Managing Retreat in Canada: Framework for the Evaluation of Property Buyout Programs

by

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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.

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Abstract

With the incidence of severe flooding on the rise, Canada's traditional approach of defending against and rebuilding after floods has become unsustainable. Managed retreat presents a practical policy option to reduce long-term flood risk by relocating people, buildings, and infrastructure from high-risk areas. It is commonly accomplished through a property buyout, where the government pays to acquire the properties of private homeowners and restore the land to an undeveloped state. Yet, despite the risk reduction benefits, this intervention is socially and politically contentious. The literature offers recommendations for the design and implementation of property buyout programs to improve the experience for homeowners but has yet to reach a consensus on what defines an effective program. This thesis aims to situate the role of evaluation in property buyout programs and identify criteria appropriate for characterizing their success. Semi-structured interviews (n=20) were conducted with academic subject matter experts, government officials, and practitioners with experience in managed retreat. Through a thematic analysis of the data, the theoretical criteria for policy evaluation (i.e., goal attainment, efficiency, political viability, robustness, flexibility, legitimacy, and equity) were compared with the actual experiences of individuals in delivering buyout programs in a Canadian context. The criteria deemed appropriate for evaluating property buyout programs were assembled into a framework, and indicators to assess the various dimensions of effectiveness were proposed. This research reveals that property buyouts are often conceived as one-off programs, undervaluing the role of evaluation. Evaluation, if completed at all, is typically informal without much deliberation given to the criteria that inform the process. The framework presented here supports a systematic assessment process to ensure that the social impacts of buyouts are considered alongside government-driven metrics such as goal attainment and cost efficiency. The evaluation findings should be shared among jurisdictions to build the capacity of governments to deliver these programs and advance policy learning on a larger scale.

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Chapter 1
Introduction

1.1 Problem Background and Research Gap

Flooding presents a significant threat to public safety. Recent modelling suggests that up to one million Canadian households are located in areas at high risk of flooding (Insurance Bureau of Canada, 2019). While Canadian governments have historically relied on structural measures such as dikes or dams to keep the water away, increasingly severe floods are overwhelming these defences. From 2005 to 2014, flood-related catastrophes accounted for over 90% of all federal disaster assistance expenditures, and average federal disaster payments for flood recovery are expected to exceed $673 million per year moving forward (Office of the Parliamentary Budget Officer, 2016). The rising cost of flood damage has prompted an enhanced focus on safeguarding the public through the diversification of Canada's approach to flood risk management (Public Safety Canada, 2021a).

Managed retreat is one strategy to reduce the risk of flood damage by removing exposed structures and infrastructure from flood-prone areas and restoring the land to its natural state (K. S. Alexander et al., 2012). It is typically accomplished through a property buyout program, in which a government agency offers to compensate homeowners within a given area for the purchase of their homes (Baker et al., 2018). Managed retreat is a legitimate policy tool with clear economic benefits (Insurance Bureau of Canada, 2019). However, it is also highly controversial, perceived as socially disruptive and politically risky (Hino et al., 2017). Research has identified the potential for managed retreat policy to exacerbate existing social inequalities (Mach et al., 2019; Siders, 2019a) and redistribute rather than reduce risk (McGhee et al., 2020). Furthermore, relocation programs have high upfront costs and low reversibility, underscoring the need to maximize their effectiveness.

Over the past decade in Canada, the use of property buyout programs has been increasing, most often deployed on an *ad hoc* basis following major flood events. Devastating flooding across southern Alberta in 2013 prompted the Government of Alberta to launch the voluntary Floodway Relocation Program (FRP) to acquire properties in

designated floodway areas, with compensation based upon the most recent municipal tax assessment (CBC News, 2013b). The Government of Quebec, in response to widespread spring flooding in 2017 and 2019, introduced the option for property buyouts based on a capped compensation model that offered up to $250,000 for the cost of the residence and associated land (Adriano, 2019). In Grand Forks, British Columbia, a severe flood event in 2018 prompted the targeted buyout of properties in high-risk neighbourhoods (Ballard, 2018). But based on the restricted funding granted by higher-level governments, the municipality could only offer compensation based upon a formula derived from the post-flood, fair market value (Keystone Appraisals, n.d.; Lirette, 2019). Significant variability in how these programs have been structured and applied makes it challenging to compare and evaluate outcomes across the various cases.

This research aims to bring together observations from the fields of policy evaluation, flood risk management, and managed retreat to establish criteria to evaluate and improve property buyout programs. In policy theory, evaluation forms an essential component of the public policy-making cycle, where policy improvement is contingent on building upon findings from the evaluation process (Wu et al., 2018). Yet, for evaluation to be meaningful, it must be based upon relevant and accepted criteria. Without greater consensus on what defines a successful buyout program and which criteria should be used to evaluate effectiveness, the concept of a successful buyout program will remain elusive.

1.2 Research Question

Through this research, I investigate how property buyout programs have been applied in Canada and explore how we appraise the success of these programs. More specifically, I ask:

(1) How do government officials and practitioners currently apply evaluation to property buyout programs?

(2) What criteria are appropriate for evaluating the effectiveness of property buyout programs for flood risk management?

1.3 Research Objective and Contributions

The objective of this research is to establish criteria relevant to the effectiveness of property buyout programs and incorporate these criteria into an evaluation framework grounded in both scholarship and practitioner testimony. The framework will provide a structure for evaluating the success of past buyout programs and guide the design of future programs.

The evaluation framework offers both scholarly and practical value. The academic contribution of this research is to advance discussion towards a unified vision for property buyout programs, with the framework serving as a starting point for dialogue and debate amongst subject matter experts. In the policy realm, this research facilitates a more intentional decision-making process. The framework can broadly guide managed retreat policy, serving as a high-level outline of principles to consider when weighing policy options. It can also be operationalized as a decision-making tool, creating a structure for policy-makers to work through the design at the program's outset to set priorities and identify potential trade-offs. By evaluating property buyout programs in a systematic way, the framework facilitates comparisons across the various programs to advance policy learning.

1.4 Thesis Outline

This thesis examines managed retreat as a component of Canada's flood risk management strategy. More specifically, it explores policy effectiveness in the context of property buyout programs and proposes how we can approach the evaluation of these programs to maximize their success. The literature review is contained within Chapters 2 through 4. It begins with a discussion of the problem of flooding and how the Government of Canada's strategy to address flooding is evolving from a hazard-based to a risk-based approach. Chapter 3 outlines the theoretical principles of flood risk management and how these have been applied in a Canadian context. Chapter 4 provides background information on managed retreat and the extent to which this policy has been adopted in Canada. It then presents theoretical criteria for the evaluation of property buyout programs based upon the

policy literature. The research methodology and findings are contained in Chapters 5 and 6. Chapter 5 describes the qualitative data collection process and the use of both thematic analysis and grounded theory to identify prominent themes relating to evaluating property buyout programs. My research findings are summarized in Chapter 6, where I describe the current approach to evaluation among practitioners and outline how well each of the theoretical criteria for policy evaluation fits in the context of managed retreat. Chapter 7 discusses the significance of each of the criteria and proposes a framework for the evaluation of property buyout programs. Concluding statements are provided in Chapter 8.

Chapter 2
The Flood Problem

2.1 Flooding as a Natural Phenomenon

The land alongside rivers, lakes, and oceans has long been considered a productive and desirable location for human settlements. The settlers of these regions accepted seasonal flooding as a reality of life (Giles, 1976). Across Canada, flooding has been recorded as far back as 1696 in the Saint John River basin of New Brunswick; in 1759 along the coast of Halifax, Nova Scotia; and in 1776 in the Red River basin of Manitoba (I. Burton et al., 2015). While flooding is by no means a new problem, its consequences and how we respond to them have evolved.

Simply put, flooding is a natural event that occurs when water flows over an area that is most often dry. The causes of flooding are varied. Fluvial flooding occurs when a river or stream overflows its banks, typically due to heavy rainfall or rapid snowmelt during the spring thaw (Insurance Bureau of Canada, 2019). Pluvial flooding, or flash flooding, commonly occurs in urban areas when heavy rainfall exceeds the rate of absorption into the ground and overwhelms the capacity of the stormwater system, causing water to flow over land (Sörensen et al., 2016). Storm surges and tsunamis can cause devastating damage to ocean coastlines, and sea-level rise is anticipated to become a more permanent form of flooding in the years to come (Bush & Lemmen, 2019). With the longest ocean coastline of any country, measuring over 243,000 kilometres across its mainland coasts and offshore islands (Statistics Canada, 2016), Canada faces significant exposure to coastal flooding.

A floodplain consists of the land adjacent to a river or stream that is subject to intermittent flooding. The fluctuation of water levels within a floodplain is a natural process that plays a vital role in maintaining healthy ecosystems (de Loë, 2000). Low- to moderate-scale flood events are often beneficial, facilitating the exchange of nutrients between aquatic and terrestrial environments and helping flush fine sediments through the river system (Peters et al., 2016). However, severe floods can be disruptive, both to ecological and human

environments, transporting contaminants from land into sensitive aquatic environments (Peters et al., 2016), causing damage to the built landscape, and, in extreme cases, inflicting human injuries or death. This threat to public safety and the need to protect property and infrastructure have been the primary drivers of the societal response to flooding.

2.2 The Costs of Flooding

Floods are currently the most widespread and costly natural disaster worldwide (OECD, 2016). Since 1980, total global flood losses have exceeded $1 trillion USD (Munich RE, n.d.), with current annual flood damage estimated to cost $40 billion per year (OECD, 2016). Hydrological modelling by the World Resources Institute using its Aqueduct Floods platform predicts a rise in the annual cost of coastal flood damage from $17 billion in 2010 to $177 billion in 2030, with the population exposed to coastal flood damage expected to increase by 8 million people over the same period (Kuzma & Luo, 2020). For riverine flooding, the annual cost of damages is anticipated to grow from $157 billion in 2010 to $535 billion in 2030, with an increase of 67 million in the exposed population (Kuzma & Luo, 2020).

In Canada, public and private disaster recovery expenditures are on the rise. Through the Disaster Financial Assistance Arrangements (DFAA) program, the federal government provides provinces and territories with financial aid to help homeowners restore their properties to their pre-disaster condition. Since its inception in 1970, the DFAA program has issued over $5 billion CAD in disaster recovery for damage not covered by private insurance (Public Safety Canada, 2021b). Flood-related catastrophes represented 93% of all DFAA expenditures from 2005 to 2014, up from 55% the decade prior (Office of the Parliamentary Budget Officer, 2016). The Office of the Parliamentary Budget Officer (2016) predicts that the average annual DFAA payments for flood recovery will exceed $673 million per annum moving forward. Insurance payouts for extreme weather events averaged $1.8 billion per year from 2009 to 2017, up from $405 million per year from 1983 to 2008 (Feltmate, 2018). Additionally, Canadians are estimated to pay $600 million per year in out-of-pocket expenses

to repair flood-related property damage (Thistlethwaite & Henstra, 2018). Flooding can also result in indirect financial costs which are more difficult to quantify, such as personal income loss due to missed work or disruptions to commercial business operations.

Although the cost of flooding is typically reflected in monetary terms, the social and environmental costs must also be considered. Floods can be harmful to physical health, causing injuries, illnesses, or medical emergencies, and in severe instances, result in deaths (H. Burton et al., 2016; Hajat et al., 2003). They also impact psychological health as manifested through increased stress, anxiety, depression, or post-traumatic stress disorder (Tunstall et al., 2006). Environmental contamination from flooding is also possible. The overflow or breach of fuel oil tanks, either above or below ground, can pose indoor air quality concerns within residences or lead to widespread contamination of soil, surface water, or ground water. While the risk of human exposure to contaminated surface water after flooding is widely recognized, the ingestion of polluted ground water after a flood event is understudied and has the potential to pose an even greater risk to human health (Andrade et al., 2018).

2.3 Changes to Flood Regimes

Changes in land use and global warming trends will affect Canada's flood risk. The intensification and expansion of urban areas will challenge stormwater infrastructure capacity and accelerate the loss of permeable land needed to absorb rainfall (Sörensen et al., 2016). Furthermore, more frequent extreme precipitation events are expected across North America (Kirchmeier-Young & Zhang, 2020), increasing the severity of flash flooding, particularly within urban areas. The effect of a rising global temperature on snowmelt-related flooding (i.e., within nival catchments) is uncertain; it may shift the timing of seasonal flood patterns (Bush & Lemmen, 2019) or reduce the overall severity of fluvial flood events (Burn & Whitfield, 2016). The frequency of storm surges from extreme weather events is also anticipated to increase, putting Canada's coastal regions at greater risk (Bush & Lemmen, 2019).

The high cost of floods and the insufficiency of individual-level responses to flood protection solidify flooding as a policy problem. The uncertainty and unpredictability of future flood regimes underscore the need for a coordinated, multi-pronged approach to flood prevention that provides greater protection in the face of changing conditions.

2.4 Evolution of Flood Management in Canada

2.4.1 The Structural Control Era

Water has had a significant influence on the development of Canada as it exists today. Historically, settlements sprung up in coastal regions and along major waterways as the "highways of the day" (Giles, 1976, p. 15) and were concentrated primarily along the Great Lakes and St. Lawrence Seaway system. Communities also developed along inland river systems, first along fur trade routes (Ogilvy, 2019) and later near natural resource projects such as mining, forestry, or hydroelectric power generation (Page, 1980). By current estimates, 20% of Canadian households, equivalent to 3.6 million homes, are located within high-risk flood zones, with 10% of those households considered to be at a very high risk of flooding (Meckbach, 2016).

Before 1953, Canadian governments did not have any formalized governance policies for water resource management. The provinces held ownership and control of their natural resources, while the federal government held legislative authority over fisheries, navigation, treaties, and inter-provincial or cross-border affairs (Bakker & Cook, 2011; Watt, 1995). In 1953, the Government of Canada passed the Canada Water Conservation Assistance Act as the first federal legislation related to the management of water as a natural resource (Environment and Climate Change Canada, 2013). This Act established a funding partnership for large-scale structural engineering projects meant to keep water away from floodplain settlements where the federal and provincial governments would each finance up to 37.5% of the cost of the project, and the municipality would finance the remaining 25% (Environment and Climate Change Canada, 2013). This partnership supported the construction of such water management projects as the Shand, Luther, and Conestogo dams

along the Grand River watershed in Ontario (Giles, 1976). However, the Canada Water Conservation Assistance Act did not facilitate consultation and planning of water resource management between the federal and provincial or territorial governments and, due to its stringent eligibility criteria, its utility was limited to the financing of costly structural works (Booth & Quinn, 1995).

To facilitate a more collaborative approach to water management between levels of government, the Canada Water Conservation Assistance Act was replaced by the Canada Water Act in 1970 (Booth & Quinn, 1995). At the same time, the Government of Canada launched the DFAA program to aid provinces and territories in responding to and recovering from natural disasters (Public Safety Canada, 2021a). Through the DFAA, federal financial assistance became available if the damage from an event exceeded what was reasonable for a province or territory to pay based on a cost-per-capita formula (Public Safety Canada, 2007).

This era of flood management in Canada was characterized by a reliance on structural works to manipulate (e.g., through channel diversions) or prevent (e.g., using dikes or berms) the flow of water (de Loë, 2000). But, despite the benefits of structural defences, the increased occurrence of damaging floods combined with mounting costs to repair flood damages signalled the need to refine Canada's approach (Watt, 1995).

2.4.2 The Non-Structural Control Era

In an effort to address the limitations of their structural-focused approach, the federal government created the Flood Damage Reduction Program (FDRP) in 1975 (Page, 1980). The FDRP was a $20-million coordinated federal-provincial effort to develop standardized flood risk mapping for the entire country and implement measures to restrict and steer development away from high-risk areas (Bruce, 1976). With this improved mapping, it was intended that lower-level governments would limit any further development within high-risk areas and that federal disaster assistance for occupants of these areas would be circumscribed (Bruce, 1976). As a key official involved in the design of the program, Bruce (1976) recognized the importance of communicating this information and intended for the efforts of

the FDRP to be shared both with relevant government decision-makers through technical maps and reports and with the public through simple, user-friendly maps and informational brochures.

To further support the intended outcomes of the FDRP, the federal government established the Canada Water Act fund with an initial budget of $17.9 million per year (Booth & Quinn, 1995). While in theory, this fund encouraged the adoption of various non-structural measures for water management, in practice, it continued to support the construction of large structural water control projects. In the view of Booth and Quinn, "The continuation of heavy expenditures on structural works overshadowed the otherwise innovative and sustainable thrust of the national FDRP and distorted the image of the [Canada Water] Act as well" (1995, p. 72).

A formal review of the FDRP was conducted in 1990, soliciting feedback from federal, provincial, and territorial representatives (Watt, 1995). The FDRP was considered successful in its mission to identify areas of flood risk and direct development away from such high-risk areas; stakeholders were in consensus regarding the value of maintaining the program in perpetuity (Watt, 1995). However, following news that the federal government would be phasing out the program through the late 1990s, many feared Canada's regression towards a fragmented, structural approach to flood management.

The FDRP is lauded for facilitating Canada's transition to a more diverse approach to flood management that emphasized non-structural solutions. It shaped a collective national vision for flood management that enabled each province and territory to reach the same high-quality standards (de Loë, 2000). A survey of government officials and consultants also identified ancillary benefits of the FDRP regarding improved practices for land use planning, greater awareness for floodplain management, and the enhanced protection of environmentally sensitive areas and wildlife habitats (de Loë & Wojtanowski, 2001). Yet over the past two decades, there has been significant variability in the efforts by the provinces and territories to maintain up-to-date mapping and by municipalities in restricting

development within floodplains (Oulahen, 2015). Many flood hazard maps have not been updated since the wind-down of the FDRP and, as such, are unsuitable for informing current land use planning at the municipal level (Henstra et al., 2019). At the turn of the 21st century, while Canada's flood management efforts had stalled, other countries began to recognize the benefits of a more comprehensive approach to mitigating flood risk alongside structural solutions and were starting to change their course (Henstra & McBean, 2005).

Chapter 3
Flood Risk Management

3.1 The Elements of Risk

Flood risk is the product of the probability that a flood event will occur and its consequences if it were to occur, where its consequences include both the exposure and the vulnerability of the assets within the floodplain (FLOODsite Consortium, 2005; Kron, 2005). Exposure represents the value of the assets within the area at-risk, while vulnerability is a measure of how susceptible those assets are to flood damage (Kron, 2005). Simply put, flood risk is defined as "the expected losses from given flood events, in a given area, over a specified period" (World Meteorological Organization, 2013, p. 6).

$$Risk = probability(hazard) * consequences$$

$$= probability(hazard) * (exposure * vulnerability)$$

Equation 1. Determination of Flood Risk

The traditional approach to flood management has focused on minimizing the hazard component of the risk equation by using built structures to direct the flow of water away from developed areas while the exposure of the assets within the floodplain has stayed the same or even increased. A risk-based approach seeks to reduce all components of risk by preventing flooding and reducing its potential consequences, as illustrated in Figure 1. By this theory, the risk posed by a flood is not only a result of the flood hazard itself but also the presence of development within the floodplain. If a flood were to occur in an area with no human development, the risk would effectively be zero.

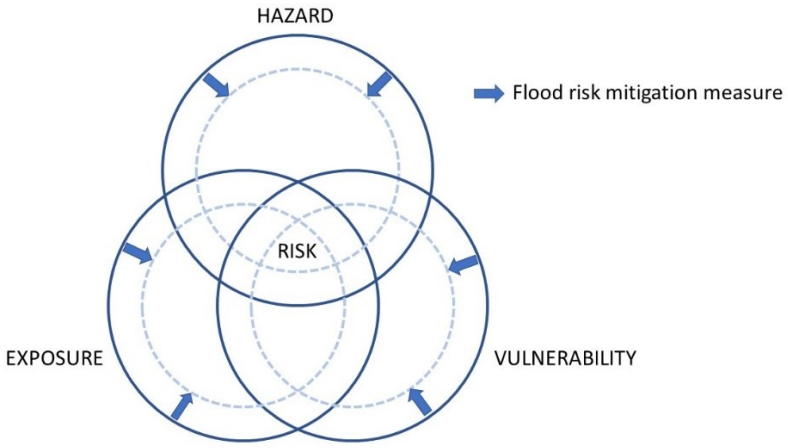

Figure 1. Flood Risk Management (Adapted from WMO, 2013, p.7)

3.2 The Design Standard

The "design flood" refers to the standard to which the flood control structure is built. The standard is selected to protect against a certain magnitude of flood and reflects the likelihood of a hazard occurring within an arbitrary period of return (APEGBC, 2018). The larger the flood, the less often it is expected to occur. For instance, a dam designed to withstand a 100-year flood protects against floods that have a 1% chance of occurring each year based upon recent modelling data (United States Geological Survey, n.d.). Selecting the appropriate design specifications for an engineered structure is a challenge as no design will provide absolute protection from hazards at all scales.

Moreover, the construction of structural defences for flood prevention has been found to increase flood risk in the long term. Engineered structures can create a false sense of security, leading to intensified development within the floodplain in a paradox termed the "levee effect" (I. Burton et al., 1968). An increase in exposed assets increases total flood risk while the level of protection provided by the engineered control remains fixed (Jakob & Church, 2011). While the traditional, hazard-focused approach to flood management is sufficient for floods of a magnitude at or below the design standard, the damage caused by an

event in exceedance of the "design flood" standard can be devastating (Jakob & Church, 2011). Furthermore, under rapidly changing flood conditions, the design flood standard becomes outdated over the course of the engineered structure's lifespan. This risk necessitates a more sustainable strategy, a combination of structural and non-structural measures that ensure a minimum level of protection against a variable threat (Kundzewicz, 2002).

3.3 The Principles of Flood Risk Management

The paradigm of flood risk management has emerged from the realization that the protection afforded by controlling the flood hazard alone is not absolute and that successful flood management policies should seek to reduce all three components of risk (Klijn et al., 2008). In line with this theory, flood risk management is defined as a systematic process for the identification, assessment, and reduction of risks to decrease both the likelihood of flooding and the damage caused by a flood event when it does occur (Klijn et al., 2008; Schanze et al., 2006). Flood risk management theory generally emphasizes three fundamental principles:

(1) Flood disasters are a human-caused problem, so flood risk management must incorporate measures to address the social dimensions of flood risk.
(2) Flood risk reduction is achieved by diversifying strategies and targeting multiple actors.
(3) Risk-based decisions should be supported by a formal risk assessment and made in consultation with stakeholders.

The Social Dimensions of Flood Risk

The attribution of flooding has evolved from an unavoidable, natural event (e.g., an "act of God" or a "force of nature") to a more complex problem created by interactions between the natural environment, the built environment, and the social environment (Mileti, 1999). Butler & Pidgeon (2011) aptly noted that the "object" to be governed has shifted from the floodwaters themselves to how we design, build, and live within our communities. This

thinking has led to a shift from the use of a singular, linear solution to decrease the likelihood of flooding (e.g., structural defences) towards a multidisciplinary approach that also reduces the impacts of flooding through non-structural means (Meijerink & Dicke, 2008). Exposure reduction seeks to limit occupancy within the floodplain, for example, through proactive land use planning or by relocating at-risk structures to higher ground. Vulnerability reduction efforts aim to lessen the extent of damages within the floodplain, like flood-proofing existing buildings or implementing monitoring and warning systems to facilitate flood preparation and evacuation.

A Diverse Strategy with Multiple Actors

A systems-level approach to managing flood risk necessitates a combination of measures that prevent and mitigate risks as well as defend against, prepare for, and recover from floods (Hegger et al., 2014; Meijerink & Dicke, 2008; Raadgever et al., 2014). Each element of the strategy can be achieved through a variety of policy tools, including laws and regulatory instruments (e.g., land use planning), economic instruments (e.g., subsidies for property-level flood-proofing), communication instruments (e.g., public engagement), or a combination of the above (Klijn et al., 2008; Thistlethwaite & Henstra, 2017). Flood risk management also warrants a diversity of actors. Risk-sharing is the process of decentralizing responsibility, shifting some of the costs and obligations for flood risk reduction onto lower-level governments and the private sector, including property owners (Meijerink & Dicke, 2008). It also aims to redistribute the burden for materialized losses (i.e., the actual cost of damage from a flood event) across stakeholders through economic instruments such as government financial aid, private insurance coverage, and reinsurance programs (World Meteorological Organization, 2013). Table 1 provides sample measures for each element of the strategy and the primary actors responsible for each component.

Table 1. Flood Risk Management Strategy

Strategy Element	Sample Measures	Main Actor(s)
Flood defence	• Engineered structures to control or prevent the flow of floodwaters (e.g., dikes, dams, sea walls, channel diversions, etc.)	• Government, all levels
Flood risk prevention	• Mapping to identify flood-prone land • Laws and regulations to prevent or restrict development within floodplains • Managed retreat, relocating infrastructure from within high-risk flood zones	• Government, typically supported at a higher level but implemented at lower levels
Flood preparation	• Flood forecasting, emergency alert systems, and evacuation plans • Public informational campaigns on flood prevention and emergency preparedness	• Government, all levels • Citizens
Flood risk mitigation	• Flood-proofing existing structures • The incorporation of flood-resistant designs for new buildings • Enhanced green infrastructure use in urban areas to help capture rainfall (e.g., green roofs, permeable pavement, etc.)	• Government, typically enforced at the local level • Owners or managers of existing buildings • Private developers for new construction, green infrastructure adoption • Citizens
Flood recovery	• Emergency response procedures, including temporary accommodation and supplies for displaced residents • Financial aid for both public efforts to restore services and infrastructure and private efforts to repair homes and replace belongings • Private flood insurance	• Government, all levels • Non-governmental agencies (e.g., Red Cross) • Private sector, particularly insurance companies • Citizens

Note: Developed by author based on Hegger et al., 2014; Raadgever et al., 2014.

The Need for Risk Assessment

Flood risk management incorporates the engineering concept of redundancy, implementing back-ups or fail-safe measures to reduce the damage from a flood event if the risk prevention or defence measures were to fail. An effective flood risk management strategy adopts measures to address all five elements of the system presented in Table 1. However, given finite resources, governments are unable to allocate efforts across all categories equally, so there will inevitably be trade-offs (Hegger et al., 2016). The risk management process is not intended to result in "zero" risk but rather to achieve a level of risk that is socially acceptable and sustainable (Klijn et al., 2008). Risk assessment is the process of identifying and evaluating these trade-offs, determining a tolerable level of risk, and optimizing the strategy to achieve the desired level of acceptable risk.

The risk assessment process consists of three stages: risk analysis, risk assessment, and risk reduction. Risk analysis is the process of characterizing the hazard and understanding how exposure and vulnerability exacerbate the risk under various scenarios. In the context of flooding, risk analysis involves modelling different probabilistic flood scenarios (i.e., past, current, and future) (APEGBC, 2018). The hydrological parameters associated with each scenario, such as the area of inundation, flow velocity, and flow depth, are also determined, and an estimation of the consequences related to each scenario is made (APEGBC, 2018). The risk assessment stage evaluates the flood risk scenarios under various management strategies. It aims to determine an acceptable level of risk based on risk perception and risk tolerance, as informed through consultations with stakeholders (Schanze et al., 2006). Then, measures are selected and implemented to reduce risk within the tolerable range as determined through the risk assessment.

Flood risk management warrants a continuous cycle of assessment to evaluate the efficacy of risk reduction efforts and make adjustments as needed, differentiating itself from the "implement and maintain" model of the past (Klijn et al., 2008; Schanze et al., 2006). The risk reduction strategy may need to adapt to changes in physical or socioeconomic

conditions (Sayers et al., 2013; Sörensen et al., 2016). In the long term, generational shifts in values and risk tolerance must also be considered (Plate, 2002).

3.4 Flood Risk Management in Canada

3.4.1 Flood Risk Governance

In Canada, water governance is shared among all three levels of government and with specialized groups such as First Nations, conservation authorities, and non-governmental organizations (Bakker & Cook, 2011). This shared arrangement extends to Canada's effort to manage flood risk (de Loë, 2000; Environment and Climate Change Canada, 2013; Henstra & McBean, 2005). The federal government's primary responsibilities are to set high-level strategies for disaster management, fund large-scale flood control works in partnership with lower-level governments, and provide financial aid to help provinces and territories recover from natural disasters. The provincial and territorial governments are responsible for developing regulations regarding land use, maintaining emergency flood forecasting and warning systems, partnering with municipalities to fund small-to-medium scale flood control measures, and administering financial assistance to the public following a disaster. Municipal governments are typically in charge of enforcing land use regulations, developing local emergency response procedures, managing stormwater discharge, and encouraging the uptake of flood prevention measures at the household level. Canada's fragmented approach to water governance has complicated its ability to manage its natural resources efficiently and has hindered its capacity to react to rapidly changing issues, such as flood risk in the face of climate change (Bakker & Cook, 2011).

3.4.2 Progress Towards a Risk-Based Approach

The need for a risk-based approach to flood management in Canada was identified as far back as the 1970s (Bruce, 1976; Giles, 1976). With the introduction of the FDRP in 1975, Canada led the way for flood risk management on a national scale. Upon the wind-down of the program in the 1990s, however, and despite momentum towards flood risk management

among the wider international community, Canada's progress stalled (Henstra & McBean, 2005).

Through the first half of the 2010s, the need to prioritize and accelerate disaster risk reduction efforts became increasingly pressing. Due to severe weather, the years from 2010 to 2013 represented four of Canada's top ten highest loss years for property and casualty insurance (Insurance Bureau of Canada, 2020). The 2013 floods in southern Alberta punctuated this mounting risk. With an estimated $6 billion in losses and recovery costs, the 2013 Alberta floods became the most costly flood event (Environment and Climate Change Canada, 2017) and the second most costly natural disaster in Canada to date (Gambrill, 2020). In 2014, the federal government made its first tangible commitment to flood risk prevention and mitigation since the wind-down of the FDRP. The 2014 federal budget allocated $200 million over five years (i.e., from 2015 to 2020) to reduce the consequences of natural disasters through the National Disaster Mitigation Program (NDMP) (Public Safety Canada, 2021a). Through the NDMP, provinces and territories could apply for federal funding to support cost-shared programs from one of four categories: risk assessments to identify flood risk exposure and vulnerability, developing or modernizing flood maps, mitigation planning, or investments in non-structural or small-scale structural mitigation projects. As of 2019, the NDMP had funded 363 mitigation projects in 117 communities across Canada, including communities with a higher representation of vulnerable populations (Public Safety Canada, 2019c). Yet, some gaps were identified, including the need to enhance mitigation tools such as flood mapping and expand Canada's flood insurance market (Public Safety Canada, 2019c).

While the NDMP was underway, a report released by the Parliamentary Budget Officer in 2016 called attention to the unsustainable trajectory of federal DFAA payouts. It presented stark predictions for the price of future disaster losses, with the average annual cost of DFAA payouts for flooding expected to rise above $673 million per year (Office of the Parliamentary Budget Officer, 2016). It underscored the need to enhance risk-sharing across all stakeholders. A shift towards risk-sharing is evident in the federal government's

Emergency Management Strategy for Canada, released in 2019, which emphasizes a "whole of society" approach to disaster risk reduction with partners stated to include: "Indigenous peoples, municipalities, communities, volunteer and non-governmental organizations, the private sector, critical infrastructure owners and operators, academia, and volunteers" (Public Safety Canada, 2019a, p. 2). Infrastructure Canada launched the Disaster Mitigation and Adaptation Fund (DMAF), a $2 billion, decade-long program to support large-scale disaster mitigation projects, in May 2018 (Infrastructure Canada, 2018). The DMAF program is intended to make communities more resilient to the social, economic, and environmental impacts of natural disasters under future climatic conditions, funding projects such as diversion channels, wetland restorations, or setback levees (Infrastructure Canada, 2021). The federal government furthered its commitment to flood risk reduction in November 2020 by creating a Task Force on Flood Insurance and Relocation (Public Safety Canada, 2020). The task force's mandate is to explore options for the delivery of affordable flood insurance to residents of high-risk flood zones and to examine the potential to relocate residents from within Canada's highest risk areas.

3.4.3 Canada's Flood Risk Management Strategy

Canada's progress within each of the five elements of the flood risk management strategy has varied. While measures to defend against, prepare for, and recover from floods are present and institutionalized, efforts to prevent and mitigate flood risk are still emerging. The status of Canada's flood risk management strategy and the relevant actors for each element are summarized in Table 2.

As previously described, flood defence using structural measures has been the focus of Canada's flood management approach for over a century. Due to the path dependency created by the development within floodplains, continued financial resources will be required to maintain and repair these existing structures.

Table 2. Current Status of Flood Risk Management in Canada

Strategy Element	Current Status	Main Actor(s)
Flood defence	**Institutionalized** • The focus of historical flood management efforts • Financial resources will be required to maintain and upgrade existing structures due to path dependency • Some new construction will be warranted in the future	• Government – municipal, provincial, federal
Flood risk prevention	**Emerging** • Efforts for high-quality mapping, risk assessment, and mitigation planning has been renewed through the NDMP • The federal government's Task Force on Flood Insurance and Relocation was created in 2020 to examine potential relocation options for residents of high-risk flood areas (e.g., managed retreat)	• Government – municipal, provincial, federal
Flood preparation	**Institutionalized** • Flood forecasting, emergency warning systems, sandbagging, evacuation measures • Household-level emergency preparedness measures	• Government – provincial/municipal governments, water management agencies, conservation authorities • Citizens
Flood risk mitigation	**Emerging** • The construction and upgrading of public infrastructure, including natural infrastructure, that mitigates or protects against the impacts of extreme weather, facilitated through the federal DMAF program • Flood-proofing existing structures • Updated building code to enhance the climate-resilience of new buildings (takes effect 2025) • Public uptake of property-level flood protection measures (e.g., sump pumps, backwater valves, property grading)	• Government – typically funded at higher levels and implemented at local levels • Building managers for existing structures • Private developers for new construction • Citizens

Strategy Element	Current Status	Main Actor(s)
Flood recovery	**Institutionalized** • Government financial disaster assistance **Emerging** • Increasing the uptake of private overland flood insurance • The federal government's Task Force on Flood Insurance and Relocation was created in 2020 to explore low-cost residential flood insurance options for residents of high-risk areas	• Government • NGOs • Citizens • Private sector, particularly insurance companies

Flood preparation encompasses a combination of flood forecasting, monitoring, and warning systems. These activities are the responsibility of the provincial governments with the support of any regional water management agencies or conservation authorities (Environment and Climate Change Canada, 2014). In northern Canada, flood forecasting is a shared effort between the territorial governments, Indian and Northern Affairs Canada, and Environment Canada (Environment and Climate Change Canada, 2014). For severe flood events, the provinces and territories can request that the federal government deploy the military to help build berms and place sandbags (The Canadian Press & Berthiaume, 2020). Canada's flood preparation efforts are well established, with a relatively low number of flood-related fatalities over recent decades (Public Safety Canada, 2019b).

Efforts to incorporate risk-based policies were initiated with the FDRP in 1975 and renewed in the 2010s with the NDMP and DMAF. However, effective risk management in Canada is contingent on developing updated hazard maps to inform the risk assessment process. Current flood mapping is, on average, 20 to 25 years out of date (CBC News, 2020) and an evaluation of flood maps from 280 municipalities across the country found 62% of maps to be of low quality (Henstra et al., 2019). In 2016, Infrastructure Canada focused on enhancing the climate resilience of new and existing buildings, allocating $42.5 million

towards the initiative (Infrastructure Canada, 2020). The National Building Code of Canada is also being updated to reflect an increasing natural hazard risk. The updated document, anticipated to be released in 2025, is intended to enhance the climate resilience of new buildings to flooding, wildfires, and storms (Arsenault, 2019). In partnership with academic institutions, Canadian insurance companies have focused on increasing the uptake of property-level flood protection measures, such as installing sump pumps and backflow valves, by individual homeowners (Evans & Feltmate, 2019).

As a result of the federal and provincial governments' financial assistance to support rebuilding efforts following a natural disaster, flood recovery has become institutionalized over the past 50 years. Yet as the severity and frequency of flood events increase, relying on government financial aid as the sole means of flood recovery is unsustainable. Mounting costs have necessitated loss sharing with the public sector, primarily through private insurance. The introduction of private overland flood insurance, which became available to Canadians in 2015, is just one way the Canadian government seeks to redistribute risk and the burden of materialized losses across stakeholders. Uptake has been slow, however, with only one-third of Canadians estimated to have overland flood coverage as of 2019 (Insurance Bureau of Canada, 2019). A national flood insurance program, such as the National Flood Insurance Program in the United States or Flood Re in the United Kingdom, could serve as a solution for these high-risk areas, but such a program has yet to be developed (Contant, 2019; Meckbach, 2019).

Conceptually, the Government of Canada is committed to the principles of flood risk management and has publicly affirmed this commitment by signing the international *Sendai Framework for Disaster Risk Reduction 2015-2030* (United Nations International Strategy for Disaster Reduction, 2015), and by adopting the national *Emergency Management Strategy for Canada* (Public Safety Canada, 2019a) and the *Pan-Canadian Framework on Clean Growth and Climate Change* (Environment and Climate Change Canada, 2016). The political will to develop more effective flood risk management is increasing as costs for flood recovery continue to rise. Disaster risk reduction was a prominent element of the current

federal Liberal government's 2019 re-election campaign, which saw them commit $150 million to update flood mapping for all provinces and territories (Lowrie & Rabson, 2019).

Despite these commitments, there is evidence that the implementation of flood risk management in Canada is lagging. A recent study conducted by the Intact Centre for Climate Adaptation (2020) assessed the flood preparedness of the Canadian provinces and territories. The study evaluated preparedness across floodplain mapping, land use planning, infrastructure systems, and emergency response. The Canadian average preparedness score was a grade of "C" with the highest individual grade of "B-" awarded to Prince Edward Island and the Yukon, indicating significant room for improvement nationwide. One promising area of policy development is managed retreat, which is growing in popularity as an effective means of implementing flood risk management in high-risk flood areas. Despite a few attempts at managed retreat among provinces and municipalities, this policy has yet to be assessed for its effectiveness in supporting flood risk management. The following section explores the role of managed retreat in ways that enhance the effectiveness of Canada's overall flood risk management strategy.

Chapter 4
Managed Retreat Policy

4.1 Policy Problems

As expressed by Hoppe (2011, p. 30), policy problems represent "non-acceptable discrepancies between real situations and desired future situations; between a socially constructed 'is' and 'ought.'" They signify public concerns that require collective action through the use of shared resources (Turnbull, 2006). Therefore, decision-makers must perceive them to be worthy of government action (Hoornbeek & Peters, 2017). In discussing the structure of a policy problem, Hoppe (2018) characterizes a typology based upon the certainty of knowledge on how to solve the problem and on the level of agreement on values, norms, and goals, with unstructured problems representing those with less certainty of knowledge and less consensus. These unstructured problems, coined "wicked problems" by Rittel and Webber (1973), are complex issues with a significant social component, where there is no simplistic, linear solution. Such problems are often contentious, and the policy options are intertwined with values, norms, and politics (Head, 2018). Newman and Head (2017) suggest that, for wicked problems, the evidence-based model for policy-making is insufficient; more data does not necessarily lead to a better solution. They argue that careful effort should be dedicated to untangling the political complexity and value-based judgements inherent to the problem. Flooding is such a wicked problem, where policy decisions can create winners and losers through both intended and unintended consequences. By affording many people the same level of protection, structural control measures typically have broader political support and greater perceived fairness. But since the structure can fail or become compromised, it comes with a higher risk. Managed retreat, on the other hand, while politically and socially more contentious, can all but eliminate the risk for the most at-risk populations. To address these political and social complexities, there is a need to unpack the various elements of managed retreat policy and explore how they contribute to the policy's overall effectiveness.

4.2 Flood Risk Reduction through Managed Retreat

Managed retreat is defined as "the purposeful, coordinated movement of people and assets out of harm's way" (Siders, 2019b). It first emerged as an ecological concept for coastal management in response to shoreline erosion, directing a gradual withdrawal from the shoreline rather than using hard defences to prevent it (Koslov, 2016). Its usefulness led the concept to be adopted as a climate change adaptation strategy, forming the "retreat" component of the "protect/accommodate/retreat/avoid" or "PARA" framework for disaster risk reduction (Doberstein et al., 2019). Managed retreat reduces the exposure component of the risk equation by removing or relocating assets from the floodplain.

While managed retreat refers broadly to the coordinated relocation process, it is typically accomplished through property acquisitions, commonly referred to as property buyout programs. In a property buyout program, the government offers to compensate eligible homeowners for the purchase of their property and, following the removal of the home, restores the land to a natural area or floodplain (Baker et al., 2018). In high-risk flood zones, property buyouts are considered a cost-effective solution with the logic that, in the long run, the cost of buyouts is cheaper for the government than paying for homeowners to repeatedly rebuild in these areas. As summarized by Robinson et al. (2018, pp. 234–235), managed retreat is based upon the reality that "a small percentage of properties experience a large percentage of the insured flood losses, so removing those properties from the set of exposed assets can be an efficient way to reduce risk." However, relocation programs, even voluntary ones, can lead to unintended social impacts. If not carefully considered, decisions based solely on the economic rationale for retreat can serve to perpetuate social inequality and risk among vulnerable populations (Siders, 2019a).

In the United States, managed retreat has become institutionalized as a strategy for disaster risk reduction, with property buyout programs dating back to the 1970s (Greer & Binder, 2017). From 1989 to 2017, the United States Federal Emergency Management Agency (FEMA) funded the acquisition of over 43,600 properties within flood-prone areas (Mach et al., 2019). Globally, over 1.3 million people in over 22 countries are estimated to

have been resettled through managed retreat to date (Hino et al., 2017). By 2050, it is predicted that at least 200 million people worldwide will need to be resettled due to the impacts of climate change (Brown, 2008), underscoring the urgency to enhance our understanding of effectiveness in managed retreat policy.

4.3 Managed Retreat in Canada

Compared to the United States, the use of managed retreat in Canada has been less common. One of the earliest instances of managed retreat was the mandatory property buyout program that followed when Hurricane Hazel struck the Toronto area in 1954 (Environment and Climate Change Canada, 2015). A facilitated process for removing structures from high-risk flood zones was envisioned as a key outcome of the federal FDRP that ran from 1975 until the 1990s (Bruce, 1976). However, despite a few relocation programs in the intervening years, managed retreat failed to become commonplace as a flood risk reduction strategy. Over the past decade, managed retreat has gained popularity as Canadian governments have demonstrated an increased willingness to consider property buyout programs for long-term flood risk prevention (e.g., Ballard, 2018; CBC News, 2013b, 2019; Krishnan & Montpetit, 2019).

Canadian managed retreat programs have primarily been *ad hoc*, typically initiated at the local or provincial level following a disaster when communities have been forced to re-evaluate their approach to flood risk management. This reactive response has created considerable variability in how these programs have been designed, delivered, and funded. Most buyouts, such as Alberta's FRP, have been event-specific and time-limited. In other instances, mounting flood risk has led governments to establish a buyout option within their disaster financial assistance program, as was done in Quebec following repeated flood events in 2017 and 2019 (Doberstein et al., 2021). Some programs have effectively been mandatory, often when rebuilding was deemed too risky or where land was needed to support the broader flood mitigation effort (e.g., Ballard, 2018; CBC News, 2013c, 2017). Others have been voluntary, often with restrictions on future disaster financial assistance should the buyout

offer be declined, as was the case with Alberta's FRP (e.g., CBC News, 2013b). The source of funding for buyouts has also varied, with compensation sometimes distributed jointly from all three tiers of government (e.g., Grand Forks, British Columbia) while other times it has been delivered by the province alone (e.g., Alberta, New Brunswick, Quebec). Except for one-off acquisitions of land needed to construct structural works, there were no instances of buyout programs funded solely at the municipal level. The compensation offers made to homeowners have ranged from pre-flood property tax assessment value (e.g., Alberta FRP), to post-flood fair market value (e.g., Grand Forks, British Columbia), to capped maximum programs (e.g., Quebec, New Brunswick). Some programs in the United States have offered financial incentives to enhance participation. For example, Kinston, North Carolina, offered a $10,000 top-up to buyout participants who relocated within the same tax base (Greer & Binder, 2017). Canadian governments have not yet employed such a strategy.

All of the Canadian programs have had some contention. Officials implementing the 1954 Hurricane Hazel buyout program faced backlash as some homeowners demanded higher compensation, and others expressed frustration at being excluded from the program (Environment and Climate Change Canada, 2015). For Alberta's FRP, launched in response to the 2013 flooding, eligible properties were selected based on outdated flood maps; the mapped floodway zones did not consistently reflect the properties with the most damage (CBC News, 2013a, 2013b). This discrepancy resulted in a low acceptance rate as many homeowners who were offered buyouts had not experienced significant flood damage. The piecemeal approach to property acquisition did little to mitigate flood risk in some Calgary neighbourhoods (Markusoff, 2018). Officials in Grand Forks, British Columbia, were forced to revise their approach when they found out that the funding from higher-level governments would only support compensation based on post-flood fair market value (Potenteau, 2019). Similarly, many homeowners in Quebec felt that they could never accept a buyout capped at $250,000 because it was a fraction of what their property was worth (Bruemmer, 2019; Perreaux, 2019).

Over the past decade, the increasing prevalence of property buyout programs shows a shift in Canadian governments' willingness to consider risk-based management efforts. This willingness has been slow to manifest into formal policy development, but there is movement in the right direction. The federal Liberal government's 2019 re-election campaign made ambitious commitments to addressing flood risk and promised a national plan to help homeowners relocate from high-risk flood zones (Lowrie & Rabson, 2019). In November 2020, the federal government announced the creation of a Task Force on Flood Insurance and Relocation to examine the potential to relocate residents from within Canada's highest risk areas (Public Safety Canada, 2020). Through a collaborative, multi-stakeholder consultation process, the task force has been mandated to develop an action plan that provides greater guidance to lower-level governments considering managed retreat.

4.4 Property Buyout Programs

A policy's ability to achieve its stated goals or objectives is regarded as the central purpose of policy design (Bali et al., 2019). Therefore, formulating specific and realistic program goals is inherent to effective policy design. For managed retreat, the program goals may be financial (e.g., reduce the cost of future flood damage), social (e.g., provide the most vulnerable citizens with the means to relocate), ecological (e.g., restore a given area to its natural condition for flood mitigation), or a combination of the above. Both the design and implementation of a property buyout program impact its ability to meet its prescribed goals.

4.4.1 Program Design

Elements of managed retreat policy design that impact its ability to meet its goals include the timing, source of funding, coerciveness, eligibility criteria, the value of the compensation, and intended use of the purchased land. These design aspects are outlined in Table 3.

Table 3. Design Criteria for Property Buyout Programs

Aspect	Definition	Decision Points
Timing	The timing of the program's initiation relative to the flood event.	• Reactive (post-disaster) • Reactive (repeated seasonal flooding) • Proactive (climate change adaptation planning)
Program Funding	How the buyout program is financed.	• Percentage contribution available from each level of government • Eligibility for grants • Requirement for matching funds from the homeowner
Coerciveness	The perceived degree of choice the homeowners have in accepting the offer.	• Voluntary, open-ended offer • Voluntary, time-limited offer • Mandatory
Eligibility	The criteria used to delineate the areal extent of the buyout.	• Based on mapping • Based on the cost of actual damage (e.g., Quebec) • Exclusions based on the availability of private insurance, whether they refused past buyout offers, etc.
Compensation	How much money the homeowner is eligible to receive for their primary dwelling, land and any outbuildings.	• Pre-flood value vs. post-flood value • Fair market value vs. tax assessment value • Cap on compensation • Restrictions (e.g., past acceptance of financial assistance for flood repairs) • Added incentives
Post-Buyout Land Use	The intended use for the acquired land.	• Protected as open-space vs. potential for future sale • Additional mitigation potential (e.g., rain retention, water quality improvements)

Some aspects of program design, such as timing, whether the program is developed reactively following a damaging flood event, or the amount of funding issued by higher levels of government, may be outside the control of the agency implementing the buyout. Other aspects, such as whether the program will be voluntary or mandatory, determining eligibility, and the value of compensation, can be adjusted accordingly to support the program's intended goals. The future use of the land can also influence the outcome of the program. In New York following Hurricane Sandy, for instance, the Oakwood Beach buyout program was initially state-run, which stipulated that the area be preserved as open-space following the removal of the homes (Koslov, 2016). When the city pre-empted the program, however, it opened up the potential for the land to be re-sold to developers. This change shifted homeowners' opinions of the program. They no longer perceived the program as being for the greater good of the area, and their willingness to participate declined (Koslov, 2016).

4.4.2 Program Implementation

The delivery of managed retreat programs also has a significant influence on buyout participants' experiences and their ability to make independent and informed decisions. Previous studies have explored the challenges households have faced as they have moved through the buyout process. Commonly-cited frustrations include poor communication by the implementing agency, a lack of resources and support in navigating the process, and a lack of trust in decision-makers (Baker et al., 2018; Binder & Greer, 2016; Perry & Lindell, 1997). These aspects are outlined in Table 4.

Table 4. Implementation Criteria for Property Buyout Programs

Aspect	Decision Points
Communication	• Opportunities for public engagement • How will information be shared with stakeholders (e.g., information portals, meetings, etc.)? • Communication strategy to support consistent messaging

Aspect	Decision Points
Resources and Support	• Amount of government involvement • Use of assigned case workers • Incorporation of supplementary support (e.g., social workers, legal aid, real estate professionals) as required • Additional resources to help homeowners locate a new property
Trust	• Opportunities for stakeholder participation in the decision-making process • Procedure for stakeholders to challenge decisions • Transparency of decision-making process

When reflecting on their experiences with buyout programs, homeowners expressed issues with access to accurate and timely information (Baker et al., 2018; Binder & Greer, 2016). A lack of information or the delivery of conflicting information led some residents to question whether the implementing agency had a proper plan in place (Binder & Greer, 2016). Binder et al. (2018) recommend creating an online portal monitored by knowledgeable municipal officials to improve communication between the implementing agency and buyout participants where community members can ask questions and receive important updates. Designated case workers with the authority to answer questions could enhance homeowners' experiences by guiding them through the process (Binder et al., 2018).

The inability to procure suitable temporary housing for the many months it took to move through the buyout process was another common frustration for homeowners (Baker et al., 2018). One instance in Allenville, Arizona, moved residents into a temporary mobile home community (Perry & Lindell, 1997). However, most programs did not provide residents with assistance in securing temporary housing, forcing them to strain relationships with friends and family, pay rent on top of a mortgage, or make basic repairs to inhabit their still damaged homes (Binder & Greer, 2016). Uncertainty surrounding the timeline for the acquisition exacerbated the challenge of procuring housing. Often, residents were given little notice on the closing date, creating a narrow window in which they could purchase their new home or face having to pay two concurrent mortgages (Baker et al., 2018). Binder et al. (2018) recommend that the timeline for buyouts should be expedient but flexible enough to

ensure that residents have secured alternate housing before closing. The value of buyout compensation will always be insufficient if there is a shortage of comparable housing in the area. Relocating homeowners within the same tax base is especially challenging in highly urbanized areas, where property values are high and the availability of undeveloped land is low (Doberstein et al., 2020).

Issues of trust and transparency were other prominent themes in the research. A study by de Vries & Fraser (2012) highlighted the critical role that trust in buyout administrators plays in increasing homeowner participation. During the buyout program in Allenville, Arizona, a group of respected community members was able to liaise with the implementing agency, representing the interests of the citizens and contributing to the overall success of the buyout program (Perry & Lindell, 1997). Public distrust of the buyout program can also stem from a lack of transparency, and transparency issues are often related to the determination of eligibility criteria (Siders, 2019a). In the case of buyouts in New York following Hurricane Sandy, for example, the requirements for eligibility were unclear, and the boundaries of the buyout area shifted and shrank over time, causing much confusion for homeowners (Baker et al., 2018; Binder & Greer, 2016). During the program planning stage, community engagement is instrumental in ensuring transparency and building trust between buyout participants and officials (Binder et al., 2018). The Lincoln Institute for Land Policy recommends that the framework for buyout programs be standardized at the federal level to promote transparency, with long-term flood risk adaptation plans developed proactively at the local level (Freudenberg et al., 2016).

Several studies have evaluated the perceived voluntariness of buyout programs (Baker et al., 2018; Binder & Greer, 2016; de Vries & Fraser, 2012) and examined factors that influence homeowner participation (Binder et al., 2015; Kick et al., 2011; Robinson et al., 2018; Song & Peng, 2017). During previous programs in the United States, reports of individuals feeling pressured into accepting offers have compromised the legitimacy of voluntary buyout programs (Binder & Greer, 2016). Financial incentives, such as a bonus for contiguous property owners who accept buyout offers, may exacerbate this pressure (Binder

et al., 2018). A review of the literature on protecting the voluntariness of the programs revealed another problematic element, where despite considering their programs as purely voluntary, buyout managers were evaluating success based on the percentage of offer acceptance and adjusting their tactics to increase participation (de Vries & Fraser, 2012). In a comparative study of two New York neighbourhoods heavily damaged by Hurricane Sandy, the difference in each community's overall willingness to accept buyout offers was attributed to their past experiences with natural disasters, community culture, and sense of place-based attachment (Binder et al., 2015). Kick et al. (2011) found that community ties and a sense of "home" influence a homeowner's willingness to relocate and stress that decisions based on place-based attachments are as rational as decisions based on finances or hazard risk. These findings suggest that homeowner acceptance is context specific and that relocation policies may be enhanced by a more nuanced approach that seeks to keep communities intact.

Researchers have investigated the reality of vulnerability reduction through relocation (Mach et al., 2019; McGhee et al., 2020) and have highlighted how the logic used for managed retreat decision-making may harm disadvantaged communities (Siders, 2019a). According to research conducted by McGhee et al. (2020), if improperly handled, property buyout programs may serve to shift or redistribute vulnerability rather than reduce it. This shift pertains both to hazard vulnerability, relocating to an area of equal or greater exposure to flooding, and social vulnerability, based on factors associated with poverty, education, and population density (McGhee et al., 2020). This finding stresses the need to support residents throughout the entire relocation process to ensure that the buyout enables residents to reduce their overall risk exposure and improve or maintain their quality of life. Siders (2019a) highlights that the economic cost-benefit analysis that is common practice in flood mitigation decision-making may prioritize the construction of structural defence measures in high-income neighbourhoods while promoting the more socially disruptive managed retreat option in areas of lower affluence. Cost-benefit analyses incorporate subjective value decisions and, if not intentionally controlled for, may perpetuate social inequality.

Much of the research on property buyout programs conducted to date has been based out of the United States, where FEMA mandates the voluntariness of the property buyout programs that it funds. Consequently, many studies have focused on the conditions that influence people's willingness to accept an offer, with high rates of participation seen as a defining measure of success (Bukvic & Owen, 2017; Kick et al., 2011; Robinson et al., 2018). Studies have also explored homeowners' satisfaction as they moved through the buyout process as a means to improve the acceptance rate of future programs (Binder & Greer, 2016; de Vries & Fraser, 2012). However, few studies have unpacked policy success across multiple dimensions. There is a need to identify these components of effectiveness to advance policy development for managed retreat through property buyout programs.

4.5 Policy Evaluation

Evaluation is an integral component of the policy-making cycle, driven by the need to optimize a policy's ability to achieve the maximum benefits equitably, with the least amount of resources (Nagel, 1986). The primary purpose of the policy evaluation process is to objectively analyze a policy's ability to meet its goals and optimize its effectiveness (Adam et al., 2018).

Early conceptualizations of policy evaluation aimed to classify policy according to the binary categories of either a success or a failure (Kerr, 1976). This thinking evolved to consider policy success on a spectrum with various outcomes, acknowledging that a policy can fail in some respects but succeed in others (McConnell, 2010). Consistent across even these early conceptualizations was the recognition that multiple criteria contribute to a policy's overall effectiveness. Kerr's (1976) approach identified three key areas where a policy could fail: failure to be implemented (implementation failure), failure to achieve its goal or purpose (instrumental failure), or failure to be considered socially or morally acceptable (normative justification). By Kerr's logic, an inability to achieve any of these three criteria would result in the policy being deemed a failure. Nagel's (1986) work on evaluation proposed a formula for policy optimization focused on effectiveness, efficiency,

and equity. Others have highlighted the need for flexibility, resilience, and robustness to deal with uncertainty in policy problems (Bali et al., 2019; Capano & Woo, 2017; Howlett et al., 2018; Olfert & Schanze, 2007), particularly problems that are expected to change over time like flood risk under climate change. Criteria to evaluate the public legitimacy of a policy have also been identified, including accountability, transparency, participation, access to information, procedural justice, acceptability and social equity (M. Alexander et al., 2016, 2018). Definitions of these criteria for the evaluation of policy effectiveness are provided in Table 5.

Table 5. Policy Evaluation Criteria

Criteria	Definition	Source
Effectiveness / Goal Attainment	The degree to which a policy achieves its stated goals or objectives.	(Nagel, 1986; OECD, 2002)
Efficiency	The policy's ability to achieve the intended outcome for the least amount of resources.	(M. Alexander et al., 2016; Nagel, 1986; OECD, 2002)
Robustness	The policy's ability to deliver the desired outcome, over time, in the face of changing conditions.	(Bali et al., 2019; Howlett et al., 2018)
Flexibility	The policy's ability to adapt to changing conditions or circumstances.	(Olfert & Schanze, 2007)
Legitimacy		(M. Alexander et al., 2016)
Accountability	The extent to which there are mechanisms in place to hold the policy actors and decision-makers to account.	
Transparency	The degree to which the rationale behind decisions was communicated clearly to stakeholders.	
Participation	The ability of stakeholders to have their views and opinions factored into the decision-making process.	

Criteria	Definition	Source
Access to Information	The ability of stakeholders to readily access information about the policy and procedure.	
Procedural Justice	The extent to which stakeholders could challenge decisions; the process for resolving disputes is perceived to be fair.	
Acceptability	The degree to which all stakeholders accepted the decision-making process.	
Equity	The extent to which costs and benefits are distributed equally among all who are affected by the policy.	(M. Alexander et al., 2016; Nagel, 1986)

Policy scholars have contributed to the establishment of a framework for evaluating policy effectiveness. Table 6 is a synthesis of the frameworks presented by Newman (2014) and 't Hart and Compton (2019). Both build upon previous frameworks by Bovens and 't Hart (1998) and Marsh and McConnell (2010), which include the programmatic, political, and process dimensions of policy effectiveness. Newman (2014) proposes distributional outcomes as a distinct indicator of success missing from previous frameworks, while 't Hart and Compton (2019) add the temporal dimension of effectiveness to examine a policy's performance over time. Then, the criteria from Table 5 were assigned to the framework as appropriate to guide the operationalization of the tool.

Table 6. Theoretical Policy Evaluation Framework

Dimension of Effectiveness	Criteria
1. Programmatic: the extent to which the policy achieves its stated goals or objectives.	
	Goal attainment Efficiency
2. Political: the extent of the political support for a particular policy.	
	Political viability

Dimension of Effectiveness	Criteria
3. Temporal: the ability of a policy to continue to meet its objectives in the face of changing conditions.	
	Robustness Flexibility
4. Process: the degree to which the policy is considered socially acceptable and morally just.	
	Accountability Transparency Participation Access to information Procedural justice Acceptability
5. Distributional Outcomes: the extent to which the costs and benefits are spread equally among those affected.	
	Social equity

This thesis explores effective policy design for property buyout programs. Chapter 6 outlines how subject matter experts, government officials, and practitioners currently approach policy evaluation and what criteria they use to measure the effectiveness of these programs and relates these findings to the theoretical criteria outlined above in Table 6. A framework appropriate for evaluating property buyout programs is proposed, and relevant indicators to assess the various dimensions of effectiveness are then recommended.

Chapter 5
Methodology

5.1 Research Approach

The theoretical concept of policy success is well developed (’t Hart & Compton, 2019) and there is a relative consensus on the criteria that contribute to policy effectiveness, as outlined in Table 6. Yet, as illustrated through the literature review, our understanding of effectiveness in property buyout programs is still evolving. A qualitative study was conducted based on interviews with subject matter experts, government officials, and practitioners with experience in managed retreat to further our knowledge in this area. Deductive thematic analysis was employed to assess the suitability of the theoretical criteria presented in Table 6 for evaluating property buyout programs. This analysis was followed by an inductive approach using grounded theory to ensure that the theoretical framework captured all relevant aspects of success in managed retreat policy.

Thematic analysis is a qualitative method used to identify and interpret themes within a data set (Braun & Clarke, 2006; Clarke & Braun, 2017). The emergent nature of qualitative research provides the flexibility to adapt the content of the discussion with research participants in response to unique contextual factors that arise within and across cases (Cresswell & Cresswell, 2018). Interviews were used to explore various property buyout programs at different scales and locations. A semi-structured interview protocol allowed informants to provide important context on social, economic, political, and environmental factors that influenced buyout program design within each community and unique insight into the rationale for decisions that were made within specific cases.

5.2 Sample Selection and Ethics Approval

This research explored property buyout policy in a Canadian context. However, relatively few buyout programs have been employed in Canada. Therefore, I also sought to complement the data with input from relevant academic researchers from Canada and the

United States. To construct the sampling frame, I compiled a database of past Canadian property buyout programs through a review of media coverage and other publicly available documents and reports. Leading academic subject matter experts in the field of managed retreat were identified through the literature review.

A purposive sampling approach was used to recruit research participants. An invitation to participate in a research interview was sent to select subject matter experts and to relevant government officials and practitioners involved in Canadian buyouts as identified through the database. An attempt was made to obtain interviews with representatives from the various buyout programs that have taken place across Canada. Where the contact information for specific individuals involved in a buyout program was not publicly available, a request to participate in an interview was sent to the appropriate public office (e.g., mayor's office). A follow-up email was sent to potential participants a few weeks following the initial request if no response was received. At the end of each interview, a snowball sampling approach was employed by asking each informant to recommend other individuals who might have information relevant to the study. The sample recruitment process continued until no further responses were received from outstanding interview requests and until the snowball process ceased to identify new informants.

Per the Tri-Council Policy Statement for research involving humans, ethics approval was required for this collaborative research project. Ethics clearance for this research program was granted through the University of Waterloo Research Ethics Committee (ORE# 42199). A signed consent form authorizing the use of data for research purposes was obtained from each research participant before the commencement of each interview.

5.3 Data Collection

Data for this research was collected through semi-structured interviews with subject matter experts, government officials, and practitioners with experience in managed retreat. Two sets of interview questions were developed; one targeted the general expertise of subject matter experts, and the second targeted the program-specific experience of government

officials and practitioners. Questions were based on the design and implementation of property buyout programs and were categorized according to program context, program design, financial considerations, governance, public engagement, and the program's trajectory. The interview guide is provided in Appendix A. The semi-structured approach allowed us to probe unique challenges and experiences and adapt the guide to suit each interviewee's individual experiences.

Due to travel restrictions posed by the COVID-19 pandemic, all interviews were conducted either by telephone or using a virtual teleconference application such as Microsoft Teams or Skype. A total of 20 interviews were conducted as part of this research program; this included 17 individual interviews and three group interviews (i.e., two or more participants) for a total of 26 participants. Five of these interviews were conducted with academic subject matter experts, three located in the United States and two within Canada. The remaining 15 interviews were conducted with government officials and practitioners; most were located in Alberta and British Columbia, but with some representation from Manitoba, Quebec, and Nova Scotia. The audio from each interview was recorded, and the audio files were transcribed. Each transcription was reviewed to correct any typographical errors and to confirm its accuracy alongside the audio recording. The audio recordings and the written transcripts were saved to a secure server per the research ethics protocol.

Sample recruitment was designed to achieve data saturation and obtain broad representation by including representatives from buyout programs of different scales and across regional jurisdictions while working within the limitations outlined in Section 7.3. The data were triangulated across the various interviews where multiple interview subjects were contacted regarding the same buyout program. The data were also verified through triangulation with publicly available information (e.g., media coverage, government reports).

5.4 Data Analysis

In support of the thematic analysis, a codebook was developed based upon the five *a priori* categories for policy evaluation identified through the literature review: programmatic

criteria, political criteria, temporal criteria, process criteria, and distributional outcomes. The data analysis was conducted in general accordance with the six phases of thematic analysis outlined by Braun and Clarke (2006). Following familiarization with the interview data, each interview transcript was coded according to these five categories. All coding was conducted using the NVIVO 12 qualitative data analysis software. Then, the data within each code was analyzed to identify potential themes. Subsequent passes of the data helped to review and solidify the themes within each code and deliberate on their fit within the proposed evaluation framework for property buyout programs.

Given the emergent nature of this research into the evaluation of managed retreat policy, grounded theory methodology was also employed to identify any potential gaps in the codebook. Grounded theory uses constant comparative analysis to compare the information within and between the *a priori* categories (Charmaz, 2011; Chun Tie et al., 2019; Corbin & Strauss, 1990). Using an inductive open coding process, I conducted an initial pass of the entire data set to identify any themes not captured by the codebook. A round of axial coding then followed to draw connections between the *a priori* categories. This process ensured that all critical aspects of property buyout programs were adequately reflected within the codebook and that nothing was missing from the proposed evaluation framework.

Chapter 6
Results

6.1 Current Approach to Policy Evaluation

To answer the first component of my research question, I sought to explore how Canadian government officials and practitioners currently apply evaluation as part of the policy development process for managed retreat. During the interviews, I prompted research participants to outline their approach to evaluation, specifically, whether it had been performed and, if so, to what extent. This question revealed much variability in how government officials and practitioners conceptualize and approach the evaluation of property buyout programs. While most interviewees recognized the value of evaluating their buyout policy, none had a formal framework for how they would determine success. Some lacked the time or resources to perform a comprehensive evaluation, while others had no plans to evaluate their program.

Of those who indicated that they had or intended to evaluate their buyout program, few seemed to have established specific or comprehensive criteria against which to assess success. One municipal official emphasized that they were constantly evaluating their buyout program, which was underway at the time of the interview. But when prompted for added detail, they spoke more to the overall flood recovery operation than to the buyout program specifically. Their review process did not appear to be based upon a specific framework, with their evaluation more closely resembling a conversational debrief:

> We did the wrap-ups with the…emergency operations people from the regional district. We've done wrap-ups ourselves internally. And so, we're constantly at this point looking at what we did and whether or not that could be done better and giving that feedback to the province on several occasions. Now we've had the province come in and ask us to formally sit down and look at what went well and what went poorly. (Interview 007)

Some research participants considered the audits required by the various funding agencies to represent the primary component of their evaluation program. For example, as one government official described, they must submit an audit to accompany each source of funding they received, including various grants from Alberta Environment and financial support through a federal DMAF agreement (Interview 0022).

In many instances, the evaluation criteria were determined retrospectively, while the buyout program was complete or well underway. When one government official was asked whether their intended evaluation would include criteria beyond a financial audit of the program, they predicted, “Oh, *I think it would be* a comprehensive report on not just financial matters, but what was accomplished, what we were able to do, what we weren't able to do” (Interview 0022, emphasis added). Another government official said that their evaluation would include a technical assessment using modelling to determine how well their entire flood mitigation program, which included buyouts and structural defence measures, worked together to increase the conveyance capacity of the river (Interview 1026_004). This same official will also prepare a close-out report to address the qualitative aspects of the flood mitigation program but had yet to decide on what content to include in the report. One municipal official recognized the value of conducting a comprehensive evaluation of their buyout program and expressed a desire to complete one, but cited capacity as a barrier to moving forward: “But we haven't, I think, done a holistic evaluation, and I'm not sure that we'll have the capacity for doing it. So, I'd say that's definitely a big gap” (Interview 0012).

The organizers of one buyout program, ongoing at the time of the interview, suggested that the ability to acquire all of the intended properties and remove them from harm’s way would be considered a big success, with one of them adding lightly, “If we don’t get sued, I think we’ll be good” (Interview 0015). This particular program did not have any plans to conduct a formal evaluation. Another practitioner, directly and peripherally involved in past buyout programs in Manitoba, was unaware of their provincial government having done any post-buyout evaluation. They felt that sufficient analysis is typically conducted on

the front-end when deciding whether to proceed with a buyout, discounting the value of conducting a post-program assessment:

> Because there's so much investigation prior to the buyouts, that usually, there's enough information gained in that kind of pre-project investigation in terms of what the benefit-cost is, what are the social benefits, or negative impacts if we don't do this project, what are the environmental impacts, positive and negative. I think a lot of that is done ahead of time, and once that decision is made and people are bought out, boom, you're done. (Interview 0018)

These findings indicate that evaluation is currently an undervalued component of the policy development process for buyout programs in Canada. At best, it comes together as an afterthought, but in reality it is often neglected. At the municipal level, property buyouts are still conceptualized as a one-off event. This perception downplays the importance of evaluation as a means to improve future buyout programs and hinders the pace of policy learning.

6.2 Effectiveness in Property Buyout Programs

This section explores the theoretical criteria for policy evaluation outlined in Section 4.5 in the context of property buyout programs. I connect these dimensions of policy effectiveness with the actual experiences of research participants in conceptualizing, designing, and delivering property buyout programs. To address the second component of my research question, I assess the suitability of each of the theoretical criteria and determine which are appropriate for evaluating the effectiveness of property buyout programs based on the results of this research. The theoretical criteria, examined in turn below, include: (a) programmatic criteria, (b) political criteria, (c) temporal criteria, (d) process criteria, and (e) distributional outcomes.

6.2.1 Programmatic Criteria

Programmatic criteria are those that evaluate whether a policy achieves its stated goals or objectives. To separate the economic considerations surrounding buyout programs

from other aspects of program design, I have included goal attainment and efficiency as sub-categories of programmatic criteria.

Goal Attainment

Among present-day policy scholars, effectiveness—the extent to which a policy achieves its intended goals—is considered the fundamental, overarching goal of policy design (Bali et al., 2019). As such, an assessment of a policy's ability to meet its stated goals should form an essential component of policy evaluation. The data set supported this principle.

As described in Section 6.1, there was much variability in the approach to evaluation across Canadian buyout programs, and this extended to the types of goals that were set. All buyout programs had an objective; however, the specificity and the scope of those objectives varied considerably. For one community, their policy objective related to their broader flood risk management strategy, to become a more resilient community by reducing their risk from natural hazards (Interview 0017). Yet this community had not set any goals specific to their intended property buyout program. Another community took a more direct approach to goal setting, aiming to achieve a rate of 100% voluntary participation and avoid the need for any expropriation of hold-out properties within the designated buyout zone (Interview 0020).

Across the data set, there were notable differences in the focus of the programs' goals, with some targeting benefits at the household level and others at the community level. In an example focused at the household level, municipal officials framed the rationale for their program around the safety of individual homeowners within high-risk flood zones (i.e., getting people out of harm's way) (Interview 0015). A buyout program in the Town of Drumheller, Alberta, focused on maintaining the economic well-being of individual homeowners. The stated goal of their Resiliency and Flood Mitigation Program was to "ensure risk is reduced to levels which allow financial and insurance products to remain available" (Town of Drumheller, 2021). Drumheller's buyout program aimed to acquire properties at a high risk of flooding that may struggle to qualify for these products. In one

instance of goal-setting at the community level, the decision to restore a residential neighbourhood to a floodplain was made to protect the downtown core, thought to be in the best interest of the city's long-term economic future (Interview 007).

As expressed by academic subject matter experts, the theoretical objectives of a buyout program often differ from the actual program objectives outlined by government officials and practitioners. Academic experts often framed the benefits of a buyout program around improving the situation of vulnerable individuals. They spoke of a successful program in terms of homeowner outcomes: their safety and well-being, a decrease in vulnerability to flooding and other socio-economic risks, and the ability to maintain or improve one's quality of life following a buyout. While government officials and practitioners did not oppose these homeowner outcomes, the individual situation of buyout participants did not feature as prominently in the descriptions of their programs. More often, government officials and practitioners reflected upon the success of buyout programs relative to program-specific metrics, indicators such as having a high percentage of participation in a voluntary program, a timely process to complete the acquisitions, and avoiding lawsuits.

Despite observed differences in the types of goals across the various buyout programs, these findings support goal attainment as a key component of effectiveness in property buyout programs.

Efficiency

This section considers efficiency in terms of the economic spending associated with a property buyout program. Property buyout programs are considered a more cost-effective option than repeatedly paying for homeowners to rebuild in high-risk flood zones, as has happened in many instances in the United States (Interview 200827_004). For this reason, several Canadian buyout programs, such as Alberta's FRP in 2013, have included restrictions on a homeowner's ability to receive future financial disaster assistance should they decline a voluntary buyout offer (CBC News, 2013b). Such conditions can enhance the cost efficiency

of the overall flood risk management effort. But within buyout programs, indeed, there are areas where spending inefficiencies can occur.

Two primary economic efficiency challenges were identified within the data set, both related to voluntary buyout scenarios that attained less than 100% homeowner participation. First, there was inefficiency associated with maintaining municipal services in an area where a partial buyout has occurred. As highlighted by one municipal official, the city must bear the cost of providing the same quality of infrastructure and services to the area, but with a reduced tax base to fund those services (Interview 0023). The second, related to ensuring the safety of the remaining residents, is the cost of installing additional structural protection (e.g., berms, dikes, dams) for the homeowners who choose to remain in the neighbourhood. A similar dilemma applies to communities with a widespread risk of flooding where it is not feasible to acquire all properties with high flood risk. In describing why their city chose not to pursue property buyouts, one municipal official explained that even buying out a small area would be a redundant use of public funds since they'd still need to pay for structural mitigation measures to protect the wider community (Interview 0014). These findings support cost efficiency as an important dimension of effectiveness to be considered in evaluating property buyout programs, where inefficiencies can have a negative impact on the feasibility of buyouts.

Cost-benefit analysis typically occurs during the policy formulation stage when deciding whether or not to proceed with buyouts as part of the flood mitigation strategy. Despite this ex-ante analysis, the complexity of buyout programs can lead to unexpected or unintended costs or benefits not captured by the initial assessment. As emphasized by one research participant:

> If I was just giving advice directly to a government considering doing buyouts, I think my first piece of advice would be take everything you think you know about buyouts and assume they may be like an order of magnitude more complex than we think they are. (Interview 0013)

The retrospective evaluation of program efficiency helps identify any aspects of the cost-benefit analysis that were inaccurate or misaligned with buyouts in practice and ensure that these findings are reflected in future programs. It is also important to note that a successful program is not limited to those whose benefits exceed the costs. Governments will sometimes decide to proceed with buyouts in the interest of safety even if the cost exceeds benefits so that all residents receive the same level of protection (Interview 0018). In these instances, an evaluation of efficiency is still relevant as it ensures the benefits have been maximized.

6.2.2 Political Criteria

Political Viability

Political viability considers the degree of public support for a particular policy. Many research participants spoke to political viability as a prerequisite for a property buyout program to proceed. They indicated that political will to pursue buyouts is proportional to the degree of public support, as aptly stated by one subject matter expert, “In order to convince the local politicians, you have to convince the public. And to convince the public, you have to get the local officials onboard. So, it’s a bit of a chicken and egg problem” (Interview 200827_004). One former government official emphasized the need for local council support, even when a higher level of government administers the buyout, because of the local council’s rapport and familiarity with the citizens to be bought out (Interview 0018).

Political viability is closely tied to public engagement, involving the local community in the planning process to enhance the legitimacy and social acceptability of buyouts. In one municipality, despite an engineering analysis recommending buyouts in select areas and early engagement efforts showing sufficient public support, the local council remained reluctant to move forward (Interview 0017). This reluctance prompted the council to request additional engagement with homeowners, further delaying the timeline for recovery in the months following the flood event.

The findings of this research support political viability as a critical component of effectiveness in property buyout programs. While political viability did not come up in the

context of evaluation, many interviewees presented it as an essential pre-condition for the initiation of a buyout program. They implied that a buyout program is unlikely to happen without sufficient local political support.

6.2.3 Temporal Criteria

Temporal criteria are those that assess a policy's ability to meet its objectives under changing circumstances. Robustness characterizes a policy's continued ability to address the problem under both the current range of known conditions (e.g., different magnitudes of flood events) and the lesser-known range of future conditions (e.g., changes to a flood risk profile under climate change). Flexibility reflects a policy's adaptability, both within and across programs, as discussed in greater detail below.

Robustness

In the context of property buyouts, robustness is primarily related to the completeness of the acquisition, that is, achieving near 100% of properties acquired within the buyout area. Incomplete buyouts can occur due to low homeowner participation, in the case of a voluntary program, or due to the eligibility criteria for the buyout. For example, following repeated severe flood events in Quebec in 2017 and 2019, the province introduced a buyout option for homes that reached a damage threshold of 50% of the home's value or $100,000 (Adriano, 2019). Quebec's policy resulted in some development remaining within the flooded areas, where a home did not reach the damage threshold to be eligible for a buyout. Incomplete buyouts represent a non-robust policy, where the buyout of only a few homes within a given area would do little to prevent damages in the event of a flood. Complete buyouts, on the other hand, effectively reduce the risk of flooding under any future flood event of a certain magnitude to zero, reflecting a robust policy.

A buyout program's ability to sustain its serviceability over a range of conditions is contingent on the community having an up-to-date understanding of their flood risk profile, including projections for how climate change will alter that risk. One subject matter expert emphasized that since structural flood control measures can fail, best management practices

support mapping the flood hazard as if there were no structural defences in place and making decisions based upon this model to enhance robustness (Interview 0010). Yet, in several instances, government officials indicated that they were performing or updating their flood risk modelling and mapping concurrent with executing the buyout program (Interview 0012; Interview 1026_004). As a result, these implementing agencies sometimes had to develop their buyouts based on outdated information, leading to inefficiencies. In High River, Alberta, the province included the neighbourhood of Beachwood Estates in their FRP, even though improvements to the area made these properties better protected than what the mapping reflected (Interview 1026_004). Conversely, the FRP initially excluded the neighbourhood of Wallaceville since it was outside of the mapped floodway zone, according to mapping from the 1990s, despite the area being heavily damaged in the 2013 flood (Franklin, 2013).

The use of the acquired land can also enhance the robustness of a buyout program, where land restored as a wetland, for instance, could provide greater flood mitigation than land left landscaped or asphalt-paved. One subject matter expert outlined how the plan for the acquired land often comes as an afterthought and stressed how integrated land use planning could increase the value of buyouts:

> We have to maximize the potential…in terms of risk reduction. So, I always advocate for putting in high utility open space land uses. I think if you can do some type of nature-based ecological restoration, I think those are great uses, because not only have you relocated people out of a high-risk area, you now have converted the land into maybe a wetland or a mangrove or oyster bank or whatever the use might be. And there's further mitigation for other types of concerns, whether it be water quality, other flood retention areas. (Interview 0019)

Based on these findings, robustness is a relevant component of effectiveness in property buyout programs that can have a broader impact on goal attainment and spending efficiency as well.

Flexibility

Research participants primarily referenced flexibility as an intra-program concept, or the ability to accommodate homeowners' needs within a given program. Flexibility came up in two ways, first, regarding whether the program's parameters were broad enough to suit the circumstances of eligible homeowners and, second, in the program's ability to adapt to unique needs that arise during the process.

Varying flexibility was observed in the models used to determine homeowner compensation. More rigid models did not allow for any negotiation (i.e., everyone gets the same deal). For example, the Government of Quebec's capped compensation model, offering up to $250,000 for the cost of a residence and the associated land, was inflexible and could not accommodate homeowners with properties worth much more than the given amount. Other models were more flexible, allowing for negotiation to better address the circumstances of each homeowner. One Canadian program addressed this issue proactively through one-on-one intake meetings with potential buyout participants. The homeowner circumstances gleaned through these meetings were then used to develop the compensation formula and inform the program design (Interview 0020). Other ways that buyout programs demonstrated flexibility included extending deadlines to give homeowners more time to contemplate a buyout (Interview 1026_004) or offering a deferred closing where there were no safety concerns with the continued short-term occupancy of the homes (Interview 007).

Flexibility also came up in the context of capacity, providing homeowners with the necessary resources to ensure their ability to navigate the program. Most government officials and practitioners acknowledged the potential need to bring in social support for homeowners and were willing to incorporate that additional support if warranted. One program identified such needs early in the buyout process while conducting intake meetings with eligible homeowners:

> We could weave in counsellors to assist them if we felt there were capacity issues. If we felt they had legal issues in regards to understanding contracts and the nature of the transaction, we would find them independent legal representation to represent

> their interests. And so, you know, whatever the weakness is, you can identify it and then try and bring tools to it to try and improve that person's position within the program, their understanding of it and their – because once the program's design is approved, the goal is to try and get everybody through the program at the highest performance level possible. (Interview 0020)

Inter-program flexibility, the ability of one buyout program to act as a model for future buyout programs either within the same community or elsewhere, did not appear to be a significant consideration for research participants. In speaking with local government officials, they primarily conceived their buyout programs as one-time, isolated events. None of the implementing agencies intended to run their programs over a longer time horizon or extend it to other geographic areas. Similarly, there was no indication that the provinces viewed the municipally-run programs as a model they intended to deploy more broadly. While provincial officials reportedly provided some input to local officials on the design of buyout programs, it was primarily tied to the funding arrangement. However, insight into the provinces' intentions surrounding managed retreat policy was restricted, as interviews were limited to local officials. This data set did not include any interviews with provincial or territorial officials.

6.2.4 Process Criteria

Legitimacy

Process criteria evaluate a policy's legitimacy, meaning the degree to which it is considered socially acceptable and morally just. As mentioned in Section 4.5, transparency, access to information, participation, accountability, procedural justice, and acceptability are all important dimensions of legitimacy (M. Alexander et al., 2016).

Transparency and access to information were the elements of legitimacy that came up most frequently in discussing how to enhance the social acceptability of buyout programs. Most research participants acknowledged the importance of providing homeowners with accurate, timely information. Beyond providing information, academic experts also

highlighted the need to provide the rationale behind the decisions to help build trust between parties:

> So at the very least, however it is done, it should be done in a really open clear manner, that anyone can understand why a decision is being made the way it is. Even if the answer is something like, "We only have money to buy up these many houses." People understand that if you're just open and honest with them, I think. At least better than they do seeing a magic box. (Interview 200827_004)

Concerning participation, academic experts stressed the need to involve the community early on in the process. Regarding the factors to be considered when deciding whether to proceed with a buyout, one subject matter expert remarked:

> I think one of those factors at the top of that list needs to be where is the community in their thinking, what is the preference of the community…and just making sure that those conversations are happening early and often because even if I'm the administrator in charge of buyouts in my community I can look at all the data I want, right. I can look at all of the projections, I can look at climate change data, I can look at flood data, and I can say gosh this neighbourhood is doomed, right. And we need to do a buyout, and that's the only viable long-term solution. But if I do that without engaging in the community first, right, then I'm kind of setting myself up to fail. (Interview 0013)

In Canada, however, buyouts have primarily been deployed reactively in the aftermath of a flood. The need to come to decisions quickly, compounded by the stress and trauma that many people are under, presents a challenge for productive public engagement during this time. As was seen in High River, Alberta, in the aftermath of the 2013 flood, it can be challenging for the public to gather when there has been significant damage to community buildings and citizens have been displaced to outlying areas (Bogdan et al., 2018). Across the data set, the public engagement process for past Canadian flood risk management strategies has varied widely, from disseminating information through webpages and mailers to town halls to more prolonged engagement campaigns with focus groups and public surveys.

Accountability becomes particularly critical in buyouts funded and delivered jointly across different levels of government. One practitioner highlighted the consequences when program parameters are not clearly defined and supported by a communication strategy:

> There's nothing worse than having to backpedal. You know, somebody who has been impacted significantly by a flood doesn't – if you tell them they're going to get pre-flood value and that's what you applied for, they're going to hook their hooks into that statement. So, when you are told by senior government nine months later that they're only going to fund you on a post-flood model, they're going to go through a second trauma. (Interview 0020)

Procedural justice in buyout programs most commonly came up in the context of challenging financial compensation. Canadian buyout programs typically allowed little to no room for homeowners to negotiate their payout. Some programs with remuneration based on fair market value permitted homeowners to obtain an independent real estate assessment for consideration. However, in one instance, the municipality was only allowed to offer the lowest appraisal, "So, it was actually in everyone's best interest to just take the first one…because it couldn't get better, it could only get worse" (Interview 0015). Procedural justice can also apply to program eligibility. The town of High River, Alberta, successfully challenged the province's initial decision to exclude the heavily damaged neighbourhood of Wallaceville from their province-wide FRP (Franklin, 2013). While the data set does not include any instances of individual homeowners fighting to have their property added or removed from a buyout program, this could be another relevant application of procedural justice pertaining to managed retreat.

Research participants conceptualized social acceptability as more of a cumulative product of all dimensions of effectiveness. Acceptability can encompass the elements of legitimacy outlined above and also the other proposed criteria, including goal attainment, efficiency, flexibility, and equity.

The dimensions of legitimacy noted above are all relevant to the effectiveness of buyout programs, but the way they are assessed may differ depending on the nature and

timeframe of the buyout program. For instance, the extent to which homeowners can participate in the development of the program depends on its timeline. As mentioned, Alberta's FRP launched in the aftermath of the 2013 floods faced numerous challenges in enabling sufficient opportunities for public participation. In the interest of establishing the program quickly, the ability to participate in program development was limited. By contrast, the City of Surrey recently conducted a multi-year consultation process to inform the development of their coastal flood adaptation strategy, which weighed managed retreat as one option. In developing their approach, the city led an extensive engagement effort that included surveys, community conversations, technical workshops, and site tours (City of Surrey, 2021). These examples illustrate that while the objectives of legitimacy might be the same, what can be achieved might differ depending on the unique circumstances of each program.

6.2.5 Distributional Outcomes

Equity

Distributional outcomes assess how the costs and benefits of a policy are spread among all affected. Equity, specifically, considers the fairness of this distribution. Examining these outcomes ensures that we define success in terms of "success for whom" (Newman, 2014) and confirms that no one is made worse off due to a buyout. Considerations regarding equity featured prominently in discussions with academic subject matter experts. One expert highlighted how historical redlining and discrimination have influenced housing patterns in the United States. By selecting communities for buyouts based solely on natural hazard risk, we can perpetuate this historical discrimination. This concern extended to wealth inequality:

> In fact, in general, our entire disaster recovery process has been shown to increase wealth inequality in the U.S. So, buyouts, but any other type of post-disaster response as well. And one of the reasons that this is suggested is that we are replacing what people had before the disaster. So inherently, we're giving people who have less, less and people who have more, we're giving them more, and so this perpetuates that inequality. (Interview 200827_004)

One recommendation to address this inequality, reportedly used in some instances in the United States but not in buyouts, is to compensate based upon the amount for a comparable home in a safer location rather than offering pre-disaster, fair market value. Many of these at-risk communities are located in the most affordable areas and simply providing fair market value is not always enough for these homeowners to relocate to a safer location. My conversations with Canadian government officials, on the other hand, focused mainly on the idea of equity and fairness as everyone gets the same deal, regardless of the circumstances. In one instance, the provincial government funding a buyout at the municipal level stipulated that they would only provide compensation based upon the tax assessed value given the precedent set by a previous, provincially-funded buyout program (Interview 0015). This compensation model was adhered to even though this former program was considered widely unpopular with low uptake as a result (Interview 0020).

A buyout program can continue to impact homeowners' lives long after the real estate transaction has closed. To accurately capture these effects, there is a need to follow up with homeowners. One academic expert spoke to some of these questions for assessing the sustained welfare of buyout participants:

> So, people commonly wrap this up, I think, as just well-being. Like, the well-being of the residents who leave. So, where did they go? Did they find a new house? Is it safer? Is it in a good community? What's their overall happiness level with the move? Things like that. (Interview 200827_004)

Despite the importance of these questions in evaluating equity in the outcomes of buyout policy, subject matter experts were not aware of any instances in the United States where government agencies had tracked the quality of life for buyout participants once they had relocated. Continued engagement with homeowners after a buyout can present logistical and ethical challenges. One government agency suggested that homeowners were not generally receptive to follow-up efforts, remarking, "They don't want to be part of an ongoing program. They just want to be done" (Interview 200827_004). Similarly, Canadian government officials did not follow up with homeowners to see how they were doing

following a buyout program. There was a similar reluctance to following-up with homeowners, “Yeah, I guess it's just how pervasive we are into their lives, you know. Moving them around and tracking them, what do we really find out as a result of that?” (Interview 0022). This issue of identifying an acceptable way to track participant outcomes to ensure that no homeowners’ quality of life is adversely affected by buyouts warrants further consideration.

The evaluation of equity as a dimension of effectiveness is critical to ensuring that a buyout program does not perpetuate issues of social inequality or force someone into a situation of greater vulnerability.

6.3 Summary of the Results

Within policy theory, evaluation is a critical component of the policy-making cycle (Wu et al., 2018). Yet, the findings of this research suggest that government officials and practitioners currently undervalue the role of evaluation in the development of managed retreat policy. There was consistent advocacy among academic subject matter experts for the critical role that evaluation must play in delivering effective managed retreat programs. One expert likened the significance of participating in a relocation program to that of receiving a major medical intervention, with the need for an evaluation process that adequately reflects the gravity of the procedure (Interview 0013). Current evaluation strategies for property buyout programs lacked this complexity, with no consensus among government officials or practitioners on how to conduct evaluation or what criteria to include.

Regarding the theoretical criteria for policy evaluation outlined in the literature, the findings of this research support these criteria as significant components of effectiveness in managed retreat policy. Some dimensions of effectiveness, such as programmatic and temporal criteria, were endorsed equally by both subject matter experts and government officials and practitioners. In contrast, process criteria and distributional outcomes were more prominent in discussions with subject matter experts in the academic realm. The following chapter discusses the relative importance of the various criteria as represented in the

interviews and establishes recommendations for incorporating these criteria into a framework for the evaluation of property buyout programs.

Chapter 7
Discussion and Recommendations

7.1 Significance of the Evaluation Criteria

This research revealed that the theoretical dimensions of policy effectiveness are relevant to managed retreat policy and that research participants broadly recognized the importance of these criteria. Yet, when it came time to evaluate a property buyout program in practice, many interviewees were vague in their approach and lacked specific metrics to assess the various criteria. These findings support the need for a framework to guide practitioners by providing a formal structure for evaluating their property buyout programs based upon these criteria.

In considering the various evaluation criteria, however, it was observed that research participants prioritized some more than others. Programmatic criteria, specifically goal attainment and efficiency, were similarly emphasized by academic subject matter experts, government officials, and practitioners as the overarching indicator of success. Every policy is motivated by an objective, yet it is difficult to imagine any policy being deemed a success if it ultimately failed to meet that objective, regardless of the amount of support the policy had received from the public. Similarly, even if it meets its goal, a policy will not be considered successful if the public perceives it as a complete waste of money.

Despite the significance of programmatic criteria in determining effectiveness, an evaluation based solely on programmatic criteria is unlikely to provide sufficient insight into the reasons why a policy may have failed to meet its goal. Academic subject matter experts emphasized the importance of process criteria and distributional outcomes in understanding the human component of buyout programs and the social factors that either build or hinder public support. They stressed the need for a more holistic approach to evaluation that looks beyond traditional government-focused metrics like percent participation or fiscal efficiency and considers the program's impact on buyout participants:

> I think you can look on the surface of a lot of buyouts that have been implemented in the U.S. and say, "Hey, those programs were a success because they relocated 80% of households in a designated area out of the floodplain, and those houses will never flood again," right. *And if that's the end of the story, then that's a good story*…Like in theory…they kind of start from the pre-storm point of their lives, right, and they're able to move on. But like in reality they're starting off several steps back…in a way that they may or may not ever actually recover from. (Interview 0013, emphasis added)

This joint support for both programmatic and process criteria aligns with the definition of success provided by McConnell, "A policy is successful if it achieves the goals that proponents set out to achieve and attracts no criticism of any significance and/or support is virtually universal" (2010, p. 351). McConnell's assertion that to accurately assess a policy's effectiveness, the determination of success must consider both its objective (i.e., programmatic criteria) and subjective (e.g., process criteria, distributional outcomes) dimensions supports the prioritization of these elements in the proposed evaluation framework.

While political viability was found to be significant to managed retreat policy, it was emphasized by interviewees as a prerequisite for a buyout program. It is less useful as a criterion for the retrospective evaluation of a buyout since it is assumed that any program that moved forward was deemed politically viable. Therefore, political criteria were not considered particularly significant to include in the proposed evaluation framework. Any indicators used to reflect the public opinion challenges a government faced in delivering a buyout program would be sufficiently captured as a component of legitimacy under process criteria.

7.2 Evaluation Framework for Property Buyout Programs

An evaluation framework was developed based upon the findings to provide practitioners with a structured process to assess property buyout programs. Within the framework, potential indicators are proposed for each criterion. These indicators are recommendations of what information might be pertinent to each category; the actual indicators used to evaluate a buyout should be program-specific and adapted to suit the

objectives of each program. Relevant excerpts from the evaluation framework are provided as tables in the following sections. The complete evaluation framework is provided in Appendix B.

7.2.1 Programmatic Criteria

The research findings solidify the programmatic criteria of goal attainment and efficiency as key components of effectiveness in managed retreat policy. In the interest of evaluating goal attainment, specific and measurable goals relevant to the property buyout program are warranted. One prominent issue identified through the interviews was that many of the program goals were too broad or vague to be assessed objectively. Therefore, in addition to evaluating whether the program goals were met, the framework should also prompt the user to reflect upon the quality of their goals.

Regarding efficiency, indicators to assess this objective should explore whether the cost-benefit analysis conducted at the outset accurately reflected once the program was implemented, and whether the benefits were maximized within the given budget. Identifying and taking steps to minimize potential inefficiencies is also essential. Cost efficiency strongly influences the political support for property buyouts as publicly-funded programs. An evaluation of public spending efficiency can enhance government accountability on costly projects such as buyouts. Evaluation provides a means to ensure that the program has planned for and taken steps to limit known inefficiencies associated with buyout programs and helps to build public support.

Proposed indicators for assessing goal attainment and efficiency are provided in Table 7.

Table 7. Evaluation Framework – Programmatic Criteria

Criteria	Indicators
Goal Attainment	Was the goal/objective of the property buyout program clearly defined at the start of the program (e.g., specific and measurable)? Was the goal/objective of the property buyout program achieved? *Potential measures:* For voluntary programs, what percentage of eligible property owners accepted the buyout? Following the buyout, what percentage of the community is eligible for insurance/mortgage products? Did the program reduce flood risk through a quantifiable reduction in exposed assets? What percentage of the target area was restored to natural space? Did eligible participants experience a decrease in vulnerability with relocation?
Efficiency	Did the program maximize risk reduction within the available budget? Was the cost of buyouts less than the expected cost of damages from a repeat flood of the same magnitude? For voluntary programs, was the cost of maintaining services to homeowners who remain accurately captured in the cost-benefit analysis? For voluntary programs, did the buyout program necessitate any duplication of economic spending to protect the homeowners who remained? Were relocated homeowners preserved within the tax base? Were there any unexpected or unintended costs associated with implementing the buyout program? Were there any unexpected or unintended benefits encountered during or following the buyout program?

7.2.2 Temporal Criteria

Temporal criteria were closely linked to programmatic criteria, where the robustness and flexibility of a buyout program can enhance goal attainment and cost efficiency. Indicators to assess robustness should consider whether the eligibility criteria for the buyout program aligned with the intended level of risk protection. They should also consider whether the data (e.g., hazard maps, flood modelling) used to inform the eligibility decision was up-to-date and indicative of current and projected future flood conditions. Lastly, but no less critical, is to ensure that the use of the acquired land enhances the risk reduction benefits of the buyout program. The plan for the newly vacant land should be made at the program outset and informed by the broader community. For high flood risk areas, a restored wetland may be necessary to create greater water storage capacity. In other instances, landscaped spaces for sports and recreation may provide some added flood mitigation while also addressing different needs within the community.

An assessment of whether a buyout program was sufficiently flexible might explore whether any participants declined an offer because it did not address their specific needs. For instance, if a homeowner refused a buyout because the compensation model could not account for the added cost of relocating a home-based business. A program's ability to address any areas of weak capacity could be examined by asking whether the implementing agency had a process to identify unique participant needs and sufficient budget to procure the necessary supports should the need arise.

Sample indicators to assess robustness and flexibility are provided in Table 8.

Table 8. Evaluation Framework – Temporal Criteria

Criteria	Indicators
Robustness	Does the buyout's area of eligibility align with the desired level of acceptable risk? Was up-to-date flood hazard mapping and/or modelling used to inform the eligibility for the buyout program? Was the size or configuration of the acquired land sufficient to reduce flood risk within the area of interest? Was the use of the acquired land informed through public consultation? *Potential measures:* Does the converted land use maximize the flood mitigation potential of the acquired land? Does the converted land support and maintain the property value of nearby properties? Does the converted land address a community need for parkland or recreational space?
Flexibility	Did any participants decline a buyout offer because it could not accommodate their needs (e.g., insufficient compensation, rigid timeline, lack of support for interim housing options)? Was the buyout conducted in a way that enabled the identification of unique participant needs and supports (e.g., social workers, legal representation, banking support)? Did the program have a contingency budget available to bring on additional support as needed?

7.2.3 Political Criteria

As described in Section 7.1, as a pre-condition for the initiation of a buyout program, political viability has limited usefulness as a criterion for the ex-post evaluation of buyout programs and, therefore, was not included as a part of the evaluation framework. However, there may still be some desire for implementing agencies to reflect upon the public opinion

challenges they faced in delivering buyout programs. These challenges could be sufficiently explored under process criteria such as transparency, accountability, and social acceptability.

7.2.4 Process Criteria

The analysis confirmed the significance of legitimacy as a critical dimension of effectiveness in managed retreat policy. Indicators to assess legitimacy should explore considerations such as the quality and ease of access to information about the program, homeowners' experiences informing or contributing to program development, and the government's adherence to their perceived responsibilities in delivering the program. Proposed indicators for assessing the dimensions of legitimacy are provided in Table 9.

Table 9. Evaluation Framework – Process Criteria

Criteria	Indicators
Transparency	Were the criteria for decision-making communicated to homeowners and made available to the public? Were the criteria for eligibility specific and logical?
Access to Information	Were property owners able to request information and receive a timely response? Was information available to property owners through a portal or online forum?
Participation	Were property owners or trusted local representatives consulted on the program design? Were property owners able to provide input on the program design?
Accountability	Were all perceived responsible parties involved in the solution (i.e., involvement of higher levels of government, if warranted)? Were the program responsibilities clearly and accurately delineated across all levels of government and organizations involved in administering the buyout program? Did the program design and implementation align with the promises made by government officials?

Criteria	Indicators
Accountability (cont'd)	Did the government take ownership of any contentious or difficult decisions that were made?
Procedural Justice	Did property owners perceive the process to be fair? Was there a process for homeowners to challenge or appeal decisions made by the implementing agency (e.g., appraisal value)?
Acceptability	Was sufficient time allotted for public review, comment, and discussion? Was the buyout timeline expedient yet flexible enough to provide homeowners with enough notice on the closing date?

7.2.5 Distributional Outcomes

The findings confirmed the importance of equity as a dimension of effectiveness in managed retreat policy. Indicators to assess equity might consider whether the supply of buyouts met demand, whether compensation was sufficient and minimized the burden on homeowners without compromising their welfare, and whether homeowners had access to adequate resources to navigate the program. These suggested indicators are included in Table 10.

Table 10. Evaluation Framework – Distributional Outcomes

Criteria	Indicators
Equity	Did everyone who wanted or needed a buyout offer receive one? Was the compensation high enough to purchase a comparable property with lower vulnerability (i.e., flood risk and social vulnerability)? Did the buyouts create any unexpected costs for some but not all property owners? Were homeowners able to maintain their economic and social supports (e.g., keep the same employment, keep children in the same school or daycare, etc.)? Were sufficient resources available to help homeowners navigate the process (e.g., case workers, aid in finding suitable housing)?

The ability to evaluate many of these homeowner outcomes, however, will depend on the relationship fostered with participants and their willingness to participate in an ongoing monitoring program. At a minimum, an exit survey provides some preliminary information on participant circumstances at the time of closing. A delayed feedback process that checks in with participants in the months following the acquisition, if feasible, may provide a more accurate picture of how the program has impacted their lives.

7.3 Research Limitations

A major challenge of this research is expressed by Newman (2014), "Establishing a single framework that cuts across lines of subjectivity, so that policy success could be recognized by observers approaching the topic from different perspectives, might be a difficult task to accomplish." Setting appropriate indicators is inherently subjective, and different stakeholders may have other priorities that they want to see captured through a property buyout program. At the very least, among subject matter experts, the proposed framework can facilitate discussion of how we measure the effectiveness of property buyout programs as a flood risk management tool. For practitioners, the formal evaluation framework can help the implementing agency set priorities and work through the program design in a structured way. As noted in Section 7.1, a policy's success depends on both objective and subjective components and a formal evaluation framework can ensure these dimensions of success are appraised transparently to all stakeholders.

This research relied on interviews with academic subject matter experts, government officials, and practitioners to inform the development of the evaluation framework. It did not seek input from homeowners who participated in or were eligible for a buyout program, nor did it seek participation from the broader taxpayer community. Given that this is a developing area of research, the selected sample population was considered a starting point for the study of managed retreat in Canada. However, the public can provide critical insight into the factors that influence their support for property buyout programs, and their perspective is worth exploring in future studies. A second limitation is related to sample

recruitment. Potential participants were limited to those identified through purposive sampling and using a snowball sampling approach. The government officials who participated in the study were all from the municipal level; no provincial, territorial, or federal representatives participated in this research. The federal government's creation of the Task Force on Flood Insurance and Relocation signals the priority of managed retreat on a national scale. In adopting this evaluation framework, feedback should be sought from provincial, territorial, and federal representatives as appropriate.

On a broader scale, it is important to note that this research on property buyout programs is based upon a land tenure system where land is held in private ownership and the homeowner's decisions regarding a buyout are made on a household level. Furthermore, while this research is considered applicable to rural and urban areas, it does not address the added complexities of relocation programs for remote communities. Marino (2018) explores the fundamental ideologies underpinning managed retreat programs in her paper on ethnocentrism in relocation policies in the United States. She highlights how the "Euro-centric worldview," specifically regarding property ownership and household-level decision-making, may lead to the exclusion of many Indigenous communities that rely on collective decision-making. Marino (2018) also outlines the challenges associated with determining fair compensation and the elevated costs of rebuilding in remote regions. The property buyout program described in this thesis would not be appropriate for relocating remote or Indigenous communities at risk of flooding due to climate change. A separate process, developed in direct consultation with Indigenous stakeholders, would be needed to address the unique context of climate change adaptation on reserves and in remote regions.

Chapter 8
Conclusion

8.1 Summary of the Research

This thesis explores Canada's flood risk management strategy, with a specific focus on flood risk reduction through managed retreat. Managed retreat is a relatively underdeveloped policy option in Canada, most often implemented as property buyout programs in response to severe flood events. There is significant variability in the design of these programs and little consensus regarding how we appraise their success. My research examines how property buyout programs are designed and applied in a Canadian context to answer the following questions:

(1) How do government officials and practitioners currently apply evaluation to property buyout programs?

(2) What criteria are appropriate for evaluating the effectiveness of property buyout programs for flood risk management?

Interviews with government officials and practitioners revealed that evaluation is currently an undervalued component of the policy development process for managed retreat in Canada. Property buyouts, particularly at the municipal level, are conceived as one-off programs, downplaying the need for evaluation as a means to improve future programs. Evaluation, if it happens at all, is often regarded as an afterthought, with little deliberation given to the criteria that inform the process. Many research participants described their evaluation procedure as an informal compilation of lessons learned, often requested by the agencies who funded the buyout program. In a few instances, capacity was cited as a barrier to conducting a proper evaluation where smaller municipalities did not have the budget or human resources to move forward with a formal evaluation process.

Theoretical criteria for policy evaluation derived from the literature were explored in relation to the actual experiences of research participants to assess which were relevant dimensions of effectiveness in managed retreat policy. These theoretical criteria included:

(1) programmatic criteria, including goal attainment and efficiency;

(2) temporal criteria, including robustness and flexibility;

(3) political criteria, including political viability;

(4) process criteria, including transparency, access to information, participation, accountability, procedural justice, and acceptability; and

(5) distributional outcomes, including social equity.

All criteria were significant to managed retreat policy, but programmatic criteria specifically were presented as the overarching measure of effectiveness. The elements of goal attainment and efficiency go hand in hand, where attaining a high rate of participation is directly related to avoiding the inefficiencies of incomplete buyouts. Academic subject matter experts also stressed the supporting role of process criteria in enhancing goal attainment and efficiency, where a deeper understanding of the social dimension of buyout programs can improve public support.

The evaluation criteria, with the exception of political viability, were organized into a framework. Indicators to assess each dimension of effectiveness within the framework were proposed based on how each criterion came up in the context of property buyout programs. As a pre-condition for the initiation of a buyout program, political viability was considered to have limited usefulness as a criterion for the ex-post evaluation of buyout programs. The framework supports a systematic assessment process intended to develop the capacity of governments to deliver effective buyout programs and advance policy learning on a larger scale.

8.2 Alignment with the Literature

Canada's efforts to prevent, prepare for, and recover from floods are well established within our current risk management strategy. However, in response to the rising incidence and cost of floods, attention has shifted towards measures that reduce and mitigate flood risk. First through the FDRP and recently renewed through the NDMP, risk reduction efforts have primarily focused on characterizing risk through improved flood mapping and modelling. Yet Canadian governments have historically shown a reluctance to move ahead with the necessary next steps to restrict or relocate development from at-risk areas. Only a few property buyout programs have taken place in Canada over the past decade, most on a relatively small scale with significant variability. Some of these programs promote a shift towards a risk-based approach to flood management, such as in Quebec, where the provincial government incorporated the buyout option into its disaster financial assistance program and initiated a review of regulations for building in high-risk flood zones. Yet others, such as those aimed at acquiring properties facing additional flood risk due to newly constructed structural control measures upstream, have played a supporting role in further entrenching the hazard-focused flood management efforts of the past. This research supports our need to define effectiveness in managed retreat policy and seek better alignment between the goals of a property buyout program and the principles of flood risk management. An evaluation framework, informed by the experiences of past Canadian buyout programs, helps consolidate and share experiences across jurisdictions, building towards a unified national approach to managed retreat.

Managed retreat policy can be controversial, both politically and socially, with a need to carefully consider the program's impacts on participants. The literature highlights the need to balance the practical elements of flood risk reduction and cost efficiency with the social and economic well-being of homeowners, ensuring that no one experiences greater vulnerability as a result of a buyout. Yet, there is little consensus on how we should characterize the success of managed retreat policy considering all of these factors. The policy literature offers theoretical criteria for such an inclusive evaluation of policy effectiveness.

The proposed evaluation framework for property buyout programs, derived from these theoretical criteria, incorporates these pragmatic, economic, and social elements of buyouts in support of a comprehensive examination of policy success.

8.3 Research Contribution

The scholarly contribution of this research is to advance discussion towards a unified vision for property buyout programs, with the framework intended to foster dialogue and debate amongst subject matter experts of what constitutes success. This research revealed a notable difference between how managed retreat is conceptualized in the academic community and how governments typically apply it. According to subject matter experts, retreat is ideally employed proactively during the disaster mitigation stage; the idea is initiated at the community level and supported by a thorough public engagement process. In practice, retreat is most often deployed reactively as part of the disaster recovery process. This is often the first time many of these homeowners have considered relocation, at the same time as they are trying to recover from a traumatic flood event. As a practical starting point, this evaluation framework can help converge these ideas and build a shared vision of what property buyout programs should look like and how they are used.

In delivering a property buyout program, there will inevitably be trade-offs between the various dimensions of effectiveness based upon the program's unique social, financial, and political context. For instance, a buyout program launched in the aftermath of a severe flood may, in the interest of prioritizing the speed of the buyouts, select the targeted area based on available risk data without a lengthy public engagement process. As a result, the indicators used to assess the process criteria regarding participation may differ from a proactive flood mitigation program with a public consultation process that takes place over several years. While this framework is envisioned for ex-post evaluation, it is intended that the evaluation questions be set in advance to foster a more intentional decision-making process. By laying out priorities at the program’s outset and being transparent about any trade-offs, the framework can provide greater accountability for governments in justifying

their design. More broadly, by evaluating property buyout programs in a systematic way, the framework facilitates comparisons across the various programs to develop the capacity to deploy managed retreat policy on a larger scale.

8.4 Areas for Further Research

Validation of evaluation concepts needs more examination by managed retreat practitioners, given this initial analysis of how programs can be designed in ways that promote effectiveness. The testing should seek feedback on the content of the evaluation framework to ensure that all relevant aspects of property buyout programs have been included and that the way the framework is intended to be used fits well within the policy development process. Then, the framework should be applied to a current buyout program, ideally in coordination with the implementing agency. This step will verify the process of establishing the appropriate indicators and identify any difficulties in interpreting the results. Once the evaluation framework is ready to be adopted more widely, there will need to be some discussion and cooperation among levels of government to determine the best way to share and consolidate the findings. Depending on the outcomes of the federal Task Force on Flood Insurance and Relocation, this evaluation framework for property buyout programs could form a valuable part of its guidance on relocation policy for lower-level governments.

Another important element that warrants further exploration is the appropriate timing for evaluation. In the interest of capacity and human resources, immediately following the last property acquisition would likely be most practical for the implementing agency. However, some homeowners may have yet to establish themselves in a new location, and any medium to long-term adverse impacts on participants would have yet to materialize. Also, as was noted in Section 6.2.5, many participants may not want to be a part of the program on an ongoing basis, and it will likely be hard to keep track of participants as time goes on. Therefore, the timing of the evaluation would need to seek a balance between what is practical for the implementing agency yet sufficient to capture the true impact of the program on participants.

Before this framework can be adopted more broadly, additional scholarly research is necessary to determine whether these findings are consistent with regions outside of Canada. The current study is based upon the experiences of government officials and practitioners in designing and delivering property buyout programs in a Canadian context. In the United States, for instance, many of the conditions of a buyout program are mandated by FEMA, including that participation in the program is voluntary and compensation is based upon fair market value. Being more prescriptive than what we have seen in Canada, such conditions may alter the relative prioritization of the dimensions of effectiveness or change the type of indicators you would include under various criteria in the framework. Further study of these dynamics is warranted.

8.5 Concluding Remarks

Extreme weather from climate change is one of the most pressing issues of our generation−and its effects are already apparent. With an increase in the frequency and severity of extreme weather events, the cost for governments to recover from flooding has become unsustainable. In the face of this challenge, it is critical that we adopt risk-based policies that remove vulnerable development and infrastructure from these highest-risk areas. As evidenced by an increasing number of buyout programs over the past decade, Canadian governments have shown momentum in this direction. While this research advocates for the use of property buyout programs to advance flood risk reduction, it is in no way intended to discount or downplay the disruption that relocation programs can cause to the lives of homeowners. Rather, this research aims to ensure that human impacts receive proper consideration alongside government-driven metrics such as goal attainment and cost efficiency. Managed retreat policy design should not be taken lightly. It must be considered equally alongside other practical risk reduction measures to ensure a safe and sustainable future for all Canadians.

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Appendix A
Interview Guide

Appendix A − Interview Guide

Questions Guide
"a)" questions = to be directed to informants who have subject matter expertise in property buyouts
"b)" questions = to be directed to informants with first-hand practical knowledge of the design and/or implementation of property buyouts

Context

1. a) In your opinion, what factors might drive a community to consider a residential property buyout program? (e.g., pre-planned or post-disaster)

1. b) In your opinion, what decisions and external factors led to the implementation of the buyout program in your community? (e.g., pre-planned before the disaster, damaging flooding events, considerations regarding equity – e.g., absence of adequate flood mitigation in some communities/neighbourhoods). **AND** Was demand for the program already present by the public?

2.a) What factors should be considered when deciding between structural control measures and property buyouts to reduce flood risk?

2.b) Can you tell me about any structural or non-structural mitigation (e.g., other policies – e.g., land use planning) measures that were considered or implemented either leading up to or following the implementation of the buyout program?

3.a) What benefits do buyout programs provide, and how can these be weighed against the costs? **AND** What pitfalls should governments anticipate when designing buyout programs?

3.b) Can you tell me about any cost-benefit analysis work that was completed ahead of the decision to implement a residential property buyout program? If a cost-benefit analysis was not completed, can you tell if why? **AND** What pitfalls should governments anticipate when designing buyout programs?

Program structure

4. a) I'd like to get a picture of what makes a good buyout program, and I have a few questions.
- should they be limited to residential properties, or also include commercial, etc.?
- how should candidate properties be identified?
- how should the purchased land be used?
- who should make these decisions?

4. b) Can you tell me about the structure of the property buyout program? For example, timelines, criteria for eligibility (residential, multi-unit residential properties, renters, commercial), how and when were properties identified? Who was responsible for making these decisions? What was the process to apply/move forward with the buyout for property owners (e.g., payment)?
Possible follow-up question: in hindsight, should the program have been designed or implemented differently?)

5. a) In your opinion, should buyouts be mandatory or voluntary? If a homeowner refuses a voluntary buyout, should restrictions be placed on their property?

5. b) From your perspective, why was the buyout program voluntary/mandatory, and how was this received by those impacted and the broader community?

Financials

6. a) What costs are involved in a buyout program and who pays for them?

6. b) Can you tell me about what costs were covered in the buyout program and who paid for them? (Probe on federal funding and timing)

7. a) In your opinion, how should buyout values be set (e.g., pre-disaster vs post-disaster market value; capped value)?

7. b) Can you tell me about how the buyout value was set (e.g., pre-flood assessed value, pre-flood market-value, post-flood assessed value, post-flood market value, another amount)?

8. a) In addition to the cost of buying the properties, what other homeowner costs should be covered by the program?

8. b) In addition to the cost of buying the properties, can you tell me what other homeowner costs were covered by the program?

Who is involved?

9. a) Research shows that voluntary buyouts typically have an uptake rate of around 30%. In your opinion, how could this rate be increased? **AND** Whose support is important to the success of a buyout program?

9. b) Given your experience with these programs, can you tell me whose support is important to the success of a buyout program?

10. a) What departments, professionals, organizations are typically involved in property buyouts?

10. b) Can you tell me what departments or organizations were involved in the property buyout?

Appendix A − Interview Guide

Role of the public and reception of PBOs

11. a) What is the optimal involvement/role of the public (residents, property owners) in these programs? (i.e., to increase/ensure its acceptability/buy-in). Can you tell me about methods that can be used to increase the public's buy-in?

11. b) Can you tell me about any public engagement initiatives that were considered and/or implemented around the program (design and implementation)? e.g., was the public surveyed prior to its implementation about the plans; were sessions held to explain the benefits of the program; were they consulted on how the land would be used following PBOs?

Program trajectory/Post-buyout

12. a) Can you tell me about any (notable/significant) changes that were made during the course of the program? (e.g., number of homes purchased, level of coerciveness, policy changes to deal with unintended consequences of the program, land use plans post-buyout., etc.)

12. b) Can you tell me about any (notable/significant) changes that were made during the course of the program? (e.g., number of homes purchased, level of coerciveness, policy changes to deal with unintended consequences of the program, land use plans post-buyout., etc.)

13. a) Can you comment on some of the important considerations for evaluating the effectiveness (success) of these programs?

13.b) Can you tell me about your community's/organization's approach to evaluate or measure the program's effectiveness?

14. Is there anything else that you would like to add? AND Is there anyone else that you think I should reach out to for an interview?

Appendix B
Framework for the Evaluation of Property Buyout Programs

DIMENSION OF EFFECTIVENESS	DESCRIPTION	CRITERIA	INDICATORS
Programmatic	The extent to which the policy achieves its stated goals or objectives.	Goal Attainment	Was the goal/objective of the property buyout program clearly defined at the start of the program (e.g., specific and measurable)? Was the goal/objective of the property buyout program achieved? *Potential measures:* For voluntary programs, what percentage of eligible property owners accepted the buyout? Following the buyout, what percentage of the community is eligible for insurance/mortgage products? Did the program reduce flood risk through a quantifiable reduction in exposed assets? What percentage of the target area was restored to natural space? Did eligible participants experience a decrease in vulnerability with relocation?
		Efficiency	Did the program maximize risk reduction within the available budget? Was the cost of buyouts less than the expected cost of damages from a repeat flood of the same magnitude? For voluntary programs, was the cost of maintaining services to homeowners who remain accurately captured in the cost-benefit analysis? For voluntary programs, did the buyout program necessitate any duplication of economic spending to protect the homeowners who remained? Were relocated homeowners preserved within the tax base? Were there any unexpected or unintended costs associated with implementing the buyout program? Were there any unexpected or unintended benefits encountered during or following the buyout program?
Temporal	The ability of a policy to continue to meet its objectives in the face of changing conditions.	Robustness	Does the buyout's area of eligibility align with the desired level of acceptable risk? Was up-to-date flood hazard mapping and/or modelling used to inform the eligibility for the buyout program? Was the size or configuration of the acquired land sufficient to reduce flood risk within the area of interest? Was the use of the acquired land informed through public consultation? *Potential measures:* Does the converted land use maximize the flood mitigation potential of the acquired land? Does the converted land support and maintain the property value of nearby properties? Does the converted land address a community need for parkland or recreational space?
		Flexibility	Did any participants decline a buyout offer because it could not accommodate their needs (e.g., insufficient compensation, rigid timeline, lack of support for interim housing options)? Was the buyout conducted in a way that enabled the identification of unique participant needs and supports (e.g., social workers, legal representation, banking support)? Did the program have a contingency budget available to bring on additional support as needed?
Process	The degree to which the policy is considered socially acceptable and morally just.	Accountability	Were all perceived responsible parties involved in the solution (i.e., involvement of higher levels of government, if warranted)? Were the program responsibilities clearly and accurately delineated across all levels of government and organizations involved in administering the buyout program? Did the program design and implementation align with the promises made by government officials? Did the government take ownership of any contentious or difficult decisions that were made?
		Transparency	Were the criteria for decision-making communicated to homeowners and made available to the public? Were the criteria for eligibility specific and logical?
		Participation	Were property owners or trusted local representatives consulted on the program design? Were property owners able provide input on the program design?
		Access to Information	Were property owners able to request information and receive a timely response? Was information available to property owners through a portal or online forum?
		Procedural Justice	Did property owners perceive the process to be fair? Was there a process for homeowners to challenge or appeal decisions made by the implementing agency (e.g., appraisal value)?
		Acceptability	Was sufficient time allotted for public review, comment, and discussion? Was the buyout timeline expedient yet flexible enough to provide homeowners with enough notice on the closing date?
Distributional Outcomes	The extent to which costs and benefits are spread equally among those affected.	Social Equity	Did everyone who wanted/needed a buyout offer receive one? Was the compensation high enough to purchase a comparable property with lower vulnerability (i.e., flood risk and social vulnerability)? Did the buyouts create any unexpected costs for some but not all property owners? Were homeowners able to maintain their economic and social supports (e.g., keep the same employment, keep children in the same school or daycare, etc.)? Were sufficient resources available to help homeowners navigate the process (e.g., case workers, aid in finding suitable housing)?