviewees generally responded in line with the status quo – focusing on the applicability and feasibility within their specific department/community/organization, with minimal thought as to what the same thing would look like if it were approached from a regional scale with multiple organizations. In many cases, qualifying statements contained elements of deliberate and/or inadvertent protectionism or individualism, both within and between organizations, a hurdle to

regional collaboration. At the same time there was also clear recognition from interviewees that the status quo is not working, in particular that it does not deal with the complexity of the current situation (e.g., multi-use watersheds, climate change, development).

Fourth – perception and understanding. How people perceive and understand everything, from legislation and regulation to relationships with neighbouring communities matters. A number of qualifiers point to this, such as references to politics and the political cycle, priorities (e.g., local government, funding), willingness, understanding, trust, and acceptability (e.g., public, political). Instances of this theme were found throughout all interviews, at all levels. For example, public acceptability was identified as playing a key role in whether something becomes a priority for local government. Things that are not well understood by the public are less apt to be accepted, and subsequently less apt to be made a priority. When discussing true cost accounting one Local Government Water Manager noted that,

People spend for water less than what they spend for going to Starbucks in a month. They spend less for water than they do for cable tv. They make choices as to what's important and right now cable tv is more important than water or wastewater to them. Why? Well if you take a look of the cable networks they're constantly promoting their product in front of people.

Beyond influencing how the public votes, this influences how the public responds to referendums (e.g., public referendums relating to new treatment technology).

Political willingness was highlighted as something that is required to ensure that improvements to drinking water systems to remain a priority and are funded accordingly. Similarly to the public example above, this is hampered by the knowledge and understanding of local politicians, as well as the election cycle (e.g., changing representatives result in changing priorities). One Local Government CAO noted that,

Well I mean there needs to be a political will and there needs to be communication of the issue to the public. So you've gotta have buy in on those two levels before you have the resources to create that plan. Because when you go to council and you say I need \$100 000 for an asset management plan, well what's that? And how's that going to help us? And wouldn't we rather spend \$100 000 on filling potholes? ... So I think having council advocate on behalf of the infrastructure is really important. It's obvious it's going to be important to staff and we don't want maintenance headaches and we want money to be able to fix the issues. But if you can get your politicians to work and get the community on side then everyone is pulling in the same direction.

Fifth - the role of external pressure. Related to the previous two themes, this was generally noted as pressure coming from outside the management of the drinking water system that forces change, such as demands from the public (e.g., addressing pollution within a watershed) or requirements from the provincial government (e.g., grant requirements for infrastructure). Without this pressure it is clear that too often items may be recognized by managers and staff as needed or good ideas, but no action is taken. An example of this is asset management, an arguably necessary best practice, but one that gained little traction until it became a requirement, “P3150 was introduced that was the idea behind it. I mean there’s nobody out there that’s really pushed for ok, now you got your background work done, move ahead with your asset management plans” – Local Government Water Manager.

Existing examples of collaborative regional efforts demonstrate how critical this pressure for accountability is. The Kettle River Management Plan and the Water Smart Peer to Peer Training Program are two regional programs that demonstrate successful collaboration across organizations. The former is a collaborative watershed planning initiative within the Regional District of Kootenay Boundary, including the regional district and municipalities, as well as representatives from multiple sectors across the region. The latter is a train the trainer program designed to empower and accredit water staff to train other staff in their organization as well as others across the region, building local capacity. For both the role of an external pressure was critical, such as demand for action around water health and supply from the public, or pressure from a third party organization to maintain program momentum. As summed up by one Supporting Organization Interviewee,

It never would have happened without those invisible thumbscrews. That integrated approach had to be catalyzed with both a carrot (some funding support) and a stick (you’re going to be lower on the application priority list). Really, really simple. And astonishingly effective.

6.5. Discussion

The goals of this research are to i) identify the potential contribution drinking water systems could make to regional resilience; ii) develop a new regionalism based approach aimed at supporting regional resilience, and iii) examine the applicability and feasibility of this approach for drinking water systems in rural BC. The proposed new regionalism based approach identifies a drinking water management approach that is broad and flexible, and one that explicitly manages

drinking water systems to support regional resilience. This section discusses the implications of the findings relating to the applicability and feasibility of this approach, both on the ground and in the literature.

While individual drinking water systems face a range of challenges, a regional approach offers rural communities the opportunity to combine strengths to overcome challenges (Breen & Minnes, 2015; Ferreyra et al., 2008; Fish, Ioris, & Watson, 2010). There are many potential benefits to a new regional approach, including a framework that supports effective, collaborative action and a flexible, integrated, multi-level approach that includes multiple, overlapping regions. In theory these benefits have the potential to support regional resilience. However, the reality on the ground is that a new regionalism based approach is clearly not a straightforward or easily implemented solution. Although a strength of new regionalism comes from combining multiple concepts (Wheeler, 2002), some of the six mechanisms presented in the proposed approach show immediate promise as collaborative regional endeavours (e.g., operations, knowledge sharing), while others remain applicable ideas, but without a local level foundation upon which to build regional level success (e.g., regional planning). From a pragmatic standpoint it is unclear whether this indicates that the proposed approach should be implemented incrementally, or if it would be more useful as a series of separate, targeted guides as opposed to one broad approach. What is clear is that the breadth of topics covered within the proposed approach present a challenge for organizations, particularly related to their current mandates and institutional structures. These results are reflective of criticisms in the literature that new regionalism is too broad and overly inclusive (Harrison, 2006; Lovering, 1999).

Examples (e.g., the Water Smart Peer-to-Peer Training Program) illustrate where specific elements of the proposed new regionalism approach exist, demonstrating recognition and willingness to shift to a collaborative, regional scale approach (Breen & Hamstead, 2016). Indeed, these examples suggest that more is going on 'on the ground' that reflects characteristics of new regionalism and a potential trend toward regional resilience than is formally recognized in local planning documents (Breen & Markey, in review). Issues related to documentation (e.g., what plans exist, level of detail) were discussed by some interviewees, often relating to capacity issues. This lack of documentation can make it difficult for managers and policy makers to create support for change, as a result of the lack of formal proof that such actions are occurring and have been successful. Additionally, this disconnect between what is on paper versus what occurs in practice highlights a challenge in documenting shifts in approaches.

Taking a new regionalism based approach follows the general trend in water management toward flexible, horizontal, multi-level management (Ferreyra et al., 2008). Additionally, by incorporating the concept of regional resilience the proposed approach guards against critiques that new regionalism on its own has an overly economic focus (Harrison, 2006). The approach offers the benefit of flexibility and integration, supporting for contextually appropriate management. However, these and other potential benefits alone are unlikely to be enough to prompt the use of the proposed framework. In particular, the barriers and challenges related to institutional structure are reflective of the overarching issue of fragmentation that surrounds water governance (Bakker & Cook, 2011; Furlong & Bakker, 2011), something continually reflected through the legislation, regulation, and governance of water in British Columbia. Implementation of an alternate approach like the one proposed seems unlikely without changes to the underlying regulatory and governance system.

The literature reviewed speaks to the contributions infrastructure, including drinking water systems, can make to the ability of regions to respond and adapt to change and threats (Boschma, 2014; Magis, 2010; Pollalis et al., 2012). Infrastructure systems can be used to support regional resilience. This potential is demonstrated through the data collected, particularly in examples like the Kettle River Management Plan and the Water Smart Peer to Peer Training Program. However, as noted above, while possible, the likelihood that this potential will be widely activated, particularly at a regional scale, is questionable.

The results of this research are not definitive in terms of whether or not a new regionalism based approach will work, nor its potential contribution to regional resilience. While the potential is there, unanswered questions remain. For example, in order for the proposed approach to be successful there is the question of where the incentive(s) will come from to encourage and facilitate use of the proposed approach? Additionally, the inherent flexibility of the approach may mean that it is too broad, or at least potentially perceived as too broad, and too difficult to determine a starting point, particularly when capacity is limited. For those communities that are currently leading in terms of innovation and management, the downside to having their house in order is the question of what do they have to gain through helping others? A history of regional competition combined with the perceived additional burden of being the leader in a collaborative environment can be a barrier to regional action. Lastly there is the question of what can truly be accomplished without major systemic change? Like the shift from old to new regionalism, the context in which the majority of jurisdictions and institutional structures were developed has

changed, but without commensurate institutional change. While a voluntary change in approach, such as the one proposed, can provide some guidance toward change, a fundamental shift in the system itself is needed. Not only can the existing system not accommodate all aspects of the proposed approach, but under the existing system such efforts are often viewed as optional or 'nice to have'. So while change is possible, it is constrained and poorly supported. Overall this is indicative that a new regionalism approach to regional resilience lacks support at a basic level as current institutions are ill-equipped to support and participate in collaboration and integration.

6.6. Conclusions

Where does the promise of the proposed approach lay? And, if implemented, will it actually increase regional resilience? From the findings it currently it appears as though management shifts are more likely to first occur within single institutions, typically at the community scale, with some exceptions (e.g., regional level knowledge sharing among managers and operators, and examples such as the Kettle River Management Plan or the Water Smart Peer to Peer Program). It is unclear whether such shifts within single institutions are incremental steps toward regional resilience reflecting characteristics of new regionalism or not. However, based on interviewee responses there seems to be a rough order to the six mechanisms in terms of immediate relevance. From a regional perspective the data suggests that certain elements of the proposed approach show more promise when applied regionally than others, including: knowledge sharing, building human capacity, and collaborative system operations. Each of these mechanisms can already be seen in practice in some settings and there is recognition and incentives to pursue these mechanisms. Conversely, water system design, implementation and evaluation at the regional scale are limited – unlikely to go far without other action first, already limited at a single organization scale and thus unlikely to be regional. Planning falls between the two – with change occurring primarily on single organizations at the moment, but with recognition of future benefits of expanding regionally. Lastly there is the need for flexible institutional structures – likely to be ongoing, first working within the existing, as demonstrated through some of the examples found in the Kootenays, but then moving to new structures entirely.

What would it require to advance the proposed approach? The themes identified in Section 6.5 suggest a response – some sort of external pressure, bolstered by political and public understanding and support is required to create the willingness to make change a priority. A successful application of the framework would encourage regional collaboration as necessary,

but also support the building of a successful local foundation. There are also many assumptions made about the term 'region' as a result of current jurisdiction, history, geography, and politics. The separation of the old, static version of region, from the new, multiple regions idea is much needed.

What does this mean for the potential contributions of drinking water systems to rural regional resilience? Each drinking water system, community, and rural region is unique. As such, a single, regional policy, plan, or manual is a challenge to produce. However, the findings around the proposed approach suggests there is potential in having flexible, open-ended guidelines for drinking water systems management capable of meeting regional needs, but only if there is recognition, change, and a baseline capacity to approach it. The proposed new regionalism based approach to managing drinking water systems is no easy task, without a specific, linear path. Moreover, Pendall et al. suggest a massive shock is needed in order to disrupt path dependence (2009). However, the potential benefits, as suggested by examples such as the Kettle River Management Plan or the Water Smart Program, are such that the result could be worth it - if the status quo could be sufficiently disrupted (e.g., the Canada wide changes that occurred following the Walkerton e-coli outbreak in 2000). Particularly in light of the challenges posed by current jurisdiction and institutional structure, without such a disruption there is little likelihood that the management of drinking water systems could make a substantial change to regional resilience.

Chapter 7. Discussion and Conclusions

7.1. Introduction

Multiple factors play a role in the future viability of rural regions in Canada. In rural regions the infrastructure deficit, as well as other challenges associated with critical infrastructure systems, exist within a unique context, given factors such as low population density, lack of economies of scale, large spatial scales, and capacity limitations (Breen & Minnes, 2015; Minnes & Vodden, 2014). Additionally, following the relatively stable post WWII period of top-down, staples focused development rural regions have seen over thirty years of restructuring. Beginning with the recession of the 1980s, rural regions have experienced changes in approach to development, economic upheaval, increased responsibilities, and decreased capacities. While infrastructure systems serve as the physical foundation of modern society, influencing present and future quality of life, economic development, and environmental quality, the rural context influences how both the challenges and opportunities surrounding infrastructure are addressed. This in turn can influence the future viability of rural regions.

Drinking water infrastructure is among the many critical infrastructure systems that impact the local economy and quality of life, while directly linking communities to the environment. These infrastructure systems, including collection, treatment, and distribution, provide a critical service. The challenges facing drinking water systems in rural regions in British Columbia (BC) require immediate attention on a number of fronts, and the responses to these challenges may have the potential to contribute to future viability. Challenges with the infrastructure deficit and regulatory compliance, as well as design, planning, and operations, can all impact if and how drinking water systems support the future viability of rural regions.

However, both the period of rural restructuring and the infrastructure related challenges offer a window of opportunity to re-imagine how we approach critical infrastructure systems, providing an opportunity to better align infrastructure with the future development needs and aspirations of rural regions. Given increasing change, regional resilience—the ability of rural regions to cope with or resist and adapt to change—becomes increasingly important. Currently much of the discourse surrounding regional resilience from a development perspective focuses on economic dimensions, however there is an identified need to broaden the exploration of the concept in other areas (e.g., environment) (Martin & Sunley, 2014). Also in need of exploration

are the approaches and mechanisms that would facilitate a greater role for infrastructure systems in building regional resilience.

This research uses drinking water systems as a lens through which to explore the intersection between rural regional development and infrastructure with the aims of broadening the existing discourse and addressing knowledge gaps, as well as informing policy and decision-making. Three separate dimensions of this relationship are considered, explored, and written as three papers:

- i) The factors contributing to and influencing the current state of infrastructure (Chapter 4);
- ii) The role of current management approaches in regional resilience (Chapter 5); and,
- iii) The potential for an alternate, new regionalism based approach to support and enhance regional resilience (Chapter 6).

This chapter provides the overarching discussion and conclusions based on the findings of these three papers. First is a synopsis of each of the three papers and how they respond to the research questions. This is followed by an overview of the evolution of this research and lessons for future research. Finally, the individual findings of each paper are brought together into overarching recommendations and conclusions.

7.2. Paper 1: the staples legacy

Paper 1 (Chapter 4) focuses on the past relationship between regional development and infrastructure, asking ***what is the legacy of staples theory and what does this mean for the future in the context of regional resilience?*** Through an exploration of the relationship between past regional development and the evolution of drinking water systems this research shows that staples theory, and its influence on early development and rural restructuring, has had an intricate relationship with drinking water systems. Staples theory provides a common thread in understanding rural development and is evident in rural and regional development policy, both implicitly and explicitly. There is a clear relationship between resource-based activities and rural regional development (Wolfe, 2010), but while regional development policies and approaches have explicitly included some infrastructure systems (e.g., transportation – roads, rail), others, like drinking water, were never explicitly included. However, while there may have been no deliberate intention to influence drinking water systems through staples-dependent regional development, the result was nevertheless that drinking water systems were shaped in pattern and

function by such development. This legacy raises questions about infrastructure and path dependency, as well as what constraints this may place on future development. Can existing infrastructure systems, influenced by the past, be re-shaped to address changes in context and facilitate a different type of development in the future?

Beyond this legacy of staples-led development are the unintended consequences related to drinking water systems that occurred as a result of the period of rural restructuring that began in the 1980s. Perhaps most obvious is the downloading of responsibilities to the local level without a comparable increase in capacity, something not unique to drinking water systems. This period of restructuring brought changes in economic structure and values as well – altering perceptions about development and development approaches. Additionally, there are several present day challenges (e.g., changes in standards and regulation, technology, management) that are seemingly unrelated to development. However, these present day challenges are exacerbated by the development legacies discussed above. For example, changes in water quality regulations alter the relationship between development and drinking water systems in that development can now be limited by drinking water systems as existing infrastructure fails to meet new regulations. The legacies of staples theory and rural restructuring exacerbate and add complexity to today's challenges.

Paper 1 clearly demonstrates regional development as a factor for consideration in understanding infrastructure. It is the legacy of development that provides the context surrounding many of the challenges rural drinking water systems presently face. Additionally, Paper 1 shows how issues relating to management and institutional structure are made more complex by rural restructuring, something excluded from much of the infrastructure deficit literature. Whether or not drinking water systems in their present form can fit our current and future context is heavily influenced by the past, both in terms of the pattern and original function of the systems, but also in the structure of the surrounding governance, namely its lateral and hierarchical fragmentation. Within this context it is little wonder that links between drinking water systems and development are not explicitly recognized and addressed through management and planning. This detailed examination of the history of drinking water systems provides much needed contextual information as to why drinking water systems remain a challenge despite (re)investment efforts, and raises questions as to the legacy of past development as it relates to other critical infrastructure systems.

How drinking water systems are planned and managed will impact future development (Connelly, Markey, & Roseland, 2009; Dale & Hamilton, 2007; Kennedy, Roseland, Markey, & Connelly, 2008; Mirza, 2007). If development considerations are not included when opportunities arise for re-investment, there is the potential for infrastructure to lock development on to an unsustainable path (Connelly et al., 2009; Dale & Hamilton, 2007; Markey et al., 2010). However, the legacy of regional development presents a critical challenge in seeking to proactively link infrastructure and regional development. Without careful consideration of factors beyond financial needs it is unlikely that we will see substantive changes to the current situation, which will exacerbate future conditions. Rural regions should address the infrastructure challenges with full knowledge of the past, building resilience as opposed to duplicating mistakes.

7.3. Paper 2: the fractured present

Paper 2 (Chapter 5) responds to the question ***do current approaches to the planning and management of drinking water systems reflect a transition toward regional resilience?*** The opportunities afforded by regionalism, both for infrastructure as well as development are highlighted within the literature. This paper explores the extent to which regionalism, as applied to drinking water systems, may serve to foster greater regional resilience - the ability of rural regions to resist and adapt to change. Additionally, this paper examines an aspect lacking within the literature – the extent to which regionalism exists under current management approaches. While regional scale links were found between drinking water systems and between communities, what exists in reality is far from the potential.

The content analysis found some evidence of regional resilience reflected within the documents reviewed. In particular there are multiple examples of recognition of the need to consider a more holistic, multi-level system perspective, within and between water systems, as well as within and between communities in the region. Indeed, there are existing examples that indicate a growth in the recognition of, and action toward, enhancing regional resilience through changes to drinking water system management. However, this evidence also appears to be emergent.

Counteracting, and perhaps undercutting the above is the continuation of a traditional, siloed, top-down policy and decision-making hierarchy, both generally and specific to drinking water systems. Current institutional structures appear to have a difficult time accommodating new

ideas and change. The focus of the organizations responsible for drinking water systems included in this research appears to be first, and often entirely, on the local scale, with only cursory consideration given to the surrounding region. It is difficult to relate these actions to the overarching question of regional resilience because the region rarely makes an explicit appearance, raising questions such as whether we can assume regional resilience can, to some degree, stem from the resilience of different, singular components. The dominance of traditional institutional structures is a barrier. These structures appear to be resistant to change towards a more integrated, collaborative approach, regardless of whether it is a shift to a multi-disciplinary perspective, a lateral perspective, or a multi-level perspective. This raises the question of whether the existing institutional structure is capable of encouraging or supporting regional resilience. Finally, complexity plays a role. Water is connected with different facets of day-to-day life. Within interlocking networks an increasing overall number of plans have been observed, potentially illustrating a growing understanding of integration, but also increasing chances of conflict between planning documents and creating challenges for coordination (Burns & Grant, 2014). Within complex policy and political environments, such as those related to drinking water, conflict and fragmentation can inhibit the impact of integration (O'Hare & White, 2013).

Overall the analysis provides an inconclusive result. While there is increasing recognition of the need for flexibility, engagement, and coordination (all potential dimensions of regional planning and collaboration), upper level organizations (e.g., provincial) continue to be top-down and hierarchical in nature. While some larger communities in the case study region demonstrate that the role of water within the community is being increasingly recognized and integrated with other aspects of community planning, whether the same is occurring in the smaller communities is unclear.

Drinking water systems clearly play a role within their communities, however the scaling up to the regional level is lacking. Instead there is a focus on the individual community scale, both specific to drinking water systems, as well as development generally. At the regional scale there is little evidence within the Kootenays of regional or sub-regional management supporting regional resilience. Presently what exists on paper is largely potential. However, it is possible that this is an inaccurate reflection of reality as interviews reference stale or unused plans, informal or unrecorded plans, challenges surrounding access to plans, lack of capacity to implement plans, and plans that exist solely as a result of regulatory requirements.

Overall the impression is that regional scale action or integration is emergent or occurring in an isolated context. While drinking water systems are recognized by overarching plans, this is often in a nested and hierarchical way that excludes consideration of the surrounding region(s). There appears to be a lack of regional cohesion and direction which, in addition to institutional structure barriers, makes it difficult to take advantage of their potential links to regional resilience. In the literature we see that regions can be locked into sub-optimal situations as a result of institutional structures (Pendall et al., 2009). In the case of the potential role for drinking water systems in supporting regional resilience in the Kootenays, it appears as though existing institutional structures limit emerging change and that this is likely enhanced by a long history of competition and rivalry between communities and strong top-down structures. However, there is also some degree of flexibility within current institutional structures, particularly at the local level, as well as some evidence of an openness to change. Existing regional organizations offer potential bridges between separate and autonomous organizations and the flexibility to create and pursue new initiatives, allowing what exists to be brought together and strengthened. What remains lacking is a push to do so. Given the gap between potential and practice, the role of drinking water systems in regional resilience warrants further exploration, particularly of the potential for alternative management approaches with the aim to use drinking water systems to enhance regional resilience.

7.4. Paper 3: future in question

Paper 3 responds to the question ***could a new regional approach be applied to the management of drinking water systems in rural BC?*** This paper explores the potential applicability and feasibility of an alternate approach that is supportive of regional resilience, specifically using new regionalism as its platform. This paper identifies the potential contribution drinking water systems could make to regional resilience as found in the literature, then uses the same literature to develop an alternate approach. The alternate approach, in theory, offers the opportunity for communities to combine strengths to overcome challenges using multiple mechanisms: integrated planning; knowledge sharing; operations; implementation and evaluation; water system design (i.e., water systems that are efficient, sustainable, and place appropriate); and institutional structure. These mechanisms are intended to result in supported development, enhanced operations, environmental stewardship, and adaptability. A regional scale also allows for the consideration of environmental elements, namely incorporation of the

watershed. Taking a new regionalist approach follows the general trend in water management toward approaches that are flexible, horizontal, and multi-level (Ferreyra et al., 2008).

Paper 3 finds that elements of the proposed new regionalism approach show promise as collaborative regional endeavours, while others remain applicable ideas but lack a local level foundation upon which to build regional success. It is unclear whether this indicates that the proposed approach should be implemented incrementally, or if the proposed approach is best split into separate ideas that can be pursued separately as opposed to a single, broad approach, although this is potentially contrary to the idea of integration. This is also contrary to new regionalism itself, which views integration and the combination of multiple concepts as a strength (Wheeler, 2002), but is perhaps in line with criticisms of new regionalism as being too broad (Harrison, 2006; Lovering, 1999).

As a single approach, the proposed new regionalism approach offers the benefit of flexibility – allowing local governments to identify what best suits their abilities and needs, allowing for contextually appropriate management. However, while the proposed approach benefits from flexibility, the same flexibility may make the approach too difficult to determine a starting point, particularly when capacity is limited. This raises questions as to whether the merit of the proposed approach is more to do with its ability to be place and contextually appropriate and less to do with its focus on the regional scale. It appears as though changes in management are more likely to begin within single institutions and it is unclear whether these changes are incremental steps building toward regional resilience or not. Existing examples reflective of elements of new regionalism demonstrate both recognition and willingness to shift to a collaborative, regional scale approach, as well as some degree of success in doing so. These examples suggest that more is going on ‘on the ground’ that reflects new regionalism than is formally recognized in the documents reviewed in Paper 2, representing a potential foundation for the approach proposed in Paper 3.

What would drive the uptake and implementation of the proposed approach? Where does the incentive or external pressure come from? While there are potential benefits to collaborative action, demonstrated in the literature and through examples, there is also perceived additional burden, particularly for those participants who have higher starting capacity relative to potential regional partners. This is indicative of the need for some outside incentive or pressure to work collaboratively. Considering this, there is also the critical question of what can truly be accomplished without massive systemic change? Like the shift from old to new regionalism (see

Chapter 2), the context in which the majority of jurisdiction and institutional structure was developed has changed. While a voluntary change in approach, such as the one proposed, can provide some guidance toward change, a fundamental shift in the system itself is needed. Not only can the existing system not fully accommodate or support the entirety of the proposed new regionalist approach, but also under the existing system such efforts are perceived as optional or 'nice to have'. This is demonstrated through the existing examples, driven by those who are so called early adopters, going above and beyond. While change is possible, without changes to the overall system it is constrained and poorly supported.

7.5. Research evolution and lessons for future research

The evolution and limitations of each of the three papers are discussed individually in their corresponding chapters. However, as a multi-year exploration of drinking water systems in rural British Columbia, the project as a whole experienced overarching evolution and limitations. Initial assumptions from the project proposal stage were proven incorrect with more in-depth research, forcing these initial assumptions to be revisited. For example, the sheer volume and differing management of drinking water systems in the case study region was unanticipated, resulting in a narrowed focus on those systems owned and operated by local governments. Additionally, information that was assumed to exist did not in reality, requiring alterations to research methods in order to address the reality of the situation. The case study region is also not static. Over the course of this research there were changes in government (locally and federally) and regulation and legislation (provincially). The context surrounding this research changed, in turn influencing the research. These types of changes are not uncommon in case study research, due to the complexity and changing nature of real life scenarios on the ground.

My research proposal initially included a comparison of results between regional districts. However, it was observed that there are more prominent differences between system sizes than system location. As a result, the research took a big picture approach to the discussion, considering the Kootenay Development Region as a whole. There are no comparisons between regional districts, regional district systems versus municipal systems, communities of different sizes, or other potential comparisons. Building on the findings of this dissertation, future research in this area may wish to consider such comparisons.

The Kootenays were chosen as a case study region reflective of characteristics of rural Canada (see Chapter 3). However, when it comes to the transferability of the findings there are two factors that merit consideration. First, drinking water in British Columbia has a complex, fragmented jurisdictional structure. This makes direct transferability to other provinces or territories challenging as many of the issues associated with jurisdiction, regulation, or institutional structure may not be the same. Second, the Kootenays are abnormal even within BC due to the sheer volume of small systems and differences in management. However, neither of these factors completely discounts the transferability of the results to other places for numerous reasons. For example, while the modern context may differ in some respects, the historic context is similar across rural Canada. Additionally, key lessons learned from this research, such as the importance of flexibility and consideration of context already account for differences places.

Finally, the use of such a large case study region presented challenges. There are multiple overlapping regions within the Kootenays, such as local governments, ecological zones, and provincial administration – illustrating an overall complex and overlapping area of multiple jurisdictions and regions/sub-regions. However, while these different regions overlap in different ‘functional regions’, the majority of these are at a smaller scale than that of the case study region whose boundaries were defined by the province as an economic region. In hindsight a more targeted study region, one specifically appropriate to drinking water considerations may have been useful.

7.6. Recommendations and Conclusions

There are many findings and recommendations contained throughout the previous chapters. Elements of this research substantiate what is found in the literature (e.g., the need to decrease fragmentation within and between governments), while others add new ideas for consideration and further testing (e.g., application of the proposed new regionalism approach to a different geographic region or infrastructure type). Below are key, generalized recommendations based on this research:

- **Consider place and context.** Without careful consideration of these factors in design and implementation, the resulting management approaches, as well as policies and programs, can be ill-suited for rural regions or fail to account for the limitations of current institutional and physical structures.
- **Enable and support flexibility.** Building on the above, every region, community, and water system differs. Management approaches, as well as policy, cannot be

done in a uniform fashion, but require the ability to adapt to local context, while maintaining core principles.

- **Make continued efforts to move beyond silos and single systems.** Holistic and integrated regional approaches offer benefits, particularly in rural places where capacity is often limited. The application of the principles of new regionalism offers one framework that may help in managing complexity and guiding regional level action.
- **Continue supporting those actions that are working.** Examples throughout the previous chapters show existing programs that display characteristics of new regionalism that are helping to address challenges. The application of new regionalism does not require the wholesale replacement of existing systems and structures, and by its own principles requires a clear assessment and understanding of existing assets.
- **Look beyond the immediate.** Addressing the infrastructure deficit, specifically related to drinking water infrastructure, goes beyond the infrastructure itself, and goes beyond immediate issues. Addressing such complex challenges requires an understanding of the interactions with surrounding community and region, both in the present and past.

The overarching question of this research is **whether a new regionalist approach to infrastructure can impact future regional development and support rural regional resilience?** There are several important factors influencing the ability of resilient regions to respond in the face of change (Wolfe, 2010). This dissertation explores one multi-faceted factor: drinking water systems. This raises the question of whether changes to the management of drinking water systems are capable of having a noticeable influence on the region as a whole? Keeping this overarching question in mind, the three research questions are summarized below, followed by an overarching discussion.

- What is the legacy of staples theory and what does this mean for the future in the context of regional resilience?*** The past matters. Moving forward, the challenge of breaking with the past will be how to manage drinking water systems, as well as other infrastructure, in order to address changes in context as well as facilitate resilient rural regions. That drinking water systems, in pattern and purpose, mirror the past, is indicative of a challenge in using infrastructure to proactively shape the future. While a growing body of literature explores infrastructure as a vehicle for fostering resilience (e.g., Connelly, Markey, & Roseland, 2009; Dale & Hamilton, 2007; Kennedy et al., 2008; Pendall, Foster, & Cowell, 2009; Pollalis et al., 2012; Robinson et al., 2008) drinking water systems continue to play catch up as opposed to proactively building resilience by integrating infrastructure into development (Pollalis et al., 2012). In order to best take advantage of this opportunity we require a better understanding of the factors that brought about this situation.
- Do current approaches to the planning and management of drinking water systems reflect a transition toward regional resilience?*** Examples demonstrate willingness, but these are undercut by challenges, in particular the hierarchical institutional structure. Presently what exists is largely potential. However, it is possible that what is on paper is an inaccurate reflection of reality. It is suggested that a massive shock is needed to change

the course of path dependence (Pendall et al., 2009). Perhaps the current infrastructure deficit offers such a shock. Infrastructure is a factor that can contribute to path dependence or that can facilitate adaptability and change, particularly as it is renewed (Christopherson et al., 2010; Pendall et al., 2009). However, to that end the role of drinking water systems in regional resilience warrants further exploration, particularly of the potential for alternative management approaches to drinking water systems aimed at enhancing regional resilience.

- iii) ***Could a new regional approach could be applied to the management of drinking water systems in rural BC?*** Of the responses the data provide, the key consideration is what can truly be accomplished without massive systemic change? Like the shift from old to new regionalism, the context in which the majority of jurisdiction and institutional structure was developed has changed. While a voluntary change in approach, such as the one proposed, can provide some guidance toward change, a fundamental shift in the system itself is needed. Not only can the existing system not accommodate avenues of the proposed approach, but under the existing system such efforts are optional. While change is possible, without changes to the overall system it is constrained and poorly supported.

The three papers demonstrate clear issues related to path dependence and lock in, as well as systemic and institutional barriers. When these issues are explored independently and together we see the impact of path dependence on drinking water systems and the resulting challenges it presents, in the present and in the future. Subsequently, when exploring how things could be done differently we see two things. First, that there is potential for alternate approaches and outcomes, but that this potential is largely blocked by the second, the surrounding systemic and institutional structure. So, it is entirely possible that changes to management of drinking water systems could have an influence on regional resilience, however this is unlikely to occur in isolation or separate from larger, systemic change.

What does this research teach us about the viability of rural places? Drawing from the example of drinking water systems, is it possible for factors such as infrastructure to support regional resilience? On one hand there are examples of efforts and initiatives at the local scale that are reflective of characteristics of new regionalism that are yielding the desired results. Such examples are indicative of the potential role infrastructure, like drinking water systems, can play in supporting regional resilience. However, on the other hand such examples are contrary to the dominant structure and function of the surrounding system. Institutions and jurisdictions are currently not set up to support integrated, regional scale efforts. As such, whatever efforts aimed at change that exist are being continuously undercut by a system that is largely outside the control of rural regions. So long as this remains the case the future viability of rural regions remains in question.

When it comes to supporting rural regional resilience is infrastructure a logical starting point? Specific to the challenges of infrastructure, this research highlights that when it comes to drinking water systems the infrastructure deficit has more to do with factors like management, governance, and policy than the actual infrastructure itself. If not for the policy window provided by the infrastructure deficit and the need to replace critical infrastructure systems, drinking water systems may in fact be an inappropriate starting point for such change. Yet the window of opportunity relative to infrastructure remains – reflected in calls for infrastructure stimulus in the most recent provincial throne speech (Government of British Columbia, 2016a) and in federal mandate letters (Government of Canada, 2016). However, it is also important to note that the infrastructure deficit is not the only window of opportunity for change. For example, in British Columbia the rollout of the new *Water Sustainability Act* also provides such a window, as despite the fragmentation between drinking water and water generally in this province the new act offers opportunities to build and strengthen links.

Given the findings, what are the logical next steps? This research highlights that it is challenging to conclusively determine the potential offered by new regionalism and further research is warranted in two areas. First, additional research exploring similar questions at the provincial and federal scales is justified. This research focused on the local level, where new regionalism is nascent, emergent, and scattered. Future research would do well to consider and explore new regionalism and new regionalism based approaches from the upper levels – what actions can be taken and change made at the provincial and federal levels? Without upper level change it appears unlikely that lower level efforts will have as much traction. Secondly, there is a question of breadth. New regionalism, as defined within this research, is a broad term. The findings of Paper 3 highlight that certain elements of new regionalism are more applicable and feasible than others. Such a finding prompts questions around the breadth and cohesiveness of new regionalism as whole. This is perhaps not unexpected when it comes to managing water, and indeed a similar critique is offered of Integrated Water Resource Management (Cohen, 2012).

Finally, specific to drinking water systems it is important to note that "attempts to fix water quality problems using technology alone have produced only limited success" (Patrick, 2011). This research demonstrates that a drinking water system is not simply pipes and pumps any more than a watershed is restricted to streams and rivers. Drinking water systems can have an enormous impact on a community or region – for better or for worse. There is a need for a collective and holistic approach to the complex problems facing our rural regions – a recognition

of connection and that a break with the past presents an opportunity to change the future. Taking an alternate approach to drinking water systems, one which is informed by the past as well as considering what we would like to see in the future, is one opportunity, and one which may also have the added benefit of helping to address the myriad of existing challenges this thesis illuminates.

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Appendix A. Co-authorship Statement

The identification of this research, its design, the practical aspects (e.g., data collection and analysis), and manuscript preparation has been carried out by Sarah-Patricia Breen. Co-authors have contributed throughout this project by providing guidance, input, and critical review of data collection methods, analysis, and paper review.

For Papers 1 and 2, Sarah-Patricia Breen was the first and corresponding author, with the second author being Sean Markey, principle supervisor. For Paper 3 Sarah-Patricia Breen is the sole author.

Appendix B. Paper 1: Semi-Structured Interview Topic Guide

Generic Questions / Topic Guide

**it is likely there will be overlap between the questions, be conscious of linking questions together and following up on comments.*

Introduction

1. Project introduction / ethics form
2. Please introduce yourself and the group/department/agency you represent
 - a. Brief job description
 - b. Brief agency overview

Household/Drinking Water Infrastructure - Overview

3. How would you describe the level and quality of water infrastructure in the region?
 - a. Type of infrastructure
 - b. Scale
 - c. Quality of water
4. Could you briefly describe the following with regard to your area?
 - a. History of water infrastructure
 1. Management
 1. *Is planning and management generally approached at a community, sub-regional, regional, or provincial level?*
 2. Does the current state differ from the past? If yes, how?
 1. *Has planning been ad hoc or long term planned?*
 3. Have infrastructure needs or requirements changed in the past 10 years?
 1. *Upgrades? Replacements? Scale? Technology?*
5. Do you feel that the current water infrastructure is planned and managed sustainably?
 - a. *If no, is this a future goal?*
 - b. *Have you made progress toward sustainable infrastructure goals? (Link with OCP)*
6. What are the key challenges you face? (E.g., scale)
 - a. *Suggestions for how to address challenges?*
7. Heading into the future, how do you see the system developing?
 - a. *Expansion? (Drivers?)*
 - b. *Taking on new systems?*
 - c. *Replacement? New Approaches?*
8. Is either of the following available for the current water system(s)?
 - a. Inventory
 - b. Infrastructure assessment/evaluation
 - c. Planning document
9. Do you have any comment on small water systems in the area?
 - a. Management
 - b. Level of compliance
 - c. History, associated policy
 - d. Challenges, issues (e.g., compliance, funding, human resources)
 1. Do you have any suggestions as to how to approach these challenges?
Noted as a challenge for RDCK. Different within other RD? Increasing or decreasing level of responsibility in this area?

10. Within your area can you think of any examples of innovative or unique technology?
 - a. *E.g., Point of entry treatment, mobile treatment units*

Jurisdiction and Integration

11. Could you please describe the jurisdiction/level of authority you have?
12. Are there other agencies whose jurisdiction overlaps/overrides/conflicts with yours?
 - a. Do you work with these agencies? If yes, how?
 - b. Conflicts? Challenges?
13. Within your department/agency what would you consider to be the level of integration between economic, environmental, and social factors?
 - a. Are there recognized connections between household/drinking water infrastructure and other aspects of water management: water stewardship, source water protection, conservation, regional development?
14. Do you see an obvious link between household/drinking water infrastructure and regional development?
 - a. If yes, please describe how state of infrastructure influences development (or vice versa).
 - b. If no – discuss.
 - c. Do you see overlap or coordination between the planning/goals for infrastructure and the planning/goals for the region/community?
 1. If no, what would have to change to reconcile the two?

Specific Policies and Programs

15. Are there any programs, policies, or standards you consider to be critical or influential when it comes to household/drinking water infrastructure?
 - a. *Foundational*
 - b. *Last 5 years*
 - c. *Last 10?*
 - d. *Last 20?*
 - e. *Role of the water act? Local government act? Community charter?*
 - f. *Participation in water smart BC*
16. Is there a city/regional district/regional/provincial water management plan?
 - a. Is infrastructure included in this?
17. Do you have the ability within the current regulatory framework to accommodate unique local elements/challenges?
 - a. If yes, how? If no, what challenges does this present? How do you deal with these?
18. Do infrastructure funding programs allow for consideration of local context?
 - a. If yes, how? If no, what challenges does this present? How do you deal with these?
19. Is there a difference between what is mandated and what occurs on the ground?

Governance / Collaboration

20. Within your agency do you collaborate with other departments or agencies?
 - a. If yes, with who, how, and on what?
 - b. Does geography play a role? (*functional regions*)
21. Outside of your agency do you collaborate with other agencies or groups?
 - a. If yes, with who, how, and on what? (Potential scale: community, regional, provincial, federal)
22. Are there any departments, ministries, or agencies you would like to develop a closer relationship with?

- a. If yes, who and why?

Examples of departments/ministries/agencies: DFO, infrastructure Canada, Rural BC, KLP, MOE, Community, Sport, Cultural Dev. Are there drinking water committees? Water stewardship groups? Source water protection plans?

Concluding

23. How would you like to see water infrastructure develop heading into the future?

- a. Future opportunities? Concerns?
- b. Links to sustainable development?

24. Is there anything else you would like to add? Documents you would like to suggest?

25. Is there anything I can provide back in terms of information that you would be interested in?

Appendix C. Paper 2: Resilience Indicators

Indicator	Description ²²
Management Structure	
Multi-level governance	<ul style="list-style-type: none"> • Governance structure and associated processes are recognized, supported, and transparent • Active engagement • Participation: diversified, inclusive, empowered, collaborative • Supportive/enabling level of capacity (e.g., human, financial) • Jurisdiction: shared, recognition of local ownership, integrated, inclusive, efficient • Understanding and consideration of cross-scale relationships, interactions, and interdependencies (nested systems) • Use of best governance practices (e.g., conflict resolution mechanisms; representative leadership; communication; knowledge sharing; understanding of power/responsibility, specific roles, place/context, risk, cost)
Robust governance structure	<ul style="list-style-type: none"> • Ability to withstand stress without suffering degradation • Ability to restructure and reorient
Redundant governance structure	<ul style="list-style-type: none"> • Elements are substitutable in the event of disruption of degradation
Alternative governance arrangement	<ul style="list-style-type: none"> • Shift to a looser, more negotiable/network based political arrangement (decentralization) • Common management of systems that are not physically connected • Structural diversity and modularity
Institutional integration	<ul style="list-style-type: none"> • Collaboration within organizations and between organizations • Balance (structural and disciplinary)
Innovative	<ul style="list-style-type: none"> • Open to alternatives • Adaptive/flexible
Evaluation	<ul style="list-style-type: none"> • Ongoing monitoring and evaluation of governance structure and processes
Policy & Planning	
Co-constructed	<ul style="list-style-type: none"> • Inclusive (government and non-government actors) • Within single system/institution and with surrounding system/institution(s)
Integrated	<ul style="list-style-type: none"> • Existence of overarching plan • Links between plans • Use of/inclusion of plans by other departments or organizations • Holistic – plans incorporate economic, social, environmental
Place-based	<ul style="list-style-type: none"> • Identifies existing opportunities, resources • Understand advantages / challenges

²² Examples of characteristics that would indicate the presence of this characteristic

Indicator	Description ²²
	<ul style="list-style-type: none"> • Inclusion of community vision, values, pride, attachment to place • Supportive of desired outcomes • Appropriate scope and scale
Informed by peer review science and other information	<ul style="list-style-type: none"> • E.g., TEK • New sources of knowledge (internal and external) • Having baseline data • Look for outside examples
Adaptive	<ul style="list-style-type: none"> • Permission to fail • Diversity in strategy • Addresses uncertainty and risk • Short and long term
Sustainability	<ul style="list-style-type: none"> • Includes sustainability characteristics • Intergenerationality, equity • Full cost accounting and financial independence
Conservation and efficiency	<ul style="list-style-type: none"> • Demand management • Includes specific conservation and efficiency elements
Holistic	<ul style="list-style-type: none"> • Balance of disciplines (integration of economic, environmental, social) • Consideration of: physical/ecological regions (e.g., watersheds), precautionary principle, pollution prevention, conservation
Implementation (of plans)	
Policies and plans are enacted	<ul style="list-style-type: none"> • Supported by capital (e.g., funding, human) • Participants are held accountable
Communication	<ul style="list-style-type: none"> • Communication of plans (internal and external)
Rapidity	<ul style="list-style-type: none"> • Capacity to achieve goals in a timely manner to contain losses and avoid disruption
Evaluation (of plans)	
Regular evaluation, education, monitoring	<ul style="list-style-type: none"> • Internal evaluation • Evaluation of external examples • Revise and continue (ongoing action)
Broad definition of success	<ul style="list-style-type: none"> • Success goes beyond financial/economic criteria
Sustainability rating system or certification	<ul style="list-style-type: none"> • E.g. LEED certification
Contribution to overall quality of life	<ul style="list-style-type: none"> • Includes: social, cultural, economic, environmental considerations • Supportive of health and well being • Supports diversification of economy (sectors, employment)
Strong Environmental Capital	<ul style="list-style-type: none"> • Maintenance of biodiversity • Sustainable management of environmental resources (high quality and availability) <ul style="list-style-type: none"> • Water • Soil • Agriculture
Meets existing regulations/standards	<ul style="list-style-type: none"> • Regulations / standards <ul style="list-style-type: none"> • Consideration of context • Outcome based regulation
Operations / Management	

Indicator	Description ²²
Capacity	<ul style="list-style-type: none"> • Ability to move to new industry and technology
Effective management and customer engagement	<ul style="list-style-type: none"> • Efficient • Communicative
Adaptive	<ul style="list-style-type: none"> • Ability to adapt management and operations • Adaptive action
Innovative	<ul style="list-style-type: none"> • Multiple sources of knowledge • Technology • Collaboration/communication/networks
Collaboration	<ul style="list-style-type: none"> • As needed (e.g., networks)
Knowledge and capacity building	<ul style="list-style-type: none"> • Understanding of specific roles, understanding of relationships and interdependencies • Owners/users have appropriate knowledge for respective roles, understand relation between service levels, risk, cost <ul style="list-style-type: none"> • Action (education, communication) to enhance capacity of citizens and institutions • Recognition of local infrastructure ownership • Willingness of community to change • Knowledge and skills (staff) – training <ul style="list-style-type: none"> ○ Professional network development ○ Appropriate level of training
Monitoring and evaluation	<ul style="list-style-type: none"> • Ongoing monitoring and evaluation of operation and management
Sustainable Drinking Water Infrastructure	
Multi-functionality	<ul style="list-style-type: none"> • Services, resources
Innovative technology	<ul style="list-style-type: none"> • Environmentally sound technology
Equity	<ul style="list-style-type: none"> • Balancing cost of service with access
Utility right sized	<ul style="list-style-type: none"> • Place/context appropriate (based on engagement with customers in terms of level of service required) • Considers environment as well as economic/social/cultural
Sustainable and efficient design / resource use	<ul style="list-style-type: none"> • Designing, building, and operating in ways that don't diminish the social, economic, and ecological processes required to maintain human equity, diversity, and function of natural systems. • Efficient (e.g., energy use, no leaks) • Adaptive • Materials (ecofriendly, re-used) • Fiscal responsibility • Supports conservation • Durability • Structural Redundancy
Evaluation of infrastructure assets	<ul style="list-style-type: none"> • Up to date data • Financial independence of systems
Asset management	<ul style="list-style-type: none"> • Asset management system in place • Full cost accounting (present, future renewal costs, externalities) and appropriate rates)
Robust infrastructure system	<ul style="list-style-type: none"> • Ability to withstand stress without suffering degradation • Modular
Redundant infrastructure system	<ul style="list-style-type: none"> • Extent to which elements are substitutable in the event of disruption of degradation

Source: *resilience*: (Barr & Devine-Wright, 2012; Beisner, Haydon, & Cuddington, 2003; Berkes & Ross, 2013; G. Bristow, 2010; Carpenter & Folke, 2006; Centre for Community Enterprise, 2000; Christopherson et al., 2010; Davoudi et al., 2012; Folke et al., 2004, 2010; Folke, 2006; Folke et al., 2002; Glover, 2012; Hudson, 2009; Kulig, Edge, Townshend, Lightfoot, & Reimer, 2013; Magis, 2010; Markey et al., 2012; Martin & Sunley, 2014; D. R. Nelson, Adger, & Brown, 2007; O'Hare & White, 2013; Pendall et al., 2009; Resilience Alliance, n.d.; Robinson et al., 2008; Simmie & Martin, 2010; Teigão dos Santos & Partidário, 2011; Wilson, 2010; Wolfe, 2010; Yamamoto, 2011); *sustainable infrastructure*: (Bakker, 2007; Berkes & Ross, 2013; Choguill, 1996; Connelly et al., 2009; Dale & Hamilton, 2007; Kennedy et al., 2008; Markey et al., 2012; Pollalis et al., 2012; Robinson et al., 2008; Roseland, 2012; Santora & Wilson, 2008; Sarte, 2010)

Appendix D. Paper 3: Framework Guide and Questionnaire

Interview Guide: Exploring alternatives for water system management

Sarah-Patricia Breen, Resource and Environmental Management, Simon Fraser University
Simon Fraser University Ethics Approval: Project Number 2012s0754

Introduction

Drinking water systems (i.e., treatment and distribution) in the Kootenay region have been identified as an issue with rural-specific challenges. Due to the wide range of challenges, finding a single solution is unlikely. However, multiple ideas for how to address challenges with drinking water systems can be found in research on regional development, water management, and resilience. My research proposes a framework of ideas drawing from these different fields. Overall, the proposed framework provides a flexible and collaborative approach that can be tailor to fit local needs.

As this framework is largely theory-based, an investigation of applicability and feasibility for rural drinking water systems is needed. Your knowledge will help us understand the real world application of these ideas.

A diagram of the proposed framework is shown on the next page. It has four goals:

1. *Enhance operations* – ensure efficient and innovative use of existing capacity
2. *Support development* – ensure drinking water systems support regional development
3. *Environmental Stewardship* – ensure attention to surrounding environment
4. *Adaptability* – avoid path dependence

Goals are achieved through actions in one or more of these six avenues:

1. *Integrated Planning* – inclusive planning process and the integration of plans
2. *Knowledge Sharing* – sharing information, using multiple sources, collaborative efforts
3. *Water System Design* – infrastructure is efficient, sustainable, and place appropriate
4. *Operations* – collaborative efforts and asset management
5. *Implement and Evaluate* – ongoing assessment and adaptation
6. *Flexible Institutional Structure* – working at different scales and with different actors

This research looks specifically at what actions could be taken by municipalities and regional districts. This does not mean provincial or federal actions are not needed – that is an important, but separate phase.

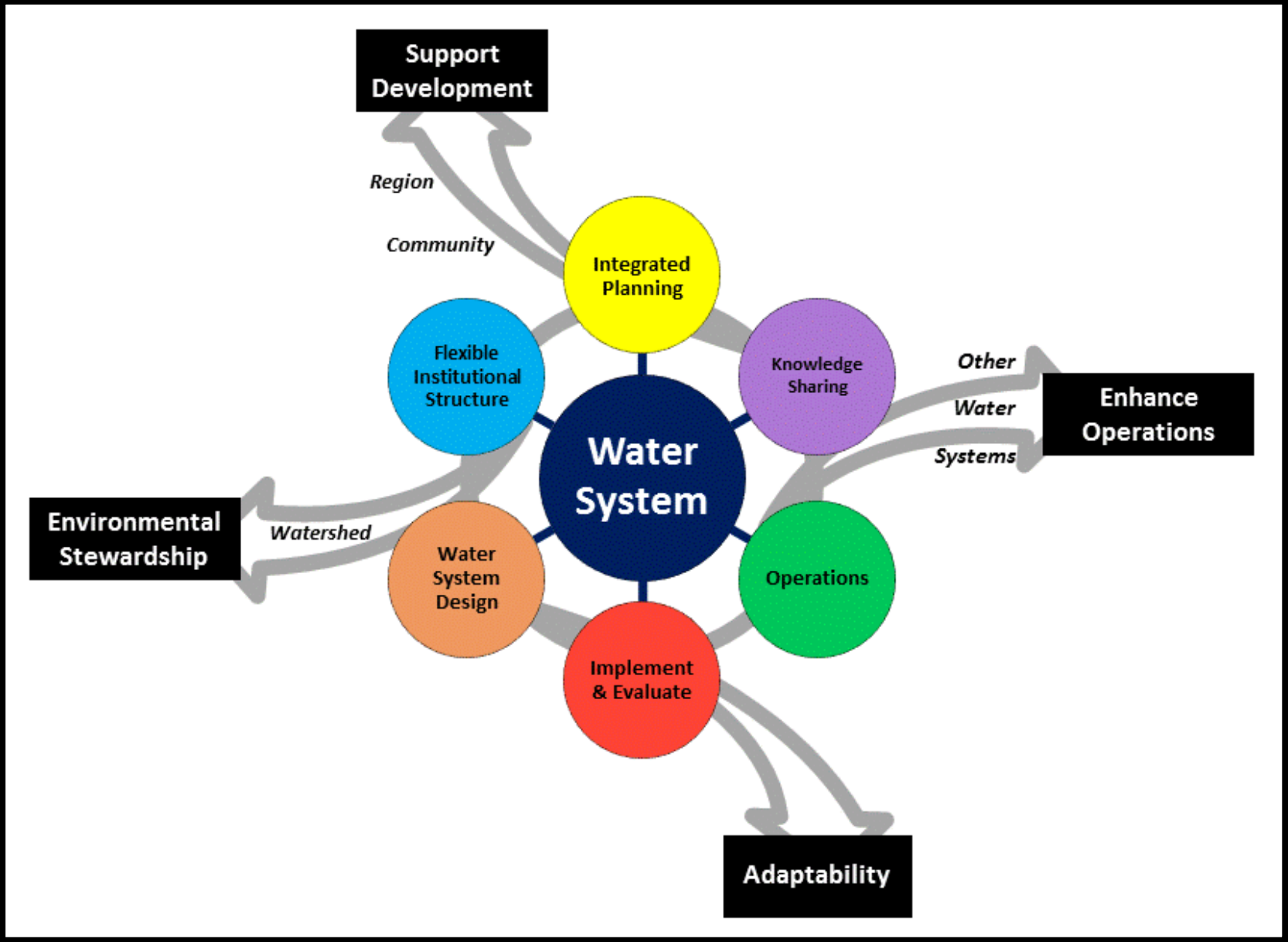
Participant Guidelines

1. Questions are split into six sections, one for each proposed avenue.
2. Questions generally have two parts (applicability and feasibility).
 - a. Applicability: is it of interest?
 - b. Feasibility: can you do it?
 - c. Some ideas may be of interest but not practical, or vice versa.
3. Questions are hypothetical, but if you already do something similar please tell me.
4. Not all questions will apply to everyone.
 - a. Feel free to ask me to skip a question or pass on responding.
5. Feel free to qualify your responses.

Interviewer Guidelines

1. Questions are written for water system managers and CAOs (or equivalent positions), as well as regulating or supporting upper level agencies.
2. Text for regulating or supporting upper level agencies is written in green or indicated with a green *.
3. Blue text are interviewer prompts and is not included in the questions provided to participants.
 - a. Consider:
 - i. Why / why not
 - ii. Potential participation
 - iii. Under what conditions
4. Before starting please review consent form and participant guidelines.

Proposed Drinking Water Management Framework



INTRODUCTION

1. Participant name:
2. Participant organization:
3. Participant role related to drinking water system(s):
4. Participant drinking water system(s) details (*if applicable*):
 - a. Number of systems managed:
 - b. Size (*small/<500 connections or large/>500*):
 - c. Water Source(s)(*ground or surface*):
 - d. Service area:
5. Does your organization's drinking water system(s)/**the drinking water systems within your region** meet existing regulatory requirements?
 - Yes
 - Some yes/some no (*if multiple*)
 - No
 - Not Sure
 - Not applicable**

AVENUE 1: INTEGRATED PLANNING

The proposed framework suggests that the water system planning process and resulting plans should be integrated. This can include involving different actors in the planning process, as well as including non-water related considerations. This also includes ensuring that drinking water system plans relate to and support development of the surrounding community and region. Best practices include attention to context, as well as active engagement.

6. **The proposed framework suggests including water-specific considerations in the water system planning process beyond what is currently required.** This can be accomplished by including information from actors from inside and outside your service area, such as:
 - Other water systems within the same watershed (e.g., source water information)
 - Water stewardship groups (e.g., aquatic environmental quality data)
 - Private business and industry (e.g., water needs, watershed activities)
 - a. Is the inclusion of additional water-related considerations in the water system planning process applicable to your organization/**local water systems**?
 - Yes
 - Not sure
 - No

Please elaborate:
 - b. Is it feasible for your organization/**local water systems** to include additional water-related considerations in your water system planning process?
 - Yes

- Not sure
- No

Please elaborate on what factors would support or prevent this:

- c. Would your organization support the inclusion of additional water-related considerations in the local water system planning process?

- Yes
- Not sure
- No
- Not applicable

Please elaborate:

7. The framework suggests including **non-water related** considerations beyond what is currently required in the water system planning process. This can be accomplished by including information from other departments or experts from within your organization, service area, or surrounding region, such as:

- Planning
- Recreation and parks
- Economic Development
- First Nations

- a. Is the inclusion of non-water related considerations in the water system planning process applicable to your organization/local water system?

- Yes
- Not sure
- No

Please elaborate:

- b. Is it feasible for your organization/local water systems to include non-water related considerations in the water system planning process?

- Yes
- Not sure
- No

Please elaborate on what factors would support or prevent this:

- c. Would your organization support the inclusion of non-water related considerations in the local water system planning process?

- Yes
- Not sure
- No
- Not applicable

Please elaborate:

8. The framework suggests that drinking water system plans should **integrate with other plans** (e.g., Official Community Plan, Regional Growth Strategy) by aligning objectives so that the resulting water system plan supports development in the surrounding area.

- a. Would it be applicable to your organization/local water systems to integrate plans so that the water system plan supports future development?
- Yes
 - Not sure
 - No

Please elaborate:

- b. Is it feasible for you organization/local water systems to integrate plans so that the water system plan supports future development?
- Yes
 - Not sure
 - No

Please elaborate on what factors would support or prevent this:

AVENUE 2: KNOWLEDGE SHARING

The proposed framework suggests different approaches to gaining knowledge. This includes large scale, collaborative knowledge sharing, as well as enhancing decision-making by including a wide range of sources. Knowledge sharing also includes collaboration around public education and building human capacity.

9. The proposed framework suggests a large scale approach to knowledge sharing surrounding water systems. Consider the following options:

- A dedicated professional network (e.g., open to all water systems or specific to system size)
- A general network involving all water actors (e.g., water systems, stewardship groups, etc.)
- A formalized knowledge sharing agreement between organizations (e.g., between a municipality and a water stewardship group)
- Collaborative communication with upper levels of government (e.g., IHA, BC Government)

- a. Are any of the above large scale, collaborative knowledge sharing approaches applicable to your organization/local water systems?
- Yes
 - Not sure
 - No

Please elaborate:

- b. Is it feasible for your organization/local water systems to participate in a large scale, collaborative knowledge sharing activity?
- Yes
 - Not sure
 - No

Please elaborate on what factors would support or prevent this:

- c. Is a large scale, collaborative approach to knowledge sharing something your organization is able to support?
- Yes

- Not sure
- No
- Not applicable

Please elaborate (include potential participation):

10. The proposed framework suggests consideration of a wide range of information when making water system decisions. This includes not only required information, but additional considerations such as: other environmental data, economic data, traditional ecological knowledge, citizen science, etc.

- a. Is consideration of a wide range of information sources applicable to water system decision-making in your organization/local water systems?
- Yes
 - Not sure
 - No

Please elaborate:

- b. Is it feasible for your organization/local water systems to consider a wide range of information?
- Yes
 - Not sure
 - No

Please elaborate on what factors would support or prevent the inclusion of a wide range of information:

- c. Is your organization able to consider information beyond what is required by your organization?
- Yes
 - Not sure
 - No
 - Not applicable

Please elaborate:

11. When it comes to effective education of the public related to water systems, the proposed framework suggests a larger scale, collaborative approaches.

Consider the following examples:

- a. Communication across an existing region (e.g., regional district) (e.g., water conservation)
- b. Combined location of information (e.g., a single website with access to information on multiple water systems)
- c. Common use of standardized detailed rate and billing information
- d. Communication across an alternative region (e.g., watershed) (e.g., knowledge of the water system)

- a. Is a larger scale, collaborative approach to public education applicable to your organization/local water systems?
- Yes
 - Not sure
 - No

Please elaborate:

- b. Is it feasible for your organization/local water systems to participate in a large scale, collaborative approach to public education?

- Yes
- Not sure
- No

Please elaborate as to what would support or prevent your organization's participation:

- c. Is your organization able to support a large scale, collaborative approach to public education?

- Yes
- Not sure
- No
- Not applicable

Please elaborate (include participation):

12. The proposed framework encourages building human capacity at a scale larger than a single system or community. Consider the following examples:

- Mobile training unit (e.g., a trainer that covers a larger geographic area)
- A regional training/testing centre
- Formalized collaboration between organizations (e.g., sharing training costs)
- Other collaboration or sharing as needed (e.g., visiting speaker)

- a. Are any of the above large scale capacity building examples applicable to your organization/local water systems?

- Yes
- Not sure
- No

Please elaborate:

- b. Is it feasible for your organization/local water systems to participate in large scale, collaborative capacity building?

- Yes
- Not sure
- No

Please elaborate on what factors would support or prevent this:

- c. Is a larger scale, collaborative approach to human capacity building something your organization is able to support?

- Yes
- Not sure
- No
- Not applicable

Please elaborate (include participation):

AVENUE 3: WATER SYSTEM DESIGN

Within the proposed framework water treatment and distribution infrastructure should be efficient, sustainable, and place appropriate. This can include linking multiple systems together, as well as use of new technological innovations or adopting sustainable design characteristics.

13. The proposed framework suggests physically linking infrastructure systems where practical. This can include:

- Separate systems with a shared treatment facility
- Separate systems with shared distribution lines
- Potential to link systems during emergencies to provide water services

a. Is physically linking your water system(s) to others applicable to your organization/*local water systems*?

- Yes
- Not sure
- No

Please elaborate:

b. Is physically linking your water system(s) feasible for your organization/*local water systems*?

- Yes
- Not sure
- No

Please elaborate as to what factors could support or prevent this:

c. *Could your organization support this type of linked water system?*

- Yes
- Not sure
- No
- Not applicable

Please elaborate:

14. The proposed framework suggests accounting for future needs that can change infrastructure design or the technology needed. This could include new users, loss of users, new standards, and conservation requirements.

a. Is consideration of future needs applicable for your water system(s)/*local water systems*?

- Yes
- Not sure
- No

Please elaborate:

b. Is it feasible for your organization/*local water systems* to access the information necessary to incorporate future needs into water system design or technology choice?

- Yes

- Not sure
- No

Please elaborate:

15. The proposed framework suggests use of **new, innovative, and sustainable technology**, such as:

- Conservation technology (e.g., water meters)
- New treatment technology (e.g., UV filtration)
- Alternative designs (e.g., Point of entry/Point of use)

a. Is a change in technology applicable to your/local water system(s)?

- Yes
- Not sure
- No

Please elaborate:

b. Is it feasible for your organization/local water systems to change to new technology?

- Yes
- Not sure
- No

Please elaborate on what factors support or prevent this:

c. Could your organization support a change to new, innovative, and sustainable technology?

- Yes
- Not sure
- No
- Not applicable

Please elaborate as to what factors would contribute or detract from your support?

16. The proposed framework includes a number of **design characteristics and considerations**, such as:

- Physical area (e.g., natural water quality)
- Multi-functionality (e.g., in-line micro hydro – generation and distribution)
- Conscious choice of construction materials (e.g., eco-friendly, re-used)
- Durability (e.g., long lasting, suited to area hazards)
- Supporting efficiency and conservation (e.g., energy use, no water loss, water consumption)

a. Are such design characteristics/considerations applicable to your water system/local water systems?

- Yes
- Not sure
- No

Please elaborate:

- b. Are such design characteristics/considerations feasible within your organization/local water systems?
- Yes
 - Not sure
 - No

Please elaborate:

- c. Could your organization support the inclusion of such design characteristics/considerations?
- Yes
 - Not sure
 - No
 - Not applicable

Please elaborate as to what factors would contribute or detract from your support?

AVENUE 4: WATER SYSTEM OPERATIONS

Within the proposed framework operations should meet the needs of users in an efficient, fiscally responsible, and environmentally friendly fashion. This includes larger scale collaborative approaches to operations, as well as asset management.

17. The proposed framework suggests larger scale collaborative approaches to water system operations. Examples include:

- Informal staff sharing as needed (e.g., during holidays, emergencies)
- Formal staff sharing agreements between systems
 - Directly related to operations (e.g., certified water operator, engineer)
 - Indirectly related (e.g., billing, administrative, planning, GIS)
- Shared equipment among multiple systems (e.g., leak detection)

- a. Are any of the above larger scale, collaborative approaches to operations applicable to your organization/local water systems?
- Yes
 - Not sure
 - No

Please elaborate:

- b. Is it feasible for your organization/local water systems to participate in larger scale collaborative approaches to operations?
- Yes
 - Not sure
 - No

Please elaborate:

- c. Is your organization currently able to support these types of collaborative approaches to water system operations?
- Yes

- Not sure
- No
- Not applicable

Please elaborate:

18. The proposed framework emphasizes the importance of Asset Management.

Within the framework critical elements of Asset Management include:

- Completed evaluation of existing assets
- Up to date data (e.g., known location/as-builts)
- Maintenance schedule
- Full cost accounting (e.g., including externalities)
- Appropriate pricing
- Renewal plan

a. Is the inclusion of these asset management elements applicable for your organization/local water systems?

- Yes
- Not sure
- No

Please elaborate:

b. Is the inclusion of these asset management elements feasible for your organization/local water systems?

- Yes
- Not sure
- No

Please elaborate as to what factors support or prevent the inclusion of these elements:

AVENUE 5: IMPLEMENTATION AND EVALUATION

This section of the framework focuses on implementation (i.e., making sure things get done) and evaluation (i.e., making sure goals are achieved). Implementation and evaluation should be ongoing and result in changes as needed. Participants should be aware of their responsibilities and held accountable.

19. Under the proposed framework implementation of policies, plans, programs, and/or processes would i) be done in a timely fashion, ii) be supported by appropriate levels of capital, and iii) hold participants accountable.

a. Is it feasible for your organization/local water systems to achieve these three elements relative to water systems?

- Yes
- Not sure
- No

Please elaborate:

20. The proposed framework suggests evaluation criteria that goes beyond existing regulations and standards. For example tracking the following relative to water system:

- Contributions to quality of life (e.g., health)
- Support of economic development (e.g., diversification, employment)
- Maintenance of environmental resources (e.g., soil, water)
- Achieving and maintaining a sustainability rating (e.g., LEED)

a. Is it applicable for your organization/local water systems to track such additional criteria relative to drinking water systems?

- Yes
- Not sure
- No

Please elaborate:

b. Is it feasible for your organization/local water systems to track such additional criteria relative to drinking water systems?

- Yes
- Not sure
- No

Please elaborate:

21. Under the proposed framework evaluation is ongoing and policies, programs, plans and/or processes can be adapted immediately following an evaluation (i.e., active adaptation).

a. Is active adaptation applicable to your organization/local water systems?

- Yes
- Not sure
- No

Please elaborate:

b. Is active adaptation is feasible for your organization/local water systems?

- Yes
- Not sure
- No

Please elaborate:

c. Is your organization able to support active adaptation of drinking water systems?

- Yes
- Not sure
- No
- Not applicable

Please elaborate:

AVENUE #6: FLEXIBLE INSTITUTIONAL STRUCTURE

Overall, the proposed framework suggests institutional structures should be flexible and encouraging of non-traditional approaches to governance or management. For water

systems this can include working at a scale, or with actors, outside what is typical for your organization. The framework also includes using best governance practices (e.g., transparency and power sharing).

22. The framework suggests institutions should be flexible enough to allow governance or management of drinking water systems at a scale larger than a single organization. Examples include:

- Watershed-level management
- Existing region (e.g., electoral area, regional district)
- Functional region (e.g., self-identified region)

a. Is having the institutional flexibility to govern or manage drinking water systems at a larger scale applicable to your organization/local water systems?

- Yes
- Not sure
- No

Please elaborate:

b. Is this institutional flexibility in terms of scale feasible for your organization/local water systems?

- Yes
- Not sure
- No

Please elaborate on what factors would support or prevent this:

c. Is this type of flexible institution related to larger scale approaches to drinking water management something that your organization could support?

- Yes
- Not sure
- No
- Not applicable

Please elaborate:

23. The proposed framework suggests institutions should have the flexibility to include multiple actors in drinking water governance or management. Examples include:

- Formal agreements with other water systems or governments
- Including non-governmental actors (e.g., water stewardship groups)
- Governance and management of separate water systems by a new regional agency

a. Is having the institutional flexibility to include multiple actors in water system governance and management applicable to your organization/local water systems?

- Yes
- Not sure
- No

Please elaborate:

b. Is this institutional flexibility in terms of actors feasible for your organization/local water systems?

- Yes
- Not sure
- No

Please elaborate on what factors would support or prevent this:

c. Is this flexibility in the actors involved in water system governance and management something that your organization could support?

- Yes
- Not sure
- No
- Not applicable

Please elaborate:

CLOSING

Many ideas and approaches fit within the proposed framework. The core idea is to allow water system managers to tailor make their own approaches to fit their needs and capabilities while asking them to consider larger scales and different actors. As a result the framework is flexible and incremental.

24. How likely would your organization/local water systems be to consider using such a framework?

- Very likely
- Likely
- Neutral
- Unlikely
- Very unlikely
- Not sure

What factors would support or detract from its use:

What would be needed in order for this to be feasible? (e.g., resources, tools, support)

How likely would your organization be to consider supporting the use of such a framework?

- Very likely
- Likely
- Neutral
- Unlikely
- Very unlikely
- Not sure

Please elaborate:

25. *Do you have any additional comments?

26. Would you like to receive project updates and products?

- Yes
- No

Thank you for your participation.