Assessing the suitability of economic policy instruments for urban flood risk management

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Although modern technology has improved stormwater management practices, municipalities remain susceptible to urban flooding. One common method for addressing flood risk is through the application of economic policy instruments, which facilitate risk reduction by way of incentivising stakeholders to engage in activities that eliminate risk. To date, several studies have analysed costs and benefits of economic policy instruments, but there are still limited insights regarding the selection and evaluation of economic policy instruments by municipal public managers. As a result, this study explored how Canadian municipal public managers assess the suitability of economic instruments for flood risk management. The economic policy instruments examined in this study included corrective taxes, special surcharges, subsidies, compassionate grants, stormwater credits and stormwater charges. Semi-structured interviews were employed and asked participants to evaluate the suitability of the instruments based on seven evaluation criteria. Thematic content analysis was utilised to identify themes among the interviewees' evaluations and resulted in a total of eighteen individual axial codes, collated under three broader suitability themes (efficiency, legitimacy and resiliency). This study concluded that municipal public managers evaluate the suitability of economic instruments for flood risk management through the use of a hierarchical framework which organises the seven evaluation criteria from most preferred to least preferred. Thus, the criteria are ordered as such; municipal capacity, effectiveness, political viability, fairness, economic efficiency, flexibility and coherence.

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1.0 Introduction

This thesis reports the findings of a qualitative study on the suitability of economic policy instruments (EPIs) for flood risk management (FRM) by municipal public managers. This study found that municipal public managers determine the suitability of EPIs for FRM using a hierarchical framework. This framework exhibits a rank ordering of the seven evaluation criteria, from most preferred to least preferred; municipal capacity, effectiveness, political viability, fairness, economic efficiency, flexibility and coherence. As well, the results demonstrated a preference for utilising the efficiency theme as the primary means of evaluating EPIs. The legitimacy of the instruments is considered as a secondary means of evaluation, and the instruments' resiliency was the least valued metric.

These findings contribute to the broader study of flood risk management, climate change adaptation and public policy by providing insights into the evaluation criteria utilised in choosing among EPIs. The results identify instrument attributes valued by municipal public managers and provide an ordering of those attributes, from most to least important. Improving the understanding of EPIs evaluation will aid in developing more robust FRM options for policymakers and other public officials.

The remainder of the thesis is structured as follows. First, this chapter presents a background to the issue of urban flood risk. Then the problem significance, study contributions and research question are presented. The second and third chapters provide a literature background regarding FRM and EPIs. Additionally, the evaluation framework for instrument suitability is discussed in chapter four. Then the methodology utilised for this study will be outlined in chapter five. Furthermore, the findings and discussion of the results will be present in chapters six and seven, respectively. Finally, the eighth chapter provides a summary of this thesis.

1.1 Problem Background

For centuries, EPIs have been utilised as a means of addressing natural hazards. In twelfth-century England, scots (a form of tax) were imposed on communities located on floodplains as means of funding flood mitigation measures, such as dikes and levees (Sayers et al., 2013). These scots were only charged to communities on floodplains, communities located away from the floodplains were exempt from the scot, and were considered to be "scot-free" (Sayers et al., 2013). Even with technological advances in flood mitigation measures, scots are still actively used.

Although there was foresight to establish a means of funding flood mitigation measures through financial instruments, modern cities remain susceptible to urban flooding. The Intergovernmental Panel on Climate Change (IPCC) notes that the risk associated with severe weather events are augmented by the degree of exposure and deficiency of essential infrastructure (IPCC, 2014). Factors such as urban population growth, expanding impermeable surfaces, and development in hazardous areas have increased cities' vulnerability to flooding (Jha, Bloch, & Lamond, 2012; Kron, 2005; Sayers et al., 2013; Thistlethwaite & Henstra, 2017).

Furthermore, the impacts of urban flooding are exacerbated by climate change. There has been an increasing trend in extreme precipitation events globally, which implies a potential for an increase in urban flooding (IPCC, 2014). For some parts of Canada, projections have indicated that forty-year event storms may occur every six years by 2050 (Insurance Bureau of Canada, 2015). More flooding will have a negative impact not only on the livelihoods and health of urban residents but will also impose higher financial costs for both those residents and municipal governments (Insurance Bureau of Canada, 2015; IPCC, 2014; Sayers et al., 2013). Consequently, urban flooding is a growing issue that needs to be addressed.

EPIs are one method that municipal public managers can utilise to address urban flooding. In general, policy instruments are governance tools utilised to facilitate change within a given political jurisdiction (Howlett, Ramesh, & Perl, 2009), and can be categorised based on several different key attributions. Further details regarding the various instrument classifications can be found in chapter 3. EPIs are a niche category of policy instruments that

seek to facilitate behavioural change through the use of financial incentives or disincentives (Rogge & Reichardt, 2016). This study examined six EPIs commonly referenced in literature; corrective taxes, compassionate grants, subsidies, special surcharges, stormwater charges and credits. These EPIs are of interest because municipal governments already utilise some of these instruments for FRM, such as stormwater charge and credits (City of Kitchener, 2018d) and sewer surcharges (City of Windsor, 2019).

1.2 Problem Statement

Canadian municipalities must already manage for urban flooding, but with a predicted increase in extreme precipitation events, new tools will be needed in order for municipalities to adapt to these climatic impacts. EPIs have been utilised by municipal public managers to address a variety of social issues, but there is little research on how municipal public manager evaluate the suitability of those EPIs (specifically corrective taxes, subsidies, surcharges and companionate grants) for addressing FRM (Morrison, Westbrook, & Noble, 2017). Therefore, this study will examine how municipal public managers evaluate the suitability of EPIs for FRM, as a means of expanding the understanding of EPIs and the role these instruments have in municipal FRM.

1.3 Study Contributions

This thesis will provide two critical contributions to the area of FRM for urban flooding. First, previous research tended to focus on the application of EPIs for FRM within the United States of America, with little attention given to the Canadian context or applications. The results of the thesis will expand the knowledge base regarding FRM in Canada, while also providing data on the use of EPIs for FRM. Secondly, much of the existing FRM research in Canada is focused on the national level government, with little focus on the application of FRM and EPIs at the local municipal level. The exploration of the municipal perspective will expand the current understanding of urban FRM to include broader insights into political opinion, utilisation of EPIs, and how policy instruments are evaluated for suitability.

1.4 Research Question

The primary goal of the study is to determine how EPIs are assessed by municipal public managers and the degree to which those instruments address FRM. As a result, the following research question guided this study: “how do municipal public managers evaluate the suitability of EPIs for FRM?”.

2.0 Flood Risk Management

This chapter is designed to provide a background on the use of EPIs for FRM and criteria used to evaluate instrument suitability. The chapter begins by discussing flood risk as a concept, followed by an exploration of the hazard and risk-based perspectives to FRM.

2.1 Flood Risk

This study utilises a definition of flood risk that is comprised of four components including the function of the probability of a flood event occurring, the degree of exposure to that event, the vulnerability of the local community to the flooding and existing social perceptions. The probability of an event occurring is demarcated to include the physical flooding caused by the event (Klijn, Kreibich, de Moel, & Penning-Rowsell, 2015). In this study, exposure is a separate component of risk due to the various determinants or characteristics of flood events (Ibid). Vulnerability is defined as the potential for a given entity or place (the local community) to be harmed by a flood event and consists of three key aspects; (1) the susceptibility of an entity or place, (2) the externalized value associated with the entity or place and (3) the resilience of the entity or place (Sayers et al., 2013). The social perception of risk has been included as an underlying influencer of flood risk since the perception can impact both probability and consequences (Sayers et al., 2013). Perceptions about losses (social, environmental or economic) associated with a phenomena's consequences can impact the overall acceptable level of risk (Bruce et al., 2006), as well these perceptions could also influence the allocation of responsibility for FRM (Mees et al., 2016). Thus, the subjective aspects of risk perception will be utilised as a lens to understand the suitability evaluations of economic policy instrument made by policy managers and other public officials.

To summarise, flood risk could be seen as a function of several complex aspects ranging from a society's perspective of a flood event to the vulnerability, exposure and probability of flood damage to a community. Thus, the perspectives of flood risk held by municipal policy managers will influence their interpretation of EPIs suitability.

2.2 Flood Risk Management

This section will provide a discussion regarding the shift from the hazard-based perspective for FRM towards the current risk-based perspective. Additional information regarding the structural and non-structural FRM approaches will be provided, as a means of facilitating an understanding of the different management approaches employed by municipal public managers.

2.2.1 The Hazard-based Perspective

Flood management, before the latter portion of the twentieth century, consisted of the hazard-based approach (Sayers et al., 2013) that targets the physical flooding (the hazard). This approach favoured the use of structural flood controls, which typically include hard engineering structures, such as dykes, dams and combined sewers (Sayers et al., 2013; Shah, Rahman, & Chowdhury, 2015; Werritty, 2006). The structural approach could also include soft engineering, such as wetlands used for stormwater storage (Sayers et al., 2013), but there remained strong support for the structural flood controls.

Although the hazard-based approach was widely utilised by municipal public managers, this approach exhibited several limitations. Firstly, the use of the hazard-based approached allowed for settlements in sensitive environments, such as wetlands and floodplains (Henstra & Thistlethwaite, 2017a; Sayers et al., 2013), which could result in a false sense of security for residents (Tobin, 1995). Secondly, the development in sensitive environments poses a consistent strain on the physical flood controls, leading to increase maintenance and financial costs for the physical flood control structures (Henstra & Thistlethwaite, 2017b). Thirdly, residents receive financial relief for flood events, which further incites development since the funding provided no incentive to abandon those high flood risk area (Ibid). Fourthly, the hazard-based approach restores communities to pre-flood conditions with no consideration for the long-term implications of increased precipitation and land use changes to the area (Ibid). Finally, the hazard-based approach does not facilitate the integration of coordinated responses between communities within the same basin, thereby leading to increased water security issues and exposure to flood risk (Ibid). Due to the above limitations, policymakers began to explore

alternative approaches to with an increasing focus on the embrace of flood risk in their management plans.

2.2.2 The Risk-Based Perspective

Modern flood risk management is marked by three notable shifts in the approaches to addressing flood events. The first shift was indicated by the change in perspective from focusing on severe flood events to considering all flood events (Merz, Hall, Disse, & Schumann, 2010). The focus on severe floods, such as a 100-year event, meant that management plans only provided compensation for re-building high-risk areas without addressing the vulnerability or exposure to the physical event (Henstra & Thistlethwaite, 2017a). There was a realisation that the reliance on the hazard based approach did not exercise foresight regarding the temporal and spatial impacts of flooding, specifically how exposure and vulnerability lead to consequences rather than just the hazard, resulting in increased damage and frequency of floods in other jurisdictions (Sayers et al., 2013; Thomas & Knüppe, 2016). Consequently, a new perspective was needed in order to adequately reduce the impacts of flood events rather than applying prescriptive responses (Merz et al., 2010; Thomas & Knüppe, 2016).

The second shift was characterised by a change towards risk-informed decision making (Merz et al., 2010). The insight gained from the first development resulted in a new understanding of how risk management tools from other sectors could be applied to flood management (Sayers et al., 2013). One such risk management tool involves risk assessment whereby data on the consequences (e.g. costs) of flooding are included alongside modelling of the hazard. Overall, this second shift required policymakers to consider the principles of risk management as a primary focus for flood management (Merz et al., 2010; Thomas & Knüppe, 2016).

The final shift towards the risk-based approach centres around integrated systems for risk reduction (Merz et al., 2010) and included increased diversity in instruments utilised to address flood risk (Marlow, Moglia, Cook, & Beale, 2013; Shah, Rahman, & Chowdhury, 2017; van de Meene, Brown, & Farrelly, 2011; van Herk, Rijke, Zevenbergen, & Ashley, 2015). In an integrated system, structural approaches are enhanced by the addition of other non-structural

approaches, such as land-use planning (Cameron, Cincar, Trudeau, Marsalek, & Schaefer, 1999; Dawson et al., 2011), insurance (Penning-Rowsell & Pardoe, 2015) and economic policy instruments (Kundzewicz, 2002; Taylor, Wong, & Cooperative Research Centre for Catchment Hydrology, 2002), as well as flood forecasting and mapping (Kundzewicz, 2002; Shrubsole & Institute for Catastrophic Loss Reduction, 2003). This increased instrument diversity allows municipal public managers to address flood risk through the promotion of risk-sharing between stakeholders (Henstra & Thistlethwaite, 2017a; Morrison et al., 2017).

The shifts noted above resulted in the development of the risk-based approach, referred to as flood risk management (FRM). FRM focuses on identifying, evaluating and mitigating the drivers behind urban flooding (Shah et al., 2015). Flood risk is always present, it cannot be fully eliminated, and vulnerability to risks are inherently dynamic (Merz et al., 2010; Sayers et al., 2013). As a result, the degree or magnitude of flood risk a community is exposed to will vary throughout time (de Brito & Evers, 2016; Merz et al., 2010).

Although FRM should consist of both non-structural and structural approaches, municipal policymakers tend only to utilise the structural approach. The preference for the structural approach exists because this approach allows FRM plans to achieve success in a shorter period and provide operational stability, but this approach is costly and ignores other successful long-term approaches (Porse, 2013; Sayers et al., 2013; Shah et al., 2017). The limited application of non-structural approaches can be attributed to existing governance paradigms that inherently favour structural approaches and the dispersion of regulative authority for FRM (Butler & Pidgeon, 2011; Porse, 2013; Werritty, 2006). The dispersion of regulative authority impedes the development of non-structural approaches since duties are scattered across departments or agencies, thereby hindering coordination for developing effective non-structural approaches (Porse, 2013). Additionally, municipalities that have invested monetary and human capital into the development of structural approaches are less likely to abandon those approaches in favour of non-structural approaches, for fear of losing those investments (Ibid).

In summary, the risk-based approach for managing flooding results in the inclusion of both structural and non-structural approaches during policy development. There remains

strong favouritism for the structural approaches by municipal public managers, but non-structural approaches are becoming more popular. For example, the City of Philadelphia used a mix of combined sewers (a structural approach) and a new stormwater rate program (an economic instrument) to manage its increasing stormwater runoff (Valderrama & Levine, 2012). Although there is evidence that FRM has been implemented in some jurisdictions, little insight remains as to the process that results in the adoption of FRM tools, such as EPIs. Thus, it would be beneficial to explore the underlying policy instruments that facilitate FRM development as a means of improving the understanding of the selection and evaluation of suitability for EPIs.

3.0 Policy Instruments

This chapter will provide an overview of the policy instruments utilised in addressing urban flood by municipal public managers. First, the various definitions and types of EPIs will be discussed, followed by example applications of these instruments for FRM.

3.1 Defining Policy Instruments

According to Howlett, Ramesh and Perl (2009), policy instruments are the tools utilised by governments to facilitate change within a given political jurisdiction. In this view, policy instruments prescribe whether action should be taken and specify discrete actions to resolve the issue in question (Howlett et al., 2009). Additionally, a policy "tool, or instrument, of public action can be defined as an identifiable method through which collective action is structured to address a public problem" (Salamon, 2001, p.1641-1642). This definition describes policy instruments as creating *collective action* (Salamon, 2001), indicating that multiple stakeholders are involved in the process and not just a government agency. Policy instruments are also building blocks for more complex policy structures and "constitute the concrete tools to achieve overarching objectives" (Rogge & Reichardt, 2016, p.1623). Overall, it could be understood that policy instruments are governance practices that facilitate change related to critical societal issues.

3.2 Categorising Policy Instruments

Due to the variety of policy instruments, several frameworks have been constructed in order to explore and classify the diversity of instruments available (Howlett et al., 2009; Salamon, 2001).

In the first framework, Rogge and Reichardt (2016) categorise policy instruments based on their type (economic, regulation or information) and purpose (technology push, demand pull and systemic concerns). As highlighted in table 1, the selection of a policy instrument could be

determined based on the intersection of the desired type and purpose. However, this framework does not share responsibility between government and non-government agents, meaning the governing body is solely responsible for designing and implementing policy instruments.

Primary Type	**Primary Purpose**		
	Technological Push	*Demand Pull*	*Systemic*
Economic	RD&D, grants and loans, tax incentives, state equity assistance	Subsidies, feed-in tariffs, trading systems, taxes, levies, deposit-refund-systems, public procurement, export credit guarantees	Tax and subsidy reforms, infrastructure provision, cooperative RD&D grants
Regulation	Patent law, intellectual property rights	Technology/performance standards, prohibition of products/practices, application constraints	Market design, grid access guarantee, priority feed-in, environmental liability law
Information	Professional training and qualification, entrepreneurship training, scientific workshops	Training on new technologies, rating and labelling programs, public information campaigns	Education system, thematic meetings, public debates, cooperative RD&D programs, clusters

Table 1 Policy Instruments Classified by Purpose (Adapted from Rogge & Reichardt, 2016)

In the second framework, the categorisation of policy instruments can be based on four elements; the type of good or activity, the delivery vehicle, the delivery system (the institutions and agents involved), and a set of rules that define the relationships between the institutions and agents (Salamon, 2001). In this framework, policy instruments can be similar in some ways, but there is at least one single difference between all of the instruments. Table 2 demonstrates how policy instruments can be categorised based on these differences. For example, a tax expenditure and fees/charges share the same vehicle and delivery system but differ in their type of activity. Although this framework includes the delivery system for each instrument, it is unclear as to what governance resources will be needed for successful implementation.

For the third framework, the policy instruments can be categorised based on the governance resources required; information (Nodality), legal power (Authority), finances (Treasure) and formal organisation (Organization) (Hood, 1983; Howlett et al., 2009). This framework has been referred to as the "NATO" model (Howlett et al., 2009). The NATO framework consists of two key elements that differentiate this framework from those previously discussed. The first element is a strong focus on the government as the dominant

policy actor. As a result, governance power and policy responsibility would be shifted towards the government, meaning the availability of governance resources will impact the choice of policy instruments.

Instrument / Tool	Type of Good / Activity	Vehicle	Delivery System
Direct Government	Good or service	Direct provision	Public agency
Social Regulation	Prohibition	Rule	Public agency / Regulatee
Economic Regulations	Fair prices	Entry and rate control	Regulatory commission
Contracting	Good or service	Contract and cash payment	Business, non-profit organisation
Grant	Good or service	Grant award / Cash payment	Lower level of Government, non-profit
Direct Loan	Cash	Loan	Public agency
Loan Guarantee	Cash	Loan	Commercial bank
Insurance	Protection	Insurance policy	Public agency
Tax Expenditure	Cash, incentives	Tax	Tax system
Fees / Charges	Financial penalty	Tax	Tax system
Liability Law	Social protections	Tort law	Court system
Government Corporations, Quasi-public Agency	Good or service	Direct provisions / Loan	
Vouchers	Good or service	Consumer subsidy	Public agency / Consumer

Table 2 Policy Instruments Classified by Defining Elements (Adapted from Salamon, 2001)

For the second element, as illustrated in table 3, policy instruments in this framework are categorised in one dimension by the governance resource used. In contrast, the multiple dimensions used in Rogge and Reichardt (2016) and Salamon (2001) allow both of those frameworks to provide more in-depth distinctions between instruments than this NATO framework. This NATO framework provides a niche, top-down governance perspective that identifies a variety of policy instruments and the governance resource needed.

Overall, the above frameworks highlight that instrument categorisation is based on the desired policy outcomes and resources available to policymakers. As well, all three frameworks do include both substantive and procedural instruments. However, these frameworks are rather general and do not include risk as a fundamental element of instrument classification.

Risk is included in the fourth framework outlined by Thistlethwaite and Henstra (2017). As depicted in table 4, policy instruments could be organised based on how they share risk through sharing the burden of loss, sharing responsibility for risk reduction, and sharing the

costs of risk reduction. The instruments under the first category, sharing the burden of loss, seek to distribute associated losses with multiple actors.

	Governance Resource			
	Nodality	*Authority*	*Treasure*	*Organisation*
Policy Instrument	Information collection and release	Command-and-control regulations	Grants and loans	Direct provision of goods and services and public enterprises
	Advice and exhortation	Self-regulation	User charges	Use of family, community and voluntary organisation
	Advertising	Standard-setting and delegated regulation	Taxes and tax expenditures	Market creation
	Commission and inquires	Advisory communities and consultation	Interest group creation and funding	Government reorganisation

Table 3 Policy Instruments Classified by Governance Resources (Adapted from Howlett et al., 2009)

The two popular instruments associated with this category (disaster financial assistance and private insurance) usually incorporate third-parties, such as other levels of government or financial institutions. The second category seeks to mitigate risk through sharing responsibility, and has a strong interest in including non-governmental actors who influence or impacted by a flood event, such as municipal residents. The final category, sharing the costs of risk reduction, allows for the financing of community risk reduction activities by garnering funds from relevant stakeholders. In short, Thistlethwaite and Henstra (2017) highlight how policy instruments similar to those employed in the other frameworks can be used to promote not only collective change but also share flood risk.

Furthermore, there are two key instrument categories utilised within the above frameworks. The first category is economic policy instruments (such as taxes, grants, or insurance) that seeks to facilitate change by implementing policy through economic markets. The second category could be referred to as regulatory, which includes instruments such as liability law, performance standards, or land use planning. The use of these two instrument categories in addressing environmental issues is not uncommon (Vollebergh, 2007). As previously mentioned, municipal policy managers have utilised policy instruments, specifically economic instruments, in addressing the issue of urban flooding. Consequently, the next section will further explore the specific types of EPIs presently employed for FRM.

Instrument Category	Example Instruments
Sharing the burden of loss	Disaster financial assistance
	Private Insurance
Sharing responsibility for risk reduction	Stakeholder engagement
	Public Engagement
	Citizen observatory
	Flood warning system
	Hazard disclosure
	Subsidy
	Credit
	Land-use planning
	Bylaws
	Flood maps
	Integrated stormwater management
Sharing the costs of risk reduction	Corrective tax
	Risk-based charge
	Special surcharge

Table 4 Policy Instruments Classified by Risk Dimensions (Adapted from Thistlethwaite & Henstra, 2017)

3.3 Economic Instruments

Economic instruments have garnered much attention within FRM literature as effective tools for facilitating the uptake of FRM at the municipal level. Unlike traditional policy instruments, economic based instruments still maintain a certain degree of command-and-control but account for the socioeconomic variations within the management area (Filatova, Mulder, & van der Veen, 2011). Residents are provided with options for implement stormwater best management strategies, such as building cisterns or bioswales on their property (Australian Agricultural and Resource Economics Society et al., 2004; Debo & Reese, 2003; Pazwash, 2011). As well, the inclusion of an economic based approach can improve the cost-efficiency of FRM by providing a long-term funding for FRM program operations and gives residents equitable opportunities to share the marginal control costs of FRM (García-Rubio, Ruiz-Villaverde, & González-Gómez, 2015; Grigg, 2013; Parikh, Taylor, Hoagland, Thurston, & Shuster, 2005). Given the benefits provided by EPIs, the following EPIs will be explored in further detail; stormwater charges, stormwater credits, corrective taxes, special surcharge, subsidies, and compassionate grants.

3.3.1 Stormwater Charges and Credits

Traditionally, stormwater management was funded through property taxes (Doll, Scodari, & Lindsey, 1998). However, there has been a shift towards managing stormwater under a specific stormwater utility, department or program within the municipal government (Doll et al., 1998; Lindsey, 1990), and to utilise stormwater charges and credits (Cameron et al., 1999; Doll et al., 1998; Lindsey, 1990).

Stormwater charges are quantified fees that property owners must pay, as required by their municipality. The specific amount charged to a property owner can be determined by either categorised rate based on the average amount of impervious area on a property or by more precise impervious area measurement through individual parcel assessments (Doll et al., 1998; Keeley, 2007; Lindsey, 1990).

Stormwater credits allow for monetary relief from a stormwater charge (Doll et al., 1998). These credits are awarded when the property owner has met a specified condition set by the municipality (Cameron et al., 1999). For example, the City of Kitchener offers a stormwater credit program to residential and non-residential properties within the municipality (City of Kitchener, 2018c). Through the credit program, property owners can reduce up to 45% of the properties' assessed stormwater charge by enacting specified best management practices outlined by the municipal government (City of Kitchener, 2012). Separate mitigation measures have been established based on the type of property, residential or non-residential, that is impacted by flooding. For residential properties, the acceptable mitigation measures include installing rain barrels, cisterns, infiltration galleries, rain gardens and permeable pavers (City of Kitchener, 2018b). For non-residential properties, there are options of installing oil grit separators, stormwater storage on rooftops or parking lots, adding filter strips to parking lots, or developing *in situ* stormwater management ponds (City of Kitchener, 2018a).

By attaching a charge to a stormwater utility or municipal water services, property owners have a choice to either pay the associated cost or enact measures that would count towards credits. It has been argued that stormwater charges and credits are more equitable and more effective than traditional policy approaches because all residents incur a stormwater charge, and the fees are determined by the estimated quantity of runoff based on property size

(Debo & Reese, 2003; Kertesz, Green, & Shuster, 2014; Pazwash, 2011). Moreover, stormwater charges and credits can incentivise individuals to enact private stormwater management practices, leading to a more effective FRM (Cameron et al., 1999; Keeley, 2007; Kertesz et al., 2014). An additional benefit, not provided by traditional policy instruments, is that the income generated from stormwater charges and credit programs can be used to fund the operation of municipal infrastructure, thereby offsetting the expenses of stormwater management projects (Reese, 1996).

It should be noted that the value of the stormwater charges is critical to incentivising private FRM (García-Rubio et al., 2015). If the charge is too low, there will be little incentive for an individual to enact a stormwater best management practices (García-Rubio et al., 2015).

3.3.2 Corrective Taxes

Like stormwater charges, corrective taxes are employed to influence the behaviour of individuals by incentivising the adoption of negative externalities and accounts for positive externalities (Filatova et al., 2011). This instrument influences behaviour by imposing a higher financial cost to those who participate in the offending activities (Cordes, 2002; Filatova et al., 2011). Unlike stormwater charges, a corrective tax is typically levied based on the means that it is the most feasible for a municipal government to manage and the tax must operate within the pre-existing administrative mechanisms of that government (Cordes, 2002). One pre-existing mechanism is the property tax rate structure, whereby the tax rate is set based on the property type. For example, residential properties in the City of Toronto pay a total property tax rate of approximately 0.63%, while general commercial properties pay a total tax rate of about 2.4% (City of Toronto, 2019). As noted by Keeley (2007), stormwater charges can be established based on measuring the size of the impervious area on a property or as a standard rate per property type. Establishing a corrective tax based on the amount of impervious area is an equitable approach, but is a costly process for the municipality (Keeley, 2007). Thus, it may not be feasible for a local government to tax based on the amount of impervious areas, but instead base the corrective tax on property type (residential, institutional, commercial etc.).

Historically, taxes relating to stormwater management were included within the municipality's property taxes (Lindsey, 1990), but there are currently limited examples of a corrective tax being used for FRM (Henstra & Thistlethwaite, 2017b). However, the city of Calgary does have a special property tax structure for those properties in flood-prone sections of the city.

In Calgary, the flood-prone Rivers District has a unique property tax structure whereby a baseline assessment and incremental assessment values are used to set the property tax. The baseline assessment is evaluated from property value at the time of December 31, 2007; this value does not change (City of Calgary, 2018a). Any increase in property value above the 2007 baseline, for all new and existing properties, is factored into a reassessment of the property tax value (Ibid) and subject to Community Revitalization Levy rate (Ibid). The funds generated from the revitalisation rate are used to fund stormwater infrastructure improvements in the district. Properties outside of the Rivers District are not subject to the Community Revitalization Levy rate and or the incremental assessment (City of Calgary, 2018b). Overall, this example of a corrective tax demonstrates that municipal public managers can address urban flood by disincentivising further development in areas of high flood risk and also generate funding for further FRM initiatives.

3.3.3 Special Surcharge

A third economic instrument is a special surcharge, which is a flat rate applicable to all properties regardless of the amount of stormwater the property produces. (Thistlethwaite & Henstra, 2017). An example of this instrument can be seen in the city of Kearney, Nebraska, where the resident's water bills contain additional monthly charge for stormwater depending on the property type (residential or non-residential) (City of Kearney, 2018). The funds generated from this surcharge are used to fund stormwater management within the city (Ibid).

3.3.4 Subsidies

In contrast to the above three instruments, subsidies provide support for the development or application of mutually beneficial initiatives within the municipality (Henstra & Thistlethwaite, 2017b). Some common examples of subsidies include loans and tax exemptions (broadly defined to include deferrals or preferred rates) (Howlett et al., 2009). Government subsidies promote the uptake of an activity in a community when an issue has high externalities because the subsidy would offset the financial barrier for implementing the targeted activity (Posner, 2002). In the case of FRM, municipalities could provide financial assistance to property owners to assist in the implementation of property-level FRM strategies (such as permeable driveways), or basement flood protection.

Due to the increasing impacts from climate change, the City of Windsor offers a basement flooding protection subsidy for residential property owners. There is a maximum subsidy limit of $2,800 per property, and the funds can be used towards installing backwater valves, sump pumps or disconnecting foundation drains from floor drains (City of Windsor, 2018). For this program, the property owners must apply and prove eligibility before obtaining the funds (Ibid).

3.3.5 Compassionate Grants

The final economic instrument is the compassionate grant, which is utilised in various forms. One common example is the use of municipal government grants for financial aid after a severe flood (Thistlethwaite & Henstra, 2017). The application of this instrument can be seen in the city of Hamilton, Ontario, after a large rainfall event in 2017. Hamilton received approximately 82 mm of rain between April 21 and May 6, 2017, which resulted in severe flooding in the city (Palumbo, 2017). At that time, the city council decided to offer compassionate grants for property owners impacted by the flooding (Craggs, 2017). Property owners could apply for a grant worth up to $1,000 to offset the costs of the floods damage (Ibid). The funding for the grants originated from the city's storm sewer reserve, and these

funds are available if the council approves a motion to enact the grant program (Palumbo, 2017).

3.4 Compromises and Instrument Mixes

Municipal public managers are not limited by the choice of policy instruments available for FRM, but all instruments present constraints and pose compromises for policy implementation. Policy instruments are constrained by the governing resources, such as; resource intensiveness, targeting precision, political risk, ideological and financial constraints (Henstra, 2016). These constraints will impact the degree to which the instrument would meet broader policy goals, given that municipalities must operate under pre-existing conditions and available resources. Thus, some instruments might be better suited for FRM in one jurisdiction, but not in another. Consequently, municipal public managers must compromise when selecting instruments due to the inherent trade-offs for each instrument (Ibid).

In order to overcome instrument constraints, policymakers might develop an instrument mix. For this study, an instrument mix is defined as the utilisation of multiple instruments that interact in order to achieve the overarching policy goals (Howlett et al., 2009; Rogge & Reichardt, 2016). The use of several instruments will aid in resolving the inherent compromises by building on the strengths of individual instruments (Henstra, 2016; Howlett et al., 2009; Rogge & Reichardt, 2016).

Although an instrument mix would assist in remedying policy constraints, the adverse implications to the spatial and temporal scales should also be considered (Henstra, 2016). With regards to spatial scales, an unproductive instrument mix may hinder the ability of policymakers at different government levels to enact effective policies (Ibid), while the same unproductive mix might limit the ability of policymakers within the same governance level (Ibid). For temporal scales, an ineffective instrument mix could limit future policy choices by generating a narrow policy development pathway (Nair & Howlett, 2016).

The above interferences could be resolved if the instrument mix is designed to garner consistency, ensure coherence between the instruments and policy processes, as well as

promote credibility for the mix (Rogge & Reichardt, 2016). Consistency is of importance because the effectiveness of the instrument mix depends on how well the instruments align with each other, and the broader policy strategy (Ibid). Moreover, coherence within an instrument mix is imperative for successful policy implementation, thus, policymakers ought to select instruments that reinforce or generate policy synergies (Henstra, 2017; Rogge & Reichardt, 2016). Finally, the credibility for the instrument mix entails reliability and believability for the instrument mix (Rogge & Reichardt, 2016). As a result, credibility is influenced by the commitment from political leaders, the ability of the instrument mix to operationalise policy goals, and the degree of responsibility or competencies given to third parties (Ibid). The interferences at spatial and temporal scales could be ameliorated if all three design principles are applied.

Overall, policymakers have access to a wide range of EPIs for creating FRM policy. The success of the FRM policy depends on the degree of constraints exerted by the instruments selected. A consistent, coherent and credible instrument mix could alleviate some instrument related constraints. Nonetheless, instruments still contain inherent weaknesses that will require policymakers to make compromises during instrument selection and, as a result, those compromises will influence the instruments' suitability (Henstra, 2017; Howlett et al., 2009). Therefore, in order to understand the influence of these inherent compromises has to EPIs selection, the next section will explore existing research on how municipal public managers evaluate instrument suitability.

4.0 Instrument Suitability

The ability of an EPI to address FRM in a municipality is dependent on how well the instrument complements the existing governance structure and available resources. This section will first present a theoretical overview of how policy instruments could be assessed for suitability by municipal public managers. Then a comprehensive framework will be presented as a means of integrating the various approaches of evaluating EPIs suitability.

4.1 Instrument Assessments

As noted by Hood (1983), assessing policy tools, or instruments, is difficult because the assessment is dependent on the temporal landscape and political climate (Hood, 1983). As a result, an assessment framework must be established that is broad enough to allow for a contextual understanding but is analytical enough to draw comparisons. One such framework, referred to as the "Five I's", provides insight into the drivers of policy choice (Capano & Lippi, 2017; Peters, 2002). The five assessment factors include interests, ideas, individuals, institutions and international environment. With regards to interests, the selection of policy instruments will be influenced by the most prevailing interests, and a policy outcome cannot incorporate the interests of every stakeholder (Peters, 2002).

The competing nature of the individual or collective interests of policy actors will demand the establishment of a compromise (Peters, 2002). These compromises are augmented by the ideas policy actors retain. The ideas around what good policy should look like would impact on the types of instruments selected (Ibid). Additionally, individuals influence instrument selection by their approval or willingness to accept the instrument, while institutions' preferences for certain instruments will also impact the final selection (Ibid). This framework identifies the international environment as an influential factor since globalisation allows for the development of policies and associated instruments that may not have been popular or known at the national level (Ibid). Thus, instrument selection depends on a broad set of criteria and the "Five I's" framework emphasises how instrument selection is inherently political (Ibid).

Salamon (2002) further refined the theoretical foundations of "Five I's" framework by outlining four criteria used to assess instruments: effectiveness, efficiency, equity and manageability. Effectiveness is determined by how well the instrument aids in achieving the policy's stated objectives (Salamon, 2002). Efficiency assesses the ability of the instrument to balance the benefits and costs of a policy (Ibid). These costs do not merely include costs imposed on the governance agent, but also includes costs imposed on other stakeholders (Ibid). Equity addresses fairness in how the instrument distributes the costs and redistributes benefits. Ideally, instruments should ensure that stakeholders who initially experience fewer benefits incur fewer costs and receive more benefits in the end (Ibid). The manageability of an instrument can be assessed based on the number of resources needed or the general difficulty in implementing the instrument (Ibid). Overall, this framework provides insight into evaluating the suitability of EPIs thought an examination of the policy's outcomes and consequences.

Expanding from Salamon (2002), Capano and Lippi (2017) explore how legitimacy and instrumentality influence instrument selection. The legitimacy criterion broadly addresses the extent to which an instrument is perceived as acceptable by stakeholders (Capano & Lippi, 2017; Salamon, 2002). More specifically, this criterion can assess the internal and external legitimacy of an instrument. Internal legitimacy refers to how the instrument is approved by decision-makers, those who have a higher degree of authority to create and enact policy (Capano & Lippi, 2017). Internal legitimisation occurs when an instrument complements the existing governance mode or matches with the present cognitive framework within policy discourse and community (Ibid). On the other hand, the external legitimacy of a given instrument is grounded in its perception by other jurisdictions, or policy community (Ibid). Thus, if the instrument has a strong reputation of being successfully utilised, then it can be deemed as valid, regardless of how it could be transferred to a new context (Ibid).

Moreover, the second criterion of instrumentality assesses the capacity the instrument has in meeting the policy's goals, the coherence of policy and the general effectiveness of the instrument (Capano & Lippi, 2017). Although this criterion shares similarities with the effectiveness criterion outlined by Salamon (2002), this instrumentality criterion is different since it allows for two subdivisions, based on perceptions of decision makers. The first

subdivision, specialised instrumentality, denotes instruments that are perceived to be unique and non- substitutable tools, that are utilised for a single problem (Capano & Lippi, 2017). The second division, generic instrumentality, refers to instruments that are seen as broadly applicable and can encompass a wider range of problems or stakeholders (Ibid). Moreover, policymakers choose instruments based on both the ability of the instrument to solve the problem in question and how the instrument would distribute political powers (Ibid). Overall, legitimacy and instrumentality can influence the selection of policy instruments through perceptions held by decision makers.

Moreover, Alexander, Priest and Mees (2016) provided insight into how to assess instruments based on efficiency. As outlined in Salamon (2002), efficiency can be determined based on the distribution of benefits and costs, with costs being broadly defined. However, a more in-depth approach to assessing efficiency would be to consider the economic, social and environmental benefits, thereby assessing the ability of the instrument to address multiple issues (Alexander, Priest, & Mees, 2016). This efficiency criterion can include technical resources, human resources and the traditional economic resources (Ibid).

Importantly, due to the increase in uncertainty associated with climate change, policy instruments are assessed based on their ability to internalise the uncertainty created by climate change. Specifically, policy instruments should not create a rigid policy path that limits the choices for future policy decisions (Nair & Howlett, 2016).

Lastly, new policies are usually never created in a political system without interference from existing policies (Howlett & Rayner, 2007). In order to have successful policy outcomes, the new policy ought to align or be coherent with existing political frameworks and policies (Ibid). Failure to consider the alignment of policy and EPIs could lead to ineffective or adverse outcomes.

4.2 Evaluation Criteria & Framework

Overall, the above literature outlined several different instrument evaluation components, which can be further separated into distinctive criteria for generating an operational assessment framework. For this study, seven evaluation criteria were established

from the above literature (See Table 5). These criteria represent the key aspects for a successfully implemented FRM policy and can be utilised to evaluate the six economic instruments.

Furthermore, in addition to the individual evaluation criteria, the literature outlines three objectives for assessing the suitability of economic instruments for FRM. These objectives consist of; effectiveness, legitimacy and resilience (Larrue, Trémorin, & Hegger, 2013). The efficiency objective considers if public and private resources are utilised in a resource-efficient manner. (Ibid). To this end, efficiency evaluates the quotient between resource requirements and beneficial outcomes from the instrument (Ibid). For this study, legitimacy is defined as the extent of acceptance and reliability for a given economic instrument (Henstra, 2016; Larrue et al., 2013).

Criteria	Source(s)	Description
Effectiveness	Salamon (2002)	The degree to which an instrument will achieve FRM mandated goals, targets or objectives.
Municipal Capacity	Alexander, Priest & Mees (2016), Salamon (2002)	The degree to which sufficient technical resources, staffing, or other related human resources are available to implement the instrument.
Political Viability	Capano & Lippi (2017) Peters (2002)	The degree to which elected officials, stakeholders and decision makers perceive the instrument to be acceptable in its applications and outcomes.
Economic Efficiency	Salamon (2002) Capano & Lippi (2017)	The degree in which the instrument generates a greater number of benefits and a lower amount of associated costs.
Fairness	Salamon (2002), Peters (2002)	The extent to which the costs and benefits of the instrument are distributed equability among stakeholders.
Flexibility	Nair & Howlett (2016)	The ability of an instrument to allow for policy decisions to be adjusted in the future.
Coherence	Howlett & Rayner (2007)	The degree to which the instrument is consistent and aligns with existing policies.

Table 5 Evaluation criteria for Policy Instruments

It is important to note that the legitimacy of an instrument will vary from one jurisdiction to another due to the variations in the perspectives of the instrument's acceptability and reliability (Larrue et al., 2013). The resiliency objective is defined based on three capacities; capacity to resist flooding, the capacity to absorb or recover when a flood event occurs and the capacity to adapt to future risks (Hegger, Driessen, & Bakker, 2016). It should be noted that there are concessions for these objectives, whereby an instrument may exhibit a strong association with one objective, but less correlation with other objectives (Larrue et al., 2013). Nonetheless, the

utilisation of these objectives improves the assessment of the suitability of EPIs in addressing FRM.

Although the literature outlines seven individual evaluation criteria, there is a need for broader assessment framework to better understand the interactions of economic instruments and FRM with municipal governance. As a result, the seven evaluation criteria can be combined with the three suitability objectives into a comprehensive framework (See Table 6).

Suitability Objective	**Evaluation Criteria**
Efficiency	Economic Efficiency & Municipal Capacity
Legitimacy	Fairness, Political Viability & Coherence
Resiliency	Flexibility & Effectiveness

Table 6 Suitability Evaluation Framework

The comprehensive framework capitalises upon the various synergies between the seven evaluation criteria. As previously discussed, the efficiency objective evaluates the utilisation of public and private resources. Thus, the criteria of *economic efficiency* and *municipal capacity* were categorised under the efficiency theme since both criteria assess the resource requirements for instrument and outcomes from instrument implementation (Alexander et al., 2016; Capano & Lippi, 2017; Salamon, 2002).

Furthermore, the legitimacy objective is comprised of the three criteria; *fairness*, *political viability* and *coherence*. The criteria of *political viability* and *coherence* were included under this objective because these criteria evaluate whether the instrument is politically accepted by political officials and is acceptable in terms of alignment with existing policy (Capano & Lippi, 2017; Howlett & Rayner, 2007; Peters, 2002). Additionally, the *fairness* criterion was included because it complements the objective's characteristic of acceptance through the evaluation of the dispersion of an instruments' impacts (Peters, 2002; Salamon, 2002). The more equitable the dispersion of impacts result in greater acceptance for the instrument.

Finally, the last two evaluation criteria, *flexibility* and *effectiveness*, were categorised under the resiliency objective. The *flexibility* criterion was categorised under this objective because flexibility evaluates the ability of the instrument to be adjusted in the future, as a means of addressing changes in FRM (Nair & Howlett, 2016). The ability to adjust the

instrument will assist in improving the capacity for FRM policy to adapt to future risks. The *effectiveness* criterion was included under this objective since the criterion assesses the capacity of an instrument through the achievement of the mandated FRM goals or targets (Salamon, 2002). The utilisation of the three suitability objectives and sub-criteria will provide improved insights into the evaluation process of EPIs by municipal public managers.

To conclude, this chapter presented an overview of the assessment processes found in the literature for evaluating EPIs. Some assessment processes focused on evaluating based on policy choice, such as the "Five I's" framework (Capano & Lippi, 2017; Peters, 2002), while other frameworks expanded upon policy choice to further define the assessment to include evaluations on the effectiveness, efficiency, equity, capacity and legitimacy (Alexander et al., 2016; Capano & Lippi, 2017; Salamon, 2002). These assessment processes lead to seven distinct evaluation criteria, which include; effectiveness, municipal capacity, political viability, economic efficiency, fairness, flexibility, and coherence. The seven evaluation criteria, in combination with three suitability objectives, reveal a framework based on existing literature that municipalities use when evaluating policy decisions. The next section will develop a methodology for assessing whether there is evidence of this approach to EPIs suitability with a municipality.

5.0 Methodology

This chapter will discuss the qualitative research approach, the specific data collection methods, and the thematic analysis of the data utilised to answer the above research question. Furthermore, details on how reliability and validity were addressed in this study will be presented. Finally, the boundaries and limitations of this study will be considered.

5.1 Ontological and Epistemological Considerations

The study accepts soft constructionism and interpretivism as its fundamental precepts. The soft constructionism ontology predicates that it is possible for an objective social reality to exist, but many of our ideas or perceptions do not fully represent that objective reality (Bryman & Bell, 2016). Those ideas and perceptions are instead created to justify our actions. The interpretivist epistemology focuses on understanding the meaning of the social actions studied, or data collected (Bryman & Bell, 2016; Schwandt, 1998). An understanding is gained by utilising the perspective of the actors studied (individuals, agencies etc.) and there is a strong interest in interpretation rather than explaining the behaviour or the data (Bryman & Bell, 2016).

5.2 Research Approach

This study utilised a qualitative search approach to developing an understanding of the perspectives held by participants. According to Bryman and Bell (2016), the main goal of qualitative research is to see through the eyes of the participants this allows researchers to establish a richer more authentic understanding of the behaviour studied or data collected (Bouma, Ling, & Wilkinson, 2012; Bryman & Bell, 2016; Liamputtong, 2009). Qualitative research emphasises multiple realities or perspectives (Liamputtong, 2009), and seeks to provide a holistic account (Bouma et al., 2012). To summarise, qualitative research focuses on the views held by participants and builds an understanding of these views by conducting research or collecting data from the participants' perspectives.

5.3 Research Sample and Data Sources

This section will begin by describing the sample selection, followed by an overview of the survey design. Finally, the data collection process will be explained.

5.3.1 Sample Selection

For this study, ten municipal public managers were contacted and interviewed as a means of gaining an understanding of their insights on evaluating the selected EPIs. The public managers were either an employee of a municipal government or employed at a water utility that operated in partnership with the municipality. Additionally, each participant had working knowledge or experience with FRM policy and applications within their jurisdiction. The participants were selected from municipalities that had metropolitan populations ranging between approximately 100,000 and 6,000,000 people.

This sample size is justifiable since there already exists a small niche of municipal experts that would have knowledge regarding FRM, EPIs and municipal policy. A key determinant of an adequate sample size is the saturation of possible responses (Baker & Edwards, 2012; Bryman & Bell, 2016). This sample size was large enough to exhibit extensive repetition in the responses provided, thereby indicating that a point of saturation was reached.

5.3.2 Data Collection & Survey Design

The data was collected during semi-structured interviews that asked municipal public managers to evaluate different EPIs using criteria identified from EPIs literature (See Table 5). These interviewers were conducted as part of a larger research project that examined a broad range of policy instruments for FRM. Each interview was audio recorded and transcribed (by an accredited third party), the transcripts were used as the data sources for this study.

The interviews were designed to use an open-ended question that asked the participants to discuss their opinion or perspective on each EPI. The interviewer then proceeded to ask additional open-ended questions, based on the seven evaluation criteria established by the literature, which required the participants to assess and provide their

opinion on the suitability of the application of the EPIs. Only the participants' responses to the EPIs selected (corrective taxes, stormwater charges, subsidies, stormwater credits, compassionate grants, surcharges) were utilised for this study.

5.4 Data Analysis

As a means of comparing the evaluation process of EPIs by the participants, a thematic content analysis (TA) was employed. This methodology was utilised because it complements the study's philosophical views (soft constructionism and interpretivism), while also aligning with the qualitative research approach. TA is a "way of seeing", it can act as a bridge to other fields of study and can improve the communication between different research traditions (Boyatzis, 1998). It is a method for encoding qualitative data to produce interpretations (or understandings) that are both insightful and contextually grounded (Boyatzis, 1998; Bryman & Bell, 2016; Lapadat, 2010). The TA methodology can incorporate constructionist views and allows for an inductive, data-driven approach to the analysis (Braun & Clarke, 2012; Bryman & Bell, 2016). These traits complement the ontological and epistemological perspectives employed in this study (Boyatzis, 1998; Liamputtong, 2009; Vaismoradi, Turunen, & Bondas, 2013).

The TA process consisted of two broad phases; first reviewing the data, and then re-examining the data for common themes, such as similar opinions and thoughts of ideas (Liamputtong, 2009). These two phases were achieved through the application of Braun and Clarke's (2012) six-step process, which will now be discussed.

5.4.1 Step One - Data Familiarisation.

The goal of the first stage of the TA process was to develop a deep understanding of the text data through reviewing and re-reading (Braun & Clarke, 2012). Since this study was examining the perceptions of EPIs, only sections of the interview transcripts relating to those instruments were extracted and analysed. As a means of understanding the data, three key questions from Braun and Clark (2012) were used: (1) How does the participant make sense of their experience? (2) What assumptions do they [the participant] make about their experience?

(3) What kind of world is revealed through the participants' account? Any notes taken during this stage were saved for future review.

5.4.2 Step Two - Developing Initial Codes

In this step, a systematic analysis of the data was started using a grounded theory or inductive approach to coding since this approach develops a theory of understanding directly from the data (Boyatzis, 1998; Gibbs, 2007). The codes were defined as labels that distinguish between general processes or different themes (Liamputtong, 2009).

The grounded theory approach was conducted in three stages; (1) Open Coding, (2) Axial Coding and (3) Selective Coding (Gibbs, 2007). Open coding was first used to develop the initial codes that thoughtfully identified relevant categories within the data (Gibbs, 2007). Codes can be developed at the semantic or latent level (Braun & Clarke, 2012). In this study, the semantic level codes were extracted first since those codes have less diversion from the content of the data and are closer to the participants' meanings (Braun & Clarke, 2012). Latent level coding only occurred in situations where the participants' implied a perspective or utilised sarcasm in their response. The initial codes gathered from the text data were compiled as a code manual in an Excel file and saved for later steps that involve axial and selective coding stages of the grounded theory approach. The goal of this step was to develop enough initial codes that would provide the diversity, and patterns within the data collected (Braun & Clarke, 2012).

5.4.3 Step Three - Searching for Themes

Once the initial open codes were developed, the axial coding stage was undertaken. Axial coding seeks to establish relationships or connections between the open codes to identify patterned relationships within the data (Braun & Clarke, 2012; Gibbs, 2007). The relationships, under each instrument, were condensed into axial codes by a winnowing exercise. The winnowing exercise involved reviewing the initial codes and identifying similar codes, or areas of overlap, resulting in the creation of an axial theme (Braun & Clarke, 2012), which are then utilised in the following step.

The frequency counts for each condensed axial theme were generated at this time. The frequency counts were determined based on the number of times a condensed axial code occurred. In most cases, a single count was given if a participant provided a relevant response. If the participant provided more than one relevant response to the same question, only the first response was counted for the frequency. In some cases, participants provided both an affirmative statement and a negative statement within their response to a question; these contradictory responses were counted under the most relevant codes. For instance, some participants felt that stormwater charges could be implemented and could not be implemented because of the types of municipal capacity, or resources available in their jurisdiction. For such a response, there would be a count under both the "can be implemented" and the "cannot be implemented" axial codes.

Furthermore, during the development of axial themes, similar axial codes were aggregated into a condensed axial code, which also allowed for the combination of frequency counts. As a result, there are some instances when the total frequency count is higher than the total number of participants. This discrepancy is warranted given the purpose of the frequency counts is to aid in depicting the various perspectives used by participants; the frequency counts are not used to derive any statistical analysis.

5.4.4 Step Four - Reviewing Potential Themes

When the clustering of themes was completed, a selective coding stage was commenced. Selective coding entails defining a core category, or theme, that relates the other themes together (Gibbs, 2007). This stage assessed the axial code themes for relevance to the entire data set (Braun & Clarke, 2012). Several questions from Braun and Clarke (2012) were considered in order to assess the relevance of the themes: (1) Is this a theme, or is it just a code? (2) Does this theme provide quality information about the dataset? (3) What does this theme include or exclude? (4) Is there enough meaningful data to support this theme? (5) Is this theme too broad, include too much? Additionally, using theme evaluation criteria from Boyatzis (1998), these themes were assessed to determine if they: (1) aid in differentiating subgroups, (2) simplify the coding of the raw data and (3) minimize exclusions.

5.4.5 Step Five - Defining and Naming Themes

Once the final set of axial themes was created, each theme was given a descriptive title based on the information represented. Furthermore, based on Boyatzis (2012), each theme included a (1) definition of what the theme concerns, (2) a description of the indicators used to identify the theme, and (3) any relevant qualifications or exclusions. This step is designed to help illustrate the *story* behind the data and highlights the relevance of the data to the search question (Braun & Clarke, 2012). Moreover, the final axial themes were grouped under the most relevant FRM objective (efficiency, legitimacy, or resiliency) resulting in new groupings called suitability themes. These new groupings helped explore the interactions between municipal governance practice, literature and the EPI selection process utilised.

5.4.6 Step Six - Producing a Report

The final step in the TA process is compiling the final themes and associated excerpts or evidence into a compelling report (Braun & Clarke, 2012). The TA report generated from this process will be discussed in the next two chapters; results and discussion. Additionally, frequency counts for each suitability theme were generated based on the frequency counts of the associated evaluation criteria in order to better understand which themes preferred by the participants.

5.5 Reliability and Validity

Reliability and validity are used to evaluate the quality of social research (Bryman & Bell, 2016). Both of these concepts were considered as a means of ensuring the utility of the study's results and the study could be replicated for future research.

In terms of qualitative studies, reliability is the consistency of judgement (Boyatzis, 1998). Reliability is divided into two categories; internal reliability, which is concerned with the consistency of the data analysis, and external reliability, which refers to the replicability of the study (Bryman & Bell, 2016). As suggested by Fereday and Muir-Cochrane (2006), to improve consistency, and internal reliability, the data was coded and analysed by the researcher for this

study. Doing so would lessen the chance of misinterpretation of the initial code and prevent redundancy (Fereday & Muir-Cochrane, 2006). An additional procedure used to improve internal reliability was the use of a semantic level interpretation of the data, which requires little deviation from the participants' response. Thus, presenting an interpretation that is more true to the participants perspective (Braun &, Clarke, 2012; Bryman & Bell, 2016). For external reliability, a clear analysis process was followed, and this process was detailed in this chapter allowing for replicability.

Validity is concerned with determining whether the variables used in the study accurately measure the topic of interest (Bouma et al., 2012). Similarly to the reliability, validity has two categories: internal validity, which seeks to evaluate how close the results fit the data collected (Bryman & Bell, 2016; Liamputtong, 2009) and external validity, which seeks to determine the overall generalisability of the findings (Bryman & Bell, 2016). The specific topics explored during the semi-structured interview were developed based on previous research regarding risk-sharing instruments and policy instrument evaluation criteria as a means of ensuring internal validity. This structuring of the semi-structured interviews ensured that there was empirical support or rationale for the data collected in this study. As noted by Bryman and Bell (2016), external validity is challenging for qualitative research because this approach tends to use smaller sample sizes. However, by providing in-depth insight into the perspectives of the participants, this study can improve external validity since that insight would act as a database for other qualitative research (Bryman & Bell, 2016) or transferability of the theoretical knowledge developed from the study (Liamputtong, 2009).

5.6 Boundaries and Limitations

This study was purposefully limited to Canadian municipalities and relevant municipal public managers. This boundary was set as a means of ensuring that the data collected would have a Canadian context, while also including participants who have the most relevant expertise related to FRM and EPIs selection. Additionally, a temporal boundary was established, and the data only reflects the views of the participants at the time of interview. The study did not seek to monitor changes in perspectives over time.

A limitation of this study is that the findings would not meet the positivist's requirements for generalisability. In order to have generalisability, the study would need to be representative of the target population (Bouma et al., 2012; Liamputtong, 2009), in this case, Canadian municipalities. The participants were not randomly selected, and the sample size is small, only ten participants. Thus, the findings of this study would provide insight into *some* municipalities. Secondly, because this study is Canadian focused, there is an impact or relevance issue with the findings, meaning that they would not apply to other regions. However, as previously mentioned, this Canadian focus provides insight into the current practices by municipal public managers.

6.0 Results

This chapter reports the findings from the semi-structured interviews and the TA process. First, the various axial codes developed from the participants' views regarding the six EPIs will be reported. Then, the frequency count for the evaluation criteria per EPI will be presented. Finally, the results for the three suitability themes will be explored as a means of understanding the relationship between the various evaluation criteria.

6.1 Identified Axial Codes & Evaluation Criteria Frequencies

There was a total of eighteen discrete axial codes among the evaluation criteria (See Appendix 1). The most frequently discussed axial code was the "can be implemented" code, under the *municipal capacity* criterion, with 25 references throughout the transcripts (See Table 7). The least discussed axial code was the "policy consistency" under the *coherence* criterion, with only two references (See Table 7).

With regards to the evaluation criteria, *municipal capacity* was the most frequently discussed criterion with a combined total frequency count of 47, followed by the *effectiveness* criterion with a frequency of 41 (See Table 7). The least discussed criteria were *flexibility* and *coherence*, with three and two references, respectively. The next section will explore the frequency counts for each evaluation criteria, and associated axial codes, under the individual EPIs.

6.1.1 Corrective Taxes

For a breakdown of the axial codes present for this instrument and associated frequency counts, see table 8. Under the suitability criterion of *effectiveness*, there were three responses to the "weak behavioural influence" axial code. The participants felt that corrective taxes would not facilitate a change in the public's behaviour, because the fees associated with the instrument were too low, resulting in less coercive influence. Additionally, the one participant under the "doesn't impact risk" code explained that corrective taxes would not

reduce flood risk because the instrument has no relationship to stormwater runoff. In contrast, the participants who responded under the “impacts risk” axial code felt that this instrument could be effective at reducing flood risk.

Frequency Count of Axial Codes			
Evaluation criteria	Axial Code Name	Frequency Count Per Axial Code	Frequency Count Per Evaluation criteria
Effectiveness	Weak behavioural influence	16	41
	Strong behavioural influence	8	
	Doesn't Impact Risk	9	
	Impacts Risk	8	
Economic Efficiency	Benefits Versus Costs	3	19
	Positive Spinoff	4	
	Shares Responsibility	12	
Fairness	Appropriate Use Or Oversight	7	24
	Fairness Concerns	13	
	Free Riders	4	
Municipal Capacity	Can Be Implemented	25	47
	Cannot Be Implemented	22	
Political Viability	No Political Support	8	27
	Political Support	7	
	Political Orientation	7	
	Internal Governance Conflict	5	
Flexibility	Can Be Adjusted	3	3
Coherence	Policy is consistent	2	2

Table 7 Frequency counts for all axial codes

With regards to the criterion of *economic efficiency,* there was one response for the "benefits versus costs" axial code, which describes how the participants discussed the trade-off between costs and benefits. The participant stressed the importance of how the benefits outweigh the costs and questioned the feasibility of FRM if the economic or social costs of FRM exceed the economic and social benefits for properties in flood-prone areas. About the "shares responsibility" axial code, three participants described how this code addresses sharing the burden for FRM between community members and the municipal government. Participants provided contrasting views on how this instrument shares the responsibility of FRM. Some participants indicated concerns with the municipality recognising flood risk, which would create additional obligations on the part of the municipality for reducing the potential flood risk. Another perspective addressed the ethical nature of placing the burden of responsibility for FRM on those who reside in flood-prone areas.

Under the third suitability criterion, f*airness*, there were three responses for the "appropriate use or oversight" axial code. For this axial code, participants indicated an interest in assuring that the monies garnered from the corrective taxes are utilised for the intended purpose of the tax. For example, one participant said, "… If I'm paying higher taxes, do I get any value?...I'll pay higher taxes if it supports a diking system that protects my house and property" (Participant 3). This excerpt demonstrates how the participant would favour corrective taxes if there is an appropriate use of the tax monies. For the "fairness concerns" axial code, three participants were concerned with imposing more financial hardships on low-income or marginalised peoples living in flood-prone areas. For the third axial code, "free riders", three participants indicated that residents who live in flood-prone areas would feel aggrieved if they had to pay the corrective tax, while residents who live in less flood-prone areas were exempt from the taxation.

The fourth criterion, *municipal* capacity, referred to the type or quantity of resources needed to implement the instrument. There were four responses for the "can be implemented" axial code, which indicated that no additional resources would be needed in order to apply the instrument. One participant aptly stated, "I think that municipalities are exceptionally good at taxation. They've already got all those people in place. That's the one thing they do really well"

(Participant 1). This excerpt highlights the shared perspective among the participants that municipalities are adequately equipped to design and implement corrective taxes. Other participants indicated that corrective taxes would benefit their municipality because the tool would influence the public and facilitate their engagement with FRM. Under the "cannot be implemented" code, three participants felt that there was no capacity to implement corrective taxes because additional resources or changes would be needed. One participant stated that they were not sure if their municipality could implement corrective taxes based on the current tax structure. Other participants noted that, even though there are available technical capacity and resources to implement corrective taxes, their municipalities lack the political will to do so.

Axial Code Frequencies - Corrective Taxes			
Evaluation Criteria	Axial Code Name	Frequency Count	Frequency Count per Evaluation Criteria
Effectiveness	Weak behavioural influence	3	5
	Doesn't Impact Risk	1	
	Impacts Risk	1	
Economic Efficiency	Benefits Versus Costs	1	4
	Shares Responsibility	3	
Fairness	Appropriate Use Or Oversight	3	9
	Fairness Concerns	3	
	Free Riders	3	
Municipal Capacity	Can Be Implemented	4	7
	Cannot Be Implemented	3	
Political Viability	No Political Support	2	4
	Political Orientation	1	
	Internal Governance Conflict	1	

Table 8 Axial Code Frequencies for Corrective Taxes

With regards to the *political viability* of corrective taxes, two participants responded to the "no political support" axial code. Those participants indicated that there could be a disinterest by the municipal council to implement corrective taxes because doing so would generate unfavourable public opinion, or because the council does not perceive flooding to be an issue for the area. Furthermore, one participant noted that the "political orientation" of the council could influence the implementation or success of the instrument. For example, one

participant mentioned, "…if you had perhaps this increased tax in the areas that perhaps are very like politically active or, you know, really vocal then you might have a really hard time developing something like that" (Participant 4). This participant indicated that the success of this instrument may depend on the position of the councillors and if the councillors are addressing the concerns of residents. Moreover, with regards to the "internal governance" axial code, one participant highlighted that there might be an internal conflict with the implementation of a corrective tax. This code specifically addresses concerns with the conflict between different municipal departments, or tiers of government.

6.1.2 Stormwater Charges

For a breakdown of the axial codes present for this instrument and associated frequency counts (See Table 9). For the first evaluation criteria, *effectiveness*, both the "weak behavioural influence" and "strong behavioural influence" axial codes had the highest frequency counts of three. The participants who responded under the "weak behavioural influence" code discussed how the stormwater charge would not influence the public to engage in FRM activities, because the public would believe they do not need to implement stormwater reduction strategies since they are paying a fee that is associated with flood risk. An example of the stormwater reduction strategy would be simply adding a rain barrel to reduce the stormwater runoff from their property. Other participants noted that the stormwater charges do not charge enough in order to motivate property owners to adopt stormwater reduction activities. For the second axial code, "strong behavioural influence", the three participants provided insights that countered the perspectives from the previous axial code. One participant explained that stormwater charges are effective at raising awareness regarding flooding within the municipality and the need to change the current management strategies.

Furthermore, other participants explained how the instrument could influence the implementation of stormwater reductions strategies because property owners are made aware of their impacts to the stormwater system, and the instrument encourages them to implement stormwater reduction strategies. The third axial code under this criterion was the "doesn't impact risk" code, with two responses. These two participants discussed how stormwater

charges could generate funds to cover the costs for repair after a flood event. However, the instrument itself would not directly reduce the flood risk since there are no requirements for property owners to implement stormwater reduction strategies as a means of preventing flooding on their property.

Moreover, there were two responses for "impacts risk axial" code that explained how previous municipal surveys and success stories from other jurisdictions indicated that stormwater charges address flood risk, given that the instrument would apply to all properties. The participants did not provide any additional details on how exactly this instrument impacts risk. Nonetheless, the participants did indicate that they felt this instrument was effective at managing flood risk.

Under the second evaluation criteria, *economic efficiency,* the "shares responsibility" axial code had two responses where participants expressed a positive view regarding how stormwater charges share the responsibility of FRM. This participant explained that the instrument shares responsibility by targeting properties that generate the most stormwater runoff, thereby requiring those property owners to take on more responsibility for FRM. Moreover, the two responses for the "positive spinoffs" axial code described how the instrument creates additional beneficial outcomes. Some beneficial outcomes discussed by the participants include increased flood risk awareness, ongoing financial support and better long-term management for related infrastructure projects.

The third evaluation criterion of *fairness* resulted in one response for the "appropriate use or oversight" axial code, whereby the participant stated that funds generated from the stormwater charges must be dedicated towards FRM implementation, and not used towards other projects. Furthermore, the two participants who responded for the "fairness concerns" axial code indicated that the stormwater charges were fair since the instrument applied to all property owners and the rationale behind the instrument is easy for the general public to understand.

For the fourth suitability criterion, *municipal capacity*, there were six responses for the "can be implemented" axial code. Many participants indicated that their municipality could adopt this instrument and that other municipalities have implemented this instrument in

similar ways. Moreover, other participants discussed how the instrument could be adapted to address flooding in their jurisdiction. On the other hand, there were four responses for the "cannot be implemented" code, whereby participants noted a lack of technical tools and administrative resources as limitations that would prevent the implementation of this instrument. Another participant explained how municipalities might also lack the capacity, in terms of staff or time, which would also hinder the implementation of this instrument.

Axial Code Frequencies - Stormwater Charges			
Evaluation criteria	Axial Code	Frequency Count	Frequency Count per Evaluation Criteria
Effectiveness	Weak behavioural influence	3	10
	Strong behavioural influence	3	
	Doesn't Impact Risk	2	
	Impacts Risk	2	
Economic Efficiency	Shares Responsibility	2	4
	Positive Spinoff	2	
Fairness	Appropriate Use Or Oversight	1	3
	Fairness Concerns	2	
Municipal Capacity	Can Be Implemented	6	11
	Cannot Be Implemented	5	
Political Viability	No Political Support	2	6
	Political Support	1	
	Internal Governance Conflict	2	
	Political Orientation	1	
Coherence	Policy is consistent	2	2

Table 9 Axial Code Frequencies for Stormwater Charges

Concerning the *political viability* criterion, the two responses for the "no political support" axial code disapproved the use of this instrument. The participants argued that there would be a lack of support by the municipal council since the instrument would impose additional financial costs for residents. Additionally, the only participant who responded under the "political support" axial code noted that there was a political consensus regarding the need to reduce flood risk and implement FRM, which indicates potential municipal support for

stormwater charges. With regards to the axial code of "internal governance conflict" there were two responses. Participants noted an expectation that provincial governments would take on more responsibility for FRM since the province has more resources and funding. However, this uptake of responsibility is not occurring at the provincial level, resulting in frustration due to the lack of response by the provincial government. There was one response to the final axial code of "political orientation". This participant explained how the underlying motivations of the municipal councillors would influence the implementation of the instrument. For example, a council that favours economic development may not be receptive to this instrument because it would restrict land development within the municipality.

Finally, for the *coherence* criterion, two relevant responses were provided under the "policy is consistent" axial code. Both participants noted that stormwater charges were coherent because the instrument can be integrated into established stormwater management and tax policies.

6.1.3 Surcharges

For a breakdown of the axial codes present for this instrument and associated frequency counts (See Table 10). Under the *effectiveness* criterion, the two responses for the "strong behavioural influence" indicated that surcharges could influence the behaviour of the public because the instrument increases awareness regarding the need for FRM, thereby motivating property owners to implement FRM strategies. For the "doesn't impact risk" axial code, the only participants who responded were concerned with a municipality preferring to focus on the number of monies generated from the surcharge, rather than how the instrument addresses FRM. On the other hand, the three responses under the "impact risk" axial code explained how the instrument would reduce flood risk since it could be implemented without much adverse public reaction, allowing for the collection of funds to use for FRM projects.

For the third evaluation criterion, *economic efficiency*, there was one response for the "shares responsibility" axial code. This participant noted that this instrument could be used to shift some risk from homeowners to business, thereby alleviating some FRM burden from the homeowners. Furthermore, the participant who responded for the "benefits versus costs" axial

code stated that surcharges produce more benefits, in terms of the number of funds generated, because a low fee is charged to property owners.

For the *fairness* suitability criterion, the "appropriate use or oversight axial" code had one response. This participant stressed that it is imperative that municipalities ensure that the monies garnered from the surcharge are only allocated for flood mitigation. In reference to the "fairness concerns" axial code, two participants explained the need to consider not only the economic impacts of the instrument but also the socioeconomic implications. As well, the participants were concerned with requiring property owners to pay twice as a result of a flood event, once when they must pay a surcharge and again when the property owner has to repair the flood damage.

Under the fourth evaluation criterion, *municipal capacity*, there were five responses for the "can be implemented" axial code. Some participants indicated that this instrument would not be difficult to implement since the administrative requirements are already established in municipalities. As well, participants discussed how this instrument was already utilised in other municipalities, thereby indicating it is possible to implement it in their municipality. Moreover, the two responses provided for the "cannot be implemented" axial code discussed concerns with operationalising the instrument if the municipality is not able to obtain new resources. As well, a participant noted that the implementation of this instrument might be limited if there are conditions placed on the funding allocated for FRM. More specifically, it might be difficult for municipal staff to adequately address FRM if the funding regulations are too narrowly defined.

The *political* viability criterion had two responses under the "no political support" axial code, whereby both participants were unsure as to whether the municipal council would support this instrument since it could garner adverse public opinion. On the other hand, the two participants who responded to the "political support" axial code indicated that this instrument could be supported because it has a specific rationale or goal that is communicated. For the third axial code, "internal governance conflict", the only participant who responded noted that municipalities that implement the instrument are inadvertently hindering themselves because property developers might prefer to develop in a different jurisdiction that

does not impose this additional charge. Thus, tension might be created between a municipality that implements this instrument and a neighbouring municipality that does not implement surcharges. With regards to the "political orientation" axial code, the three responses indicated that the political interests of the councillors would impact the implementation of the instrument. One participant explained that a progressive council might in favour of the instrument, while conservative councils may not utilise surcharges. While another participant discussed the degree of engagement the councillor has with their constituents might also influence the acceptance of the instrument, highly engaged councillors would be more likely to act on the interests of their constituents.

Finally, there were two responses for the "can be adjusted" axial code, under the *flexibility* criterion. Those participants described how surcharges could be modified in the future as the needs of the municipality change. The surcharge framework is similar to property taxes, meaning the surcharge rates could be increased if needed.

Axial Code Frequency - Surcharges			
Evaluation Criteria	Axial Code	Frequency Count	Frequency Count per Evaluation Criteria
Effectiveness	Strong behavioural influence	2	6
	Doesn't Impact Risk	1	
	Impacts Risk	3	
Economic Efficiency	Shares Responsibility	1	2
	Benefits Versus Costs	1	
Fairness	Appropriate Use Or Oversight	1	3
	Fairness Concerns	2	
Municipal Capacity	Can Be Implemented	5	7
	Cannot Be Implemented	2	
Political Viability	No Political Support	2	8
	Political Support	2	
	Internal Governance Conflict	1	
	Political Orientation	3	
Flexibility	Can Be Adjusted	2	2

Table 10 Axial Code Frequencies for Surcharges

6.1.4 Stormwater Credits

For a breakdown of the axial codes present for this instrument and associated frequency counts (See Table 11). As part of the *effectiveness* criterion, the "weak behavioural influence"

axial code had four relevant responses. Some participants highlighted how low participation in existing stormwater credit programs indicates that this instrument has a weak behavioural influence. Additionally, participants discussed how stormwater credits would not influence behaviour because there was a lack of substantial incentives, such as higher stormwater charges for the property owners to reduce their flood risk. Moreover, there were three responses for the "strong behavioural influence" axial code. One participant explained how stormwater credits would have low behavioural influence in the short term, but over the longer term, there would be a stronger influence because of the increased awareness around the instrument. Another participant felt that the stormwater credits would influence behaviour because, if it is combined with stormwater charges, the instrument promotes responsibility on the part of the property owner.

Additionally, participants noted how the instrument provides education for property owners, whereby they might consider new options for in situ stormwater management. There was one response under the "impacts risk" axial code whereby the participant expressed that instrument would reduce flood risk because it engages the general public, which improves the implementation of FRM within the municipality. On the other hand, the response for the "doesn't impact risk" axial code explained that the low uptake and unsuccessful stormwater credit programs was evidence to conclude that this instrument would not address flood risk. From the participant's perspective, flood risk can only be addressed if the instrument successfully results in widespread acceptance and active participation within the stormwater credit initiatives.

For the suitability criterion of *efficiency*, there were three responses for the "shares responsibility" axial code. These participants indicated that utilising stormwater credits would be sensible because it provides options for property owners to reducing flood on their property and the annual taxes for the property. As well, it was noted that having specific FRM best management strategies, such as disconnecting a downspout from the stormwater drain, would reduce the overall strain on the stormwater system. Thus, these participants have highlighted how the responsibility for FRM is distributed between the municipality and property owners. Furthermore, there was one response for the "positive spinoff" axial code, which argued that

this instrument creates political protection since it provides a rationale for the municipal government to implement FRM related policies.

Under the third suitability criterion, *fairness,* the only response for the "appropriate use of oversight" axial code stressed the need for careful oversight to ensure that all aspects of the instrument are verified and implemented properly. The two responses identified for the "fairness concerns" axial code considered how residents would feel about the instrument, one participant felt that is was not the fault of property owners if they are at risk since the development of the property was approved by the municipality. The second participant explained how the instrument might treat all properties the same regardless of the degree of impermeable surface on the property. This participant felt that a lack of distinction between properties would be unfair because it would impose undue fees on properties that do not contribute a large amount of stormwater runoff. The final axial code, "free riders", also had one relevant response. The participant was concerned about how this instrument could be exploited by individuals who do nothing to reduce their flood risk and expect the other municipal residents to pay for the individual's own risk.

For the *municipal capacity* criterion, there were four responses for the "can be implemented axial code". These participants indicated that the instrument could be implemented because there were already established mechanisms for operating the instrument or considerable public interest in having the instrument. In contrast, there were six relevant responses for the "cannot be implemented" axial code. Those participants felt that stormwater credits would require additional resources in order to implement effectively. Also, some participants questioned the feasibility of assessing every property within the municipality and felt that this instrument would require too many resources, such a staff time, in order to implement.

Under the *political viability* criterion, the "political support" axial code had two relevant responses, whereby participants noted that there was strong support for the instrument from the municipal council. This support was generated by the public's request for options to reduce their stormwater fee rates or because the council exhibited a strong preference towards utilising this instrument for FRM. As well, there were also two responses for the "no political

support" axial code, which explained how the municipal council was not interested in considering the instrument. Finally, there was one response under the "political orientation" axial code, where the participant described how the influence from the mayor played a role in shaping municipal councils' decision about implement the instrument. This insight demonstrates how the perspective of one or a few key political leaders could influence the uptake of FRM instruments.

For *flexibility* criterion, the only participant who responded under the "can be adjusted" axial code felt that stormwater credits were flexible because the municipality could adjust the allocation of credits in the future.

Axial Code Frequencies - Stormwater Credit			
Evaluation criteria	Axial Code	Frequency Count	Frequency Count per Evaluation Criteria
Effectiveness	Weak behavioural influence	4	9
	Strong behavioural influence	3	
	Impacts Risk	1	
	Doesn't Impact Risk	1	
Economic Efficiency	Shares Responsibility	3	4
	Positive Spinoff	1	
Fairness	Appropriate Use Or Oversight	1	4
	Fairness Concerns	2	
	Free Riders	1	
Municipal Capacity	Can Be Implemented	5	9
	Cannot Be Implemented	4	
Political Viability	Political Support	2	5
	No Political Support	2	
	Political Orientation	1	
Flexibility	Can Be Adjusted	1	1

Table 11 Axial Code Frequencies for Stormwater Credits

6.1.5 Subsidies

For a breakdown of the axial codes present for this instrument and associated frequency counts (See Table 12). For the "weak behavioural influence" axial code, under the *effectiveness* criterion, there were five relevant responses. These participants noted that the low uptake of

similar subsidy programs did not convince them that this instrument would strongly influence a behavioural change with regards to the public adopting FRM. One participant was concerned with the difficulty in generating awareness of the instrument, but many other participants felt that the subsidies would not provide enough financial incentive for participation by property owners.

Under the *economic efficiency* suitability criterion, there was one response for "costs versus benefits" axial code, this participant felt that there were fewer financial costs for the municipality due to the low uptake of the programs, resulting in more benefits for the community when a property owner does participant in the subsidy program. For the "positive spinoff" axial code, the only response for this code indicated that this instrument would reduce the overall flood risk for the municipality since property owners are encouraged to implement flood risk reduction activities that prevent future flooding on their property.

Under the *fairness* criterion, there was one response for "appropriate use or oversight" axial codes. This participant expressed interest in having the proper oversight to ensure accurate assessment of applications and that the subsidy funds are properly distributed. In reference to the "fairness concerns" axial code, two participants provided relevant responses. One participant noted that with the reduction of insurance coverage for flooding, the municipality might have to provide partial incentives for property owners in order to assist in compensation for approving the development of those flood-prone areas. On the other hand, another participant felt that the instrument was not fair because it requires the use of monies collected from the general public. The participant further explained that not every property is at risk for flooding, and it would be unfair to use the monies collected from those non-risk properties towards flood risk reductions strategies on flood-prone properties.

For the *municipal capacity* criterion, there were four responses under the "can be implemented" axial code. Some participants explained that municipalities have used stormwater charges, so no new resources would be needed to utilise this instrument because it operates similarly to the stormwater charges. As well, one participant noted that this instrument would reduce the human resources strain because it is application based and resulted in fewer site visits for staff. Under "cannot be implemented" axial code five

participants highlighted resources difficulties with implementing subsidies. Most participants noted that although the municipality has the technical capacity to implement the instrument, they may not have the time to implement communication and advertising campaigns. As well, one participant explained that a municipality might not have enough data to adequately determine the compensation amount or eligibility requirements for the instrument.

With regards to the last criterion, *political viability*, there were two responses for the "political support" axial code. One participant felt that there might be political support if the municipality experiences frequent flooding. As well, another participant explained that municipalities would be interested in providing relief to high-risk properties, so the municipal council might be in support of offering subsidy programs.

Axial Code Frequencies - Subsidies			
Evaluation criteria	Axial Code	Frequency Count	Frequency Count per Evaluation Criteria
Effectiveness	Weak behavioural influence	5	5
Economic Efficiency	Costs Versus Benefits	1	2
	Positive Spinoff	1	
Fairness	Appropriate Use Or Oversight	1	3
	Fairness Concerns	2	
Municipal Capacity	Can Be Implemented	4	9
	Cannot Be Implemented	5	
Political Viability	Political Support	2	2

Table 12 Axial Code Frequencies for Subsidies

6.1.6 Compassionate Grants

For a breakdown of the axial codes present for this instrument and associated frequency counts (See Table 13). There was one relevant response for the "weak behavioural influence" axial code, under the *effectiveness* criterion. This participant noted that providing funding, without the requirement of executing flood risk-reducing strategies, would not influence the behaviour of property owners due to low incentivisation. For the second axial code, "doesn't impact risk", there were four relevant responses. Most participants discussed that the instrument does not address risk because the EPI is not connected with the goal of

reducing risk, but instead promotes reconstruction after the flood event. In contrast, the response under the "reduces risk" axial code argued that this instrument could improve the management of flood risk.

Under the *efficiency* criterion, three responses were provided for the "shares responsibility" axial code, whereby participants felt that it there is a moral imperative for municipalities and property owners to take responsibility for flood risk reductions. They also mentioned that the instrument allows the municipality to share the risk through the provisioning of monies for impacted properties, and those property owners can utilise the funds for flood risk reduction activities.

With regards to the *fairness* criterion, there was two responses for the "fairness concerns" axial code that highlighted concerns about the dispersion of funds from the compassionate grants. One participant was concerned with the equitable distribution of funding between the different demographics and income levels. The other participant discussed how some property owners might receive more funding because they are more engaged with the municipal council, which may limit the amount of funding available to other property owners.

For the *municipal* capacity axial code, there was only one relevant response for the "can be implemented" axial code. The participant noted that this instrument is best suited to be implemented by the municipality because the municipal government can distribute funds. On the other hand, three responses were highlighting the difficulties in implement the instrument, under the "cannot be implemented" axial code. Participants explained that it would be difficult for municipalities to maintain the funding capacity for the instrument. As well, one participant noted how this instrument would be difficult to implement in smaller municipalities that lack the necessary resources since the instrument is resource intensive.

Finally, for the *political viability* criterion, one participant responded under the "political orientation" axial code. The participant indicated that this is a viable instrument because municipal councils tend to be focused on bolstering positive public opinion by providing financial assistance. Moreover, there was one response in relation to the "internal governance conflict" axial code, whereby the participant questioned whether the instrument should be

mandated at the provincial level, rather than the municipal level, which indicates a perceived difference between the services that are offered at the municipal level and services that should be offered at the provincial level.

Axial Code Frequencies - Compassionate Grants			
Evaluation criteria	Axial Code	Frequency Count	Frequency Count per Evaluation Criteria
Effectiveness	Weak behavioural influence	1	6
	Doesn't Impact Risk	4	
	Reduce Risk	1	
Economic Efficiency	Shares Responsibility	3	3
Fairness	Fairness Concerns	2	2
Municipal Capacity	Can Be Implemented	1	4
	Cannot Be Implemented	3	
Political Viability	Political Orientation	1	2
	Internal Governance Conflict	1	

Table 13 Axial Code Frequencies for Compassionate Grants

6.2 Suitability Themes

As outlined in chapter 4, the comprehensive framework utilised during the interview process is comprised of several evaluation criteria identified by FRM literature, including effectiveness, municipal capacity, political viability, economic efficiency, fairness, flexibility and coherence (see Table 5). The individual evaluation criteria gathered from policy, and FRM literature was categorised under the most relevant objective (resiliency, efficiency, legitimacy) to construct suitability themes, which represent a higher order selection process for EPIs (See Table 6). The following section will outline the results for each suitability theme, and the themes' associated evaluation criteria.

6.2.1 Efficiency

The efficiency theme focuses on ensuring that the number of resources, or costs, needed for FRM implementation are lessened, while simultaneously maximising the benefits from the policy. The criterion of *economic efficiency* was included because it is concerned with increasing the benefits of an instrument and lowering the associated costs or resources needed. Additionally, the *municipal capacity* criterion was added under this theme, since it describes whether additional resources (technical or human) would be needed to implement a particular instrument.

Overall, when considering the frequency counts for each of the included criteria, this theme had a total frequency count of 66 (see Table 14). Additionally, the total frequency counts of each theme indicate that four instruments (stormwater charges, stormwater credits, subsidies and compassionate grants) were strongly associated with the efficiency theme since they had the highest gross frequency counts for the economic efficiency and municipal capacity criteria.

Suitability Theme	Evaluation Criteria	Frequency Count per Criteria	Total Theme Frequency
Efficiency	Economic Efficiency	19	66
	Municipal Capacity	47	
Legitimacy	Fairness	24	53
	Political Viability	27	
	Coherence	2	
Resiliency	Effectiveness	41	44
	Flexibility	3	

Table 14 Total Instrument Frequency Counts per Suitability Theme

Economic Efficiency

This criterion had 19 relevant responses (see Table 14), and participants often discussed how the economic instruments provide benefits for both the municipality and property owners. Of the 19 responses, 12 discussed how the instruments distributed the role of risk management between landowners, businesses and the municipality.

Participants reasoned that the instruments provide property owners with education regarding flood mitigation strategies, which encourages those individuals to reduce the flood risk for their property. As well, participants indicated that instruments might shift some of the burdens for flood risk to business owners, thereby alleviating strain from homeowners and the municipality.

Municipal Capacity

There were 47 responses for this criterion, which is the highest frequency count of all evaluation criteria (See Table 14) Of the 47 responses, 25 responses referred to the ability to implement an instrument, while 22 discussed how an instrument could not be implemented (See Table 7).

The participants did not provide a conclusive answer regarding if municipalities could implement the instruments. Some participants felt that an instrument could be implemented in their jurisdiction since no additional resources were needed due to the existing management structure or the municipality could easily obtain the resources needed for the operation of the instrument. However, there were several reasons as to why an instrument could not be utilised. Participants frequently noted that a lack of capacity was the primary reason why the municipality could not implement an instrument. Similarly, the availability of sustained funding was another reason why an instrument could not be implemented. Moreover, a municipality might not be able to utilise an instrument because the acquisition of necessary resources is hindered by the small size of the jurisdiction, meaning smaller municipalities might not be able to obtain the resources needed.

6.2.2 Legitimacy

The legitimacy theme represents how the costs and benefits of FRM are equitably distributed within the community, as well as the acceptance of the policy by the community. For this theme, the *fairness* criterion was included since the criteria assessed the degree to which the costs and benefits attributed to an instrument are distributed. The *political viability*

criterion was integrated because it evaluates the acceptability of the instrument by the stakeholders. Although the coherence criterion assesses an instrument's consistency and alignment with existing policy, this criterion was added because the acceptance of FRM is contingent on how well the strategy corresponds to current practice.

Moreover, by summarising the frequency counts for the related criteria, this theme had a total frequency count of 53. There were two instruments (corrective taxes and surcharges) that were strongly evaluated based on the criteria associated with this theme (See Table 14).

Fairness

There was 24 response for the *fairness* criterion, with most of the responses expressing concerns about ensuring equitable distribution of the funds or benefits from the economic instruments to the property owners who needed the most assistance (See Table 14). This theme essentially revolves around the issue of financial equity and the social implication of the instruments. Similarly, there was a discussion related to public concerns over the fairness of requiring non-flood-prone properties to pay flood-related fees or charges.

A common point for discussion was the potential conflict between higher income households versus lower income households, specifically about requiring low-income households to pay into a fund or tax. As well, Participants indicated approval for requiring property owners of flood-prone properties to pay fees because it would be unfair to require properties in low flood-prone areas to pay fees.

Political Viability

There were 27 relevant responses established for this criterion. Both the "no political support" and "political orientation" axial codes had the highest frequencies of eight. With regards to the "no political support" code, there were concerns that some instruments, particularly those that require property owners to pay a fee, would not be supported by municipal councils. Participants explained that councils would prefer not to issue new taxes or surcharges because those instruments face political opposition. Contrarily, participants

discussed whether their municipal council would support specific economic instruments, such as stormwater credits or subsidies) because the municipal council had a keen interest in utilising the instrument or because the council was addressing the needs of the constituents.

Furthermore, the "political support" axial code exhibited seven responses. Many participants highlighted how the specific "political orientation" (e.g. conservative view, progressive views, etc.) of the municipal council could influence the outcomes or adoption of the various instruments. A participant aptly explained that if municipalities experienced frequent flooding, then the municipal council might be more receptive to FRM instruments.

Coherence

Overall, the two responses for this criterion both described how some instruments, such as corrective taxes and stormwater charges, are consistent with existing tax-related policies. Also, the participants noted that they considered an instrument to be coherent if its implementation is unnoticed by the general public. If the instrument is not coherent, then there would be public discontent regarding the instrument. This insight indicates that the legitimate acceptance of an instrument by the community is conditional on the overall coherence of the instrument.

6.2.3 Resiliency

The resiliency theme characterises the increased capacity of a community to resist, recover and adapt to flooding. The *flexibility* criterion measured the ability for an instrument to be adjusted to meet future needs and was included under this theme because the policies in place must be able to adjust to future adaptation requirements. Moreover, the *effectiveness* criterion evaluates whether an instrument would achieve its mandated outcomes or goals. Considering that the resiliency theme focuses on improving the recovery efforts, it would be imperative to ensure that policies successfully build those capacities.

This theme had the lowest total frequency count (See Table 4) with a value of 44. When reviewing the frequency counts per instrument, there were no instruments that were strongly

evaluated based on this theme. As per table 14, this theme was utilised during the assessments, but the efficiency theme was referred to more often in the participant's evaluations than this theme.

Flexibility

Overall, there were only three responses to this criterion. The participants discussed how instruments could be modified over time to meet the needs of the community. As well, one participant explained how some instruments could be adjusted for different demographics within a community, thereby increasing the flexibility of the instruments' application.

Effectiveness

This theme had a total frequency count of 41 responses, with 16 responses occurring under the "weak behavioural influence" axial code (see Table 14). Several participants discussed the inability of some instruments, such as compassionate grants, subsidies and credits, to influence public behaviour. Participants felt that those instruments did not provide enough incentive, by way of a high enough fee, to sway the public's behaviour.

As well, there were nine responses for the "does not impact risk" axial code, whereby concerns were raised regarding financial aid (See Table 7). The participants felt that providing financial aid would be interpreted as permission to rebuild on flood-prone properties, thereby hindering risk reduction within the municipality. Participants described that instruments might not necessarily reduce flood risk if there is a disconnect between the instrument and flood mitigation strategies, resulting in a policy that focuses on financial revenue and not risk reduction. Participants felt that this disconnect could be resolved if the instrument was designed so that it assists those most at risk from flooding by reducing their vulnerability.

Finally, there were eight responses for the "impacts risk" axial code, see table 7. Under this axial code, a participant explained that there had been success stories from some instruments in other municipalities, thereby arguing that the instruments do reduce flood risk.

6.3 Summary of Findings

The analysis of the semi-structured interviews revealed eighteen discrete axial codes utilised in the evaluation of the selected EPIs. The most frequently discussed evaluation criteria were *municipal capacity*, with 47 responses, and *effectiveness* with 41 responses. While the least discussed criteria were *flexibility* and *coherence*, with three and two responses, respectively. All eighteen axial codes provided insight into the key issues and perspectives the participants held with regards to evaluating the suitability of EPIs.

The prominence of each suitability theme arises when considering the combined frequency counts for evaluation criteria under each theme. The efficiency theme was the most prominently discussed theme with a frequency count of 66. This total frequency count was the combination of the *economic efficiency* and *municipal capacity* criteria, with frequency counts of 19 and 47, respectively.

The legitimacy theme was the second most prominent with a combined frequency count of 53. The *political viability* axial code contributed the most with a frequency of 27, which was followed by the *fairness* axial code, with a frequency of 24. The *coherence* axial code only contributed to a frequency of two.

Finally, the resiliency theme was the least discussed theme and had a frequency count of 44. The majority of the combined frequency count was derived from the *effectiveness* axial code, which had a frequency of 41. While the *flexibility* axial code only contributed a frequency of three.

7.0 Discussion

The purpose of this study was to explore how municipal public managers evaluate the suitability of EPIs for FRM. Through the use of semi-structured interviews and thematic content analysis, this study concludes that municipal public managers evaluate the suitability of EPIs by utilising a hierarchical framework, which is comprised of the evaluation criteria established by existing literature. The framework exhibits an order of preference for criteria that are associated with the efficiency theme; these criteria include *economic efficiency* and *municipal capacity*. The legitimacy theme is of secondary importance for EPIs suitability; this theme would include the *fairness, political viability* and *coherence* criteria. While the third theme of resiliency was the least valued metric, indicating that the criteria of *flexibility* and *effectiveness* are not essential for assessing EPIs suitability. The remainder of this chapter will provide a rationale for the above conclusion. It is important to note that effectiveness within the theme of resiliency did receive a high value, which suggests that the infrequent consideration for flexibility had an unbalanced impact to the overall frequency count for the theme. Similarly, low values for coherence influenced perspectives towards legitimacy as a measure of suitability.

7.1 Supporting Evidence for a Hierarchical Framework

A hierarchical framework is denoted by an ordering of metrics based on the degree of importance indicated by the total frequency counts, for both the individual evaluation criteria and broader suitability themes. With regards to the individual evaluation criteria, the observable differences between the frequency counts indicate an order of preference, whereby municipal public managers prefer to utilise the *municipal capacity* and *effectiveness* criteria. The *municipal capacity* criterion exhibited a frequency count of 47, which is also the highest frequency count reported. The *effectiveness* criterion had a frequency count of 41, making this the second most utilised criterion. While the *flexibility* and *coherence* criteria were the least utilised criteria since these criteria exhibited the lowest frequency counts of three and two, respectively. When considering the frequency counts for the remaining criteria (*political viability*, *fairness*, and *economic efficiency*), these criteria fall within the middle range of the

frequency counts. The higher frequency counts for the *municipal capacity* and *effectiveness* criteria illustrates a preference for those two criteria, thereby supporting the evidence for a hierarchical framework.

The individual criteria were categorised under the suitability themes of efficiency, legitimacy and resiliency as a means of establishing a comprehensive framework. This comprehensive framework would provide insight into interactions of EPIs and FRM with municipal governance. Akin to the individual evaluation criteria, the broader suitability themes exhibit a hierarchical structure, but with some inconsistencies given low values for some criteria, including flexibility and coherence.

The total frequency counts for each theme indicates a rank ordering with the efficiency theme being the most significant, followed by the legitimacy theme, and finally, the resiliency theme.

Under the efficiency theme, municipal public managers evaluated the suitability of the FRM instruments based on the resource strain and benefits the instruments would provide. This theme had the highest total frequency count with a value of 67, with the most frequently referenced criterion being *municipal capacity*. The *municipal capacity* criterion was used to assess the ability of an instrument to be implemented without the need for additional technical or administrative resources. The axial codes associated with this criterion illustrate that participants felt that instruments with lower resource requirements were easier to implement. Subsequently, the recurring use of the *municipal capacity* criterion demonstrates that municipal public managers strongly evaluated the resources requirements as a means of determining the efficiency of an instrument. This finding suggests that higher resource requirements may impede FRM adoption at the municipal level, which is consistent with previous research (Henstra & Thistlethwaite, 2017b).

With regards to the *economic efficiency* criterion, this criterion had a total frequency count of 19, indicating a lower ranking in the hierarchy. Many participants discussed how the instrument would share the responsibility of FRM between property owners and municipalities. The focus on sharing risk seems peculiar, given that literature defines economic efficiency as balancing the costs and benefits (Capano & Lippi, 2017). However, the focus on risk sharing

could be accounted for because municipalities are concerned with reducing operational costs of FRM (Salamon, 2002). Participants noted two means by which responsibility is shared between the municipality and property owners. First, participants discussed that the funding the instruments generated could be applied to financially support the municipality's operational costs for flood risk mitigation. Second, participants explained that the instruments provided knowledge regarding flood mitigation measures for property owners. This sharing of knowledge would lower the flood risk of properties, while also lowering operational costs for the municipality due to the implementation of flood risk mitigation activities by property owners. These insights confirm that municipal public managers consider the *economic efficiency* of an instrument, but greatly value the *municipal capacity* criterion. The high frequency count for efficiency demonstrates that this theme is critical for assessing the suitability of instruments by municipal public managers.

Following from the efficiency theme, the second theme of legitimacy had a total frequency count of 53. For this theme, the suitability of an instrument was evaluated based on the distribution and acceptance of flood risk remediation within the community. The most frequently discussed criterion was the *political viability* with a frequency count of 27. This criterion assessed how the instruments would align with existing political ideologies in the municipality. The participants preferred to discuss whether there would be support for an instrument by their municipal council, as well as how difference governance orientation would respond to any given instrument. Due to its high frequency count, *political viability* is the primary evaluation criterion under the legitimacy theme and demonstrates that municipal public managers strongly consider the role of other governance agents, such as municipal councillors. Furthermore, municipal public managers also assess the equitable distribution of the burden for FRM under the legitimacy theme.

The *fairness* criterion was the second most frequently discussed under the legitimacy theme with a frequency count of 24. The participants demonstrated concerns with how the instruments distributed the responsibility for FRM between the various socioeconomic groups within a municipality. For example, participants noted that stormwater charges were fair because the charge would be applied to all property owners, thereby equitably sharing the

responsibility for reducing flood risk. While for corrective taxes, participants expressed concerns with applying a tax to economically disadvantaged households, since doing so would increase the financial burden for those individuals. Although the *fairness* criterion provided unique insights into the impacts of the EPIs, the frequency count for this criterion is less than the *political viability* criterion. Thus, the *fairness* criterion is ranked seconded under the legitimacy theme.

The *coherence* criterion was the least considered criteria under the legitimacy theme, with a total frequency of two. The issues highlighted during the participants' evaluations included how the instrument would complement current municipal practices and policies and be accepted by the municipality's constituents. The literature suggests that the legitimate acceptance of an instrument depends on the instrument's coherence (Howlett & Rayner, 2007), but the low frequency count provides little evidence for the robust use of this criterion. Consequently, the *coherence* criterion is ranked as third under the legitimacy theme.

The resiliency theme exhibited the lowest total frequency count of 44, suggesting this theme was of less importance to municipal public managers when assessing EPIs suitability. The most frequently discussed criterion for this theme was the *effectiveness* criterion, which had a total frequency count of 41. Under the *effectiveness* criterion, participants primarily discussed whether the instruments would positively influence the behaviour of the general public, so that there would be the uptake of the instrument, resulting in reductions of flood risk in the municipality. These insights indicate that municipal public managers perceive some instruments to be more persuasive with regards to positively influencing behaviour. For example, participants discussed how corrective taxes would not positively influence behaviour because the fee charged is not large enough to act as an incentive for the property owner to address flood risk. However, participants indicated that subsidies would have a positive behavioural influence because the funding would aid in improving the awareness regarding flood risk and prompt actions on the part of property owners. Based on the above insights and frequency counts, the *effectiveness* criterion is ranked as the primary evaluation metric for the resiliency theme.

The final criterion *flexibility* had a total frequency count of three, for this criterion participants discussed a preference for instruments that could be modified to meet future needs, such as altering financial charges or allocation of stormwater credits. These insights denote a desire for flexibility in FRM instruments, but the frequency counts demonstrate that the effectiveness of an instrument is more critical to the evaluation. Thus, the *flexibility* criterion is ranked below the *effectiveness* criterion under the resiliency theme.

To summarise, there appears to be a hierarchical nature to the use of the evaluation criteria for EPIs, as seen by the frequency counts of both the individual evaluation criteria, which impacts the application of the broader suitability themes. When examining the frequency counts for the individual evaluation criteria, there are three distinct groupings with the specific criteria, such *as municipal capacity* and *effectiveness,* utilised more than the other criteria. In turn, the results of the broader suitability themes indicates a hierarchical structure, but there are some limitations. When the individual criteria are aggregated into the broader suitability themes, the frequency counts for each theme suggests that that the efficiency and legitimacy themes are most preferred for evaluating EPIs. While the low frequency count for the resiliency theme indicates that municipal public managers utilised this theme less during the evaluation of EPIs, but this could be a consequence of a minimal valuation of flexibility as a measure of suitability.

This hierarchical nature poses compromises for municipal public managers during the evaluation of EPIs. Each instrument has inherent strengths and weaknesses, which could impact the success of FRM within a municipality. Some instruments may provide a binding requirement for FRM, but those instruments may pose larger financial costs for implementation (Henstra, 2016). Furthermore, this compromise also suggests that there is less consideration for the long-term implications or operations of the instruments in the evaluation framework. The low frequency count for the flexibility criteria illustrates an inclination in the framework towards evaluating the immediate efficiencies gained or lost from the instruments rather than the need for potential adjustment.

In addition to potential compromises, the results indicate that the municipal public managers do not consider the mixing of instruments during their evaluations. When discussing

the evaluation criteria, participants typically assessed each criterion independently. The literature highlights how instrument mixes assist in remedying the limitations or constraints of the economic instruments (Henstra, 2016; Howlett & Rayner, 2007; Rogge & Reichardt, 2016). This lack of consideration for instrument mixes may result in ineffective FRM and overall policy failure. As a result, it is imperative that municipal public manager considers the interactions of potential EPIs, and seek to develop an effective instrument mix.

To conclude this section, the results of this study highlight how municipal public managers employed all seven evaluation criteria, but those evaluation criteria are not uniformly applied in the assessment process. Consequently, the criteria of *economic efficiency* and *municipal capacity*, under the suitability theme of efficiency, are the principal means for assessment.

7.2 Relationship to Literature

This section will discuss the relationship between the literature and findings of this study, while also draw conclusions based on this study's results. Overall, there appears to be some discrepancy between the evaluation of FRM objectives outlined in the literature and the objectives utilised in practice. Specifically, the literature assumes an equal weighting of the FRM objectives (efficiency, legitimacy, and resiliency) (Larrue et al., 2013), but the results indicate that the efficiency objective is weighted more than the other objectives. This preference for efficiency was seen in the higher frequency counts for the efficiency theme. Additionally, the literature indicated that resiliency was an important aspect of FRM policy (Larrue et al., 2013; Nair & Howlett, 2016). However, the lower frequency counts for the resiliency theme and flexibility criterion suggest that municipal public managers do not value instrument resiliency the same as the literature. Those discrepancies highlight some of the differences between FRM literature and FRM practice, the remainder of this section will explore additional differences and present any relevant similarities found between the literature and FRM practice.

With regards to the *effectiveness* criterion, the participants discussed how corrective taxes, stormwater credits and subsidies lack the financial incentives required to facilitate successful implementation and would fail to meet the policy's mandate. The effectiveness of an

instrument is determined by the instrument's ability to meet the FRM policy mandate and the goals or desires of the municipality (Henstra, 2016). Results indicate that municipal public managers perceive an EPI as effective if the instrument influences FRM adoption both within municipal government and within the wider community. For instance, under the strong behavioural influence axial code, participants noted how the instruments could influence management strategies within the municipal government, as well as educate property owners regarding flood risk reduction practices. Therefore, the participants demonstrated that the goals or desires of the municipality would impact the evaluation of effectiveness, thereby aligning with the views of Henstra (2016) and Salamon (2002).

The literature highlighted how the successful implementation of flood mitigation could be lessened if the financial costs (e.g. corrective taxes or stormwater charges) are too low, resulting in poor enticement for individuals (García-Rubio et al., 2015). The alteration of an individual's behaviour is dependent on a high financial cost attributed to not mitigating the flood risk (Cordes, 2002; Filatova et al., 2011). The participants noted a lack of action due to low charges; if the stormwater charge were larger, there would be a greater degree of influence. Under the stormwater charge instrument, both the axial codes for "weak behavioural influence" and "strong behavioural influence" occurred three times. The rationales given for the "weak behavioural influence" axial code included the view that the public would not act because they are paying a fee that already reduces flood risk. The participant's evaluations based on the degree of influence exerted by the instruments is consistent with the views of the literature, thereby confirming that behavioural influence is a valid metric for evaluating instrument effectiveness.

Additionally, the literature argues that instrument mixes allow for the amelioration of EPIs weaknesses and would improve the effectiveness of the instruments (Henstra, 2016; Howlett et al., 2009; Rogge & Reichardt, 2016). Interestingly, the participants did not explicitly discuss the need for an instrument or policy mix but did allude to the role education, or awareness campaigns would have on the success of EPIs. Education and awareness campaigns would be classified as nodality instruments, while EPIs are considered to be treasure instruments under the NATO policy framework (see Howlett et al., 2009). The mention of

different instrument classes by the participants suggests that there is knowledge of the importance of instrument mixes. The lack of direct discussion of instrument mixes demonstrates that municipal public managers can overlook the use of instrument mixes as a necessary factor for evaluating EPIs effectiveness.

Under the *municipal capacity* criterion, municipal public managers indicated that the primary barrier to implementation of EPIs is the associated resource requirements. In many instances, participants discussed how each instrument would require new resources or an increase in the number of current resources in order for the instruments to be implemented successfully. For example, there was a discussion regarding how compassionate grants would need additional funding in order to operate the instrument, whereas subsidies would require additional research data and administrative time to assess funding applications adequately. As well, there was a consensus that corrective taxes, stormwater charge, surcharges and stormwater credits would require more resources than what is currently available in the participants' municipalities. This perspective is contrary to the view expressed by Henstra (2016), who argues that treasure instruments are typically less resource intensive. This difference in perspective highlights the importance of both technical and human resources have for a municipal public manager in their evaluation of EPI suitability.

Furthermore, the participants frequently justified that stormwater charges and surcharges could be implemented because those instruments were already utilised in other municipalities. This reference to the application of an EPI in another jurisdiction aligns with the concept of external legitimisation, which values the perception of the EPI held by other jurisdictions (Capano & Lippi, 2017). The utilisation of a legitimacy metric for *municipal capacity* may appear anomalous but is, in fact, a logical means of assessing resource capacity. The participants indicated that many municipalities contain parallel resources. Thus the application of an EPI in a similar jurisdiction would provide insight into how existing resources could be used. Therefore, municipal public managers are utilising this comparison as a means of determining the potential success of applying the EPI in their jurisdiction. This use of external legitimisation for the *municipal capacity* criterion indicates that resources are not only a key

factor for EPIs suitability, but the influence other municipalities also have a role in the selection of EPIs.

In terms of the *political viability* criterion, municipal public managers frequently considered how their municipal council views the instrument. Some participants felt that there would be political support from their municipal council because the instrument aligned with the interests of the council. These interests could include reducing flood risk, providing financial relief or would facilitate a positive public opinion of the municipal council. The consideration of the council's perspective would correlate with the concept of internal legitimisation discussed by the literature. As per Capano and Lippi (2017), internal legitimisation assesses whether the EPI is congruent with the existing governance paradigms employed by a governing institution. Throughout their evaluations, the participants utilised their knowledge of the councils' interests and governance paradigms to assess the internal legitimisation of the EPI.

Additionally, the "political orientation" axial code allowed participants to evaluate the *political viability* of EPIs by making predictions on how different governance paradigms might influence the acceptance of an EPI. For example, some participants discussed how a politically progressive council would be more willing to implement surcharges, while a council that prefers economic development might not favour the use of stormwater charges. As well, the participants indicated the acceptance of an EPI could also be influenced by key agents within the municipal council, such as the mayor or a highly influential councillor. The participants' evaluations indicated that the collective interests of the municipal institutions were utilised to assess the viability of the EPI. Consequently, those evaluations align with the argument from Peters (2002) that an institution's collective interests will influence the adoption of policy instruments.

Furthermore, the participants' discussion regarding the influential nature of key agents demonstrates how the prevailing interests of individual agents could direct the selection of an instrument. As noted by Peters (2002), instrument selection is driven by prevailing interests. Thus, the insights provided by the participants indicates that utilisation of *political viability* criterion is consistent with existing literature, thereby validating the use of this criterion for EPI suitability.

Participants assessed the economic efficiency of the EPIs through the consideration of how an instrument would share FRM responsibility, the positive spinoffs the instrument would generate and comparison of the costs to implement versus benefits created by the instrument. The most frequently discussed axial code under the *economic efficiency* criterion was "share responsibility", whereby participants discussed how an instrument would allow for lessen the financial costs of implementation, as well as reduced flood risk, by facilitating the involvement of both the municipality and private property owners. In the policy literature, Capano and Lippi (2017) state that instrument selection is based on the policymakers' interpretations of how an instrument would distribute or influence political power relationships. The consideration of power relationships and the modification of those relationships is apparent in the results. The participants indicated a preference for EPIs that shares the responsibility of FRM between the municipal government and property owners. Thus, municipal public managers evaluate the economic efficiency of EPIs based on how the instruments would modify the existing political power relationships to increase the sharing of responsibility for FRM.

In addition to the sharing of responsibility, the participants evaluated EPIs based on the costs and benefits generated by the instrument. For many participants, the selection process should avoid creating economic inefficiencies. Specifically, the financial costs of EPIs should not exceed the social benefits generated by the instrument. As noted by Salamon (2002), the *economic efficiency* of an EPI is determined based on how the instrument balances the benefits created against the costs of implementation. In the evaluations, participants considered the direct benefits of flood risk reduction, as well as reflected on both the financial and the social costs of implementing EPIs.

Furthermore, the participants considered the possibility of indirect benefits or spinoff effects created by an instrument. Some of the indirect benefits described by the participants included stable revenue from the instrument and improved awareness of flood risk. This consideration demonstrates that municipal public managers would consider both the direct and indirect benefits generated in their assessments of EPIs suitability.

Under the *fairness* criterion, participants considered the implications EPIs would have on a range of stakeholders, with specific concerns for the impacts to low-income households.

Participants argued that EPIs needs adequate oversight during implementation in order to ensure fair and equitable distribution of costs and benefits. The participants have indicated that they evaluate *fairness* based on the financial implications generated by an instrument specifically how an instrument distributes the costs and redistributes the associated benefits. Additionally, in the FRM literature, some instruments, such as stormwater charges and subsidies, were seen to be equitable in distributing the financial burden of an instrument, because the financial burden is either shared among all stakeholders or financial assistance is provided to aid with implementation (Debo & Reese, 2003; Kertesz et al., 2014; Pazwash, 2011; Posner, 2002). Consequently, the usage of equity for sharing the financial costs of EPIs correlates with previous research regarding FRM instruments and validates the *fairness* criterion.

The *flexibility* criterion was one of the least discussed criteria by participants but was seen as strategically important in the literature. Nair and Howlett (2016) discussed how instrument choice must be adaptable to new evidence and changes over the long-term. The EPIs selected should not limit future policy choices by creating a rigid policy pathway (Ibid). Discussions for *flexibility* focused on the ability of an EPI to be modified or adjusted in order to meet future needs. Thus, the importance of long-term policy implications was utilised by municipal public managers to determine the *flexibility* of the instruments. However, the infrequent use of the *flexibility* criterion indicates that municipal public managers do not perceive this criterion to be an important metrics for evaluating the suitability of EPIs.

Moreover, the participants rarely discussed the *coherence* criterion. In the literature, policy instruments are considered to be coherent if they align or complement existing policies (Nair & Howlett, 2016). As noted by one participant, stormwater charges could be utilised because it shares similarities with existing fee base initiatives. The insight provided by the participants are similar to the definition generated by the literature, but the infrequent discussion of this criterion indicates it is not important for the evaluation of EPIs. Thus, municipal public managers do not widely assess suitability based on this criterion, thereby illustrating a divergence in perspective between policy practice and policy literature.

In summary, the participants used the seven evaluation criteria identified by literature but weighed some criteria as being more important in the evaluation process. Additionally, the participants indicated that instrument mixes were of less importance in the evaluation scheme than literature noted. As well, there was little discussion of the *flexibility* and *coherence* criteria by the participants, demonstrating that those criteria are not critical metrics for evaluating EPIs suitability.

8.0 Conclusion

The purpose of this study was to explore how municipal public managers assessed the suitability of economic policy instruments (EPIs) for flood risk management (FRM). This study utilised semi-structured interviews and thematic content analysis in order to explore the suitability of six EPIs. The findings indicate that municipal public managers utilised hierarchical structuring for evaluating the suitability of EPIs. This hierarchical structuring organises the seven evaluation criteria as such (from most preferred to least preferred); municipal capacity, effectiveness, political viability, fairness, economic efficiency, flexibility and coherence.

With regards to future research, there are several avenues in which the findings of this study could be expanded on. One key area for future study is to expand the data set with other municipal officials or stakeholders involved in FRM (e.g. developers, insurers, planners). An attempt to vary and control for the size of the municipality could also improve the understanding of whether the availability of resources has an impact on evaluations of suitability. A logical next step would be to explore how an instrument mix could better balance considerations for suitability across the criteria. Since participants tended to discuss only one instrument, combining them into scenarios could offer a clearer understanding of their support for FRM. Lastly, analysis on the trade-offs between different instruments could also clarify considerations for suitability given the pursuit of one instrument or scenario over another implies a trade-off that is recognised within existing literature as an important factor in local decision-making.

In conclusion, the historical scots of twelfth-century England are not lost in modern politics; they are revived and embodied as economic policy instruments to address urban flooding. With the increasing impact from climate change, there is no longer an option of getting away “scot free”.

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Appendix 1: Table of Axial Codes

Axial Code	**Description of Code**
Appropriate Use Or Oversight	Describes participant desire for the revenue generated from the instrument to be used to fund stormwater management or related programs. Or, there needs to be additional oversight or monitoring of the program
Balance Between Cost And Impact	Participant discusses the trade-off between costs and benefits and stresses the importance of benefits outweigh the costs
Can Be Adjusted	The ability of the instrument to be modified in the future, in order to meet the needs of the community are discussed by participants
Can Be Implemented	Participant indicates that no additional resources are needed in order to implement the instrument
Cannot Be Implemented	Participant indicates that additional resources are needed in order to implement the instrument
Doesn't Impact Risk	Participant discusses how the instrument doesn't reduce or address flood risk
Fairness Concerns	Participant expresses worry regarding the internal fairness of the instrument and the social implications of the instrument's application
Free riders	A participant expressed concern regarding individuals that benefit from the instrument, but do not assist in address the flood risk

Impacts Risk	Participant discusses how instrument does reduce or address flood risk
Internal Governance Conflict	A participant describes the conflict between different municipal departments or tiers of government
Policy is consistent	A participant explains how the instrument is consistent with current policy or is allowable under the current municipal policy
No Political Support	Describes the participant's view of the instrument not being supported by the municipal council
Strong behavioural influence	Participant discusses how the instrument would influence the uptake of mitigation behaviours by the property owner, home owner, renting tenant or business owners
Political Orientation	Discussion regarding the views of various difference councils and their governance styles (e.g. business orientated, green council, etc.). Could also describe how the council wants to maintain a good public image
Political Support	Describes the participant's view of the instrument as being supported by the municipal council
Positive Spinoff	Participant mentions that instrument creates additional beneficial outcomes (e.g. revenue, stable long-term planning)
Shares Responsibility	Participant discusses how an instrument targets or impact properties with higher runoff contributions. Community members and municipal government share the burden

Weak behavioural influence	Describes participant's view of the instrument not being capable of influencing mitigation behaviours in property owner, homeowner, renting tenant or business owners