Non-Structural Flood Mitigation Technical Report

FINAL REPORT

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Regional District of Central Okanagan

Central Okanagan
FLOOD
MITIGATION
PLANNING

Acknowledgements

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This project has taken place on the unceded traditional territories of the Syilx people.

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1 Introduction

Floods matter. People whose homes are inundated or damaged will remember for the rest of their lives; landscapes are changed forever; regional and national economies suffer. With climate change driving up the frequency and intensity of flooding and other natural hazards, the risks and impacts to the Okanagan's economic vitality, infrastructure, environment, and citizens will only continue to grow.

The Regional District of the Central Okanagan (RDCO) along with regional First Nation and Local Governments and other regional partners have been working together for many years to increase understanding of the local flood hazards and their trajectory with climate change. This new information, coupled with recent damaging floods has highlighted the need for new approaches in flood management.

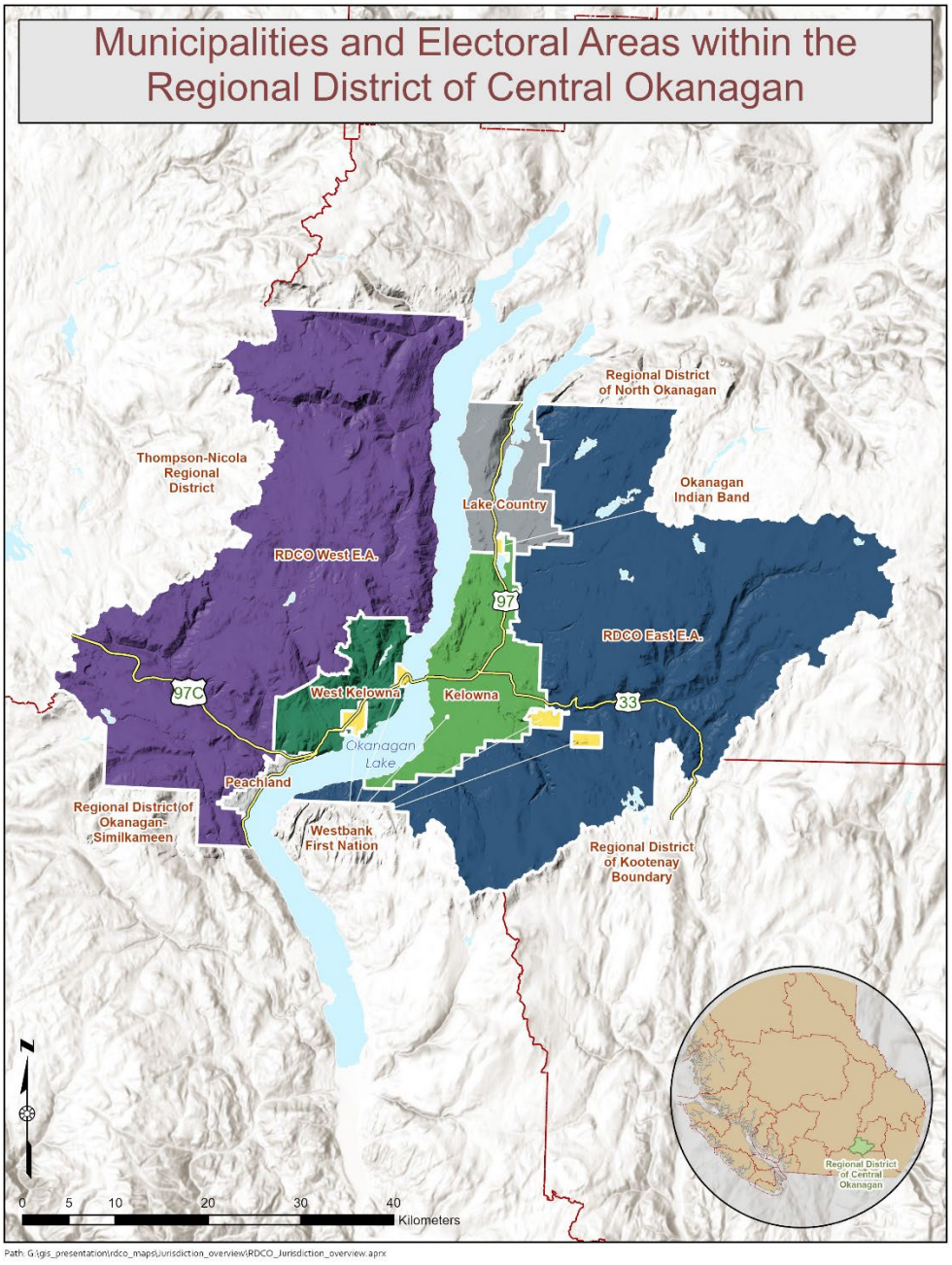
Non-structural flood mitigation actions - the broad group of actions that can be taken to reduce flood risk and increase resilience that are not large engineering works - offer an excellent opportunity to reduce flood risk and gain valuable co-benefits. These actions also align more closely with Traditional Indigenous practices than do large engineering works.

There is much value in non-structural flood mitigation actions. However, they can be challenging to implement because they are less common and governance structures and systems are not in place to support their execution. And so, the RDCO and partners embarked on a project to provide resources to Local and First Nations governments in the Okanagan that would support them in getting non-structural mitigation actions up and running.

In early 2021, the RDCO retained the consultant team of Ebbwater Consulting Inc. (Ebbwater), SHIFT Collaborative (SHIFT), and EcoPlan International (EcoPlan) to work with governments and community members in the Okanagan to build a shared understanding of the wicked nature of flood management and to then provide a strategic resource guide to support governments and others to act both individually and collectively to enable non-structural flood mitigation actions.

1.1 Project Area and Scope

The RDCO, as the central regional government within the Okanagan Valley has taken on a role as a facilitator for Local Governments within the valley. The project is focused on the flood hazard areas and flood hazard types found within the RDCO, inclusive of First Nation reserves and member municipalities (Figure 1). Although this area and these jurisdictions have been the focus of the project, the toolbox of mitigation actions and decision supports are more widely applicable to the Okanagan Valley and the British Columbia (BC) at large.



1.2 Document Purpose and Report Structure

This report is a companion document for the Central Okanagan Non-Structural Flood Mitigation Resource Guide (Resource Guide). The Resource Guide provides concepts and actionable steps that can be taken at a local or First Nation government level to execute non-structural flood mitigation actions. Whereas this document provides background context on flood hazards in the Okanagan Valley, the best practice management context, key international guidance, and the British Columbia governance

context (Section 2). It also provides the methods (Section 3), and the results (Section 4) of a public and stakeholder engagement process that informed the development of values-based criteria to support the selection of most preferred non-structural mitigation activities (as outlined in the Resource Guide). These sections also summarize a policy scan of existing flood management regulations in the RDCO and member communities. This is followed by recommendations, including key concepts that should be tackled at a regional scale (Section 5), and finally some concluding remarks (Section 6).

2 Background and Supporting Information

Flood is a natural and regular phenomenon that has shaped the physical geography of the Okanagan Valley since time immemorial. With more people and development in the region now, these floodwaters cause more damage and devastation, most recently in 2017 when high lake levels caused widespread flooding along the shorelines in the region, and in 2018 when creeks spilled their banks onto adjacent floodplains.

Flood is not a straightforward hazard that is either present or absent. There is much nuance in the type, likelihood, and severity of flood, which are further complicated by climate change. Further, there is great diversity in how flood waters interact with the communities and assets that sit in flood hazard areas.

This section first provides some high-level background information on flood hazards in the Okanagan, and then describes the concepts of risk, risk reduction, and resilience, which are used later to organize and score non-structural flood mitigation options. Key international guidance materials are also summarised and placed into the context of the BC regulatory and governance regime.

2.1 Flood Hazards in the Okanagan Valley

Not all floods are created equal. When planning for flood mitigation, it is important to first understand the different types of floods we face today and will face in the decades to come.

2.1.1 Flood Types in the Central Okanagan

The Central Okanagan faces four main kinds of flood hazards, summarized here. We encourage readers to look at other resources (Associated Environmental Consultants Inc., 2016; Ebbwater Consulting Inc., 2019; Northwest Hydraulic Consultants Ltd., 2020) for additional and more detailed information.

1. **Lake (coastal) flooding**. Occurs when lake levels reach higher-than-normal levels and cause flooding along the shoreline. This can be either a result of total water volumes in the watershed being high, or because of storm conditions that push water and waves onshore
2. **Creek and river flooding**. This type of flooding can include:
    a. Clearwater flood, which is when high volumes of water coming from precipitation or snowmelt exceeds the capacity of rivers or creeks and flows onto adjacent lands.
    b. Debris floods and flows, which is when debris (soil, rocks, trees, etc.) are entrained in water coming off steep slopes. Like clearwater floods, when normal channel capacity is exceeded, this flows onto adjacent land. Debris floods and flows are particularly damaging because warning times are short, velocities are high, and the entrained materials become powerful projectiles.
3. **Pluvial flooding**. Occurs when heavy precipitation cannot be absorbed into natural or infrastructure systems, creating localized ponding.

4. **Secondary hazards** that result from first two types of floods above. These include erosion (the displacement of soil or rock by water) and avulsion (the sudden change of the course of a river).

Each of these flood types has different characteristics. There is also great range within a flood type. These characteristics affect hazard and risk profiles, as well as the effectiveness of flood mitigation actions. A few of the characteristics that are especially relevant to non-structural mitigation actions are outlined below.

2.1.2 Flood Hazard Likelihood and Magnitude

Likelihood (the probability that a flood of a certain size will occur) and magnitude (the size of a flood) are two defining characteristics of flood. These are inversely proportional to each other; large events occur rarely, and small events more frequently (see Figure 2). Frequent but small floods present very different risks than rare and large floods.

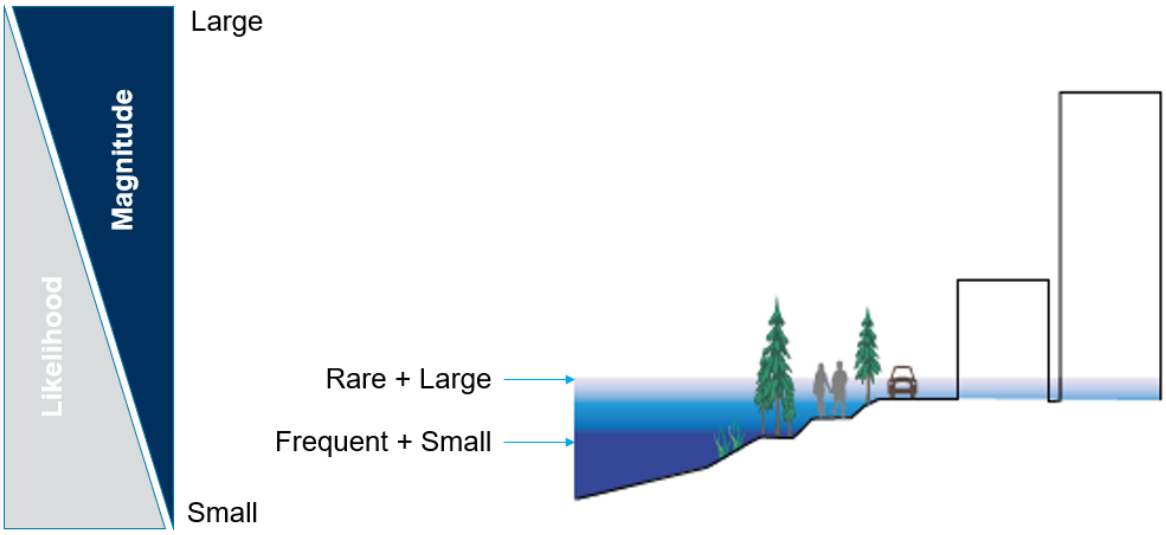


Figure 2: Simplified relationship between flood hazard likelihood and magnitude.

Flood magnitude describes the size of an event. It is measured in cubic metres per second for creek and river flooding and in elevation or volume for lake (coastal) flooding.

Likelihood is generally defined or presented as an Annual Exceedance Probability (AEP), which is the probability of an event of a given size occurring or being exceeded in any year, described as a percentage. For example, a 0.5% AEP event, has a 0.5% chance of occurring or being exceeded in any given year. This is sometimes referred to as a 1/200 or 200-year event. However, this is misleading, as it infers that once an event of this size has occurred, it will not occur again for 200-years, which is not the case.

Another way to think about flood likelihood is through the use of encounter probabilities, where it is possible to calculate the likelihood of encountering an event of a given size over a defined time period—for example, the duration of an average mortgage (25 years) or the lifespan of a human (75 years). For instance, for a 1% AEP event, there is a 22% chance that an event of this size or greater will occur over a 25-year period (Table 1). Understanding the likelihood of an event, as well as the encounter probability of an event, can support decisions related to flood management.

Table 1: Encounter probabilities for various flood likelihoods.

Annual Exceedance Probability (AEP)	Indicative Return Period	Encounter Probability in 25 years	Encounter Probability in 50 years	Encounter Probability in 75 years	Encounter Probability in 100 years
6.67%	Once every 15 years	82%	97%	99%	100%
2%	Once every 50 years	40%	64%	78%	87%
1%	Once every 100 years	22%	39%	53%	63%
0.5%	Once every 200 years	12%	22%	31%	39%
0.2%	Once every 500 years	5%	10%	14%	18%

2.1.3 Flood Hazard Depth and Power

In addition to the total volume or flow associated with a flood event, how the water spreads and moves over the floodplain is an important consideration.

Flood depth is a big determinant of how much damage is caused. Nuisance flooding in a basement, for example, is very different from moderate (>30 cm) or severe (>2m) flooding, which can cause significant to sometimes unrecoverable damage. Depth generally, but not always, decreases with distance from the water source.

Water velocity as it moves down a channel or across a floodplain also affects its damage potential. Faster moving water, especially if it has entrained materials (this could be rocks and logs from natural slopes, or garden furniture or cars that are picked off the urban floodplain) can be more damaging than slow, stagnant water. Higher velocity systems have more power, and can cause erosion or avulsion of natural systems, as well as knocking over people, cars, and even some structures.

Similarly, powerful waves on the shoreline of lakes have additional energy that can cause erosion and other damage to assets within the wave zone.

2.1.4 Flood Hazard Spatial Scale

The spatial scale (how widespread or localized a flood is) will matter for response and recovery. Large regional events that affect many communities at once may stretch

resources, whereas a small, localized event on one creek might be more manageable, if it is a location with good access and response systems.

2.1.5 Flood Onset and Duration

Finally, the characteristic of temporal scale (how quickly it happens, when, and how long it lasts) is an important consideration. The onset time is directly related to the efficacy of many temporary flood mitigation actions, as these are only effective if they are put in place in time. This may be possible for some larger lake flooding events for which there may be a week or even a month of lead time but are not practical for sudden pluvial or some creek flooding events.

Further, it is important to consider how long an event will last, and therefore how long water will be in contact with elements on the flood plain. In general, the damage associated with flood is less for shorter events, whereas if a building is wet for days or weeks the structural damage will be severe and may require that the building be destroyed.

In summary, floods are very nuanced. Therefore, policies and actions need to be equally nuanced, and be selected based on their effectiveness against the type of flood conditions in a given place or neighbourhood.

2.1.6 Historic Events in the Okanagan

The project area has a history of flood events, which were originally documented by Septer (2006). Based on summaries documented by Associated Environmental (2016, 2017a), watercourses and lakes have flooded multiple times (with the specific number for each shown in brackets) during the period 1894 to 2015, as follows by watershed:

- Okanagan Lake (12)
- Mission Creek (8)
- Mill Creek (4)
- Trout Creek (3)
- Kalamalka Lake (3)
- Vaseux (McIntyre) Creek (3)
- Penticton Creek (3)
- Shuttleworth Creek (3)
- Joe Rich Creek (2)
- McDougall Creek (2)
- Single Creek (2)
- Naramata Creek (2)

Widespread floods and debris flows were experienced in the project area in 2017 and 2018. Within the historical context, the events were exceptional. Accordingly, public discourse following the events questioned the role of climate change in their occurrence. The Government of BC's Abbott/Chapman Report (Abbott and Chapman, 2018), commissioned in late 2017, which also included unprecedented wildfires,

suggested that, indeed, disaster management in BC needs to address a “new normal” due to climate change effects.

In the Okanagan watershed in 2017, most areas experienced flows that approximated the 5% AEP (20-year indicative return period), but some areas such as Vernon and Penticton experienced flows that exceeded the 1% AEP (100-year indicative return period). Multiple factors played a role in flooding, with spring precipitation being central. Kelowna experienced the fourth-highest precipitation on record for the period of March to May, inclusive. Vernon experienced the second-highest record for those three months while Penticton experienced the highest precipitation ever in that period.

As a result of the high snowpack and spring precipitation, the inflows to Okanagan Lake during May 2017 were the highest on record, which caused the lake to rise to its highest level since the dam was built. The Water Survey of Canada gauge at Kelowna (08NM083) recorded a water level of 343.472 m CGVD2013. Water levels were approximately 0.20 m above the estimated 0.5% AEP (200-year indicative return period) (Associated Environmental, 2017b). In 2018, the hazard levels were in the range of 2%-5% AEP (50 to 20-year indicative return period), with impacts that included combined flood and debris flow events.

2.1.7 Climate Change and Cumulative Pressures Affecting Flood

Beyond understanding the floods we are facing today, it is important to consider how they will change over time and how they interact with other hazards, particularly wildfires. Climate change has been identified as a key force behind recent flooding in BC (Abbott and Chapman, 2018). Increased spring and fall precipitation, which will cause more frequent and intense flooding, is projected for the Okanagan (Pinna Sustainability, 2020) (see also Figure 3, an excerpted map from this same study).

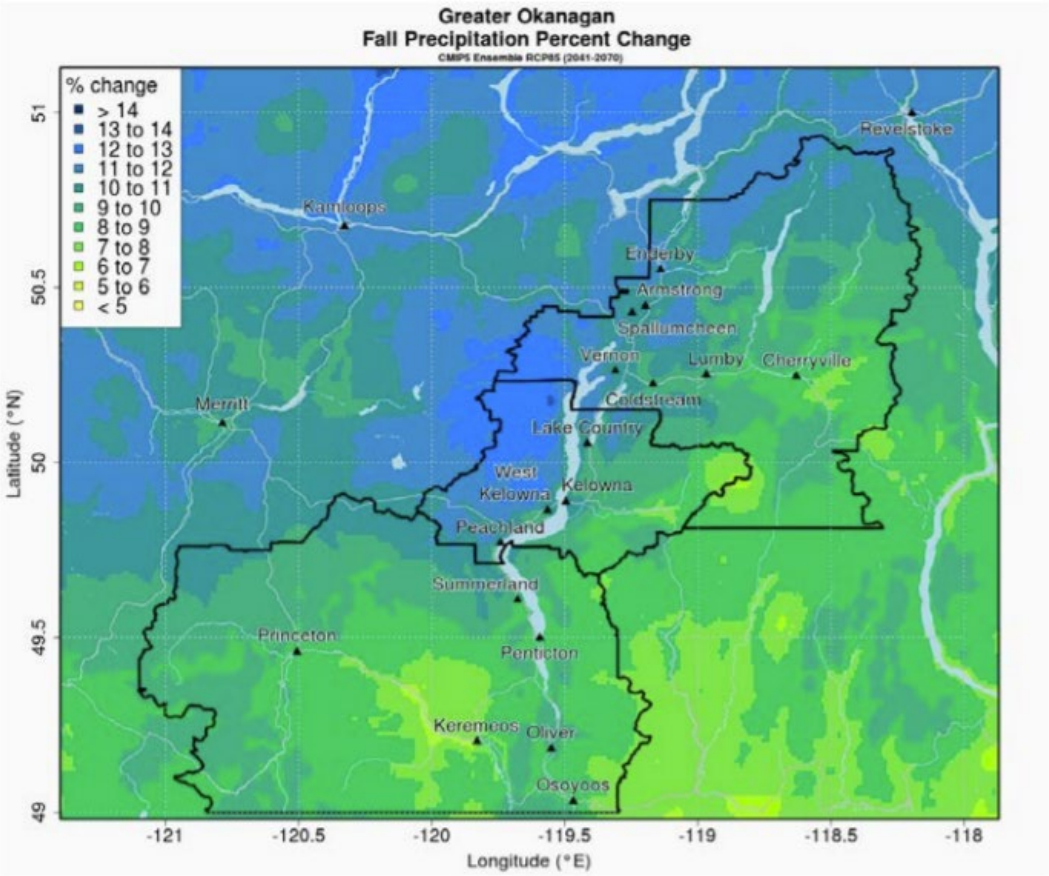


FIGURE 11: AUTUMN PRECIPITATION – PERCENT CHANGE (2050s)

Figure 3: Precipitation trends with climate change in the Region (From Pinna Sustainability, 2020).

On top of climate change, research indicates that other cumulative pressures (such as wildfires, urban development, and industrial activities) are worsening disasters like flooding (Ebbwater Consulting Inc., 2019b).

There will be worsening floods in future, and there is significant uncertainty associated with our understanding of the characteristics of these floods (type, magnitude, likelihood, etc.). Therefore, whatever mitigation actions are used should, as much as possible be effective over a range of potential future conditions.

2.2 Best Management Practice Context

Many jurisdictions around the world are in the process of transitioning toward a risk-based approach to flood management. The following sections summarize some of the key frameworks on disaster risk reduction and flood risk management that have informed our approach and guiding principles for this work.

2.2.1 Reducing Risk and Building Resilience

Rivers and lakes overflowing their banks are not in themselves a problem. It is when flood waters interact with things we care about on the floodplain and cause damage and negative consequences that we have cause for concern. This project uses the concepts of risk and resilience to support a holistic understanding of flood and the non-structural strategies or actions that can be taken to mitigate its damages.

Risk is the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society, or a community, determined probabilistically as a function of hazard, exposure and vulnerability (UNDRR, 2017).

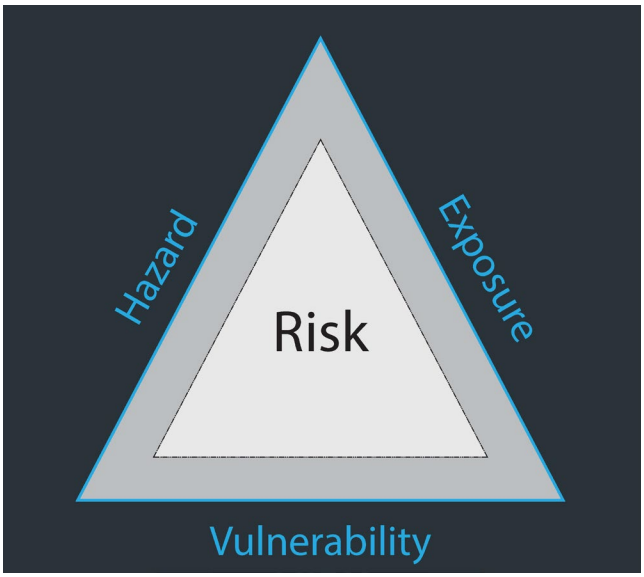


Figure 4: Risk as a function of hazard, exposure and vulnerability. Based on (GFDRR, 2016)

As illustrated in Figure 4, risk is defined by the total area of a triangle, whose vertices are hazard (in this case flood), exposure (the things people, organizations, and stakeholders care about that are exposed to floodwaters) and the vulnerability or susceptibility of these things being damaged by floodwaters.

There are three levers to increase OR reduce risk. Hazard, exposure and/or vulnerability reduction can all play a role in overall risk reduction. This more complex, but important take on flood mitigation, means that there are many more tools available to support risk reduction.

In the last hundred or so years, many western governments have focused on trying to stop water from interacting with assets through the construction of large engineering works. This effectively limits risk reduction options to one of three possible levers (i.e., hazard).

2.2.2 Dynamic Risk

Risk is not static. It can both increase and decrease with time. The challenge is that given present day pressures, two vertices are trending outwards, increasing the overall risk (Figure 5). Climate change is affecting the frequency and severity of flood events, increasing the overall hazard, and development pressures and trends mean that more people and things are being placed in flood hazard areas (i.e., increased exposure).

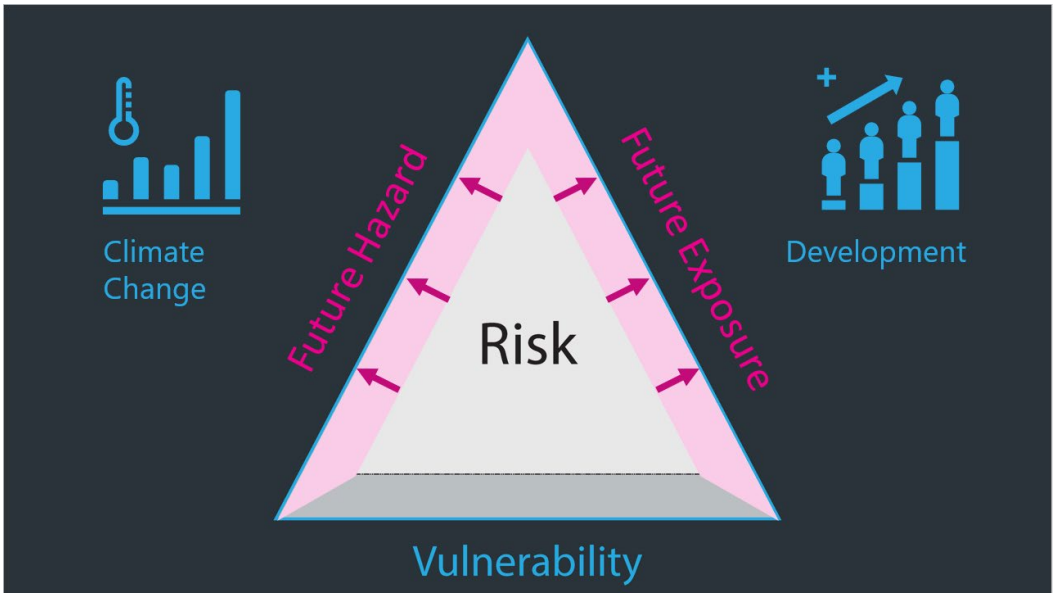


Figure 5: Increasing risk with climate change and increased development.

Although risk is tending to increase, there is still opportunity to arrest the increase, especially as it relates to increased exposure.

And, of course, there is still opportunity to reduce risk through careful considerations of actions that reduce future hazard, exposure, and/or vulnerability.

2.2.3 Systemic and Wide-Ranging Risk

Floods and disasters are extremely complex. Society has become acutely aware of the complexity of disaster throughout the COVID-19 pandemic. Impacts have been felt widely to human health, but also to local and global economies. Impacts have not been felt equally, as some people have faced insurmountable challenges, whereas others have had limited impacts. The following section highlights at a high-level some of the complexities associated with disaster impacts and risks.

2.2.3.1 Holistic Indicators for Risk

Floods and disasters affect many things in different ways (Figure 6). People might be killed or injured, especially during rapid onset and high energy floods. Other people might lose their homes or treasured possessions. Businesses are damaged and may close for short periods of time, or sometimes forever. Economies suffer with disruption of critical services and business closure, and there are generally large financial implications associated with damages to structures and infrastructure. Further, floods

can cause damage to cultural artefacts and cultural spaces, and importantly floods can cause significant environmental damages, especially when contaminants on the floodplain (e.g., pesticides, septic tanks, etc.) seep into waterways and beyond.

Within each of these broadly grouped indicators (see Figure 6), there are additional nuances and complexities. For example, if we consider the potential for an individual to be impacted by a flood, their age, income, education, and even personality will affect their capacity to plan for, respond to, and recover from a flood event. Similar variation in impacts is seen across all the indicator categories.

Figure 6: High-level indicators for holistic flood risk assessment.

Any risk assessment, or risk-based flood mitigation plan, must be mindful of the many and varied tentacles of disaster impacts, and ideally work to ensure that risks are reduced equitably.

2.2.3.2 Indirect and Direct Impacts

Flood hazards may lead to direct and indirect consequences. Direct consequences describe all harm that is caused by the direct physical contact of water with people, infrastructure, or the environment (Figure 7) (AIDR, 2015). This includes, for example, damage to buildings and other assets through floodwaters, damage to the environment through contaminated floodwaters, or loss of human life.

It is important to also think about indirect consequences, which can be somewhat more complex. Indirect consequences will increase the spatial and temporal extent of the consequence, meaning that an area larger than where the hazard occurs can experience disruption in some form. They are typically consequences that are caused by the disruption of the physical and economic links in the region, as well as the costs

associated with the emergency response to a hazard. As shown in Figure 7, when, for example, road access is affected by a natural hazard, schools or other buildings may become inaccessible and emergency services may not be able to reach certain areas or may need to travel longer distances. Another example is business losses because of the interruption of normal activities. Disruption of critical infrastructure, such as electrical power lines, can lead to cascading consequences for many sectors.

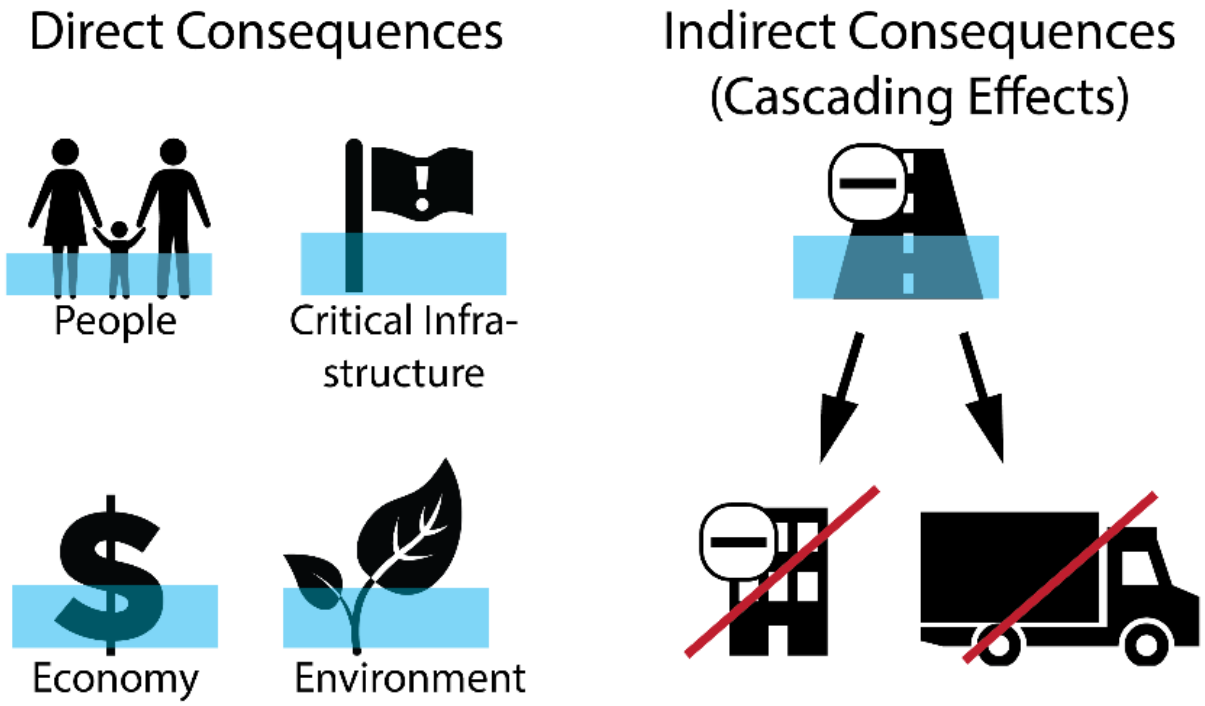


Figure 7: Direct and indirect consequences of flood hazards.

2.2.3.3 Tangible and Intangible Consequences

The effects of a flood hazard event on the environment, human or community health, or loss of life are difficult to quantify in terms of financial values or other quantifiable measures. These impacts are therefore considered to be intangible impacts. On the other hand, the tangible dollar losses from a damaged building or ruined infrastructure are more easily calculated. This does not mean that tangible losses are more important than the intangibles, just that they are easier to quantify and assess. The inclusion of intangible impacts is desirable for the development of a robust risk assessment (Messner and Meyer, 2006). Figure 8 provides examples of direct/indirect and tangible/intangible consequences. While not all these consequence types are easy to estimate, they should still be considered. At a minimum, it is important to recognize what types of consequences have been included in a risk assessment and/or decision tool, and to be explicit about those that have not.

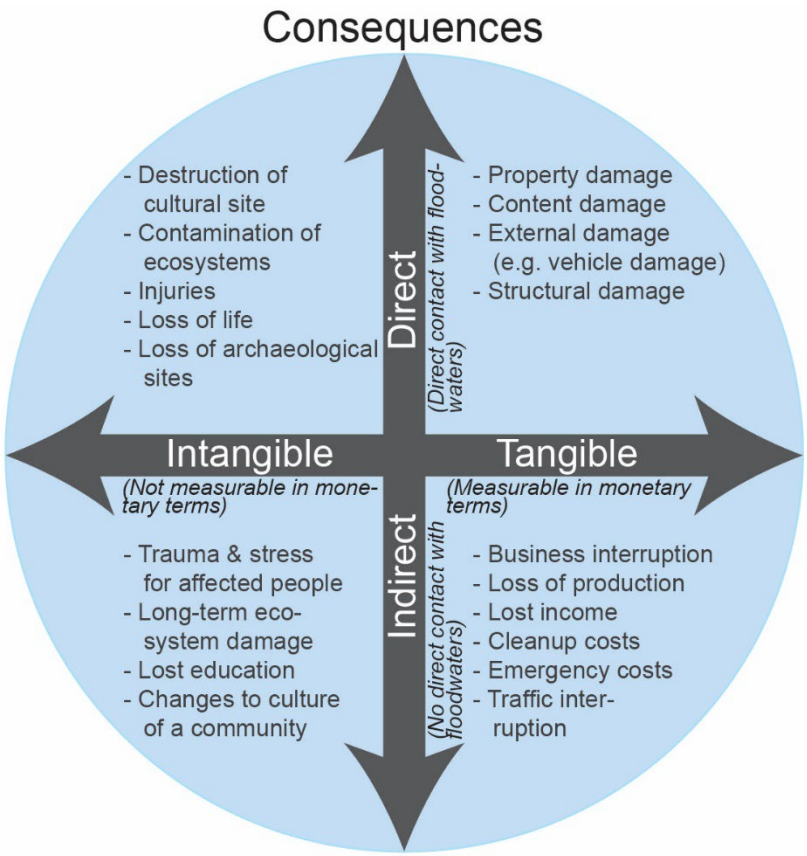


Figure 8: Types of consequences to flooding (Figure from (Murphy *et al.*, 2020)*; used with permission).*

Risk is the basis for good decisions in flood or natural hazard management. It is important to understand the full definition of risk, as a function of hazard, exposure, and vulnerability. Risk is inherently, systemic, and complex.

2.3 Key International Guidance and Syilx Context

Flood and disaster management have evolved significantly over the last couple of decades, moving from an era of "fighting" nature with large engineering works, into an era with a more complex understanding of risk and the many ways that it can be mitigated. The following provides a summary of major international frameworks for flood risk management and closes with a connection between these "new" frameworks and the Traditional *Syilx* ways of knowing and being.

2.3.1 Sendai Framework for Disaster Risk Reduction

The Sendai Framework for Disaster Risk Reduction (Sendai) is the global blueprint for reducing disaster risk and increasing community resilience. The goal of Sendai is to "prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures… to strengthen resilience" (UNDRR, 2015). The framework is thus multi-disciplinary and follows four priorities. This project's activities fit mainly within Priorities 1 and 2 (Figure 9).

Figure 9: Four priorities of the Sendai Framework for Disaster Risk Reduction.

Sendai recognizes that humans are at the centre of disasters. I.e., not only are humans responsible for increasing hazards, hazards themselves are not problematic unless they interact with humans. The framework thus places human decisions at the centre of disaster risk reduction, and advocates for a risk-based approach to managing multiple hazards (i.e., all-hazards approach). Sendai also encourages whole-of-society engagement actions, such as "To empower local authorities, as appropriate, through regulatory and financial means to work and coordinate with civil society, communities and Indigenous peoples and migrants in disaster risk management at the local level."

Both Canada and British Columbia are signatories to the Sendai Framework.

2.3.2 Strategic Flood Risk Management: The Ten Golden Rules

The consensus in global peer-reviewed literature is that implementing a holistic, risk-based approach to flood management reduces negative impacts while promoting other aspects of societal well-being over the long-term. In this section we draw on an internationally recognised paper by Sayers et al. (Sayers *et al.*, 2014), which captures guiding approaches and rules for sound strategic flood management. This paper and framework have been cited more than 50 times in peer-reviewed journals since its publication. Further, this paper and the 'golden rules' also map well with Sendai.

The Sayers et al. (2014) paper was co-authored by representatives of diverse perspectives (academic and government officials, engineers, and planners) as well as recognized leaders in the field of flood risk management. The authors suggest that strategic flood risk management provides a means of working towards sustainable development, and associated social, environmental, and economic goals. However, they also acknowledge that resources to achieve this are limited, and that pragmatic trade-offs must be made between reducing flood risk and investing resources towards achieving other societal goals. In this respect, they emphasise the importance of investing resources effectively and efficiently.

Therefore, the primary goals of strategic flood management are to efficiently use limited resources to:

- Reduce risk to people and communities from flood sources;
- Promote ecosystem goods and services;
- Reduce risk to, and promote, economies; and
- Promote social well-being.

The authors note that these are lofty goals; however, programs aren't expected to reach these goals at the outset. Rather, the goals are intended to guide an iterative, adaptive strategic planning process. The authors go on to outline several common characteristics of successful, strategic plans including:

1. They will be based on understanding of the whole-system behaviour and societal goals (i.e., consideration of cumulative pressures and associated values);
2. Decision-making will be informed by knowledge of risk and uncertainty over time; and
3. A portfolio of measures and instruments will be used to manage risk.

In addition to these characteristics, the authors present ten 'golden rules' for sound strategic flood management. The authors state that these 'golden rules' are necessary, but not sufficient, components of successful flood management.

Table 2: Ten golden rules for flood management.

Rule	Description
1. Accept that absolute protection is not possible and plan for exceedance.	There will always be a bigger flood. Residual risk always exists and resilience to future, inevitable, flood events can be built through the planning process.
2. Promote some flooding as desirable.	The natural connection between land and water is critical. Flood plains provide fertile land and other ecosystem services in addition to accommodating flood waters.
3. Base decisions on understanding risk and uncertainty	Managers should not delay decision-making and action on the basis of uncertainty. Rather, managers should draw on the available knowledge, explicitly account for uncertainty, and then monitor and adapt management plans with time.
4. Recognize that the future will be different from the past	Climate and flood risk are changing. Managers need to move beyond planning processes that focus on historic flood records and information, and account for future changes in flood risk.
5. Do not rely on a single measure; implement a portfolio of responses	Flood risk has multiple components. Management tools can be used to reduce hazard, exposure, and consequence while also working towards other environmental, economic, and social goals.

6. Utilize limited resources efficiently and fairly to reduce risk	A management plan should be tailored to the specific context, with consideration of not only the cost-efficiency of risk reduction outcomes, but also the fairness of these outcomes and the associated ecosystem enhancement opportunities.
7. Be clear on responsibilities for governance and action	Funding and decision-making should reflect shared responsibility. Collaboration on a watershed scale is critical to achieve shared outcomes and to avoid conflicts.
8. Communicate risk and uncertainty effectively and widely	The public does not often understand the degree of flood risk they face. Significant and targeted awareness programs are required to obtain greater public and political support for progressive management initiatives.
9. Promote stakeholder participation in the decision-making process	All interested and affected people play an important role in developing and delivering management activities. This should be done in a way that promotes "living with floods" rather than "fighting against them".
0. Reflect local context and integrate with other planning processes	There is a need for locally relevant and specific management planning, as opposed to focusing on compliance with a one-size-fits-all engineering standard.

The golden rules should be considered throughout the process of adapting to flood risk. Sayers et al. (2014) mentions that plans themselves should be adaptive and underpinned by a continuous process of monitoring and review to be flexible to shifting priorities and governance structures.

2.4 *Syilx* Okanagan Perspective

The following is drawn from *Syilx* Okanagan Flood and Debris Flow Risk Assessment: Basis of Study (Ebbwater Consulting Inc., 2019c). It provides context on the *Syilx* Okanagan worldview as it relates to water and flood. We encourage readers to review the full Flood and Debris Flow project for additional information.

2.4.1 Introduction

"If people can't understand that we *are* water; they have missed the point."
– Arnie Baptiste, *Syilx* Representative

The *Syilx* Okanagan worldview is complex and diverges from the western science worldview. It cannot be fully summarized in this report format; however, in the community discussions and engagement that laid the foundation for the Flood and Debris Flow project, several themes emerged that have been employed as ways of increasing the alignment of this project with *Syilx* Okanagan perspectives. These themes are:

1. Uphold Water Responsibilities
2. Apply *Syilx* Okanagan knowledge
3. Connect to place
4. Value *tmix*^{w} (all living things)
5. Collaborate and develop water partnerships

An overarching understanding that ties all these themes together is: “Water is connection.”

2.4.2 Uphold Water Responsibilities

Syilx Okanagan communities have a deep intrinsic connection to *siwɬk*^{w} (water). Maintaining the integrity of *siwɬk*^{w} and respecting its relationship to all life is essential to *Syilx* Okanagan identity and is entrenched in responsibility to the *tmx*^{w}*ulax*^{w} (land).

Syilx Okanagan community members and ONA staff repeated throughout this project that water is “the most important thing and gives us life”. The *Syilx* Okanagan perspective respects the power of water and recognizes that “water will go where it needs to go”. Within this understanding, there is also a recognition that not all flooding is bad, and that there are positive regenerative aspects of natural phenomena such as flood and debris flows. These phenomena are an intrinsic part of *tmx*^{w}*ulax*^{w} (land) and are connected to *tmix*^{w} (all living things, sacred life forces).

Syilx Okanagan water laws and values related to *siwɬk*^{w} are outlined in the *Syilx* Okanagan Water Declaration (Okanagan Nation Alliance, 2014), which was endorsed by the ONA Chiefs Executive Council in July 2014. The Water Declaration communicates not only water responsibilities that *Syilx* Okanagan people carry, but also water-supporting activities that everyone residing in *Syilx* Okanagan territory can implement in their daily lives.

2.4.3 Apply Syilx Okanagan Knowledge

The *Syilx* Okanagan people have a manifest reverence for Elders and Traditional Ecological Knowledge Keepers who carry a deep responsibility to teach future generations about environmental conditions of the past and present. Elders also offer reminders of historical events that have set the stage for the challenges of today. The history of colonization and settlement patterns of immigrants since 1811 have affected hazards, exposure, and vulnerability in palpable ways for everyone in the region.

Over the generations, the *Syilx* Okanagan have passed down teachings through oral literature such as *captíkʷɬ*. These *captíkʷɬ* contain a collection of laws, customs, values, and principles that reveal truths about the meaning of being *Syilx* Okanagan. Taken together, the *captíkʷɬ* define and inform *Syilx* Okanagan rights and responsibilities to the *siwɬk*^{w}*,* to the land, and to one another. *captíkʷɬ* stories hold teachings on how we all can relate to and live on this land. They serve as reminders of natural laws and protocols that need to be followed for all the future generations to survive in harmony with the *tmix*^{w}.

2.4.4 Connect to Place

From a *Syilx* Okanagan perspective, to effectively engage in watershed planning, it is important for researchers, Elders, community members, and decision makers to venture out into the watershed and observe it from the headwaters to the valley bottoms. This has always been an important part of the sacred responsibilities that *Syilx* communities and families have to their local watersheds. For several years now, the ONA has been implementing watershed tours in support of *Syilx* Okanagan watershed responsibility processes. Watershed tours can range in size from a single creek to the Columbia River. They consist of getting out into a watershed with *Syilx* Okanagan community members or Elders who have intergenerational knowledge of those systems. On the watershed tours, *Syilx* Okanagan community members share not only important knowledge about the water itself but also about the surrounding ecosystem.

2.4.5 Value tmix^{w} (All Living Things)

tmix^{w} is *t*he *nsyilxcən* word that most closely translates as “ecology”. The *Syilx* Okanagan understanding is that *siwɬk*^{w}, *tmx*^{w}*ulax*^{w} (land), and all living things are all part of *tmix*^{w} and are all intricately connected. What we do to one of them, we do to them all. *Syilx* Okanagan responsibilities extend beyond fellow human beings to include everything within the ecosystem: water, plants, animals, land. With the word *tmix*^{w}, the *Syilx* Okanagan responsibility to honour the natural laws of that which gives us life is embedded within the *nsyilxcən* language itself.

As is stated in the *Syilx siwɬk*^{w} (Water) Declaration: “The Okanagan Nation has accepted the unique responsibility bestowed upon us by the Creator to serve for all time as protectors of the lands and waters in our territories, so that all living things return to us regenerated. When we take care of the land and water, the land and water takes care of us. This is our law.”

Throughout the Flood and Debris Flow project, *Syilx* Okanagan knowledge, the *Syilx siwɬk*^{w} (Water) Declaration, *captík*^{w}*ɬ*, and watershed tours were integrated into the risk assessment. The Okanagan Nation is confident that by incorporating *Syilx* Okanagan values, perspectives, and processes into regional planning efforts, a new way of working with nature will emerge that is to the benefit of everyone, inclusive of the *tmix*^{w}.

2.4.6 Collaborate and Develop Water Partnerships

The *Syilx* Okanagan Nation is committed to continued efforts of building relationships and collaborative initiatives towards respecting the shared responsibility for the health of *siwɬk*^{w} and aquatic ecosystems. For example, ONA hosts an annual Water Forum for both *Syilx* and non-*Syilx* participants to build a collective knowledge around *siwɬk*^{w} based on principles from *Syilx* Okanagan natural law. Participants come from a range of backgrounds including all levels of government, academia, industry and non-governmental organizations (NGOs).

At the Environmental Flow Needs Conference held in Kelowna in October 2018, Grand Chief Stewart Phillip spoke of the relationship between the *Syilx* Okanagan people and

the settlers in the region. He explained that the relationship is now entering a phase where climate change is causing widespread havoc on the land. The resulting impacts are creating complexities and interconnections. Responding to these requires non-linear and systems thinking approaches to innovation. This is resulting in non-*Syilx* people, governments, and organizations looking for guidance and insight from *Syilx* Okanagan and other Indigenous Nations whose knowledge systems are holistic, "spiral," and ecosystem-based.

A diversity of perspectives must be coordinated to create more resilient and dynamic planning and responses to care for *siwɬkʷ*. The Grand Chief said that the *Syilx* Okanagan people are up for the challenge and welcome collaboration with others to address these issues.

2.5 Governance Context for First Nation and Local Government Management of Flood in British Columbia

Effective governance of flood risk needs to recognise the wicked[1] and systemic[2] nature of disaster risk. Governance describes the process by which society organizes itself to make decisions and includes consideration of who has power, who makes decisions, how decisions are made, and how the ideas of interested and affected parties and broader society are considered and included in decision processes. Therefore, effective flood risk governance needs to balance the intractable nature of flood with a consistent vision, defined roles and responsibilities, clear planning frameworks, meaningful engagement, and robust decision processes.

Where governance describes the process by which society organises itself to make decisions, flood risk governance describes this process as it relates to flood hazard, flood risk, and flood resilience.

Flood risk governance in BC has shifted over time because of a multitude of intentional and unintentional decisions, political priorities, and directions related to larger shifts in governance approaches, and interjurisdictional relations. The occurrence of actual flood events (in the province or elsewhere in the world) have often been the impetus for (mostly reactive) decisions that shape flood risk governance in BC today.

Presently, the overall approach is polycentric, in that authority and responsibility for flood management activities is spread across different levels of government (e.g., Federal, Provincial, Local and First Nation), and across many sectors within each of these governments (e.g., natural resources, infrastructure, etc.). The private sector also implicitly plays a role. For example, major critical asset holders have responsibility to consider the flood resilience of their infrastructure and have financial self-interest in

[1] A wicked problem in policy, planning, or natural resource management is one that is difficult or impossible to solve. Where competing interests mean that there is no single solution, and because of complex interdependencies, solving one part of the problem will worsen or create other problems.

[2] In this instance the term 'systemic' is used to describe the widespread impacts of flood that can affect all parts of society, are widespread, and can persist for long periods of time.

doing so. The insurance and re-insurance industry, who support the financing of residual risk, are explicitly involved in flood risk governance. Simply, there are a lot of actors who in some cases have overlapping interests, and in other cases have competing interests.

2.5.1 Current Provincial and Federal Direction on Flood and Disaster Risk Reduction

Canada, and more recently BC, are signatories to Sendai (see above). The BC Government is actively taking steps to incorporate Sendai into its activities. For example, the BC Government Action Plan (Emergency Management BC, 2018), developed to answer the Abbott/Chapman Report following the 2017-2018 floods and wildfires in BC, outlines a plan for an Integrated Disaster Recovery Framework. The multi-disciplinary framework is currently under development by various agencies and is focused on activities related to Sendai Priority 4 (see Figure 9).

Further, the Province is currently reviewing the *Emergency Program Act* [1996] and proposing changes to bring it in line with modern best practices. With the modernization of the act, BC becomes the first province in Canada to officially adopt Sendai, which it is using as a cornerstone of the process. This includes the need to:

- Demonstrate stronger connections to climate change and Sendai (see above).
- Recognition that additional resources and capacity will be required.
- Recognition of a broader definition of emergency management to include mitigation and risk reduction.
- Recognition that the *Declaration of the Rights of Indigenous Peoples Act* [2018] (DRIPA, see also below) means that Indigenous Peoples have rights to self-determination over all issues, including emergency management and response.
- Streamline government activities.

The Province has also committed to begin and implement a BC Flood Strategy to "continue to improve flood management and governance for a resilient BC" (Province of British Columbia, 2021).

2.5.2 Indigenous Inclusion

Increasingly, First Nations are being empowered by a changing regulatory landscape. One key driver has been the *United Nations Declaration on the Rights of Indigenous Peoples* (UNDRIP), and its implementation in BC law in 2019. In Canada and BC, other key drivers include the Tsilhqot'in decision [2014], and BC's *Water Sustainability Act* [2016].

UNDRIP is the most comprehensive international instrument pertaining to the rights of Indigenous Peoples. It establishes a framework for minimum standards for the survival, dignity, and well-being of the Indigenous peoples of the world and it elaborates on existing human rights standards and fundamental freedoms as they apply to the specific

situation of Indigenous Peoples. A tenet of UNDRIP is the duty for government to obtain free, prior, and informed consent (FPIC) from Indigenous People on issues that might affect their interest.

In late 2019, BC became one of the first jurisdictions in the world to table and pass legislation, Bill 41, to implement UNDRIP and uphold the rights of Indigenous Peoples. The *Declaration of the Rights of Indigenous People Act* (DRIPA) requires the BC government to bring its laws into alignment with the UNDRIP over time, with mechanisms for transparency, accountability and entering into agreements with a wider range of Indigenous governments.

In Canada, Indigenous People have a constitutional relationship with the Crown based on Section 35 of the *Constitution Act* [1982]. This relationship includes existing Aboriginal and treaty rights. In 2014, the Tsilhqot'in decision by the Supreme Court of Canada clarified that First Nations must be involved in decisions (i.e., at all government levels) that affect their territory; natural hazard adaptation planning falls into this category. The decision also clarified that Aboriginal rights and title exist on a territorial basis, and it recognized ownership rights to Indigenous peoples, including rights related to land use and economic benefits.

Though water management continues to be a provincial responsibility under the *Water Sustainability Act* [2016], the Act envisions delegating aspects of watershed governance to bodies other than the Government of British Columbia. For example, Section 115 of the Act refers to the establishment of Advisory Boards consisting of local groups or entities to provide local expertise and input into statutory decision-making. Local groups could provide recommendations on the appointment of Advisory Board members and developing terms of reference (Polis Project on Ecological Governance, 2019). The Act represents improvements with regard to Indigenous participation in water management compared to its predecessor. However, it has been criticized for the limited consultation process that was used in its development (Joe, Bakker and Harris, 2017), and its disregard for the "unextinguished" water rights of Indigenous People (Gullason, 2018).

An adaptable and sustainable path is forged for all when Indigenous Peoples are recognized as decision makers who have stewarded their territories for millennia and who have inherent jurisdiction with Indigenous natural laws.

2.6 Practical Implementation of Flood Mitigation Activities in British Columbia

Successful flood mitigation actions require that successive or parallel processes be completed. For example, legislation and regulation set the legal framework, guidance documents provide interpretation of the regulations, and funding programs incentivize or disincentivize activities and the monitoring and enforcement of activities. We organize these activities into five components: planning/visioning, regulation, guidance, funding, and monitoring. Each of these is discussed below as a component of the "process context" to flood management. These groupings are also reflected in the Resource

Guide, where they are used on the option implementation pages to describe actions under each process element that can be taken by First Nation or local governments.

2.6.1 Process Context

Implementation of flood management requires consideration of various enabling activities. For the purposes of this project, five distinct process components have been considered. This includes high-level activities such as planning/visioning, as well as the monitoring of activities, successes, and failures, along with both positive and negative levers for action (e.g., regulatory sticks and incentivizing carrots). Each of the process components are described in the next section.

Table 3: Process elements to implement flood management activities.

Process Element	Description
Plan	Good governance of flood risk includes the need for clear direction. The "Plan" component includes the function of providing direction, which in turn can describe a spectrum of activities. At one end, the existence of an authority with a well-developed, transparent, and public strategic vision, and at the other end a simple planning document or an individual person or group with a less well-developed concept for action. The act of developing a strategic direction or vision and articulating steps or components needed to achieve that vision – often developed through engagement and collaboration – is also included in this component.
Regulate	Regulation describes various forms of law and includes legislation and regulations. A mandate to act on issues of flood is necessary, which is generally enabled through legislation, and both creates authorities (the 'who') to carry out flood risk reduction activities, and creates rules for action (the 'what'). Legislation in BC is enacted by the Federal and Provincial governments through parliamentary processes. Regulations refer to rules that are enacted by a legislated authority. With regards to flood management in BC, these generally refer to bylaws or other regulations promulgated by a local or First Nation government. The Province also has regulations related to riparian areas and dam safety for example, which are relevant to flood management.
Guide	As opposed to regulations, which are enforceable and prescriptive, guidelines provide passive regulation. Guidelines are documents that are used to interpret legislation and/or regulation and can provide direction on how to comply with a law. They do not, however, have the force of law behind them.

	In BC, guideline documents are produced by all levels of government, as well as non-governmental bodies. Where applicable, guideline documents – both those that provide guidance to First Nation and local government, and those that are developed by local authorities to guide stakeholders, businesses, residents, etc. are provided in the Resource Guide for each mitigation option.
Fund	An obvious tool for the implementation of most flood management activities is financial investment. Most, if not all, activities require some level of funding, whether it be to resource people, research and development, or physical instruments or structures. A full list of funding programs is presented in Appendix A. And, where applicable is listed under individual mitigation actions in the Resource Guide.
Monitor	An element of any good governance process is a measure of accountability. Ideally, activities should be monitored and reviewed to see if they are successful in achieving the desired outcome. Activities can also have specific targets, which may or may not have penalties for lack of performance. Beyond the function of accountability, monitoring and learning are crucial elements of an adaptive management approach, which is imperative in a changing climate and in the context of continuous change in social, economic, political, and environmental factors.

Given the systemic and broad issue of flood, there are innumerable activities and competencies that are required. In many cases there are dependencies between components and activities (e.g., property level building controls require local government building bylaws, potentially updates to provincial and federal building codes, guidelines, financing to incentivize the activity, as well as enforcement to ensure success).

2.6.2 Authority and Responsibility for Flood Risk Reduction

The implementation of flood mitigation activities needs to be mindful of the governance context. Governance is the regime that creates the authority to act and provides incentives or disincentives for action. In British Columbia, the authority, and other levers for action (e.g., funding, regulation, etc.) is devolved, which means that all levels of government play a variety of sometimes overlapping roles.

This section includes an overview of the legislative, regulatory, and other authorities held by the various levels and types of governments involved. More detailed tables of regulations, funding and authoritative agencies is provided in Appendix A.

2.6.2.1 Federal Government

Canada is a federalist country, where the central government deals with national and international matters. And, although many issues of flood risk governance are devolved to lower levels of government, the systemic nature of flood means that there are some issues that are governed at the federal level. These include issues related to national water resources, fisheries, and natural resource extraction and supporting information. The Federal government also provides some guidance related to the foundational tools (hydrometric data, flood mapping, flood risk assessment, etc.) for flood, to provide some consistency in public safety across the country.

2.6.2.2 Provincial Government

The Provincial Government has several roles and responsibilities related to flood risk governance. The primary role is to set out and enforce legislation related to public safety, water use and land use. The primary agencies with responsibility for flood risk governance are the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) and Emergency Management BC (EMBC); as well, the BC Ministry of Municipal Affairs (MMA) plays an important role in supporting local governments to manage their responsibilities related to flood risk governance.

The *Local Government Act* (LGA) and *Land Title Act* were amended in 2003 and 2004 to remove the role of the BC Minister of Environment (the predecessor to MFLNRORD) from floodplain designation and approving administration, shifting the authority to local governments. Due to this change, local governments have an increasingly important role to play in the management of flood hazards and gain this authority from the provincial legislation—the *Community Charter* and the *Local Government Act*.

2.6.2.3 Local Government

Local governments in BC get their authority from the Province, and include municipalities and regional districts, who each have slightly different roles, responsibilities, and policy tools.

Local governments are extremely diverse, from small rural villages with very limited capacity, to large metropolitan centres with significant populations, tax base, and operations. Municipal governments generally have a larger role, more resources, and greater responsibilities than regional districts, who are obligated to consider emergency management, regional solid waste planning, and some broader governance for electoral areas. In general, local governments, especially municipalities, have a lot of authority and responsibility for flood management because they are the lead agencies for land use planning (and therefore exposure to flood hazard), are able to modify and enhance building controls (i.e., vulnerability), and also typically responsible for initial emergency response. Local governments also have some authority over flood protection infrastructure.

The *Community Charter* [2003] provides the statutory framework for local governments within the province of BC; it sets out areas of authority and procedures. Of relevance to

flood management are the provisions with Division 8 of the Charter that set out the authority of local government to have a Chief Building Inspector permit buildings and occupancy of structures, and to require certification of a qualified professional that "land may be safely used" in areas subject to flood (and other hazards).

The use of the *Community Charter* generally requires base information from flood mapping (either extents or extents and flood depths or Flood Construction Levels, FCLs) to support the Chief Building Inspector and qualified professionals to determine if a site and/or building is safe for intended use. In the absence of an approved flood map, this statute still provides a local government's Chief Building Inspector with the ability to require a geotechnical report to be prepared by a qualified professional for new buildings and for structural alteration or addition to an existing building or structure.

Where flood mapping is available, the LGA provides both policy and regulatory provisions that can be implemented as stand-alone provisions or collectively to form a framework to effectively manage flood hazard areas. Specific tools available under the LGA relevant to natural hazard management are summarised in Table 4.

The LGA provides provisions that enable local governments to manage development in relation to lands prone to flooding. In doing so, the local government must consider the Provincial Flood Hazard Area Land Use Management Guidelines (the Provincial Guidelines). The guidelines are intended to minimize injury and property damage resulting from flooding and are linked to the Provincial Compensation and Disaster Financial Assistance Regulation. Together, the Provincial Regulation and Guidelines are used to determine if property has been adequately protected and whether a local government is eligible for financial assistance following a flood event.

Table 4: Summary of regulatory tools for local government within Local Government Act.

Regulatory Tool	Description
Regional Growth Strategy (RGS) Bylaw	Is a strategic plan that defines a regional vision for sustainable growth. Objectives and policies can be incorporated into an RGS to prepare for flooding and climate change. RGS are developed by regional governments in partnership with membership municipalities (i.e., RDCO)
Official Community Plan (OCP) Bylaw	Is a guiding policy document used to inform land use decisions. OCPs can include policies in support of climate adaptation and risk reduction. OCPs are developed by local governments through a public consultation and visioning process.
Development Permit Areas (DPAs)	Are designated areas requiring special treatment. An OCP may designate DPAs for specified purposes, including the protection of development from hazardous conditions like flooding, wildfire, and slope stability [Section 488]. Hazard DPAs are generally triggered by alterations to the land associated with development activities. DPAs must include contributions or objectives that justify the designation and must also provide guidelines for

	developers and homeowners to meet the requirements of the DPA.
Flood Bylaw	If a local government considers that flooding may occur on land, the local government may adopt a bylaw to designate a floodplain area and specify flood levels for it, establish setbacks and construction elevations for habitable space for new buildings and structures, and for landfill within the flood hazard area [Section 524]. Most often, applications for building and development permits trigger flood bylaw requirements.
Zoning Bylaw	Land use zoning bylaws are used to regulate the use of individual parcels of land, including parcel configuration, the density of the land use, and siting and standards of buildings and structures [Section 479]. These bylaws have been used historically for flood hazard areas to ensure public safety is maintained by limiting the types of uses associated with those lands.
Subdivision Bylaw	Standards for subdivision design that take into consideration sea level rise can be established by local governments (within the Provincial Guidelines). In the case of regional districts, the Approving Authority for subdivision is the Ministry of Transportation and Infrastructure, who is required to consider the Provincial Guidelines to determine the conditions for subdivision approval.
Local Building Bylaw	There is also provision under Section 694 for a local building bylaw or permit process to require floodproofing. Generally, these are no longer used as the updated BC Building Code has some provisions for floodproofing and any additional conditions can also be integrated into a flood bylaw. It should also be noted that the National Research Council of Canada and partners are working to incorporate new floodproofing standards into future iterations of the Canadian Building Code.

2.6.2.4 First Nation Governments

Under Canadian legislation, First Nation Band Councils get some authority from the *Indian Act* [1953], which provides limited powers. This Act is very dated and under review. Under the Indian Act, authority for issues of land management, and therefore flood management, are held by the crown, with Indigenous Services Canada (ISC) providing operational resources.

In 1999, and amended in 2019, the *First Nations Land Management Act* [1999] allows First Nation governments to opt out of approximately 40 sections of the Indian Act. This enables First Nations to develop their own laws related to land use, environment, and natural resources. A First Nation government transitions to this state by first becoming a signatory to the Framework Agreement on First Nation Land Management (the Framework Agreement), which sets out the principal components of governance of

reserve land (Westbank *et al.*, 1999). First Nation governments can ratify the Framework Agreement by enacting a Land Code, which then returns authority for land management from the Crown to the First Nation. In Canada, as of 2019, 165 First Nations have become signatories to the Framework Agreement and 91 have fully enacted Land Codes (First Nations Land Management Reource Centre, 2019), many of which are in BC. Westbank First Nation has a fully enacted Land Code. The Okanagan Indian Band does not (Lands Advisory Board, 2021).

First Nations that have fully enacted Land Codes have authority to:

- Make laws (i.e., regulations as described in Section 2.5.2) with "respect to the development, conservation, protection, management, use and possession of First Nation Land. This includes laws on zoning, land use, interests and licenses, environment and assessment and protection, services…" (First Nations Land Management Reource Centre, 2019).
- Manage land within their jurisdiction related to natural resources, including leasing, managing revenues and expenditures.
- Environmental protection through the authority to require environmental assessments and environmental protection through the implementation of First Nation laws.
- Exchange lands of equal area and quality if advantageous to the First Nation.

There is huge variation in the approaches and tools used by individual First Nations to consider issues of flood risk governance.

For example, the Okanagan Nation Alliance (ONA), has taken a leadership role in flood (ɬ̓ikt) for the Syilx Okanagan Territory, which covers more than 15,000 km^2 of lands in the southern Okanagan and Similkameen watersheds (Ebbwater Consulting Inc., 2019b). They have developed a plan that has the objective to "understand the risk due to ɬ̓ikt and debris flows within the Okanagan and Similkameen Basin in order to support flood risk mitigation planning" and explicitly includes collaboration with local governments within the watersheds. This project is still in its infancy and no on the ground implementation of flood policies has yet occurred, but foundational information that was developed by weaving traditional knowledge and western science has been created and shared.

Other First Nations have policies and tools that are similar or parallel policies to those developed by local governments. For example, the Tsawwassen First Nation (a Treaty Nation), has community area plans, and a Development Permit Area regulation to require that new buildings in the floodplain be built to appropriate standards on reserve lands (Tsawwassen First Nation, 2021).

Some Nations have limited policies, for example, developed during an emergency (e.g. the Declaration of a Local State of Emergency under a Band Council Resolution (BCR) for the Okanagan Indian Band (Louis and Louis, 2017).

Other Nations have partnered with non-Indigenous jurisdictions to develop flood management plans (e.g., Squamish Nation and District of Squamish, and Cowichan Tribes and Cowichan Valley Regional District) for reserve areas.

With regards to Emergency Response, many First Nations have ISC funded Emergency Co-ordinator positions to support the development of emergency plans. ISC has a service agreement with EMBC to provide emergency services; EMBC is the lead in supporting First Nations with response activities (Indigenous Services Canada, 2021).

2.6.3 Summary of Authority for Local Governments

Flood risk governance in BC is very complex and dispersed. There are some activities for which local governments and some First Nation governments have responsibility and strong authority (e.g., land use regulations to reduce flood exposure). However, many actions are outside the authority of local governments currently. In this case, local governments, especially if they work together, can advocate for change to senior governments and others.

3 Project Methods and Evolved Principles and Objectives

This section describes the approaches and methods used to meet the project goals and objectives. It also provides rationale for the evolution of the goals into guiding principles that framed the work. Methods are described for engagement, the development of a decision framework, the population of a toolbox of non-structural flood mitigation options, as well as a baseline policy scan of flood regulations and policies within the RDCO and member communities.

3.1 Project Goals and Objectives

This project is the third phase of work that has been conducted by the RDCO. In earlier phases, an overall planning approach was identified (Phase 1) and flood hazard mapping and some risk assessment was completed (Phase 2). These two projects helped inform the overall goal and objectives for this third phase of work. At the outset of the project, three broad objectives were provided to guide the work (Figure 10).

Figure 10: Project goals as defined by the RDCO.

These objectives are very high-level, but they provide good direction. They also map well to best practice (see previous section). These objectives were reviewed and confirmed by the steering committee (see engagement sections below) at an early stage in the project.

3.2 Guiding Principles

Building on the project objectives, and informed by best management practices, as well as early engagement, four guiding principles were evolved to better frame the needs of the project. These are:

1. Water is sacred and should be nurtured:

   The Okanagan Nation has accepted the unique responsibility bestowed upon us by the Creator to serve for all time as protectors of the lands and waters in our

territories, so that all living things return to us regenerated. When we take care of the land and water, the land and water takes care of us. This is our law.---Syilx Water Declaration

2. Flood mitigation should be focused on reducing the risk and increasing the resilience of the region to flood events. Focusing on the goal of reducing the damages and consequences of flood rather than on trying to control water, opens the door to many more possible flood mitigation options.

3. Reducing flood risk and enhancing resilience is best achieved through the implementation of a range of flood mitigation options. There are dozens of tools in the toolbox, and several can be used at once to complement each other and to provide redundancy.

4. The unique context of the Okanagan Valley and the values of its residents are important factors affecting the relative benefits and costs of different options. Choices need to be informed by these local conditions and preferences.

3.3 Project Elements

To meet the project objectives and be true to the evolved guiding principles, the project was broken into three elements (Figure 11). Although these are presented as distinct options here, and the report is essentially structured to follow these, the actual project effort involved considerable feedback and iterations between the elements.

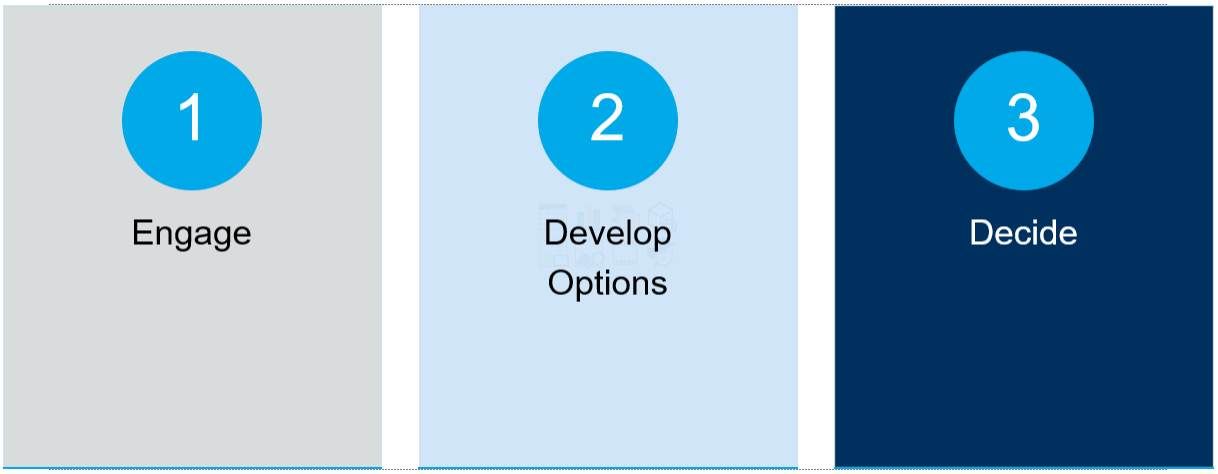


Figure 11: Core elements of project.

1. **Engage**. This element involved engaging with a wide variety of stakeholders, decision-makers and the public to better understand local values related to hazard and water. These values were then used to inform the types of options and the criteria used to understand trade-offs between them.

2. **Develop Options**. This project element consisted of developing and fleshing out the details of a wide array of potential non-structural flood mitigation options suited to the Okanagan.
3. **Decide**. This final element involved conducting research into the suitability of various options to different circumstances, as well as developing a values-based decision tool to inform on trade-offs between different types of options, and finally placing these into the context of existing local government authority and responsibility, and the baseline policy initiatives that exist in the Okanagan today.

3.4 Engagement methods

Engagement was a core component of this process and was key to ensuring that the mitigation options presented are acceptable and supported by member local governments, *Syilx* communities, stakeholders, and the public.

One of the first project tasks was the development of an Engagement and Communications Framework, which was reviewed and contributed to by the Project Steering Committee (see below, Appendices B and C). The Framework guided engagement and communications throughout the project, although the Project Team adapted some steps along the way in response to what worked well, what didn't, and other external factors (e.g., summer events and wildfires that redirected community members' focus).

The Engagement Approach was founded on six principles:

- Equitable and Inclusive
- Two-Way Communication
- Respectful Partnerships
- Transparency
- Knowledge and Education
- Structured

All engagement followed the provincial guidelines around COVID-19, respecting social distancing and limitations on gatherings. This presented an opportunity to utilize the many online and remote engagement platforms and techniques; at the same time, the Project Team continued to utilize some traditional media (e.g., local news outlet) and paper communications (e.g., posters) to include those who aren't online.

General project communications took place across social media (Facebook, Instagram), e-Newsletters, an RDCO webpage set up for this project, a two-page project overview distributed online and on paper, local advertising, phone calls and emails with individuals and specific groups, and posted print materials.

As described below, engagement employed a variety of tools and techniques with three key groups: the General Public, a Project Steering Committee, and Stakeholders. For additional detail, please see the Full Engagement Summary Report (Appendix E).

3.4.1 General Public

Public engagement sought to engage community members and residents from RDCO member municipalities, electoral areas, and Syilx First Nations including Westbank First Nation and Okanagan Indian Band. Efforts were made to focus on residents living in floodplain areas (such as by posting notice of engagement opportunities in neighbourhoods that were particularly affected by past floods) and Syilx community members (such as by working directly with Syilx First Nation representatives on the Steering Committee to understand the best way to engage community members).

The focus of public engagement was to build broad public support for and understanding around flood mitigation planning in the Central Okanagan, promote education around flood and climate change, and to elicit community values that help inform decision making around options.

3.4.1.1 Tools and Methods

Two primary engagement formats were used in engaging the public, along with various communication tools and approaches.

First, a series of Community Conversations were organized as 1-hour Zoom sessions. These included a short PowerPoint Presentation from the Project Team, followed by interactive activities and discussion with participants, utilizing Mentimeter for online instant polling. The series was broken out into two rounds, which were organized as follows:

- Round 1 focused on the question “what do you care about with flooding and your home and community?” This helped shape values which later fed into decision criteria used to evaluate non-structural options.
- Round 2 focused on the question “which flood mitigation options do you want to see in your community?” which introduced residents to non-structural options and sought their high-level feedback.

The first Round included two Zoom sessions with a total of seven participants; due to low registration, the second Round included just one Zoom session which was also attended by seven participants.

Second, an online survey offered similar content and questions as the Community Conversations for those who preferred to participate on their own time. The survey was active for close to a month and received 39 responses.

The Community Conversations and survey were advertised through various communication platforms including a dedicated RDCO webpage, RDCO and City of Kelowna social media pages, RDCO and City of Kelowna e-Newsletters, a series of ads run on Castanet, as well as a digital signboard, paper posters, and sandwich boards strategically placed in neighbourhoods that have experienced significant flooding in the past.

3.4.2 Project Steering Committee

Key decision-makers and governing bodies within the project area were convened to form a Steering Committee for this project. This group of approximately 25 included RDCO project staff and relevant departments, City of Kelowna, City of West Kelowna, District of Peachland, District of Lake Country, Westbank First Nation, Okanagan Indian Band, Okanagan Nation Alliance, Okanagan Collaborative Conservation Program, the Okanagan Basin Water Board, and UBC Okanagan (Watershed Management Research Extension Facilitator).

Guided by a Terms of Reference (see Appendix C), the Steering Committee provided key feedback and high-level direction on the project. They reviewed and provided feedback on deliverables such as the Engagement Framework and draft Flood Mitigation Resource Guide; helped spread information and project awareness (e.g., sharing social media posts about public engagement opportunities); attended and supported other project engagement sessions; and helped integrate and coordinate this project with other Okanagan projects and initiatives.

3.4.2.1 Tools and Methods

The Steering Committee was primarily engaged through three 1.5-hour Zoom meetings that focused on the following:

1. Project introduction, discussion of project objectives, and engagement framework review.
2. Presentation of the structured decision-making process, review of values-based criteria used in evaluating mitigation options, and identification of case studies for discussing mitigation options with stakeholders.
3. Discussion and feedback on the draft Flood Mitigation Resource Guide, which was shared prior to the meeting.

3.4.3 Stakeholders

Stakeholders included a broader representation of local governments (beyond those included in the Steering Committee) such as the North Okanagan and Okanagan-Similkameen Regional Districts, as well as other relevant groups such as non-government organizations doing flood-related work, the School District, Interior Health, relevant provincial ministries, local business representatives (e.g., Chamber of Commerce), neighbourhood / residents associations, and land and asset owners (e.g., Fortis BC, City of Kelowna International Airport, BC Hydro). Over 120 workshop invitations were sent to stakeholders; for a full list of those invited to participate, please see Appendix D.

Stakeholders were engaged to: provide input on values that, together with feedback from the general public, helped inform decision making criteria; and help identify challenges and opportunities with non-structural flood mitigation options and how they can be implemented both locally and regionally.

3.4.3.1 Tools and Methods

Stakeholders were primarily engaged through two 2-hour workshops held over Zoom that also used Mentimeter and Mural online engagement platforms. Content for the two sessions were as follows:

1. Project introduction, flood background, values and impacts, and discussion of opportunities and challenges with the six non-structural options.
2. Group exploration of how to apply non-structural options to two case study locations in the Central Okanagan, and how to address flood risk as a region.

These two sessions included a combination of presentations from the Project Team, interactive small group activities (using facilitated Zoom break out rooms), and plenary discussions.

3.5 Development of Criteria, Objectives and Measures

Most flood-management options involve the *definite* expenditure of resources and alteration of current land uses or environments to create new situations that, except during future *potential* flood events themselves, are otherwise less-desirable than they were before: a scenic beach becomes spoiled by a berm; a café near the shoreline has its view of the water obscured by a raised seawall. It is certainly not inevitable that all changes are negative; with creativity and skill, such physical features can become seamlessly integrated into the landscape to the point that their function is not obvious to the casual observer, and form and functionality may even be increased. Nevertheless, where there is a need to take an existing location and intervene to incorporate design features that are only necessary in rare flood events, controversy is to be expected, no matter which mitigation approach is selected.

The selection of preferred options will often be reduced to questions of values-based trade-offs. Is it better to accept the loss of tax revenues from increased development in the floodplain by holding the land and developing park spaces, or to accept the occasional costs associated with response and recovery to the increased development areas? Should government help a location become more resilient to occasional floods rather than trying to prevent it from ever getting wet? These questions have no technically optimal answers. An informed consultation of this kind requires communication about what the choices might entail and analysis on how these choices might affect the things people value the most.

For this project, a values-based approach to decision making was used. This involved first identifying locally relevant values through engagement (see above), then developing decision objectives and measures. A basket of options was then developed (see next section), and these were compared against the objectives and measures (see Figure 12)

A note on terminology

Objectives are simple values-based statements of the things that matter to people when considering flooding.

Performance measures provide a means of assessing the performance of different flood mitigation options across objectives. Various methods may be used to estimate the value of the performance measures under each of the flood management alternatives.

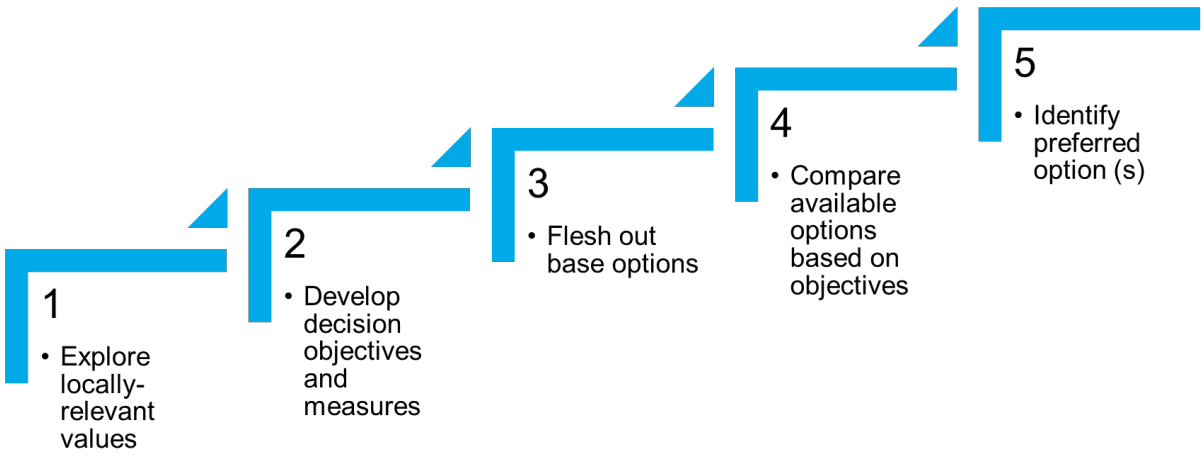


Figure 12: Decision-making process.

A simplified set of criteria were developed from the more detailed objectives and measures to support the development of the Resource Guide for a lay audience. Some important criteria were collapsed or eliminated during this process. The simplified criteria provide an excellent base for initial screening of options. However, if and when more detailed work is completed, the full list of objectives and measures should be considered.

3.5.1 Strengths and Limitations of this Approach

This structured approach to looking at options allows for easy identification of preferred options (or low-hanging fruit) as well as least preferred options. This approach also provides additional information on the weak points of an option that might be improved by augmenting the concept, or alternately might be complemented with a second or third option to better score across all criteria.

This approach does not however provide 'an answer'. The provision of a single solution does not in itself make a lot of sense, as it is important to consider the very local context where an option might be implemented.

3.6 Development of Options

One of the guiding principles for this work was to develop a full toolbox of options to provide a range of tools that can complement each other and provide redundancy. This was accomplished by first developing a structure to understand the full toolbox of options, and then through the authors' knowledge and research tools were established and fleshed out.

3.6.1 Grouping of Non-Structural Mitigation Approaches

To provide some structure to the numerous options, some overarching strategy groups were developed. If risk is a function of hazard, exposure, and vulnerability, then there are three broad non-structural approaches or strategies that can be taken to reduce the risk.

1. **Reducing local flood hazards through land stewardship**. This can include maintaining and restoring natural assets and systems (e.g., watersheds, wetlands, riparian areas, natural waterways) to help reduce flooding.
2. **Reducing local exposure to flood hazards through land use management.** This can include encouraging or requiring types of land use in flood hazard areas that will prevent or reduce potential damage. For example, a green space would be less affected by flooding than a new subdivision.
3. **Reducing local vulnerability through building management**. This can include regulations and strategies that make structures and belongings less susceptible to flood damage. For example, using flood-resistant materials for the ground floor of a building.

These approaches can be pursued individually or in combination with one another to minimize damages during a flood.

In addition to risk reduction strategies, activities to increase resilience will benefit communities and reduce the long-term impacts of flood. Resilience is defined as the "ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of the essential basic structures and functions through risk management." (UNDRR, 2015).

Resilience strategies are those non-structural flood mitigation options, or groups of options, that can be taken in advance of a flood to ensure a robust and rapid recovery after a flood event. There are three broad strategies that can be applied:

1. **Education and awareness.** Homeowner guides, flood and climate change education, neighbourhood preparedness programs, and other learning resources.
2. **Emergency response**. Early warning systems, temporary barriers, and other flood response programs.
3. **Insurance and disaster financial assistance**. Managing financial risks where no other mitigation strategies are available.

3.6.2 Materials Reviewed to Develop Toolbox

The authors approached the task of filling the toolbox with tools using “blue-sky” thinking; we assumed that there were no bounds to the possible options. For example, we did not limit the options to those that would function under current governance systems, rather we included options that would require significant shifts in senior government policy alongside those that would be easily achieved today.

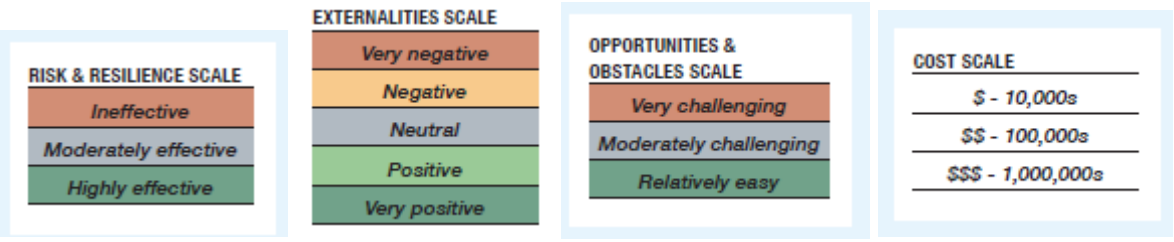
An initial list of options was developed by considering previous lists of non-structural mitigation activities, for example within the core competencies list of the BC Flood Governance Review reporting (Ebbwater Consulting Inc. and Pinna Sustainability, 2021), the Federal Land Use Guide for Flood Risk Areas (Ebbwater Consulting Inc., 2019a) and the relevant approaches with the Sea Level Rise Adaptation Primer (Arlington Group; EBA Engineering Consultants; DE Jardine Consulting; Sustainability Solutions Group, 2013) and the Flood Protection Strategies for BC (The Arlington Group, 2010). We then built on this list through internet searches and author knowledge. We researched many reports related to sea level rise adaptation, as the trend in expanding flood areas for coastal areas is more recognised at this time than changing flood inland flood hazard, and many resources and toolkits have been developed in the last few years to address this.

The full list of options was then simplified and reduced through amalgamation (when two options were deemed similar enough to combine) and some separation (when for example the option would be different based on the existing condition (e.g., retrofitting a building is very different than requiring floodproofing in a new build).

3.7 Scoring of Criteria

Each of the options was scored against the simplified criteria developed from the more detailed objectives and measures. This process was conducted by the project team, based on their understanding of the criteria and the options, these are therefore subjective scores. The scores are meant to be indicative to highlight relative differences and trade-offs between flood mitigation options.

The following scales were used:



Further, the scoring was conducted in the absence of “place”. Whereas the effectiveness of an option is in large part determined based on the local circumstances for which it is being considered. For example, the risk reduction efficiency of an option is dependent on the existing exposure and vulnerability of a neighbourhood or place.

We encourage users of the Resource Guide and this report to score their own projects, using local, and quantifiable (where available) information.

3.8 Policy Scan

In addition to understanding what non-structural flood mitigation options are possible, and the trade-offs associated with each of them, it is important to understand the baseline of existing policies in the region. This is especially important given the dependencies in policy (e.g., having a floodplain map that is then designated within a flood bylaw or DPA prior to being able to enact many building controls or land use controls; see also Background and Supporting Information).

A high-level policy scan was conducted for the RDCO and First Nation and local governments within the RDCO boundaries. For each jurisdiction a number of policy and/or regulatory tools were reviewed to establish how flood is currently managed, which tools are currently in place to support non-structural mitigation, and finally where the gaps lie.

A relatively simple scan approach was taken. For each jurisdiction:

1. The presence or absence of local government regulatory tools (see Table 4 and First Nation Governments section) was determined.
2. When a local government regulatory tool was present, it was reviewed for elements related to flood, natural hazards, climate adaptation.
3. A broader search of all public materials on the jurisdiction's website was also conducted for any other policy direction (e.g., board or council resolutions, etc.)
4. Where relevant, this was compared to materials in recently completed *Analysis of Flood Resilience Policy and Planning Tools in the Okanagan Valley* (Nahiduzzaman *et al.*, 2021).

For each jurisdiction a summary of relevant policies were summarised in text and tables, and a brief analysis of opportunities and gaps to the implementation of non-structural flood mitigation was developed.

4 Results

The following section provides a summary of results from the various tasks described in the previous section. First a summary of the engagement is provided. This is followed by a full list of project-specific objectives and measures and the summarised criteria used to score the options. The options themselves are presented within the Resource Guide, although a full scoring table is presented in Appendix F. This section also provides the results of the policy scan and presents next step policy actions for each jurisdiction within the RDCO.

4.1 Engagement Summary

On top of supporting education and awareness building, engagement with the public, Stakeholders, and the Steering Committee the engagement process helped elicit values – i.e., what people care about when it comes to flooding and its impacts, and approaches to building resilience and reducing risk. This feedback informed the Project Team's development of values-based criteria to evaluate non-structural mitigation options.

Engagement activities were also designed to gauge perceptions and preferences around the various flood mitigation options. The public was introduced to and engaged on these options at a high-level. Further detail was sought from the Steering Committee and Stakeholders which helped to characterize the challenges and opportunities in implementing suites of mitigation options and coordinating at a regional scale.

Altogether, **engagement findings helped to identify a suite of non-structural mitigation options that are broadly accepted and supported**, and to understand which options are appropriate when and where.

4.1.1 Values and Principles

Both Stakeholders and the public were asked what they value about living among rivers and lakes in the Okanagan. Their responses touched on key themes such as:

- Recreation and outdoor, healthy lifestyle
- Water quality and access (e.g., for drinking water, cultural uses, etc.)
- Nature and biodiversity, with frequent mention of aquatic habitat
- Aesthetics (beauty, sounds, scenery, etc.)
- Weather and climate

When asked to prioritize a list of pre-determined flood impacts, the top three* were as follows:

Table 5: Stakeholder and public ranking of flood impacts.

Ranking	Stakeholders	General Public
1	Environment	Affected People
2	Affected People	Environment
3	Economics	Infrastructure Disruption

*Other impacts included mortality and cultural impacts.

4.1.2 Options

The general public and Stakeholders were both asked which of the six non-structural mitigation strategies they are most drawn to. Based on their input, the options were ranked as follows:

Table 6: Stakeholder and public ranking of non-structural mitigation strategies.

Ranking	Stakeholders	General Public
1	Land Use Management	Land Stewardship
2	Land Stewardship	Land Use Management
3	Education and Awareness(tie)	Education and Awareness
4	Building Management (tie)	Building Management
5	Emergency Response	Emergency Response
6	Insurance and DFA	Insurance and DFA

For additional detail on the challenges and opportunities that stakeholders and the public identified with each of these options, please see the Full Engagement Summary Report (Appendix E).

4.1.3 Implementation through Regional Coordination

During the two workshops, stakeholders were asked to consider how some of the non-structural options could be implemented regionally and where coordination is needed. There was widespread agreement that there needs to be a consistent and coordinated approach across the region, with more detail in the following themes:

- **Take a watershed and natural assets approach**. Centring discussion and policy on watershed protection helps underscore the importance of working collaboratively across the region, rather than following jurisdictional boundaries. It is also important to see natural assets as infrastructure that offer opportunities and positive values.
- **Manage "transfer of risk" across properties or jurisdictions**. Actions taken on one property can inadvertently transfer flood risk to other sites up or downstream. This needs to be managed regionally (e.g., through monitoring and response of even small-scale property-level changes that affect hydrology) as changing lake levels and stream flooding take place across property lines and jurisdictional boundaries.
- **Consistent policies across the region could enable bolder action**. For example, buy-out and retreat options would require a regional approach. Having consistent policy and messaging across the region strengthens the abilities of each jurisdiction within to implement some of the more 'controversial' options.
- **Approach regional coordination with everyone at the table, including upper levels of government**. A regional approach needs to be developed collaboratively to ensure everyone in the region (e.g., member municipalities and

First Nations) is on board. It will also be important to work with the provincial and federal governments to clarify roles and responsibilities, align approaches, and seek to create policy at the provincial and federal level policy that enables, rather than limits, local governments to adequately implement flood mitigation options.

- **Align and adapt funding priorities**. Local governments need to have a mechanism to buy land (rather than obtaining funding for infrastructure projects, which is a more common funding priority) to support managed retreat.

4.2 Objectives, Measures, and Criteria for Decision-Making

The following briefly summarises how the criteria, presented in the Resource Guide, were developed.

4.2.1 Locally Relevant Values

First, locally relevant values were determined through the stakeholder engagement process (specifically Round 1). Through a series of workshops and surveys a list of important values were developed (see Figure 13 and Engagement Summary).

Figure 13: Locally relevant values used in decision tool.

4.2.2 Objectives and Measures

Using the previously identified values, along with standard indicators used in Disaster Risk Reduction literature (see Best Management Practice Context, Section 2.2), an initial list of objectives and measures were developed.

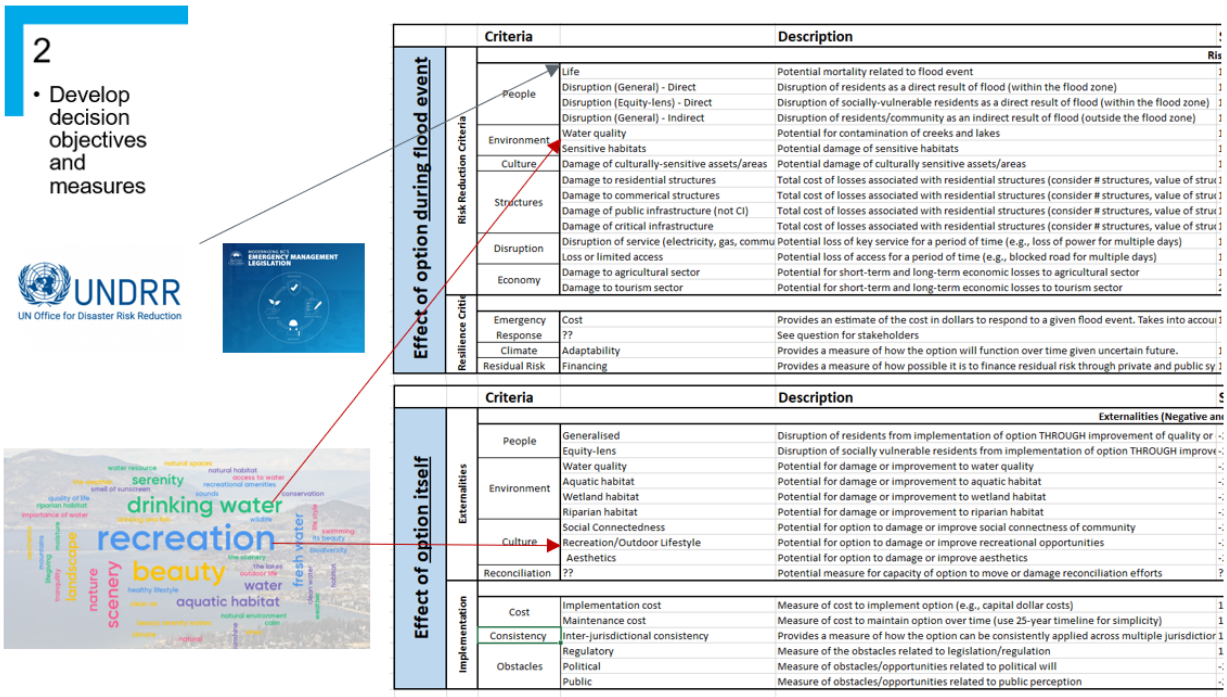


Figure 14: Example process to develop objectives and measures from values.

These objectives and measures were then workshopped with the Steering Committee and refined (see Figure 15 and Figure 16). Importantly, the decision objectives were grouped into two distinct categories. The first category includes objectives to determine the effectiveness of the option for flood risk reduction or increasing resilience (i.e., the effect of the option during a flood event). The second category of objectives relates to the potential co-benefits or negative externalities that will result from the implementation of the option; these are the impacts that will be felt 'year-round', as opposed to the benefits that are brought during a flood event.

Effect of option during flood event		Criteria (Objective)	Measure
Risk Reduction Criteria			Risk Reduction Criteria
	People	Health & safety	Potential mortality related to flood event
		Disruption (General) - Direct	Disruption of residents as a direct result of flood (within the flood zone)
		Disruption (Equity-lens) - Direct	Disruption of socially-vulnerable residents as a direct result of flood (within the flood zone)
		Disruption (General) - Indirect	Disruption of residents/community as an indirect result of flood (outside the flood zone)
	Environment	Water quality	Potential for contamination of creeks and lakes
		Fish population health	Potential damage or improvement of fish population health
		Change to sensitive habitats	Potential damage or improvement of sensitive habitats
	Culture	Damage of culturally-sensitive assets/area	Potential damage of culturally sensitive assets/areas
	Structures	Damage to residential structures	Total cost of losses associated with residential structures (consider # structures, value of structure, and susceptibility of structure to
		Damage to commercial structures	Total cost of losses associated with commercial structures (consider # structures, value of structure, and susceptibility of structure t
		Damage of public infrastructure (not CI)	Total cost of losses associated with public infrastructure (consider # structures, value of structure, and susceptibility of structure to
		Damage of critical infrastructure	Total cost of losses associated with critical infrastructure (consider # structures, value of structure, and susceptibility of structure to
	Disruption	Disruption of service (electricity, gas, comm	Potential loss of key service for a period of time (e.g., loss of power for multiple days)
		Disruption of transportation and mobility	Potential loss of access for a period of time (e.g., blocked road for multiple days)
	Economy	Damage to local economy	Potential for short-term and long-term economic losses to broader local economy
		Damage to agricultural sector	Potential for short-term and long-term economic losses to agricultural sector
		Damage to tourism sector	Potential for short-term and long-term economic losses to tourism sector
Resilience Criteria			Resilience Criteria
	Emergency Response	Cost of response	Provides an estimate of the cost in dollars to respond to a given flood event. Takes into account costs associated with deployment o
		Retention of human resources and capacity	Potential for burnout and turnover of emergency response staff
	Climate	Adaptability of option to multiple climate	Provides a measure of how the option will function over time given uncertain future
	Residual Risk	Access to financing	Provides a measure of how possible it is to finance residual risk through private and public systems

Figure 15: Objectives and measures related to the effectiveness of an option during a flood event.

Effect of option itself		Criteria (Objective)	Measure
Externalities			**Externalities (Negative and/or Positive) (a.k.a. co-benefits for positive)**
	Community	Location/character of housing and neighbo	Disruption of residents from implementation of option THROUGH improvement of quality or quantity of housing and community
		Equity-lens (relative impacts for population	Disruption of socially vulnerable residents from implementation of option THROUGH improvement of quality or quantity of housing
	Environment	Social Connectedness & Support	Potential for option to damage or improve social connectness of community
		Water quality	Potential for damage or improvement to water quality
		Aquatic habitat health	Potential for damage or improvement to aquatic habitat
		Wetland habitat	Potential for damage or improvement to wetland habitat
		Riparian habitat	Potential for damage or improvement to riparian habitat
		Aesthetics	Potential for option to damage or improve aesthetics
	Culture	Recreation/Outdoor Lifestyle	Potential for option to damage or improve recreational opportunities
		Indigenous Culture	Potential for damage or improvement to Indigenous cultural sites
		Non-Indigenous Culture	Potential for damage or improvement to non-Indigenous cultural sites
	Reconciliation	(Pending discussion with Syilx Okanagan Peoples)	
Implementation			**Implementation Criteria**
	Cost	Implementation cost	Measure of cost to implement option (e.g., capital dollar costs)
		Maintenance cost	Measure of cost to maintain option over time (use 25-year timeline for simplicity)
	Consistency	Inter-jurisdictional consistency	Provides a measure of how the option can be consistently applied across multiple jurisdictions
	Obstacles	Regulatory	Measure of the obstacles related to legislation/regulation
		Political	Measure of obstacles/opportunities related to political will
		Public	Measure of obstacles/opportunities related to public perception

Figure 16: Objectives and measures related of the effect of the option itself.

The final list of detailed objectives and measures are presented in the figures above. A digital version of this list that includes potential scales of measurement (either quantifiable from risk analyses, or simple expert judgement likert scales) was provided alongside this report.

4.2.3 Simplified Criteria

Given the complexity of the full list of objectives and measures, and the need for place-based analysis to score many of the objectives, a simplified list of criteria and targets were evolved.

Table 7: Simplified criteria applied to non-structural flood mitigation options.

Criteria			Target
Effect of option during flood event	**Risk Reduction Criteria**	**People**	Reduce risks to health and safety of people
		Structures	Reduce damage to structures
		Disruption	Minimize disruption of services and mobility (electricity, gas, communications, etc.)
		Economy	Minimize damage to local economy including agriculture and tourism
	Resilience Criteria	**Emergency Response**	Increase the effectiveness of response
		Climate	Increase adaptability of option to multiple climate futures
Effect of option itself	**Externalities**	**Community**	Housing
			Social connectedness and supports
		Environment	Habitat health (aquatic, wetland, riparian, and water quality)
		Culture	Recreation and outdoor lifestyle
	Implementation Criteria	**Obstacles**	Regulatory
			Political and public will
		Cost	Implementation cost
			Maintenance cost

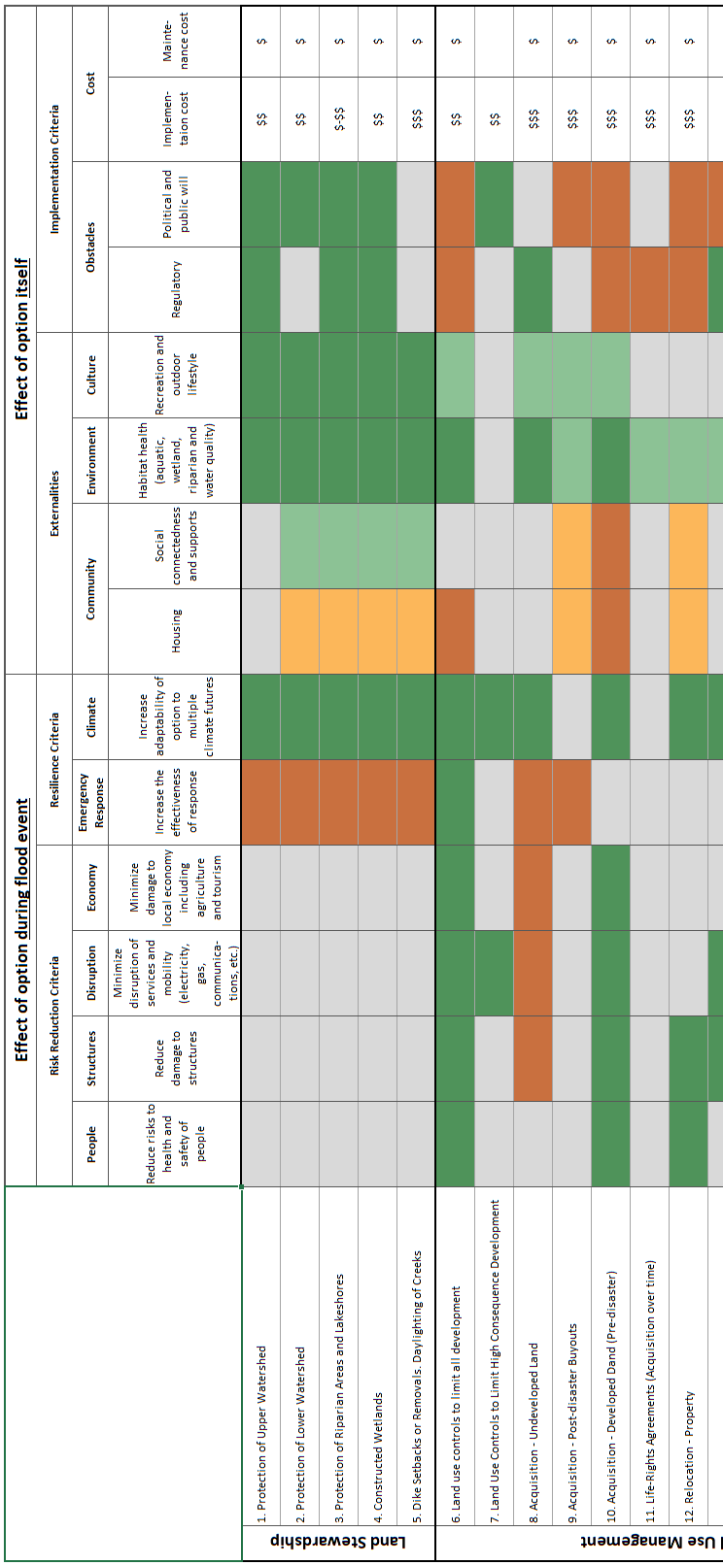
4.2.4 Options Development

The Resource Guide showcases 40 non-structural flood mitigation options that may be applied within the Okanagan. For each option, a description is given. This is followed by a table and narrative description of trade-offs associated with the option. Implementation steps are also provided along with example applications if known. Please refer to the Resource Guide for the results of the options development.

4.2.5 Scoring and Trade-offs

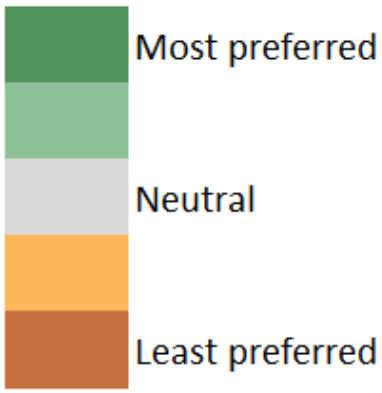
Each of the 40 non-structural mitigation options developed and fleshed out earlier were then scored against the simplified criteria, using the subjective judgement of the consultant team. The scores are presented in the option summary sheets within the

Resource Guide, as well as a group below (illustrative only) and in a large format within Appendix F.



		Effect of option during flood event							Effect of option itself									
		Risk Reduction Criteria				Resilience Criteria		Externalities					Implementation Criteria			Cost		
		People	Structures	Disruption	Economy	Emergency Response	Climate	Community		Environment	Culture	Obstacles						
		Reduce risks to health and safety of people	Reduce damage to structures	Minimize disruption of services and mobility (electricity, gas, communications, etc.)	Minimize damage to local economy including agriculture and tourism	Increase the effectiveness of response	Increase adaptability of option to multiple climate futures	Housing	Social connectedness and supports	Habitat health (aquatic, wetland, riparian and water quality)	Recreation and outdoor lifestyle	Regulatory	Political and public will	Implementation cost	Maintenance cost		
Land Stewardship	1. Protection of Upper Watershed													$$	$		
	2. Protection of Lower Watershed													$$	$		
	3. Protection of Riparian Areas and Lakeshores													$-$$	$		
	4. Constructed Wetlands													$$	$		
	5. Dike Setbacks or Removals. Daylighting of Creeks													$$$	$		
Land Use Management	6. Land use controls to limit all development													$$	$		
	7. Land Use Controls to Limit High Consequence Development													$$			
	8. Acquisition - Undeveloped Land													$$$	$		
	9. Acquisition - Post-disaster Buyouts													$$$	$		
	10. Acquisition - Developed Dand (Pre-disaster)													$$$	$		
	11. Life-Rights Agreements (Acquisition over time)													$$$	$		
	12. Relocation - Property													$$$	$		

Table 8: Illustrative partial consequence table for non-structural flood mitigation options (refer to Appendix F for full table).



The table (illustrative above, and complete in Appendix F) shows at a glance how each option has different trade-offs. Some options are reasonably effective at reducing risk, and offer many positive co-benefits, but have significant implementation challenges (e.g., land stewardship options; top few rows of the table). Whereas, other options have excellent co-benefits, are relatively easy to implement, but are only moderately effective or barely effective at actual risk reduction (e.g., emergency response options).

The key to meeting the project objectives of reducing risk and increasing resilience is to develop a suite of options that can be applied together.

The scoring results can and should be used by local governments to support initial screening and prioritisation of a tool or suite of tools for a specific area. Given the unique hazard and risk profiles of any given area, and of any potential co-benefits or externalities, the scoring and objectives should be revisited and updated as appropriate prior to being used to determine final plans.

4.3 Policy Scan

The following provides an overview of existing policies and regulations that are in place within the RDCO and member communities.

4.3.1 Regional District of Central Okanagan

The RDCO has a number of regulations and policies related to flood management along Okanagan Lake and other watercourses. This includes broad policy statements within the RGS, more detailed policy statements within four OCPs, a Zoning Bylaw, and one Rural Land Use Bylaw. The OCPs and Rural Land Use Bylaw also include an Aquatic Ecosystems DPA, which covers the creek systems. The RDCO Zoning and Rural Land Use Bylaws have a full section on floodplain regulations, that for the most part follow the Provincial guidelines.

Table 9: Regulations related to flood management within the Regional District of Central Okanagan

Regulation	Section	Details/Description
Regional Board Strategic Priorities (2020 Update)	Environment	This section includes several relevant priorities: 1. A commitment to “a reduction in new construction in higher risk floodplain areas” 2. A commitment to collaborate with other regional partners to “address dangers from flooding and enhance the region’s ecosystems”
	Sustainable Communities	A commitment to “advocate to the Province to review Okanagan Lake levels to reduce the risk of flooding”
Regional Growth Strategy	Section 3.2.3	This includes a policy to “work with local governments, provincial agencies to assess and mitigate risks in floodplains”

(RDCO, 2013)	Section 3.2.7	This includes a policy to "encourage land use and transportation infrastructure that improves the ability to withstand climate change impacts and natural hazard risks"
RGS Monitoring Program (2019)	Section C.7	Includes a proposed indicator for Natural Disaster Resilience of "# of dwellings in flood risk (hazard) zone"
OCPs (Electoral Areas) Bylaws Nos. 1124,1274, 1303 and 1304 (Sections and Policies noted for Brent Road-Trepanier OCP, similar policies and statements are within all 4 OCPs, exceptions are noted as separate rows below)	Section 5.1.1	P3 "Work with provincial and federal water and resource managers to protect and enhance water quality, base flows, natural drainage patterns, and continuous riparian corridors of sufficient width to accommodate the dynamic nature of the hydrologic system, to avoid and reduce flood damage…" P7 "Support efforts that maintain appropriate riparian buffers, determined by qualified professionals that take account processes of natural erosion, deposition and movement of natural stream boundaries, floodplain provisions and sensitive terrestrial habitats" P12 "Local low intensity land uses and manage forms of development on floodplains and aquifers in accordance with provincial regulations"
	Section 5.2	P9 "Discourage development that may be damaged by flooding from being located on land that might be flooded as identified by setbacks and elevation provisions recommended by Water Management officials of the Province of BC and outlined in Zoning Bylaw No 871. This includes flood construction levels 1.5 m above the natural boundary of certain watercourses. Where construction may occur on existing parcels that might be flooded, buildings should meet those construction and location requirements. Development of property should be consistent with the provincial Flood Hazard Land Use Management Guidelines"
	Section 7.3 (Agriculture)	P10 "Investigate methods to jointly administer storm water drainage systems with the Ministry of Transportation and Infrastructure and provide sustainable funding for stormwater management and flood protection works"

		P11 “Support development designs involving major flood control works when sustainable funding to maintain these works is secured”
	Aquatic Ecosystems DPA	Describes active floodplains as areas that are flooded more frequently than 1 in 5 years (20% AEP). Mapping includes creeks but does not include Okanagan Lake; although a 15 m riparian buffer is applied to all watercourses. Guidelines generally promote natural processes and limit the use of engineered solutions (e.g., riprap to manage bank erosion).
Rural Westside OCP	Section 3	This OCP includes a description of normal and flood lake levels; a 200-year (0.5% AEP) design level of 343 m (no datum) is given.
Zoning Bylaw 871	Section 3.28 Floodplain Regulations	This defines FCLs for Okanagan Lake (343.66 m, no datum is given), 3 m above Mission Creek natural boundary, and 1.5 m above natural boundary of any other watercourse. It also defines horizontal setbacks from Okanagan Lake (15 m) and from other water sources (7.5 m to 30 m) The remaining text is generally pulled from the Provincial guidelines. It has a provision to require a covenant on title related to any exemption under Section 219 of the Land Title Act.
Joe Rich Rural Land Use Bylaw 1195 [2007]	Section 3.1	This, like the Zoning Bylaw, provides specific regulations for floodplains within the Joe Rich area. The regulations mimic those in the Zoning Bylaw with the exception of an additional statement to limit liability to the RDCO: Damage by Flooding By the enactment, administration or enforcement of this bylaw the Regional District of Central Okanagan does not represent to any person that any building or structure, including a manufactured home, located, constructed, sited or used in accordance with the provisions of this bylaw, or in accordance with any advice, information, direction or guidance provided by the Regional District of

		Central Okanagan in the course of the administration of this bylaw will not be damaged by flooding.
Development Application Procedure Bylaw 944	Section 6.2 (f)	Provides potential to require reporting prepared by a qualified professional related to flooding.

In addition to the regulations above, the RDCO has relevant guidelines. This includes the 2007 Central Okanagan Foreshore Plan, which maps out a Foreshore Area, and provides guidance on the management, development and use of lands within the foreshore area. This document provides useful guidance as it relates to issues of land stewardship, as it has a focus on the protection and naturalisation of foreshore (i.e., flood hazard) areas. The document also has specific policies for *designated* flood plains within the RDCO. However, as noted elsewhere, this terminology is outdated and is likely in reference to the pre-2004 era when floodplains were provincially designated. Regardless, there are some strong tools within this guidance document to support non-structural flood mitigation actions.

As companions to the above document, the RDCO has worked to update the foreshore mapping in the plan in the Okanagan Lake foreshore inventory and mapping project, and has complemented this with their Sensitive Habitat Inventory Mapping.

4.3.1.1 Opportunities for non-structural mitigation

The RDCO regulations and policies set an excellent foundation for non-structural mitigation actions. The RGS strategies reflect many of the best practices highlighted earlier in this document, and the recommendation for leadership and regional collaboration reflected in the recommendations (later in this document).

4.3.1.2 Challenges for non-structural mitigation

The current regulations reflect older information related to flood hazard from the lakes. The newly reported FCL (Northwest Hydraulic Consultants Ltd., 2020) for Okanagan Lake is 344.6 m (CGVD2013)/ 344.3 m (CGVD1928) which is significantly higher than the FCL within the current policy.

The current zoning bylaws reflect provincial guidance, and therefore limit vulnerability reduction approaches to raising structures above the FCL, whereas, best practice (as described in this report and elsewhere) highlights the possibility of using a broader definition of flood proofing, to include all the measures within the building management section of the Resource Guide.

4.3.1.3 Next steps for non-structural mitigation

As an immediate next step, the RDCO should consider updating the zoning bylaw to reflect the new FCLs for Okanagan Lake (and potentially including an easy mechanism to continue to update these levels as they are reviewed in future).

The RDCO could also consider developing a hazard area DPA (to include Okanagan Lake) within the OCPs to better reflect and manage flood hazards, as opposed to relying on related measures within the Aquatic Ecosystems DPA.

4.3.2 Westbank First Nation

As noted earlier, the Westbank First Nation has a Land Code, and as such has authority to manage land use decisions on their reserves. They also have greater rights and title that are in flux (see earlier sections on Governance Context for First Nation and local governments). In this section, we review the Comprehensive Community Plan, as the existing *de jure* regulatory tool for the Nation. An updated version of the plan is being developed at this time.

Table 10: Regulations related to flood management within Westbank First Nation.

Regulation	Section	Details/Description
Community Plan (Westbank First Nation, 2015)	Section 3.3	The plan defines an Environmentally Sensitive Area that considers the foreshore and floodways for watercourses.
	Principle 3.3.1 (c)	This principle aims to "minimize the hazard of floodplains on development by locating lower intensity land uses in these areas and regulating development within the floodplains"

4.3.2.1 Opportunities for non-structural mitigation

The overarching principle within the Plan to locate lower intensity land uses in flood hazard areas is very much in line with best practice for flood risk reduction. As long as this principle is followed through in land use planning then there is a good opportunity to reduce risk in the community.

4.3.2.2 Challenges for non-structural mitigation

A primary challenge to implement non-structural mitigation is the lack of specificity in the regulations. For example, flood hazard areas are not defined, nor are "lower intensity land uses" described.

4.3.2.3 Next steps for non-structural mitigation

As an immediate next step, WFN could consider adopting the 2020 Flood Maps (Northwest Hydraulic Consultants Ltd., 2020) and explicitly including them in the community plan within the Environmentally Sensitive Area or as a new Hazard Area. In the medium term, more detail on land and building controls could be developed with the community.

4.3.3 Okanagan Indian Band

As noted earlier, the Okanagan Indian Band (OKIB) does not have a Land Code, and as such has limited authority to manage land use/hazard decisions on their reserves. They also have greater rights and title that are in flux (see earlier sections on Governance Context for First Nation and local governments).

In this section, we review the 2020 Strategic Plan, as an existing public document. The OKIB has draft land use plans for areas outside the RDCO jurisdictional boundary, but these are for OKIB members only.

The 2020 Plan and accompanying 2020 annual report lays out high level priorities for the OIB. As a high-level document, this makes no reference to flood or hazard. However, a key theme relates to lands and territory: "We exercise our inherent rights over OKIB lands, water and territory through culture, technical expertise, strategic partnerships, and Syilx laws." Under this strategic goal are objectives related to land use planning and the development of environmental management protocols. Within the long-term objectives are a desire to build relationships and protocols with Local and Regional governments, as well as an objective to build a Land Governance Model (i.e., adopt a Land Code).

4.3.3.1 Opportunities for non-structural mitigation

As the OKIB works towards a Land Governance Model, there is excellent opportunity for the nation to work collaboratively with regional governments to implement non-structural mitigation options, especially those related to land stewardship.

4.3.3.2 Challenges for non-structural mitigation

While the OKIB works towards a Land Governance Model, there are considerable challenges to applying non-structural flood mitigation options as outlined in the resource guide, which was developed on the precept that land use regulations are an option.

4.3.3.3 Next steps for non-structural mitigation

The OKIB may wish to consider the inclusion of land stewardship concepts that mitigate flood risk as they work on next steps in their land use planning.

4.3.4 City of Kelowna

The City of Kelowna has very recently (January 2022) finalised its OCP, which contains some excellent and progressive objectives and policies related to flood. Given the timing of the project, the majority of insights were gleaned from a version of the Draft OCP.

We note that the Okanagan Lake floodplain that is included in OCP 2030 has been removed from OCP 2040, which only includes the Mill Creek floodplain within the hazardous area DPA.

The City also has a bylaw for the Mill Creek floodplain, which has language is pulled from provincial guidance. The City Building Bylaw does not reference flood or flood mitigation. The draft City Zoning Bylaw includes a Riparian Management Area setback, but does not directly reference flood hazard areas.

The City also has a dated policy that has applicability for non-structural mitigation, specifically a 1971 Land Acquisition/Long Range Development Plan.

Table 11: Regulations related to flood management within the City of Kelowna.

Regulation	Section	Details/Description
OCP Bylaw No. 12300 (City of Kelowna, 2022)	Objective 13.3	Design stormwater infrastructure to mitigate flooding and pollution to our neighbourhoods, streams, and Okanagan Lake. This includes policy direction to manage stormwater infrastructure to mimic natural conditions.
	Objective 14.3	Preserve Okanagan Lake for its environmental, traditional, cultural, spiritual, and recreational values. This includes policy direction to use avoid hard armouring (structural controls) and where possible use green infrastructure.
	Object 15.4	Reduce flood risk to health and safety, infrastructure, property, and natural assets. Policy 15.4.1. **Developing in Floodplains**. Where development is already located in a floodplain, or zoning permits new development in these areas, as identified in Map 16.5: Hazardous Condition Development Permit Area or along any watercourse, the future construction of, addition to, or alteration of a building or structure should be constructed to minimize impacts of future flooding as well as meet Natural Environment Development Permit Guidelines. Development where threat to life and property is low, such as agriculture, parks or greenspace is preferred. Policy 15.4.2. **Maintain Flood Data**. Maintain up to date flood data to understand the risk to the community and where necessary consult local Indigenous organizations for expertise and oral historical data. Policy 15.4.3. **Retrofit Critical Infrastructure**. Continue to retrofit critical infrastructure (airport, roads, bridges, sewer) within the floodplain to withstand increased frequency and intensity of flood events. Policy 15.4.4. **Repurpose public infrastructure during disruptions**. Repurpose public

		infrastructure (e.g. roads, parks, trails) during seasonal flood events to minimize flood impacts that may disrupt city services.
	Implementation Action 59	Develop a plan to "identify floodplain areas and develop policies to minimize flood risk" in the short-term.
	Proposed Hazardous Condition DP/DPA	Includes Mill Creek Floodplain and proposes updates to include new flood hazard areas as mapping becomes available. Provides basic guidance on how to achieve permit through elevation to FCL or through sign off by a qualified professional.
Mill Creek Flood Plain Bylaw 10248 [2010]	Section 2	Designates the flood plain area for Mill Creek based on engineering studies.
	Section 3	Sets the FCL for the floodplain and describes the requirements to build the base floor above the FCL.
	Section 5	Includes provisions for exemptions, primarily for secondary buildings, storage, etc. This also provides a potential for an exemption if a report/design from a Professional Engineer or Geoscientist that declares that "the land may be safely used for the use intended".
DRAFT Building Bylaw [2021]	Section 6.6	This section sets out the requirements for a setback of between 15 m and 30 m from naturalised streams.
Land Acquisition Policy 75 [1971]		This policy provides guidance to City staff and council on the potential acquisition of properties that could be applied to long range development planning.

4.3.4.1 Opportunities for non-structural mitigation

The City of Kelowna has some excellent provisions within OCP 2040, which if passed provide a solid, but adaptive basis to reduce risk from flooding. The connection to natural areas protection and the recognition of these as assets to reduce flooding is particularly novel and interesting. Further, the consideration for temporal redistribution of flood risk, and the co-benefits of using public amenities to mitigate flood impacts is an excellent consideration.

The 1971 land acquisition policy may support many of the non-structural mitigation actions that require acquisition of hazardous lands.

4.3.4.2 Challenges for non-structural mitigation

The obvious challenge in the City of Kelowna regulations and OCP2040 is the lack of explicit consideration of flooding along Okanagan Lake. The 2020 floodplain mapping (Northwest Hydraulic Consultants Ltd., 2020) shows extensive flood hazard along the lake, outside the Mill Creek floodplain (see Figure 10).

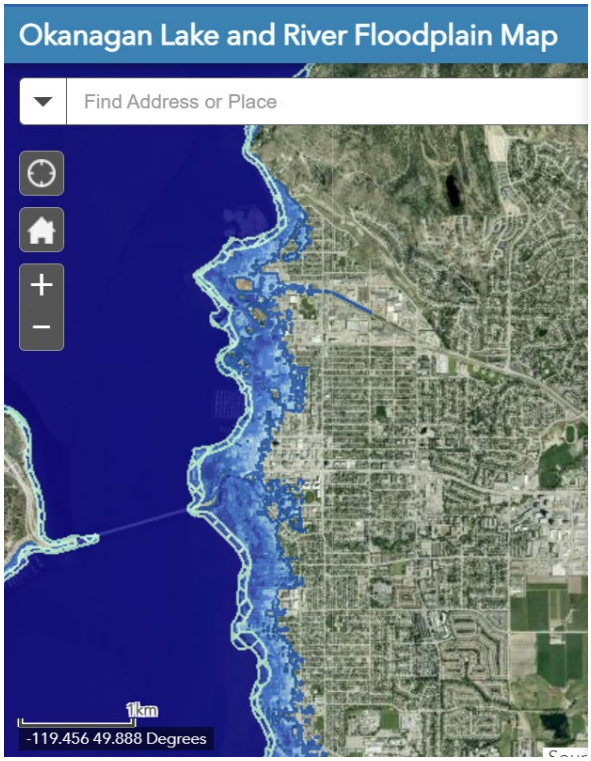


Figure 17: Screenshot of flood hazard area along Okanagan Lake in the City of Kelowna.

A second identified challenge, is that within the Mill Creek Flood Plain bylaw, although a "restrictive covenant" is defined, it is not used in the bylaw itself. There is no explicit mention of requiring a covenant if an exemption is granted.

4.3.4.3 Next steps for non-structural mitigation

As an immediate next step, the City should consider adding the Okanagan Lake floodplain, as identified in the 2020 flood mapping into the hazardous areas development permit area.

The City should also consider updating the Mill Creek Flood Plain bylaw to include a requirement that covenants be on title at a minimum when an exemption is granted, and ideally, over time for all parcels within the flood plain.

As a next step, a more progressive policy could be developed through a Flood Bylaw, which creates targeted opportunity for risk reduction policies that focus on exposure

reduction (land use) and vulnerability reduction (building controls), and/or through the use of a flood hazard DPA, which will support vulnerability reduction over time.

4.3.5 City of West Kelowna

The City of West Kelowna was only incorporated in 2007, until when it was under the jurisdictional authority of the RDCO, and as such has some remnant policies and systems from this era.

The City of West Kelowna is in the early stages of updating its OCP, which is planned for completion in 2022. The existing, in force, OCP (2011) was reviewed for this report. The City also has a zoning bylaw with a section on floodplain regulations. The building bylaw does not consider flooding. The City also has a Waterfront Plan (HB Lanarc and Ecoscape Environmental Consultants, 2011), which does not mention flood (or any natural) hazards specifically, but does include a modicum of concepts to enhance an 'natural lakeshore environment', including an approach to preserve and restore natural areas.

Table 12: Regulations related to flood management within the City of West Kelowna

Regulation	Section	Details/Description
OCP, Bylaw 0100 (City of West Kelowna, 2010)	3.2.12	Requires consideration of natural hazards, including flood, in the development of Comprehensive Development or Area Plans.
	3.6.3	Highlights the importance of balancing flood protection against ecosystem and aquatic habitat values. And has a Servicing Objective to "manage stormwater to mitigate risks and damages associated with flooding"
	3.7.1	The OCP includes a section on natural hazards with the objectives of: 1. Identify potential and existing natural hazards and avoid or mitigate the impacts on people, property, and the environment. 2. Raise awareness of wildfire and other natural hazards through public education.
	4.3.6 (Aquatic Ecosystem DPA)	This DPA includes the objective of "discourage(ing) development in areas that are susceptible to flooding as a result of proximity to a watercourse that could flood, as identified by the Province" (noting here that the Province never had any mapping within the City of West Kelowna, nor do they currently have the authority to designate flood hazard areas).

		The DPA guidelines cite the Provincial guidelines and use the standard setbacks of 1.5 m vertically above a natural boundary of a watercourse to identify areas that may be impacted by flood. The DPA also includes mention of an 343.66 m FCL (no datum) for Okanagan Lake
Zoning Bylaw 154 [2014]	Section 3.24 Floodplain Regulations	This defines FCLs for Okanagan Lake (343.66 m, no datum detail), 3 m above Mission Creek natural boundary, and 1.5 m above natural boundary of any other watercourse. It also defines horizontal setbacks from Okanagan Lake (15 m) and from other water sources (7.5 m to 30 m)

4.3.5.1 Opportunities for non-structural mitigation

The City of West Kelowna uniquely identifies the need to communicate about natural hazards to the public within its OCP, this is focused on wildfire, but could easily be stretched to include flood.

4.3.5.2 Challenges for non-structural mitigation

The current regulations reflect older information related to flood hazard from the Okanagan. The newly reported FCL (Northwest Hydraulic Consultants Ltd., 2020) Okanagan Lake is 344.6 m (CGVD2013)/ 344.3 m (CGVD1928) which is higher than the FCL within the current policy.

The current building and zoning bylaws reflect provincial guidance, and therefore limit vulnerability reduction approaches to raising structures above the FCL, whereas, best practice (as described in this report and elsewhere) highlights the possibility of using a broader definition of flood proofing, to include all the measures within the building management section of the Resource Guide.

There is no explicit mention of requiring a restrictive covenant if an exemption is granted.

4.3.5.3 Next steps for non-structural mitigation

The clear next step for the City is to update FCL regulations within the zoning bylaw and new OCP to reflect new information.

As a next step, a more progressive policy could be developed through a Flood Bylaw, which creates targeted opportunity for risk reduction policies that focus on exposure reduction (land use) and vulnerability reduction (building controls), and/or through the use of a flood hazard DPA, which will support vulnerability reduction over time. Given that the City is in the midst of renewing its OCP, there is a strategic opportunity to develop a hazard DPA at this time.

4.3.6 District of Lake Country

The District of Lake Country has existing policies in place that support flood risk reduction. These include policies within the OCP that outline future direction on hazard management, as well as series of land use and building control bylaws that provide basic regulations.

Table 13: Regulations related to flood management within the District of Lake Country.

Regulation	Section	Details/Description
OCP, Bylaw 1065 **(District of Lake Country, 2018)**	Objective 3.1.16	Minimize risk to citizens and development from natural hazards: b. Provide clear development guidelines for safe and environmentally sensitive development c. Seek to identify potential floodplain areas within the District.
	Objective 3.14.1	Reduce potential to development of damage from flooding: a. Conduct floodplain mapping. b. Prepare floodplain management plan. c. Avoid new development in areas within and close to the floodplain.
	Section 9.2	"stormwater management plans must accommodate the 10-year flood event onsite and provide positive relief for a 100-year flood event."
	Natural Environment DPA and Guidelines	This DPA is intended to support ecological function and values of natural areas. An explicitly noted co-benefit is a reduction in flood hazard.
Stormwater management Bylaw		Bylaw to support servicing of new developments to ensure that stormwater is managed appropriately, and largely onsite.
Building Regulation Bylaw 1070	Section 10.3	"for a parcel of land on which a building or structure is proposed if the building official believes the parcel is or is likely to be subject to flooding, mud flows, debris flows, debris torrents, erosion, land slip, rock falls, subsidence, or avalanche, and the requirements for a professional design is in addition to a requirement under Part 3, Division 8 of the Community Charter (i) for a report certified by a professional engineer with experience in geotechnical engineering that the parcel may be used safely for the use intended, and (ii) that the plans submitted with the application comply with the relevant provisions of the Building Code and applicable bylaws of the District.

	Section 11.4	Requires that for complex buildings that the underslab of the structure meet provincial flood mapping requirements (noting that there are none within Lake Country) or District land use regulations (see Zoning Bylaw).
Zoning Bylaw 561 [2007, amendments to 2021]	Section 7.16.1	Limits development within a buffer zone from a still water body (7.5m) or a moving watercourse (15 m). It also provides elevations below which construction should not occur in relation to Okanagan (343.66 m, no datum detail) and Kalamalka and Wood Lakes (393.2 m, no datum detail).
Development Applications Bylaw 1133	Section 6.2 (o)	Opens the door to requiring reporting prepared by a qualified professional related to flooding.

4.3.6.1 Opportunities for non-structural mitigation

The District of Lake Country has in place many of the policy tools that are precursors to non-structural mitigation. The OCP policies set an excellent foundation for future risk reduction and resilience building, and the existing Building Regulation and Zoning Bylaw lay the groundwork for future enhancements once more information is available (i.e. a engineering quality flood map with elevations for multiple climate futures).

4.3.6.2 Challenges for non-structural mitigation

The current regulations reflect older information related to flood hazard from the lakes. The newly reported FCL (Northwest Hydraulic Consultants Ltd., 2020) for in the vicinity of Lake Country for Okanagan Lake is 344.6 m (CGVD2013)/ 344.3 m (CGVD1928), and for Wood and Kalamalka Lakes is 393.7 m (CGVD2013)/ 393.4 m (CGVD1928) which is higher than the FCL within the current policy.

The current building and zoning bylaws reflect provincial guidance, and therefore limit vulnerability reduction approaches to raising structures above the FCL, whereas, best practice (as described in this report and elsewhere) highlights the possibility of using a broader definition of flood proofing, to include all the measures within the building management section of the Resource Guide.

4.3.6.3 Next steps for non-structural mitigation

The clear next step for the District of Lake Country is to update FCL regulations within the zoning bylaw to reflect new information.

As a next step, a more progressive policy could be developed through a Flood Bylaw, which creates targeted opportunity for risk reduction policies that focus on exposure reduction (land use) and vulnerability reduction (building controls), and/or through the use of a flood hazard DPA, which will support vulnerability reduction over time.

4.3.7 District of Peachland

The District of Peachland has some good direction in flood policy within their OCP, although details are limited. Basic conditions (boiler plate text from provincial guidance) for non-structural flood mitigation is included within zoning and building bylaws (see Table 14).

Table 14: Regulations related to flood management within the District of Peachland

Regulation	Section	Details/Description
OCP, Bylaw 2220 (District of Peachland, 2018)	5.4.4	The stormwater management section of the OCP notes the need to develop Integrated Stormwater Management Plans to incorporate and consider both climate change and flood protection.
	5.6	The natural environment section of the OCP notes the importance of collaboration with "senior levels of government to mitigate the risks of development in the floodplain"
	5.6.1	Notes the potential to update the Shoreland Plan to incorporate new floodplain mapping (now complete).
	6.3.1	The Aquatic DPA for Peachland includes a provision to include areas within a 1:5 year (20% AEP) flood level, as determined by the Province (no such determination exists) or lower than 343 m (no datum provided).
	6.4	A natural hazard area inclusive of floodplains is described, but no details on flood specific information is provided. No map showing DPA is included.
Zoning Bylaw 2100 [2014]	5.16	Creates a 15 m horizontal and 1.5 m vertical buffer from natural watercourses, and a 7.5 m horizontal boundary from Okanagan Lake. An FCL of 343.75 m (no datum) is also given.
Building Bylaw 2273 [2020]	9.3	Allows for a building official (inspector) to require for a report and/or design from a qualified professional if a property is considered likely subject to flooding.
	10.2	Requires that for complex buildings that the underslab of the structure meet provincial flood mapping requirements (noting that there are none within Lake Country) or District land use regulations (see Zoning Bylaw).
	10.4	Much like for complex buildings, simple buildings are required to have the underslab of the structure meet provincial flood mapping requirements (noting that there are none within Lake Country) or District land use regulations (see Zoning Bylaw).

Development & License Approval Procedures Bylaw 2278 [2020]	5.7	Provides detail on requiring reporting prepared by a qualified professional related to flooding.
	5.23 (f)	References Natural Hazard Area DPA with regards to permitting fees.

In addition to the policies above, the District has recently completed a flood risk assessment and mitigation plan for its shoreline. This has a focus on understanding local-level hazards (including the important secondary hazard associated with erosion). Several structural engineering projects are proposed within this project.

4.3.7.1 Opportunities for non-structural mitigation

The current regulations include the basic information to support flood mitigation; policy objectives within the OCP, plus basic minimum standards within zoning and building bylaws.

4.3.7.2 Challenges for non-structural mitigation

The current regulations reflect older information related to flood hazard from Okanagan Lake. The newly reported FCL (Northwest Hydraulic Consultants Ltd., 2020) for in the vicinity of Peachland is 344.6 m (CGVD2013)/ 344.3 m (CGVD1928), which is significantly higher than the FCL within the current policy.

The OCP includes reference to flood hazard, but not substantive policies or guidance. For example, although the Natural Hazard DPA references floods, there is no accompanying map to describe the DPA.

The current building and zoning bylaws reflect provincial guidance, and therefore limit vulnerability reduction approaches to raising structures above the FCL, whereas, best practice (as described in this report and elsewhere) highlights the possibility of using a broader definition of flood proofing, to include all the measures within the building management section of the Resource Guide.

4.3.7.3 Next steps for non-structural mitigation

Next short-term steps for the District of Peachland, include reviewing the 2020 and 2021 mapping updates for the Okanagan (Northwest Hydraulic Consultants Ltd., 2020) and the adoption of the these new FCLs into current policy (i.e. by updating zoning bylaw). This mapping could also be used to refine the OCP to include a mapped DPA for flood.

In the longer-term the District could consider developing a flood bylaw (to subsume information in existing zoning and building bylaws) that would allow for more flexibility in mitigation actions, as well as being flexible to updates in hazard information or provincial direction.

5 Recommendations – Taking Action as a Region

Flood knows no boundaries – it is a shared risk that is best mitigated by working regionally and across scales to coordinate action and mobilize the necessary resources to effectively address this issue. Stakeholders and partners from across the Central Okanagan took part in shaping this Resource Guide and expressed a strong desire to continue to work together on flood and disaster resilience, for the good of everyone across the region.

While much of the work to plan, make decisions, and implement non-structural flood mitigation will be carried out separately by many actors across the region, there are also a suite of actions needed at a regional level to enable and support those distributed actions and to reduce the potential for working at cross-purposes. The rationale for a regional approach, an indication of which non-structural mitigation options are best implemented at a regional level, as well as specific next steps are presented in the accompanying Resource Guide.

6 Conclusions

The Regional District of the Central Okanagan (RDCO) along with regional First Nation and Local Governments and other regional partners have been working together for many years to increase understanding of the local flood hazards and their trajectory with climate change. This new information, coupled with recent damaging floods have highlighted the need for new approaches in flood management.

This project, report and accompanying resource guide form a strategic next step, to help local governments implement flood risk reduction and resiliency strategies. The strategies developed as part of this project have been grounded in the Okanagan context through engagement and research. So, that despite the many implementation challenges associated with more novel non-structural management approaches, the region now has actionable concepts to move forward with both as individual local and First Nation governments, and collectively as a region.

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Appendix A Legislation and Regulation in British Columbia

The following appendix outlines the division of roles and responsibilities for senior government in BC (Federal and Provincial). For each order of government, enabling legislation or other mandate is provided, along with additional information on regulations, funding or investment programs, and other activities. This information has been taken from (Ebbwater Consulting Inc., 2021); additional information and context, as well as visualisations of the policy can be found in this document.

Federal Government

Canada is a federalist country, where the central government deals with national and international matters. And, although many issues of flood risk governance are devolved to lower levels of government, the systemic nature of flood means that there are some issues that are governed at the federal level. For example, issues related to national water resources, fisheries, and natural resource extraction and supporting information. This is particularly relevant to the Okanagan watershed, which is shared with the United States.

The Federal government also provides some guidance related to the foundational tools for flood, in an effort to provide some consistency in public safety across the country. The major legislation, guidelines, funding programs and lead agencies are presented in the following tables.

Table A-1: Federal government activities in flood risk governance. Part 1: Legislation and Mandate (Regulation).

	What	Description
Legislation and Mandate	*Fisheries Act* [1985] amended in 2019	This modernized act sets out provisions for protecting and restoring fish populations and fish habitat. Recognizing the link between healthy ecological systems and water means that this act is relevant to some flood management actions.
	Emergency Management Act [2007]	This act sets out the leadership and responsibilities of the Minister of Public Safety and Emergency Preparedness, including coordinating emergency management activities among government institutions and in cooperation with the provinces and other entities.
	Species at Risk Act [2002]	This act sets out federal responsibilities for the protection of species at risk, including aquatic species.
	First Nations Land Management Act [1999] amended in 2019	This act, which has recently been updated, allows First Nation governments to opt out of 40 sections of the *Indian Act* (see below). This enables First Nations to develop their own laws related to land use, environment, and natural resources.
	Canada Water Act [1985]	This act sets out the federal responsibilities relating to water, such as fisheries and navigation. It notes that Provinces are "owners" of water resources within their jurisdiction and have the responsibility for day-to-day management of water.
	Canada Navigable Waters Act [1985]	This act sets out provisions to keep navigable waters open for public use. This has implications for some structural flood management activities. This act is currently under review.
	Canada Land Surveys Act [1985]	This act sets out the responsibility and jurisdiction for the survey of public lands. The foundational tools for flood risk reduction (e.g. land surveys) are governed in part by this Act.
	Resources and Technical Services Act [1985]	This act sets out the responsibility and jurisdiction for the collection of geological, geographical, geodetic, topographical, hydrographic, hydrogeological, oceanographic, and other similar surveys.
	Income Tax Act [1985]	This act includes provisions for the deferral of income for agricultural operators if income is impacted by flood.
	Indian Act [1985]	This act sets out the framework for governance of Indigenous People and their land. It provides direction on the powers of Band Council related to land use and infrastructure. This act is under revision.

Table A-2: Federal government activities in flood risk governance. Part 2: Guidelines

	What	Description
Guidelines	National Building Code of Canada (2015)	The National Building Code of Canada is developed by the National Research Council of Canada. It is a model code that has no legal status until adopted by a jurisdiction (i.e., Province of BC or City of Vancouver). It does not currently include any provisions for flood resilient design. However, it is a tool that could be used in future. New standards for flood-resilient design are being developed by the National Research Council and Canadian Standards Association, which is the first step to updating the National Building Code.
	Federal Flood Mapping Guideline Series	Public Safety Canada and Natural Resources Canada are co-leads of a program to develop a series of guideline documents associated with flood mapping. These include information on LiDAR acquisition, geomatics, hydrology and hydraulics, and flood damage estimation, as well as case studies. Future guidelines are being prepared on flood risk assessment and land use planning in flood risk areas.
	National Research Council of Canada Guideline Series	The National Research Council of Canada produces many guidelines, some of which relate to flood. Recent relevant publications include Flood Risk Assessment Guidelines for Coastal Areas (Murphy et al. 2020), as well as supporting in the development of the Canadian Standards Association (CSA) Basement Flood Prevention and New Residential Communities Guidelines (CSA Group 2018, 2019).
	Standards Council of Canada Standards Flood Mapping Standards (in progress)	The Standards Council of Canada (SCC) is currently embarking on a process to develop flood mapping standards. This will build on the work of the Federal Flood Mapping Guidelines. Standards, if developed, are not expected for several years.
	Indigenous Inclusion Guidelines	NRCan and ISC are currently working on developing guidelines for Indigenous Inclusion in the Development of the Federal Flood Mapping Guideline Series (Public Works and Government Services Canada 2020). These complement the Federally funded quasi-guidelines from the Centre for Indigenous and Environmental Resources (CIER) Climate Change Adaptation Planning Toolkit for Indigenous Communities, which include a section on flood risk assessment and planning (Carlson, Johnson, and Low 2020).

Table A-3: Federal government activities in flood risk governance. Part 3: Funding and Investment

	What	Description
Funding and Investment	National Disaster Mitigation Program (NDMP)	The NDMP is a fund with the objective to address rising flood risks in Canada by supporting the development of foundational information (flood maps, flood risk assessments, flood plans, etc.). A key objective of the program was to support the creation of a private flood insurance sector to manage residual risks. The fund has been in place since 2013. In its first 5 years $200M was available to Provinces and Territories (P/Ts) on a 50/50 cost-sharing model for Provinces. The program has been renewed through March 2022, with an additional $25M. In addition to the core funding that was used for individual flood projects across the country, the fund was used to invest in tools and educational campaigns to support flood risk reduction. A review of the program in 2019 (Public Safety Canada 2019b) noted that the program had a slow start (potentially due to lack of knowledge of the program or lack of capacity at P/Ts), but had significant uptake towards the end. In the first five years, 82 projects were funded at a cost of $22.4M (Federal contribution). A noted failure of the program was access for Indigenous communities; some received funds by working with neighbouring jurisdictions. The review also noted challenges associated with capacity (at all levels) to manage the program. The program is expected to continue in some form but will likely evolve. For example, to include an all-hazards rather than a single flood hazard focus.
	Disaster Mitigation Adaptation Fund (DMAF)	DMAF aims to strengthen the resilience of Canadian communities through investments in large-scale infrastructure projects, with the intent of reducing risk to people, critical infrastructure, and the economy. This is a $2B merit-based program that to date has supported a variety projects in the province (e.g. City of Surrey coastal dike upgrades, City of Chilliwack dike upgrades, Cowichan Valley flood infrastructure program) DMAF projects must have a minimum of $20 million in eligible expenditures, while NDMP focuses on small-scale infrastructure mitigation projects.
	Disaster Financial Assistance	The DFAA is an agreement between the Federal and Provincial governments that sets out funding formula and limits for disaster response and recovery.

	Arrangements (DFAA)	In addition, the DFAA allows for 15% of funds to be spent on mitigation enhancements after a disaster occurs, while NDMP focuses on mitigating before a disaster. It is the authors' understanding that the build back better component of the DFAA is not commonly, if ever, applied.
	First Nations Adapt Funding	This program supports Indigenous governments to prepare for and adapt to climate change. This includes projects related to sea level rise and other types of flooding. There have been several First Nations Adapt funded programs in BC both on the coast and for inland communities (e.g., Coastal Vulnerability Studies for Core Infrastructure, Okanagan Nation Alliance Flood Risk Assessment, Scw'emex Tribal Council Flood Impacts under Climate Change).
	Various infrastructure funds with a flood mitigation component	Infrastructure Canada's Provincial-Territorial Infrastructure Component (PTIC) provides support for projects of national, local, or regional significance. This includes the $1 billion Small Communities Fund (PTIC–SCF) to provide financial support to projects in municipalities with fewer than 100,000 residents. This program has been in place since 2014-15. Other programs of note are the First Nation Infrastructure Fund and Emergency Management Assistance Program from Indigenous Services Canada.
	Green Municipal Fund	This is a program run by the Federation of Canadian Municipalities (FCM) through an endowment from the Federal Government. This fund can support up to 50% of project costs and can be used for flood related projects under the 'water' stream. Projects can be plans, feasibility studies and pilot projects as well as capital projects.

Table A-4: Federal government activities in flood risk governance. Part 4: Lead Agencies.

	What	Description
Lead Agencies	Natural Resources Canada (NRCan)	This agency has several responsibilities related to flood management. This includes being the co-lead agency for the Federal Flood Mapping Framework, as well as being the lead agency for the collection of survey information. The Western Region of the Geological Survey of Canada (GSC) conducts research into Disaster Risk Reduction, primarily for earthquake hazard, but also publishes information and datasets relevant for flood hazard. Under the current government, NRCan has the mandate to "Work with the Minister of Public Safety and Emergency Preparedness and with the provinces and territories and Indigenous Peoples to complete all flood maps in Canada" (Office of the Prime Minister of Canada 2019a) and to "to develop a national climate change adaptation strategy and invest in reducing the impact of climate-related disasters, such as floods and wildfires, to make communities safer and more resilient." (Office of the Prime Minister of Canada 2021d).
	Environment and Climate Change Canada (ECCC)	This agency has several evolving responsibilities related to flood management. They have been the long-standing coordinating agency for the Meteorological Service of Canada, Water Survey of Canada and the Canadian Hydrographic Service. It is also the proposed co-lead agency for the newly proposed Canada Water Agency, which, if formed, will have the mandate to improve freshwater management across Canada (flood is listed as part of the mandate within discussion documents). Under the current government, ECCC has the mandate to "Work with the Minister of Natural Resources and provinces and territories to complete all flood maps in Canada." (Office of the Prime Minister of Canada 2018) and "to develop a national climate change adaptation strategy and invest in reducing the impact of climate-related disasters, like floods and wildfires, to make communities safer and more resilient."(Office of the Prime Minister of Canada 2021a).
	Fisheries and Oceans Canada (FOC)	This agency has a few responsibilities related to flood management, especially coastal flood. Specifically, they house the Canadian Hydrographic Service, which provides hydrographic and hydrometric data for coastal regions. They are also charged with the management of fisheries, including the enforcement of the Fisheries Act, which has implications to some structural and non-

		structural activities (e.g., the limiting of Harmful Alteration, Disruption and Destruction (HADD) of fish habitat).
	Public Safety Canada (PSC)	PSC is the lead agency for the development of Canada's Emergency Management Strategy, which aims to reduce losses from disasters across the country and provides a framework for the sharing of responsibilities amongst P/Ts (Public Safety Canada 2019a). PSC currently has the mandate to "create a new low-cost national flood insurance program to protect homeowners at high risk of flooding and without adequate insurance protection, as well as to develop a national action plan to assist homeowners with potential relocation for those at the highest risk of repeat flooding." (Office of the Prime Minister of Canada 2019b) and to "to develop a national climate change adaptation strategy and invest in reducing the impact of climate-related disasters, like floods and wildfires, to make communities safer and more resilient. In particular, continue working to create a new low-cost national flood insurance program to protect homeowners at high risk of flooding and without adequate insurance protection, as well as to develop a national action plan to assist homeowners with potential relocation for those at the highest risk of repeat flooding."(Office of the Prime Minister of Canada 2021e).
	Indigenous Services Canada (ISC)	ISC is the federal agency with responsibility for policies relating to Indigenous People in Canada. This includes supporting Indigenous Peoples to be resilient to floods and includes specific responsibility to support on-reserve lands. In 2021, the ISC mandate for the minister was revised to" expect you and all ministers to pursue complementary partnerships and initiatives that will support our work to exceed our emissions reduction target, seize new market opportunities to create good jobs and prepare our country to adapt to the impacts of a changing climate." (Office of the Prime Minister of Canada 2021b).
	Infrastructure Canada (IC)	Infrastructure Canada is the agency charged with supporting the development of large-scale public infrastructure in Canada. The 2021 complementary mandate letter includes the statement "to develop a national climate change adaptation strategy and invest in reducing the impact of climate-related disasters, like floods and wildfires, to make communities safer and more resilient. This includes leveraging proposals received for the Disaster Mitigation and Adaptation Fund to accelerate this work." (Office of the Prime Minister of Canada 2021c).
	National Research Council of Canada (NRC)	National Research Council of Canada is the primary national research and technology organization of the Government of Canada, in science and technology research and

		development. They have recently supported on the development of guidelines related to flood mitigation (see above).
	Department of National Defence (DND) and Defence Research and Development Canada (DRDC)	This agency is charged with support on flood response for major incidents in Canada if requested by the Province. DRDC runs a research program related to the mandate to respond to national disasters. DRDC is the co-lead (with PSC) for the development of a National Risk Profile (NRP) that considers flood as a priority hazard.

Provincial Government

The Provincial Government has a number of roles and responsibilities related to flood risk governance. The primary role is to set out and enforce legislation related to public safety, water use and land use. The primary agencies with responsibility for flood risk governance are MFLNRORD and EMBC, the BC Ministry of Municipal Affairs (MMA) plays an important role in supporting local governments to manage their responsibilities related to flood risk governance.

The following tables provide a big picture overview of the mandate, legislation, regulation, and authorities within the provincial government with regards to flood management.

Table A-5: Provincial government activities in flood risk governance. Part 1: Legislation and Mandate (Regulation).

	What	Description
Legislation and Mandate	*Professional Governance Act* [2021]	This legislation has only recently come into force. It has created a new government office, the Office of the Superintendent of Professional Governance, and institutes best practices for professional regulators (e.g. Engineers and Geoscientists BC, BC Institute of Agrologists, etc.) to ensure that professionals are held to high technical and ethical standards. As this is a new piece of legislation, the implications for the use of qualified professionals to hold liability for determining areas or building "safe for intended use" is not yet clear (see also *Community Charter* [2003]).
	Declaration on the Rights of Indigenous Peoples Act [2019]	In 2019, the Province took an important step in legislating a change in their relationship with the Indigenous Peoples of BC. DRIPA sets out important considerations as it relates to land, and therefore flood management and governance. A key tenet of DRIPA is the legislated requirement to "recognize and respect the rights of Indigenous peoples in all areas of life – human rights, environment, language, education and more."

	Local Government Act [2015]	Creates the authority for a local government to designate a floodplain and to set development controls and construction requirements in these areas. This legislation also enabled the creation of a new local watershed-based authority in the Cowichan Valley.
	Water Sustainability Act [2014] (WSA)	This legislation is used to manage water resources in B.C., including regulation of water levels and flows associated with dams, flood control and other licensed structures. The WSA also enables the Dam Safety Regulation, which outlines requirements for dam owners to inspect and maintain their dams to ensure compliance, and to mitigate the impacts of dam failure.
	Riparian Areas Protection Regulation [2004]	This legislation and related regulation calls on local governments to protect riparian areas and their various functions to maintain stream health and productivity. Although the primary focus is on fish habitat and ecological health, it also is aimed at providing stable streambanks, sufficient space for channel migration (including active and seasonally wetted floodplains).
	Community Charter [2003]	Creates the authority for local governments to issue building permits. Further, it creates the authority for Building Inspectors to require that hazard reports be prepared by a qualified professional.
	Environmental Management Act [2003]	This legislation gives the authority to the Minister of Environment to prepare and publish plans related to "flood control, flood hazard management and development of land that is subject to flooding". This Act also outlines requirements and project triggers for undertaking environmental assessments, which includes large river diking projects under some certain circumstances.
	Flood Hazard Statutes Amendment Act [2003] and *Miscellaneous Statutes Amendment Act* [2004]	This legislation tidied the transfer of power on issues of flood from the Province to Local Governments in the wake of changes to the Community Charter and Local Government Acts.
	Land Title Act [1996]	This legislation creates authority for an approving officer to refuse a subdivision subject to a flood hazard and grants the mandate for an approving authority (e.g. local government) to require a report from a qualified professional that provides for the "safe use of land and building development", and registers this report with a covenant on title.

	Land Act [1996]	This creates the authority for the disposition, lease, or use of crown land including for the purpose of flood protection and/or erosion protection.
	Emergency Program Act [1996]	This legislation grants local governments the authority to be first responders to emergency situations, including flood. MFLRNORD is designated as the lead agency for flood response and corresponding emergency plans and procedures and their implementation. EMBC is given the responsibility to co-ordinate provincial emergency management activities, and Disaster Financial Assistance.
	Emergency Management Program Regulation [1994]	This regulation outlines roles and responsibilities for Provincial Ministries and Crown Corporations during an Emergency.
	Dike Maintenance Act [1996]	This legislation creates the position of the Inspector of Dikes who has the statutory authority to establish flood protection standards, monitor management of works by local diking authorities, approve changes to dikes and new dikes and issue orders respecting flood hazard planning
	Drainage, Ditch and Dike Act [1996] (to be repealed)	This document provides authority to independent diking districts (i.e., districts not associated with another jurisdiction) to collect taxes. It is to be repealed once MFLNRORD has transitioned the independent diking assets to local government authorities.
	Municipalities Enabling and Validating Act [1970]	This legislation established the authority for the creation of the Okanagan Basin Watershed Board, a watershed-based organization that plays a coordinating role in flood management.

Table A-6: Provincial government activities in flood risk governance. Part 2: Guidelines.

	What	Description
Guidelines	Flood Hazard Area Land Use Management Guidelines [2004, amended 2011, 2018]	This presents guidelines for the administration of land use management within flood hazard areas including, official community plans, bylaws, development permits, subdivision approvals, covenants, crown land dispositions, requests for bylaw modifications, and requests for modification of floodplain covenants. In addition, the document provides guidelines for communities to withhold consent where hazard cannot be practically alleviated. • Provides guidelines for minimum setbacks and minimum elevations or Flood Construction Levels (FCLs) to protect

		development from flood hazards from the sea, lakes, and rivers (including alluvial fans and debris flows). • Coastal FCL updated based on the 2011 coastal flood hazard land use guideline to allow use of either a combined or probabilistic method to calculate water levels. • Document defines a 0.5 % AEP (200-year indicative) design standard to be applied to habitable land use, defined as residential, commercial, and institutional land uses. Slightly altered standards are provided for agricultural and industrial uses. • Development on high hazard alluvial and/or debris flow fans is discouraged, and land should be retained for no-intensive uses, such as, parks, open- space recreation and agriculture. (Above modified from (Northwest Hydraulic Consultants Ltd. 2021c))
	Guidelines for Management of Coastal Flood Hazard Land Use (2011)	This Guideline is intended for local governments, land use managers, and approving officers to develop and implement land use management plans and make land use approval decisions for lands exposed to coastal flood hazards. Presents projections for sea level rise and potential approaches for land use planning within existing and future hazard zones. Historically, coastal FCL's were determined based on the location of the natural boundary, which is defined by law and can be interpreted as the visible high-water mark, where the presence and action of water has left a distinct variation in the bank, soil, and vegetation characteristics of the shore. For present day water levels, the natural boundary can be established by a professional land surveyor. However, it is not possible to survey the future location of the natural boundary due to the effects of sea level rise and other climate change related factors, or estimate the extreme water levels on lakes. This guideline presents the combined method to determine a coastal FCL based on projections of future conditions. Accompanying document, Draft Policy Discussion Paper, presents risk concepts for flood hazard land use; that is adjusting design event (probability) based on consequence of flooding (i.e. increasing design event to 0.025% AEP, instead of the 0.5% AEP year event typically applied in BC. (Above modified from (Northwest Hydraulic Consultants Ltd. 2021c))

	Coastal Floodplain Mapping – Guidelines and Specifications (2011)	This guideline document outlines methods and expected mapping deliverables for coastal flood mapping completed in the BC Coast (Kerr Wood Leidal 2011). It draws from information in guidance documents on sea level rise.
	Flood hazard assessments – Guidance for Selection of Qualified Professionals	This is a document on selection of a qualified professional to assess floodplain hazards, but mislabels qualified professionals as being "geotechnical" professional (i.e. focus on ground conditions) instead of qualified professional that could include both geotechnical or hydrotechnical (i.e. focus on water and its interaction with natural and anthropogenic environment). (Above from (Northwest Hydraulic Consultants Ltd. 2021c))
	Dike Design and Construction Guide: Best Management Practices for British Columbia (2003, updated in 2011)	This document outlines the process to build or upgrade a dike in the Province. It provides guidance on hiring a consultant engineer, some design criteria for both hydraulic and geotechnical considerations and construction best practices. (From BGC Engineering Inc. and Ebbwater Consulting 2017)
	Sea Dike Guidelines (2011)	This document provides guidelines for the design of sea dikes to protect low lying lands that are exposed to coastal flood hazards arising from their exposure to the sea and to expected sea level rise due to climate change (Ausenco-Sandwell 2011).
	Hydrologic and Hydraulic Design Report Submitted in Support of Dike Maintenance Act Approvals (2008).	To support both diking authorities and regional/deputy IODs the province released a series of documents in around 2008 describing the requirements for proper design and documentation to receive a Dike Maintenance Act Approval. One of these documents outlines the minimum requirements for hydrologic and hydraulic designs. Of relevance to the Lower Fraser River is the statement that the Province has an approved design flood profile from 2008 that is nominally based on a 0.2% AEP event. It also notes: *"A freeboard allowance is applied to flood profile to determine the construction of crest elevation of the flood protection works. Freeboard may be different for local conditions, however, the province historically has applied the following minimum freeboard allowance for open water conditions: The higher of:* *600 mm vertical allowance above the calculated 1 in 200-year peak mean daily flow profile, which normally applies to large river systems; or* *300 mm vertical allowance above the calculated 1 in 200-year peak instantaneous flow profile. Where the channel is potentially subject to sediment aggradation and/or debris jamming additional freeboard may be required."* (Ministry of the Environment 2008) (From BGC Engineering Inc. and Ebbwater Consulting 2017)

	Seismic Design Guidelines for Dikes (2011, updated in 2014).	In recognition of the high earthquake hazard in parts of British Columbia, this report provides design guidance for "High Consequence" dikes in high earthquake hazard areas primarily, although not exclusively, for the Fraser Valley.
	Diking Authorities for New Dikes Policy (2010)	This document sets out the reasoning and policy requiring that for any new dikes constructed in the province, the diking authority must be a local government. (BC Ministry of Forests Lands and Natural Resources Operations and Rural Development 2010)
	Environmental Guidelines for Vegetation on Flood Protection Works to Protect Public Safety and the Environment (1999)	The guidelines present minimum standards under the Dike Maintenance Act for vegetation management on flood control structures to protect public safety, and identify opportunities to protect and/or enhance habitat to benefit the environment. (British Columbia. Ministry of Environment and Canada. Department of Fisheries and Oceans 1999)
	Riprap Design and Construction Guide (2000)	This document outlines guidance for the "design and construction of slope or bank protection works and to provide current information on the design and construction of riprap in BC" (British Columbia. Ministry of Environment 2000).
	Critical Infrastructure Assessment Tool (2016)	"The primary purpose of the Critical Infrastructure (CI) Assessment Tool and associated process is to provide a single venue for participants from various local authority departments/agencies to discuss what services they feel are critical to provide to residents during an emergency, the assets they need to provide those services, and who/what they rely on in order to make those assets available." (Emergency Management BC, Development Research Defence Canada, and Justice Institute of BC 2016)

Table A-7: Provincial government activities in flood risk governance. Part 3: Funding and Investment.

	What	Description
Funding and Investment	National Disaster Mitigation Program (NDMP)	BC, unlike any other P/T has cost-shared half the NDMP program. EMBC works with other Provincial agencies to screen and put forward applications to PSC. Successful applicants can receive 100% of project costs through this program. See Table A-3 for more information on the program.
	Community Emergency Preparedness Fund (CEPF)	The CEPF program has been in place in some form since 2017. Since 2018 it has been operated by the Union of BC Municipalities (UBCM). It provides grant funding (with no cost-sharing) for various project streams. The four streams echo the project types within the NDMP; these have a maximum fund cap of $150,000. Additional funding streams available in 2021 include: • Structural Flood Mitigation (cap of $750,000) • Indigenous Cultural Safety and Cultural Humility Training • Emergency Support Services • Emergency Operations Centres and Training • Evacuation Route Planning
	Disaster Financial Assistance Arrangements (DFAA)	Like the parallel federal program, BC provides emergency funding post-disaster under specific criteria. Namely that a disaster must first be declared eligible, and losses must not be otherwise insurable. The cost-sharing model between the Province and Federal government varies depending on the severity of the disaster.
	Gas Tax Fund (Strategic Priorities Fund)	The Gas Tax Fund, administered by UBCM, has been in place since 2005. It provides a "stable funding source to local governments for investment in infrastructure and capacity building projects". Some flood projects (e.g., Okanagan floodplain mapping) have been partially funded through this program.

Table A-8: Provincial government activities in flood risk governance. Part 4: Lead Agencies.

	Who	Description
Lead Agencies	MFLNRORD	MFLNRORD is one of the lead agencies and an important player in acting to reduce flood risk in the province. *Environmental Management Act* – Under Section 5(f) (i), the Minister has broad powers and authority over local governments to establish guidelines, regulations, and flood hazard management plans with respect to flood control, flood hazard management, and the development of land subject to flooding. *Local Government Act* – MFLNRORD currently publishes "Flood Hazard Area Land Use Guidelines" that must be considered by local governments when enacting floodplain bylaws (see also Table A-6). *Dike Maintenance Act* – The ministry's Inspector of Dikes and Deputy Inspectors of Dikes have the statutory authority to establish flood protection standards, monitor management of works by local diking authorities, approve changes to dikes and new dikes and issue orders respecting flood hazard planning. *Drainage, Ditch and Dike Act* – The ministry is responsible for supporting the transition of the assets and responsibilities of five diking districts to local governments prior to the repeal of the Act. *Water Sustainability Act* – The ministry is responsible for this legislation which is used to manage water resources in B.C., including regulation of water levels and flows associated with dams, flood control and other licensed structures. The Dam Safety Regulation, also under the WSA, outlines requirements for dam owners to inspect and maintain their dams to ensure compliance and mitigate the impacts of dam failure. *Emergency Program Act* – FLNR is designated as the lead ministry for flooding and any corresponding emergency plans and procedures and their implementation. *Land Act* – Disposition, lease, or use of crown land for the purpose of flood protection and/or erosion protection. *Riparian Areas Protection Act* and *Riparian Areas Regulation* – The ministry is responsible for this legislation which calls on local governments to protect riparian areas and their various functions to maintain stream health and productivity. Although the primary focus is on fish habitat and ecological health, it also is aimed at providing stable streambanks, sufficient space for channel migration, and community flood protection. The Provincial Flood Emergency Plan: FLNR is mandated to provide the required technical expertise to support EMBC including flood

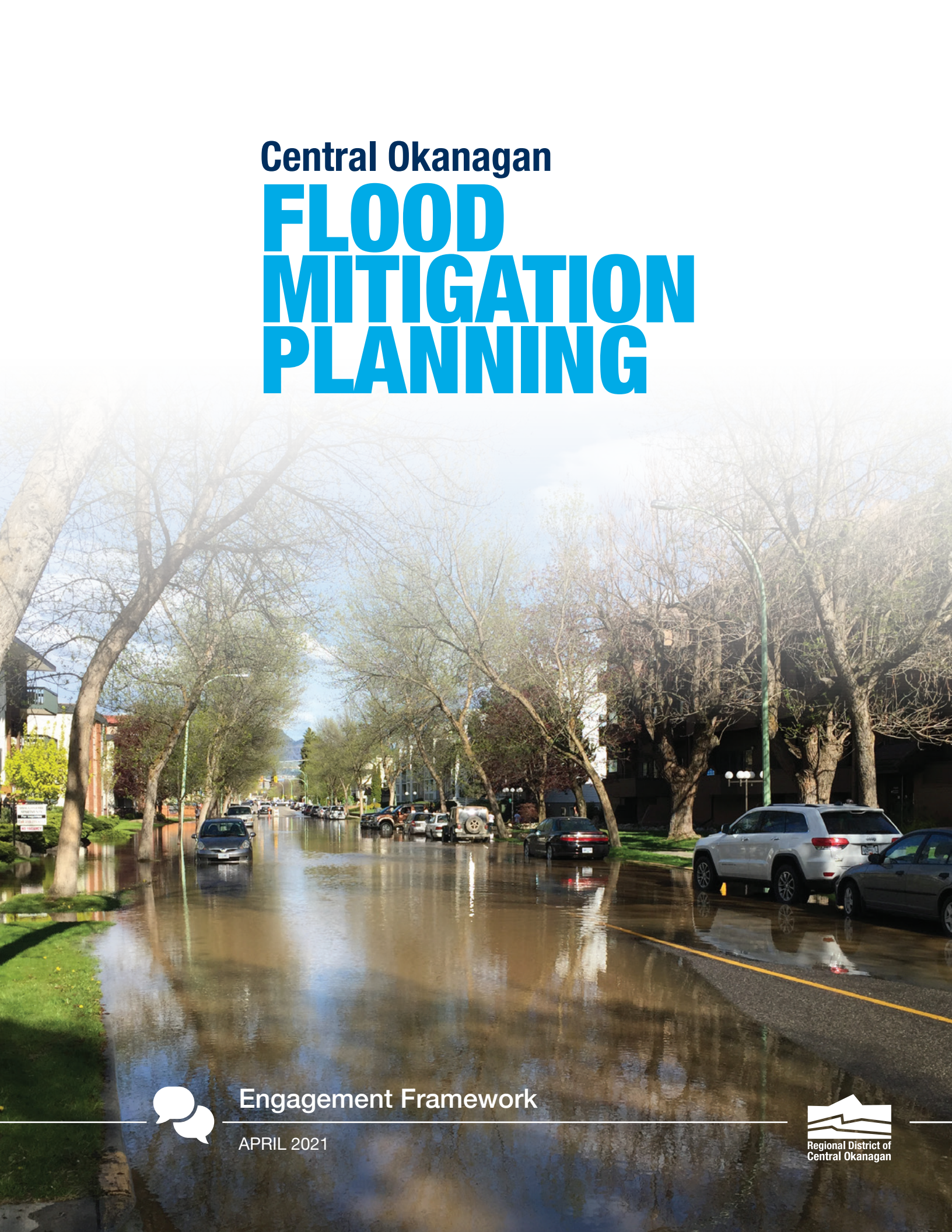
		forecasting (River Forecast Centre), imagery and data tools (GeoBC), the Fraser River flood level modelling (Flood Safety Section), flood assessors and observers, and deployment of BC Wildfire staff for construction of emergency flood protection works. Legacy Floodplain Mapping: MFLNRORD and Ministry of Environment maintain access to the legacy floodplain maps and data developed during the 1987 to 1997 Federal/Provincial mapping program. (Information provided by MFLNRORD)
	EMBC, Lead Agency for Emergency Management operating under the Ministry of Public Safety and the Solicitor General (PSSG)	Specifically, with respect to flooding and the Provincial Flood Emergency Plan, which was updated under EMBC leadership in 2019, the provincial coordination of this plan rests with EMBC and includes mitigation, preparedness, response and recovery. Emergency prevention and preparedness is a shared responsibility in collaboration with all levels of government and British Columbians and is also instrumental in keeping our communities safe – EMBC coordinates these activities for a variety of hazards including flood and other hydrologic events. As legislated in the Emergency Management Regulation, EMBC must prepare Provincial emergency plans and provide a 24-hour capability to direct requests from local governments and First Nations for emergency assistance which are often in response to flooding or other hydrologic events. EMBC administers all provincial and federal government disaster mitigation funding programs, including the former National Disaster Mitigation Program and the Disaster Mitigation and Adaptation Fund. EMBC is the lead, in partnership with MOTI, for access to federal infrastructure programs for disaster mitigation. Since 2008, EMBC has led and managed the Fraser River Sediment Management Program, to maintain the current flood profile of the Fraser Gravel Reach (Mission to Hope). However, this program has not removed gravel since 2012. EMBC also manages (contracts out operation) the Fraser River Debris Trap which intercepts large volumes of natural wood debris during freshet. (Information provided by MFLNRORD)
	Ministry of Transportation and Infrastructure (MOTI)	Under the Land Title Act, MOTI development approving officers must consider flood hazards in the approval of subdivisions (within regional districts electoral areas). The Provincial Flood Emergency Plan: MoTI is primarily responsible for the safety and protection of provincial public highway, road and bridge infrastructure. The first priority of the ministry is to

		ensure that provincially-owned infrastructure is intact which includes maintaining command at the site level of events impacting provincially managed infrastructure. (Information provided by MFLNRORD)
	Ministry of Health (MoH)	The Provincial Flood Emergency Plan: support the local health authorities to maintain the delivery of health services. If required, the MoH Health Emergency Coordination Centre (HECC) may be activated to provide a coordinated response across all health system stakeholders. (Information provided by MFLNRORD)
	Ministry of Environment and Climate Change Strategy (MECCS)	The Provincial Flood Emergency Plan: During a provincial response to floods, the main supporting role of ENV is to respond to hazardous materials and other threats to the environment. ENV is responsible for coordinating the operation and maintenance of the provincial hydrometric network (water and snow gauges) and data quality provided by these gauges. These gauges are used by the RFC in FLNRORD to provide seasonal forecasts and bulletins as well as flood advisories. (Information provided by MFLNRORD)
	Ministry of Agriculture (MoA)	The Provincial Flood Emergency Plan (2019): Support to EMBC including: facilitating relocations of commercial livestock, providing support to farmers, aqua culturalists and fishers for the protection of crops, livestock and provincially managed fish and marine plant stocks, and advanced planning which may include mass livestock carcass disposal planning. MoA offers a variety of funding programs to flood impacted communities. (Information provided by MFLNRORD)
	Ministry of Municipal Affairs (MMA)	May approve special operating authority/funds for local authorities (in an emergency event). Specifically, the Minister may "ratify" a borrowing by-law under the Emergency Program Act (13(6)) if a local state of emergency is declared. The Provincial Flood Emergency Plan: In support of local authority recovery, provide guidance and assistance to local authorities regarding infrastructure. (Information provided by MFLNRORD)

Appendix B Engagement Framework

Central Okanagan

FLOOD MITIGATION PLANNING



Engagement Framework

APRIL 2021

Regional District of Central Okanagan

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1 INTRODUCTION

The purpose of this *Engagement Framework* is to guide the work of the project team in gathering input and feedback for the Regional District of Central Okanagan Flood Mitigation Planning project.

This framework includes:

- **Engagement Approach:** an overview of the engagement objectives and goals.
- **Stakeholder / Partner Overview:** core stakeholder groups and partners to be engaged.
- **Engagement Tools:** an outline of the engagement tools, channels, and strategies the project team will use to involve stakeholder groups.
- **Activities and Timing:** an overview of the meetings and activities anticipated for this project and their general format.
- **Management Concerns:** a description of any anticipated management concerns.
- **Engagement Monitoring and Evaluation:** an engagement monitoring sub-plan to track stakeholder participation and ensure that any gaps are rectified.

The Framework is a living document that will be revised and expanded as work progresses and as necessitated by engagement evaluation through the process (i.e., whether engagement objectives are being met).

1.1 Project Overview/Background

The Regional District Central Okanagan (RDCO) has initiated a Flood Mitigation Planning project to identify the best and most cost-effective mitigation strategies to build local resilience and reduce risk. This project is Phase 3 of several years of work, with the previous two Phases including investigations of lake and creek flood hazard, as well as flood risk assessments. Phase 2 was completed in 2020 and provides flood mapping and quantitative assessments of hazard, consequence, and risk in some high priority areas. Building on this previous work, a consulting project team (Ebbwater Consulting Inc. and partners EcoPlan and SHIFT Collaborative) will support the RDCO in preparing a mitigation plan to reduce flood risks, focusing on non-structural mitigation strategies.

The RDCO has identified three specific project objectives to frame the mitigation plan:

1. Reduce flood risk.
2. Improve emergency response.
3. Increase resiliency to climate change.

Between March and October 2021, this project will consist of five main steps:

1. Project Initiation.
2. Recommend amendments to plans, policies, and bylaws.
3. Gather input on proposed mitigation strategies, including communication and engagement.
4. Complete a Flood Mitigation Plan.
5. Presentations.

The project will include an extensive outreach component to member local governments, *Syilx*

communities, stakeholders, and the public to ensure that the proposed mitigation options are acceptable and supported. This Framework provides an outline of the Engagement and Communication that will support this process.

2 ENGAGEMENT APPROACH

All engagement will follow the provincial guidelines around COVID-19, respecting social distancing and limitations on gatherings. This presents an opportunity to utilize the many online and remote engagement platforms and techniques; at the same time, the Project Team will work to ensure that those who rely on traditional communication channels (e.g., newspaper, phone, paper mail) will still be included.

Extensive engagement with stakeholders and project partners is paramount to the success of this project and will follow objectives and principles as outlined below. The design of engagement and communications materials and approaches will also be informed by our review of past and current engagement and communications for flood risk management in the area (Task 2.1 in the project proposal).

2.1 Engagement Principles

Project engagement will be underpinned by the following principles:

- **Equitable and Inclusive:** The project planning team will apply an equity lens to the design of public facing engagement activities and work to ensure that project outcomes reflect and meet the needs of those disproportionately affected by rising water levels, flooding, and climate change. This will involve actively engaging under-represented groups and communities, holding space for their voices and perspectives to be heard, and acknowledging and valuing the views of all participants. It will also involve offering multiple methods of participation to help ensure that stakeholders who cannot attend project meetings or workshops can provide feedback through other methods.

- **Two-Way Communication:** Communication between the project planning team and stakeholders will be timely, responsive, transparent, collaborative, and provide opportunities for the engagement of the community, stakeholder groups, and the community at large at each of the five project phases.

- **Respectful Partnerships:** The project planning team will work to build and maintain relationships that reflect constructive, respectful, meaningful, inclusive, and compassionate partnerships aimed at achieving outcomes built upon a broad range of voices.

- **Transparency:** The project process will provide substantive opportunities for input and feedback through all project phases and include robust participation opportunities at key decision points. Transparency is critical for building trust and community buy-in, which is important for the success of any planning initiative, especially those that may require difficult trade-offs and decisions. A more transparent engagement process can be achieved through:

    - An open and honest approach.
    - Use of clear, plain-language materials so people understand the context, what they are being asked, and why.
    - Clear reporting back, so that partners and stakeholders can validate and confirm their initial input, see how it was used in the process, and provide feedback on the outputs their feedback helped generate.

- **Knowledge and Education:** Lake and riverine flooding and climate change are serious and important (and inter-related) issues that demand informed input from stakeholders. Community education and learning will be a part of most project phases.

- **Structured:** Engagement will rely on structured decision-making methods to help ensure that stakeholder and community engagement is focused on the project questions that matter. It also allows us to capture feedback in a way that can be used as part of later decision-making in a transparent and defensible way. A well-structured process – focused on clearly understood objectives – will also contribute to transparency and trust in the project process.

Following these principles will help meet the RDCO's goals for this project of reducing flood risk, improving emergency response, and increasing resiliency to climate change.

2.2 Engagement Objectives

The broad objectives of the *Engagement Framework* are to:

- Ensure that the proposed mitigation options are generally acceptable and supported region-wide.
- Ensure engagement is linked to, and integrated with the project's overarching, participatory, decision-making process around shaping and refining mitigation options.
- Ensure that a broad range of stakeholders are meaningfully engaged, and able to participate at key decision points through the process.
- Set out clear goals and objectives for project engagement and communications at each phase of work so that stakeholders and partners understand how they can participate and how their input is incorporated at key project decision points.
- Educate stakeholders, partners and the public on riverine and lake flood hazards, climate change, and mitigation strategies.

3 STAKEHOLDERS AND PARTNERS

The following key stakeholders and partners will be engaged using various avenues and approaches. Project stakeholder groups and their involvement are outlined in the following table.

Table 1 Stakeholder List

Group	Involvement
Core Groups	
Project Steering Committee	A Steering Committee for this project will be formed, involving representatives from the RDCO project staff and relevant departments, City of Kelowna, City of West Kelowna, District of Peachland, District of Lake Country, Westbank First Nation, Okanagan Indian Band, Okanagan Nation Alliance, Okanagan Collaborative Conservation Program, the Okanagan Basin Water Board, and UBC Okanagan (Watershed Management Research Extension Facilitator). The Project Consultant Team will meet regularly with the Steering Committee throughout the project to support communications and engagement, share information, and review drafts of the Flood Mitigation Plan. Steering Committee members will also be invited to participate in stakeholder workshops. A core activity for the Steering Committee will be the integration and coordination with other RDCO and Okanagan projects and initiatives. A Terms of Reference for the Steering Committee has been provided to Committee members.
Existing Flood-related Groups	
Okanagan Collaborative Flood Planning Group	The Okanagan Collaborative Flood Planning Group involves key stakeholders including the RDCO, Regional District of Okanagan Similkameen (RDOS), Regional District of North Okanagan (RDNO), member municipalities, representatives of local *Syilx* communities (see First Nations below), Provincial staff, the Okanagan Basin Water Board (OBWB), and community organizations (see Local organizations/NGOs below). The Project Team anticipates engaging with this group as the primary avenue for engaging Okanagan local governments beyond the RDCO region, with a focus on sharing lessons learned and seeking general feedback. Engagement will consist of attending their existing meetings, as well as focus groups and structured interviews as appropriate.
Okanagan Basin Water Board	The Okanagan Basin Water Board (OBWB) is a collaboration between the three Okanagan regional districts to provide leadership on water issues across the valley. This group will be engaged directly as part of the Project Steering Committee as well as through their participation in the Okanagan Collaborative Flood Planning Group.
Various Local Government Staff and Elected Officials	We will also inform the project by engaging with a range of local government staff (supplementing the Steering Committee members as needed) who can provide specific knowledge and experience relating to various local flood risk and resilience considerations, including: Elected Officials, RDCO Environmental Advisory Commission members, RDCO Governance and Services Committee, Central Okanagan Emergency Operations staff, and other local government staff in Engineering, Development Services / Planning, Watershed / Environmental, Public Works, Finance / Asset Management, Economic Development, Parks, and Social Planning.

Table 2 Stakeholder List cont.

Group	Involvement
First Nations	
Okanagan Nation Alliance (ONA) Westbank First Nation (WFN) Okanagan Indian Band (OKIB)	Engagement with First Nations will start with asking how they would like to be involved. At a minimum, First Nations engagement will take place through Steering Committee meetings and meetings with Indigenous representatives from across the valley through participation in the Okanagan Collaborative Flood Planning Group, as well as general public engagement directed at local *Syilx* members. Members from the *Syilx* Okanagan Nation will be invited to participate in specific Community Conversations for their communities and can also participate in valley-wide Community Conversations. We will also listen for additional methods that may be needed to ensure First Nations are meaningfully included. WFN, ONA, and OKIB have been invited to participate on the Project Steering Committee.
Residents	
Community members – RDCO member municipalities and electoral areas	Community members from RDCO member municipalities and electoral areas will be engaged through Community Conversations (i.e., online workshops) and through other online channels (e.g., social media, RDCO on-line engagement platform, surveys, etc.). Resident engagement will employ an equity lens to ensure those of all demographics, backgrounds, cultures, and language groups are included (see below).
Youth, Seniors, under-represented groups	Those who have been historically discriminated against and/or excluded as well as those who will be disproportionately affected by the impacts of rising water levels and climate change.
Residents and asset owners in floodplain areas	Residents living in floodplains will be a special focus of engagement. They will be identified using floodplain mapping completed during prior Phases of flood planning work in collaboration with RDCO project staff.
Local organizations	
Okanagan Collaborative Conservation Program	This group will be engaged through their participation on the Steering Committee and the Okanagan Collaborative Flood Planning Group. If necessary, the Project Team will conduct specific follow up phone calls, emails, and interviews with this group and other local organizations and NGOs as identified with the Steering Committee.
Other key local organizations and service providers	We will invite a number of local organizations to take part in the stakeholder workshops, to represent a broader range of interests, including: School District, Interior Health, Related NGOs (e.g. Mission Creek Restoration Initiative, Friends of Mission Creek, Society for the Protection of Kalamalka Lake, Allan Brooks Nature Centre, Central Okanagan Land Trust), Local Business (Chamber of Commerce, Association of Interior Realtors, Urban Development Institute Okanagan Chapter, Tourism Associations), Neighbourhood / Residents Associations (Okanagan Mission (OMRA), others.)

Table 3 Stakeholder List cont.

Group	Involvement
Regulators, Land and Asset Owners	
Provincial Government	Relevant Provincial ministries will be engaged through their role as External Participants in the Okanagan Collaborative Flood Planning Group, and invited to stakeholder workshops. Invitations will be extended to: Ministry of Forests, Lands and Natural Resource Operations (FLNR), Emergency Management BC (EMBC), Ministry of Transportation and Infrastructure (MoTI), BC Ministry of Environment and Climate Change Strategy.
Land and Asset Owners	Other land and asset owners that have a stake in flood risk and resilience will also be invited to participate in stakeholder workshops, including: FortisBC, BC Hydro, City of Kelowna International Airport, School Districts, Interior Health, Irrigation/improvement districts (Black Mountain Irrigation District, Glenmore-Ellison Improvement District, South-East Kelowna Irrigation District), Water Purveyors, Agricultural Producers and Associations.
Experts/academic	
Dr. Nahiduzzaman, of UBC-Okanagan	An academic, expert perspective will be solicited through Dr. Nahiduzzaman, whose research focuses on valley-wide flood planning and policy. They will be engaged through their participation on the Steering Committee and the Okanagan Collaborative Flood Planning Group. If necessary, the Project Team will conduct specific follow up phone calls, emails, and interviews Dr. Nahiduzzaman and other local experts and academics as identified with the Steering Committee.

4 ENGAGEMENT ACTIVITIES AND TIMING

Engagement and communications activities will be organized into three rounds, as described below.

1. **Setting the Stage: Building Awareness and Refining Objectives** *(April – June)*
   Round 1 will introduce residents and other stakeholders to the project (including an explanation of how it builds on earlier completed phases) and flood mitigation best practices. Activities will be organized to elicit community values, review current flood management objectives (i.e., reduce flood risk, improve flood emergency response, increase climate change resiliency) and identify / revise any additional objectives to inform and guide development of the strategy. Laying the groundwork for Round 2, engagement and communications will introduce and explore potential non-structural mitigation options (i.e., issues, opportunities, challenges).

2. **Exploring Alternatives: Review Scenarios and Proposed Mitigation Strategies** *(June - July)*
   Round 2 will promote education and awareness around potential trade-offs and complexities in the proposed options under consideration. The Project team will take care to illustrate how community values and objectives (identified during Round 1) were used to inform the draft options / strategy. Finally, Round 2 engagement will seek input and feedback on non-structural flood mitigation options.

3. **Review and Finalize Engagement Summary and Draft Strategy** *(September - October)*
   During the final round of engagement, the final draft strategy will be presented to core project partners for review, along with an engagement summary and key highlights. This will provide a basis for refining and prioritizing the proposed mitigation options and amendments to plans, policies and bylaws. Structured decision-making will be used. Final project deliverables will be presented to the RDCO Regional Board, member municipalities, Okanagan Nation Alliance, Westbank First Nation, and Okanagan Indian Band.

The table below summarizes general engagement and outreach activities, indicating their approximate timing. The primary responsibilities for each activity (e.g., EcoPlan, SHIFT, RDCO) are also identified.

Table 4 Engagement Activities

Activity/Communication ***Timing***	**Description**	**Roles**
Steering Committee Meetings (April – September, dates TBD)	Approximately four meetings will be held (over Zoom during COVID-19) with Steering Committee Members (see *Table 1: Stakeholder List*) to: • Provide input on the public communication and engagement framework; • Identify other key information sources and appropriate external contributors/reviewers; • Provide advice on priorities, issues, and solutions related to flood planning; • Advise on the development of non-structural flood mitigation strategies in the Central Okanagan; and, • Review and comment on several drafts of the Flood Mitigation Plan.	• SHIFT to lead • EcoPlan to design materials and support SHIFT • RDCO to convene Members
Initial Stakeholder Outreach (April)	Targeted emails and phone calls to key groups beyond the Core Groups (neighbourhood groups and associations, local organizations and service providers, underrepresented groups, academic experts, regulators and land and asset owners) to: • Introduce them to the project. • Advise them of upcoming opportunities to get involved. • Provide links to more information. • Ask them how they would like to participate.	• EcoPlan to lead and prepare materials • SHIFT to support • RDCO to provide contact information
Stakeholder Workshops (Round 1 - May, Round 2 – June)	Two structured workshops will be organized with Core groups, First Nations (possibly as separate meetings), neighbourhood groups and associations, local organizations and service providers, underrepresented groups, academic experts, regulators and land and asset owners. These will include interactive presentations and small group activities designed to build awareness while supporting dialogue across perspectives and input on values, issues of concern, and mitigation approaches. Workshops will take place over Zoom during COVID-19; additional platforms such as Mentimeter and Mural can be used to support interactive activities like instant polling and digital whiteboards.	• SHIFT to lead • EcoPlan to design materials and support SHIFT • RDCO to send invites

	Spread across the two workshops, topics will include: • Project introduction, including Phases 1 and 2 of flood management planning. • Education around climate change and lake and riverine flooding risks and hazards. • Elicitation of values and flood management objectives. • Discussion of high-level, non-structural flood mitigation approaches.	
Presentation to Governance and Services Committee (June 10 or July 8)	A mid-project update will be presented to the RDCO Governance and Services Committee during one of their regularly scheduled meetings to: • Provide an overview of the project and its progress so far; • Obtain input from Committee members on values and flood management objectives; • Discuss high-level, non-structural flood mitigation approaches; and, • Build municipal project awareness prior to presentations of the Draft Plan at the end of the project.	• EcoPlan/SHIFT • RDCO to send invites
Community Conversations (Round 1 - May, Round 2 - July)	Two community conversations (or workshops) will be organized to support broad public engagement (residents and *Syilx* community members) on flood mitigation planning and education around flood and climate change. The 1 to 1.5-hour sessions would include structured discussion and activities and will take place over Zoom during COVID-19. Additional platforms such as Mentimeter on-line polling and Mural digital whiteboarding would be used to make sessions more interactive and to share feedback instantly. Engagement topics will be organized as follows: • Round 1: Building project, flood, and climate change awareness; shaping values. • Round 2: Exploring alternatives; reviewing scenarios and proposed mitigation strategies. Multiple sessions per round can be organized at different times of day to include various	• EcoPlan to lead and prepare materials • SHIFT to support • RDCO to advertise events

	neighbourhoods and community members. Syilx members are welcome at any of the conversations, and we will also hold a separate Community Conversation specific to Syilx communities and ONA. We may hold additional sessions for key groups such as underrepresented groups and floodplain residents, asset-owners and associations, as needed.	
Council/Board Presentations	Following the completion of the Central Okanagan Flood Mitigation Planning project, the project team will prepare a presentation for the RDCO Board, First Nations, and member municipalities on the project. Ideally, presentations to municipalities will take place prior to the Board presentation.	• EcoPlan, SHIFT, and Ebbwater

5 GENERAL COMMUNICATIONS AND OUTREACH

In addition to the project meetings and workshops summarized in the previous section, the project team will also carry out broader-scale general communications and outreach activities through all project phases. The table summarizes general communication and outreach avenues and tools.

Table 5 Communication Tools and Tactics

Surveys	As part of Rounds 1 and 2, to create an opportunity for those who were unable to attend workshops to provide their input. - Round 1: to introduce the project, elicit community values, review flood management objectives, and explore non-structural mitigation options - Round 2: to inform people about considerations and trade-offs with this type of decision making and gather their thoughts on proposed options
Workbooks	To accompany the survey, a community workbook could be distributed digitally and in print (to include those who are not online).
Social Media	RDCO Communications Team will manage social media for this project using established RDCO accounts (e.g., Twitter, Instagram, Facebook). The Project Consulting Team will provide content, graphics, and suggestions on timing.
Traditional Media	There will be regular media releases on project updates, milestones, and current and upcoming activities using the range of media available in the Central Okanagan (e.g., Kelowna Daily Courier, Castanet).
Signage	The project team has had success with project signage (small election signs) in floodplain areas (parks and trails) to help raise awareness of flood risks in the area and to help promote the project and drive people to the project website using a QR code on the signs.
Project Webpage	A webpage will be created on the RDCO website to provide project information and updates, notices of and links to opportunities to get involved (e.g., surveys, workbooks), and project materials as they are developed. A link to the webpage will be included on all other communication materials.
Newsletters and Mailouts	The project team can develop a project newsletter and other collaterals (e.g., project postcard) that could be delivered to residents living in floodplain areas and through project partner websites and other channels. These materials will be distributed through RDCO communication channels.
Piggybacking on Parallel Events and Processes	Over the course of the project, parallel/concurrent RDCO and partner processes will provide an opportunity to link and coordinate planning projects and broaden the project exposure. This could include attending meetings of existing groups and organizations or sharing communication materials with them for distribution through their networks.

6 ENGAGEMENT CONSIDERATIONS

A number of potential challenges are considered here, along with potential mitigation measures.

- **Engagement during COVID-19:** Residents, organizations, and governing bodies may be more focused on dealing with COVID-19 than participating in or thinking about projects such as this one. Additionally, COVID-19 has significantly changed what engagement can safely look like, with most events shifting to online platforms and increasing reliance on remote methods.
    - **Mitigation approach:** This also represents an opportunity to be creative and innovative with the use of different and multiple online platforms. The Project Team will also be considerate of folks who are not online, and conduct engagement and communications for all levels of digital literacy. This means continuing to rely on traditional media like newspaper ads and phone calls.

- **Resources (time, cost, human capacity):** Every project would be benefit from additional resources. This project has a relatively short timeline, part of which takes place over the summer months which are not ideal for community engagement.
    - **Mitigation approach:** The project team will aim to leverage other parallel engagement processes and events (see next bullet) to make best use of this project's resources. Engagement events will be scheduled strategically around key holiday periods.

- **Coordination with other local government planning initiatives:** There are numerous concurrent and parallel planning projects on both the local and regional level that must be coordinated with this project. This also means that residents and stakeholders may already be engaged in other projects, and have less time for participating in this project.
    - **Mitigation approach:** Project coordination and integration will be a key focus of Steering Committee work. Coordination with existing Committees and Stakeholder Groups will support opportunities to coordinate with and integrate both local and regional planning projects with this project. This includes 'piggybacking' on existing engagement events and opportunities to avoid engagement fatigue. We will also be reviewing past and ongoing flood-related engagement and communications, including the joint RDCO-OBWB public outreach program on lakeshore flood hazard maps, to ensure that our approach builds from the work and learning that has already occurred.

In addition to these logistical concerns, some potential psychological challenges, or barriers, can be expected as a result of the scale and scope of the complex challenges posed by climate change and flooding.

- **Protection motivation:** The concept that stakeholders and partners may need to feel a certain degree of personal threat before they are motivated to make behavioural changes and/or trade-off decisions around mitigation options. The behavioural challenge may also support stakeholders and partners in having an anchor bias in protection-based adaptation pathways versus other pathways (i.e., accommodate, move/avoid).

- **Psychological distancing:** The concept that stakeholders and partners may distance themselves from large scale, long-term challenges like climate change and flood by disconnecting themselves from its implications. Stakeholders and partners may subconsciously underestimate the flood risk they face as a means of psychologically managing the challenge.

- **Displacing risk:** The concept that stakeholders, particularly people living and working in vulnerable, at-risk areas will tend to direct their attention towards the most immediate concerns (e.g., winter storm protection works) while ignoring the longer-term climate and riverine and flooding risks and hazards perceived to be either happening too far in the future or with associated uncertainties.

We consider these psychological barriers in our design of engagement and communications materials and aim to engage and communicate in ways that allow people to take in and make sense of more of the story than they might, if they were simply provided with flood risk information alone.

7 ENGAGEMENT MONITORING AND REPORTING

Monitoring and reporting on engagement and communications activities will help to track stakeholder participation and feedback and ensure that any gaps are identified and rectified as the project unfolds.

Workshop evaluation questions will be asked at the end of Community Conversations and Stakeholder Workshops. These will be short (one to three questions) online polls (e.g., Mentimeter) that ask participants to reflect on how effective the session was and if/how it could've been improved.

Summaries of all engagement events and activities will be created at the end of engagement Rounds 1 and 2. The Project Team will monitor what's working well and what could be improved (e.g., are any key voices missing?), and track key measures like responses to the workshop evaluation questions, participation rates, return vs. new participants, etc. Any gaps or challenges identified will be discussed with RDCO staff and addressed by the Project Team.

A Draft Engagement Summary will be developed that documents the process and summarizes "What was heard" from all project engagement. Drawing on Round 1 and Round 2 event summaries, this report will be prepared at the end of the engagement phase. It will include the following information:

- Project overview: Engagement process overview
- Project events and activities overview: A summary of project outreach and engagement, including participation numbers and feedback from workshop evaluation questions.
- Gaps, challenges and lessons learned: A summary of engagement challenges and issues and any strategies developed to address them through the project.
- Summary of key findings/feedback: A summary of community feedback on values, flood mitigation objectives, and how community feedback informed the Draft and Final Flood Mitigation Plan. This feedback would be broken down, where possible, by partners and stakeholder groups (i.e., Project Steering Committee, Existing Flood Related Groups, First Nations, residents and *Syilx* community members, asset owners, other project stakeholders).

Engagement activities and strategies as listed above may change or be adjusted during the project. These changes and outcomes will also be summarized in the final project engagement report.

The report will be circulated for review by RDCO Staff and the Project Steering Committee before posting online for broader distribution.

8 PROPOSED TIMELINE

Engagement & Communications Activities	April	May	June	July	Aug	Sept	Oct
Stage 1 - Setting the Stage							
Steering Committee Meeting #1 & #2							
Initial Stakeholder Outreach							
Stakeholder Workshop #1							
Community Conversations							
Public Survey / Workbook							
Stage 2 - Exploring Alternatives							
Stakeholder Workshop #2							
Community Conversations							
Public Survey / Workbook							
Steering Committee Meeting #3							
Governance and Services Committee							
Stage 3 - Review & Finalize							
Steering Committee Meeting #4							
Presentations to Councils, Boards							
Ongoing Communications							
Signage							
Project Webpage							
Social & traditional media							
Newsletters & Collateral							

Steering Committee Meeting Proposed Schedule:

1. April 14th
2. Week of May 31st
3. Week of July 5th
4. Week of Sept 7th

Governance and Services Committee Proposed date: July 8th

Appendix C Steering Committee Terms of Reference

Central Okanagan Regional Floodplain Management Plan
Phase 3 – Flood Mitigation Planning Steering Committee

Terms of Reference – May 2021

The **Flood Mitigation Planning Steering Committee** is a volunteer committee created on a limited term basis (approx. March – September 2021) to direct and advise on flooding and flood management for integration within the Regional Floodplain Management Plan. Specifically, the TAC will direct and advise on the development of a Flood Mitigation Plan within the Central Okanagan mainstem lakes and tributaries. Terms of Reference of this committee may change in order to accommodate the needs of the committee in achieving its stated goal. The committee will ensure the interests of all members – and the broader public interest – are considered in its work.

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1) Name: RDCO Flood Mitigation Planning Steering Committee (SC)

2) Goals: The goals of the SC are to:

1. Advise on the development of the RDCO Flood Mitigation Plan; and
2. Advise on how to incorporate and best use non-structural flood mitigation options into the development of the Flood Mitigation Plan, such as regional priorities, identifying suitable alternatives to flood mitigation, and to inform decision making.

3) Scope of Work:

- Provide expertise, input, and advice to support the successful completion of the RDCO Flood Mitigation Plan, including:
    - Advise on the development of non-structural flood mitigation strategies in the Central Okanagan;
    - Provide advice on priorities, issues, and solutions related to flood planning;
    - Provide input on the public communication and engagement framework;
    - Identify other key information sources and appropriate external contributors/reviewers; and,
    - Review and comment on several drafts of the Flood Mitigation Plan.
- Work with consultant on development of the RDCO Flood Mitigation plan:
    - Advise and review RFP materials prepared by Ebbwater Consulting.
    - Monitor consultant progress.
- Other tasks as needed.

4) Desired Outcomes:

- Completion of the scope of work outlined above.
- Incorporation of best management practices and tools into the development of the Strategy, such as regional priorities, identifying suitable alternatives to flood mitigation, and informed decision making.

5) Committee Governance, Decision Making, Roles and Responsibilities:

- Meetings will be held approximately every second month, supplemented by teleconferences, emails, webinars, and other means as needed.

- Committee composition will strive to include all levels of government, Indigenous partners, non-government and academic sectors as well as others with relevant interests and knowledge where appropriate. Committee members may appoint alternates to ensure optimal attendance.
- Decisions and recommendations of the committee will be made by consensus, which is defined as agreement / acceptance by committee members or a lack of expressed disagreement / disapproval.
- If one or more members do not agree, the committee will continue dialogue, provide more information and/or modify the decision or recommendation to reach consensus.
- The core guiding principles for the committee include:
    - Supporting a collaborative, consensus-based model;
    - Being respectful of one another, including diverse perspectives;
    - Focusing on interests rather than positions; and,
    - Utilizing dialogue rather than debate.

Roles of Committee Members:

- Actively participate in committee meetings, activities, and decisions.
- Assist in acquiring data, reports and other information as relevant, particularly where sourced from within their own organizations.
- Provide advice to the committee.
- Provide two-way liaison and communication between the committee and the member's organization (if applicable).

Roles of RDCO:

- Organize and provide notices for all meetings.
- Document meeting minutes/actions/communications.
- Undertake committee actions as needed and as appropriate (in collaboration with committee members, sub-contractors, and other organizations).
- Assist in acquiring data, reports and other information where relevant, particularly where sourced from organizations outside of the committee membership.
- Communicate and coordinate committee work with SC members, the Okanagan Flood Collaboration Group, funders and other organizations as appropriate.
- Provide overall program management, project management, contract management, and other administrative functions, including, but not limited to budget tracking and management, request for proposal processes, retaining and liaising with sub-contractors, preparing progress reports and briefing notes, etc.

Funding: Meeting expenses will be covered by an allocation from the overall budget of the Phase 3 – Flood Mitigation Planning project.

6) Backgrounder and terminology:

Effective flood management requires implementing a range of options, rather than relying solely on traditional structures such as dikes or dams. So called "non-structural

options", like policies, programs and initiatives play an important role in reducing risk and improving flood resiliency and include:

Risk Reduction

- **Land stewardship** – maintaining and restoring natural areas (e.g., watersheds, wetlands, riparian areas, natural waterways) to help reduce downstream flooding.
- **Land use management** - encouraging or requiring types of land use in flood hazard areas that will prevent or reduce potential damage. For example, a green space would be less affected by flooding than a new sub-division.
- **Building management** - regulations and strategies that make structures and belongings less susceptible to flood damage. For example, using flood-resistant materials for the ground floor of a building.

Resilience

- **Education and awareness** – Homeowner guides, flood and climate change education, neighbourhood preparedness programs, and other learning resources.
- **Emergency response** - early warning systems, temporary barriers, and other flood response programs.
- **Insurance and disaster financial assistance -** managing financial risks where no other mitigation strategies are available.

Resilience is the "ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of the essential basic structures and functions through risk management." (UNDRR 2017; UN 2016)

Risk is "the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity." (UNDRR 2017; UN 2016)

Appendix D List of Stakeholders

Invited Organizations	Attended Session #1	Attended Session #2
Okanagan Nation Alliance		✔
Westbank First Nation	✔	
Okanagan Indian Band		
City of Kelowna	✔	✔
District of Lake Country	✔	✔
District of Peachland		✔
City of West Kelowna	✔	✔
RDCO	✔	✔
RDCO Environmental Advisory Commission		✔
Central Okanagan Emergency Operations staff	✔	
FortisBC	✔	✔
BC Hydro		
City of Kelowna International Airport		
School District		
Interior Health	✔	✔
Irrigation/improvement districts		
Water Purveyors		
Agricultural Associations / Specialists	✔	✔
Project Steering Committee	✔	✔
Okanagan Collaborative Flood Planning Group	✔	✔
Okanagan Basin Water Board	✔	✔
BC Ministry of Forests Lands, Natural Resource Operations and Rural Development	✔	✔
Emergency Management BC	✔	✔
BC Ministry of Transportation and Infrastructure		
BC Ministry of Environment and Climate Change Strategy		
Okanagan Collaborative Conservation Program	✔	✔
Mission Creek Restoration Initiative		
Friends of Mission Creek		
Society for the Protection of Kalamalka Lake		
Allan Brooks Nature Centre		
Central Okanagan Land Trust		
Chamber of Commerce		
Association of Interior Realtors		
Urban Development Institute, Okanagan Chapter		
Tourism Associations		
Okanagan Mission (OMRA)		
Dobson Engineering		✔
Aecom		✔
Ecoscape LTD		
UBC Okanagan	✔	✔
Clarke Geoscience		
Canadian Homebuilders Association		
Waters Edge Engineering		✔

Appendix E Engagement Summary Report

Central Okanagan

FLOOD MITIGATION PLANNING

Engagement Summary

AUGUST 2021

Regional District of Central Okanagan

Table of Contents

1. Overview

Between March and July of 2021, the Regional District of Central Okanagan hosted a series of online engagement events as part of its process of developing a flood mitigation strategy with a focus on non-structural approaches (e.g., policies, programs, initiatives). These sessions were hosted on the unceded traditional territories of the *Syilx* people. We were honoured to be gathered together with an opening prayer and welcome at the first stakeholder and partner session, from *Syilx* Elder Grouse Barnes.

Engagement and communication with stakeholders and project partners were core components of the Central Okanagan Flood Mitigation Planning project. The main activities[1] included:

- Two Steering Committee Meetings
    - When: April 14th & June 2nd
    - Purpose: to support communications and engagement, review project processes and draft materials, share information and support integration and coordination with other RDCO and Okanagan projects and initiatives.
    - Who: representatives from the RDCO project staff and relevant departments, City of Kelowna, City of West Kelowna, District of Peachland, District of Lake Country, Westbank First Nation, Okanagan Indian Band, Okanagan Nation Alliance, Okanagan Collaborative Conservation Program, the Okanagan Basin Water Board, and UBC Okanagan.

- Two Stakeholder Workshops
    - When: May 20th and June 22nd 2021
    - Purpose: to build awareness, support dialogue across perspectives, and seek input on values, issues of concern, and mitigation approaches.
    - Who: Invitations were extended to members of the Steering Committee plus neighbourhood groups and associations, local organizations and service providers, consulting professionals and academic experts, regulators, provincial and federal government staff and land and asset owners. Participating organizations included:
        - Okanagan Nation Alliance
        - Westbank First Nation
        - City of Kelowna
        - District of Lake Country
        - District of Peachland
        - City of West Kelowna
        - Regional District of the Central Okanagan

[1] Other outreach via email and phone calls with individuals and specific groups was conducted at the start and throughout the project as needed.

    - RDCO Environmental Advisory Commission
    - Central Okanagan Emergency Operations staff
    - FortisBC
    - Interior Health
    - Agricultural Associations / Specialists
    - Project Steering Committee
    - Okanagan Collaborative Flood Planning Group
    - Okanagan Basin Water Board
    - BC Ministry of Forests Lands, Natural Resource Operations and Rural Development
    - Emergency Management BC
    - Okanagan Collaborative Conservation Program
    - Private Consultants

- Three Community Conversations
    - When: May 26th and May 27th (Round 1), and June 24th (Round 2) 2021
    - Purpose: to support broad public engagement on flood mitigation planning and education around flood and climate change.
    - Who: Residents and community members

- One Online Survey:
    - When: May 27th to June 25th 2021
    - Purpose: create an opportunity for those who were unable to attend workshops to provide their input.
    - Who: Residents and stakeholders

Additional project communications and engagement were conducted across social media (Facebook, Instagram), e-Newsletters, an RDCO webpage set up for this project, local advertising, phone calls and emails with individuals and specific groups, and posted print materials.

On top of supporting public education and awareness building, community engagement sessions helped elicit what people care about and are most concerned about in flood mitigation. This feedback informed the project team's development of values-based criteria to evaluate non-structural mitigation options. Input from the Steering Committee and Stakeholder Workshops helped to characterize the challenges and opportunities in implementing suites of mitigation options in specific places (using two case studies) and at a regional scale. Incorporating all of this information into the final report will help to ensure that the suite of proposed mitigation options is broadly acceptable and supported.

The outcomes and key findings of our engagement activities is summarized in the remaining sections of this report.

Gaps & Challenges

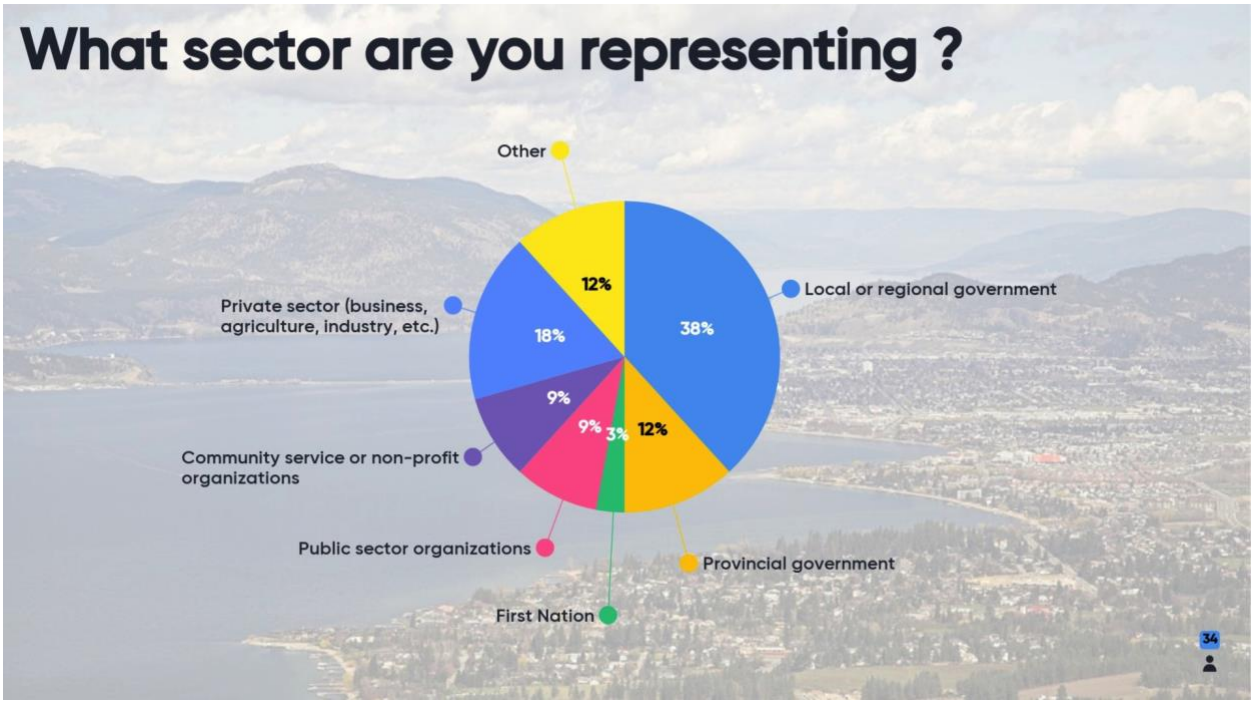
There were some challenges associated with the engagement around this project; namely, the involvement of the general public (i.e., there was low registration for the Community Conversations). This could have been due to the timing of engagement coinciding with the summertime, Zoom fatigue, and loosening of COVID-19 travel restrictions. Additionally, the region was experiencing a heat wave and subsequent wildfires around the same time as the engagement period, so peoples' focus was less likely to be on flood. This challenge was mitigated by reallocating the Project Team's resources to focus more on Stakeholder and Steering Committee engagement.

The original engagement framework included plans for specific outreach sessions with *Syilx* communities; however, *Syilx* community members and staff have been engaged in a lot of work recently, including the ONA's recent flood & debris flow risk assessment. The project team consulted with Steering Committee members from ONA, OKIB and WFN to explore preferred ways to include *Syilx* values and priorities in this process. Instead of holding specific sessions, it was suggested that this project focus on integrating the findings from that project. In addition, we worked with the representatives on the Steering Committee where possible, to guide and provide feedback on the work.

2. Stakeholder & Partner Engagement Session #1

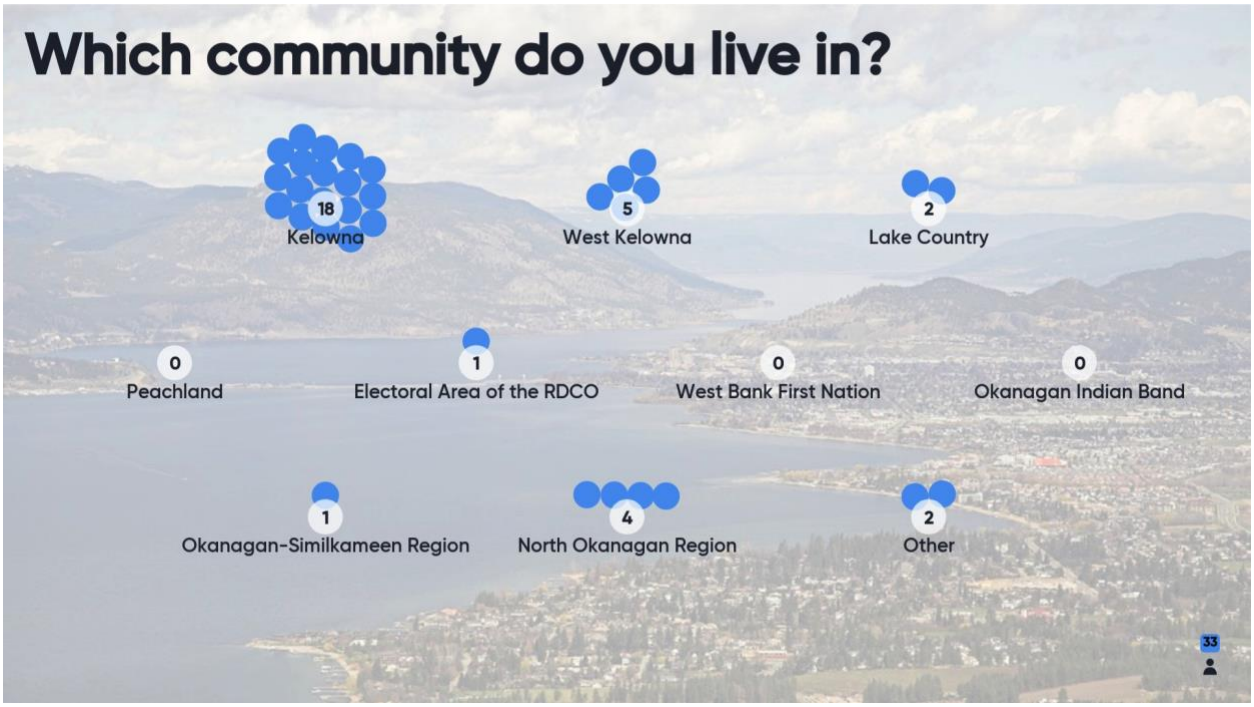
a. Overview

Over 120 invitations were sent to a wide range of stakeholder and partner groups, with the intention of gathering input from, and enabling conversation across, many different perspectives. A list of partners, groups, and organizations who were invited, and those who attended, are listed in Appendix B. In total, approximately 34 people attended the session. The chart below shows the distribution of represented sectors:

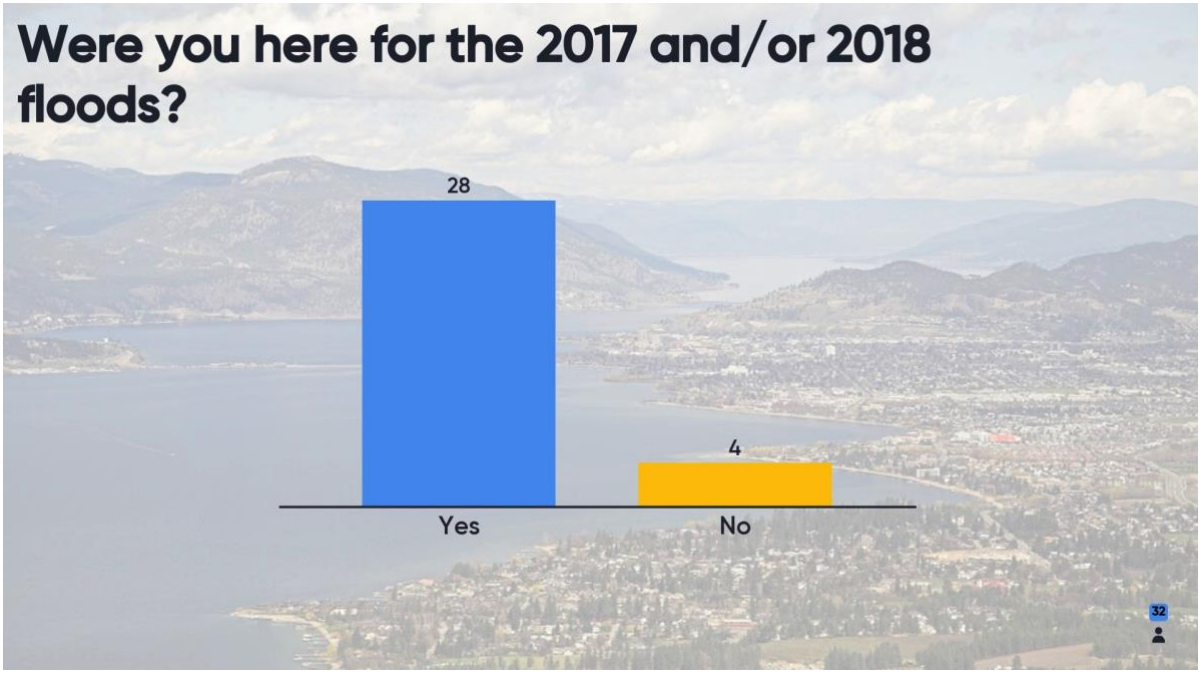


There was strong representation from local and regional governments in the Central Okanagan, as well as a few from North and South Okanagan regions, with whom the Regional District of Central Okanagan is collaborating on flood management. A representative from one of the First Nation partners was able to attend. A number of provincial government ministries took part, including the Ministry of Agriculture, Ministry of Forests, Lands, Natural Resources and Rural Development, Emergency Management BC and Ministry of Transportation and Infrastructure. We also had a number of participants from public, private and non-profit organizations. Those reporting “Other” included participants from UBC Okanagan (academia).

Participants also came from across the Central Okanagan and elsewhere, with a concentration of people coming from the largest urban centre in the region (Kelowna) as reflected in the graphic below:



Most participants reported that they were in the region during the flooding events of 2017 or 2018:



This session covered three main topics:

- Values to guide the choice of strategies and approaches
- Current objectives for the project
- At a high level, types of non-structural flood mitigation options to be considered

b. Summary of Results

i. Values

During the session, participants were asked in a number of different ways about their values in relation to flood, its impacts and approaches to building resilience and reducing risk. The first question asked generally about what people value as part of living among lakes and rivers:

Key themes:

- Recreation; outdoor, healthy lifestyle
- Water quality (fresh & drinking water)
- Nature and biodiversity, with frequent mention of aquatic habitat
- Aesthetics (beauty, sounds, scenery, etc.)
- A few people mentioned weather or climate, as well as a quality of serenity and tranquility

Participants were also asked about their values in relation to flood specifically. Some of the key themes were:

1. Impacts to ***people***
    a. personal health and safety
    b. social and community impacts
    c. addressing the needs of those who experience the most vulnerability and risk

2. Impacts to the ***environment***
    a. water quality, drinking water
    b. environmental resilience
    c. agricultural resilience

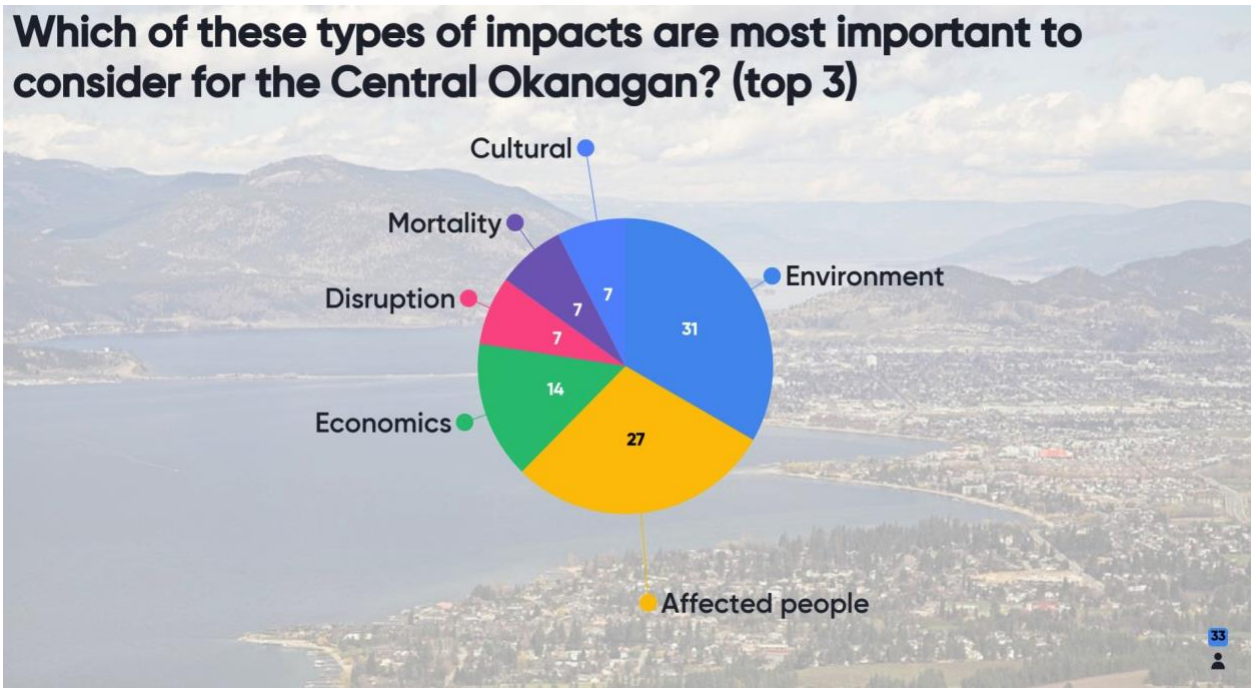
3. Impacts to ***property***
    a. homes and personal property
    b. private and public infrastructure

4. Implications for ***planning and decision-making***
    a. being proactive, planning ahead
    b. being adaptive in our planning (with mention of managed retreat)
    c. moving from risk to resilience
    d. working with the "problem" of flood – recognizing that every problem also has opportunities

Asked to identify their top 3 priorities out of a set of pre-defined types of impacts, participants showed a clear prioritization of:

1. Environment (33%)
2. Affected people (29%)
3. Economics (15%)

The categories of disruption, mortality and cultural impacts were all lower, at 8% each.



Participants split into small groups to discuss three values & strengths related questions. Key themes and points are summarized below.

What is most important to address when it comes to building flood resilience as a region?

- Need to understand flood risk: improve data and its implementation
- Regional collaboration & engagement
- Land use management tools:
    - Zoning, bylaws, policies, building code, setback requirements, construction levels
- Consistency between policies
- Being more proactive and less reactive
- Respect floodplains, get out of the way of water
    - Stop building in floodplains, use floodproofing when this is not possible
- Work with nature, not against it
- Invest in restoration of natural areas, riparian areas,
    - use of greenspaces, green rooves
    - zero tolerance for wetland loss
    - give creeks natural capacity to handle high flows
    - secure additional lands
- Build and plan for future conditions with climate change
- Public education & awareness

What do we already do well in this region, in terms of building our resilience?

- Emergency response & preparedness (high praise)
- Collaboration & communication
- Data & mapping
- Resources, support & coordination
    - OBWB's role in collaboration, data, mapping, etc
    - RDCO, regional planning
    - Expertise, support and funding from provincial government
- Learning from experience with flood
- Okanagan Lake regulation system

What values should guide our choice of strategies and approaches to build flood resilience?

- Empathy
- **Equity**
- Environment & climate change
- Collaboration
- Responsibility (for impacts)
- Informed
- Recognize change
- **Reconciliation**
- Don't repeat the mistakes of the past
- **Proactive**, plan to reduce risk
- More non-structural mitigation
- **Work with nature & flood**
- Respect floodplains, get out of the way of water

ii. Feedback on Objectives

There are 3 high-level objectives for this phase of the Central Okanagan Flood Planning work:

1. Reduce flood risk
2. Improve emergency flood response
3. Increase resiliency to climate change

Overall, most participants thought that these objectives captured what we should be working towards (28 = yes, 4 = somewhat, 0 = no). When asked if there was anything missing, some suggestions included:

- Define and provide more specifics
- Recognize the beneficial impacts of flooding for ecosystems and culture
- Enhancement of the environment should be a goal on its own
- Include an equity lens
- Consider how to live in sustainable ways with flood
- Emphasize a proactive stance rather than response

iii. Challenges & Opportunities With Non-Structural Options

Participants were asked at the beginning of the session, and again at the end, to identify which two of the six types of non-structural flood mitigation options they were most drawn to. The intention was to see if their preferences changed after having had the chance to discuss challenges and opportunities with other stakeholders. The results are shown in the two charts below. The only significant change was a reduction in votes for land stewardship (-9% of total votes) and an increase in votes for education and awareness (+10% of total votes). All other options stayed more or less the same.

After discussing options, the top three of interest were:

1. Land use management (40%)
2. Land stewardship (23%)
3. Education & awareness (22%)

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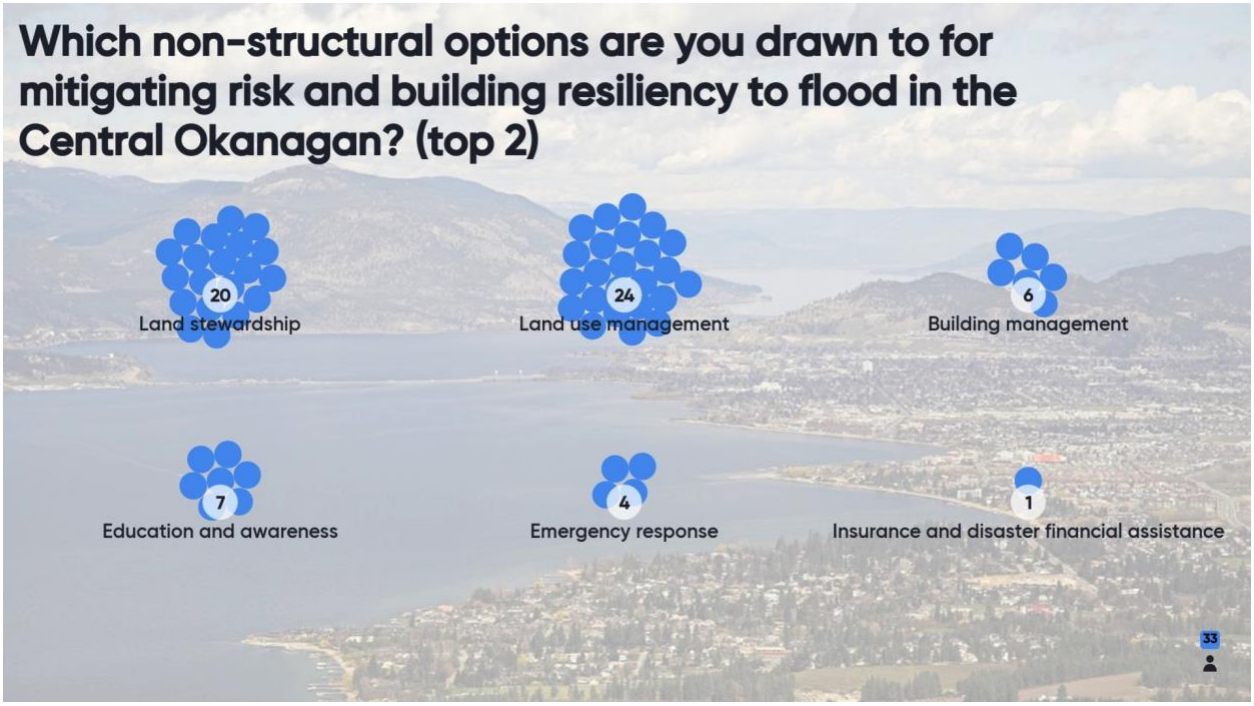

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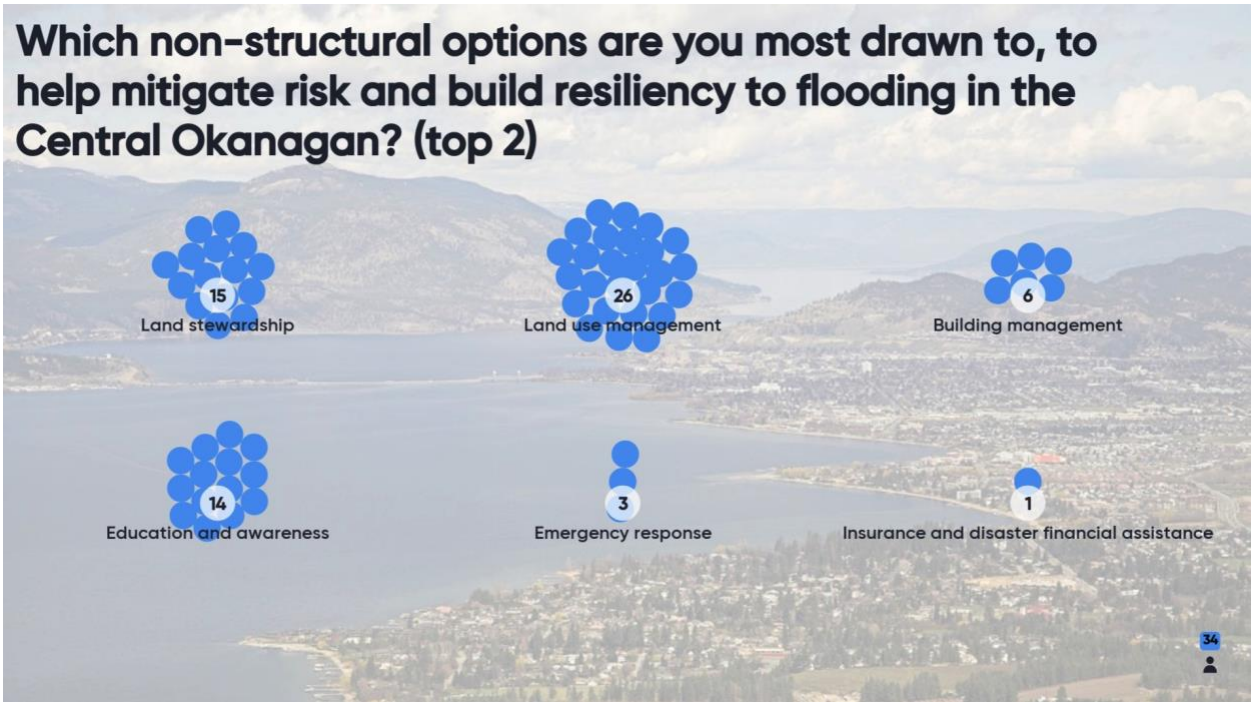

Which non-structural options are you most drawn to, to help mitigate risk and build resiliency to flooding in the Central Okanagan? (top 2)
15
Land stewardship
26
Land use management
6
Building management
14
Education and awareness
3
Emergency response
1
Insurance and disaster financial assistance
34

In small groups, participants were asked:

What Challenges and Opportunities do you anticipate, in applying these options in the Central Okanagan?
What patterns or trends do you notice?
What rules or systems affect this?
What beliefs or values affect this?
Is the challenge or opportunity specific to a place, group of people or type of impact?

Responses are summarized in the table below.

Non-Structural Option	Challenges	Opportunities

Land Stewardship 	• Balancing competing interests
	• Changing policy and legislation, enabling protection & stewardship
	• Lack of local government authority (e.g. involves crown lands)
	• Understanding the complexity (watershed dynamics, climate change, etc.)
	• Short-term thinking & memory
	• Resources
	  ○ Cost of land protection / restoration
	  ○ Costs to farmers for lost use
	• Existing infrastructure & development
	• Consistency and collaboration along the whole valley
	• Scale: can we even restore 5% of the floodplain?
		• More discussion
		• Floodplain areas without structures could be re-naturalized
		• Education & awareness raising around buy back programs
		• Holistic approach (whole watershed, adapt to what works in different areas)
		• Work with farmers & land owners; use existing farm practices
		• Natural asset management planning/protection and including that into local government asset management. Enables local governments to provide services such as stormwater management, water filtration and protection from flooding and erosion.
		• Natural asset management provides additional benefits relating to recreation, biodiversity, health and culture, and community resilience to climate change.

Non-Structural Option	Challenges	Opportunities
Land Stewardship cont.		• Natural landscapes in urban centres like tree planting can reduce storm water runoff and can help to remove green house gases from the air reducing ozone destruction and have climate cooling effects. • Going above the minimum for riparian area protections and buffers from agriculture • Looking at/advocating for changes with forestry/logging practices, especially in watersheds • Mitigating effects of development close to watercourses/wetlands

Land Use Management 	• Complexity
	  ○ Flood is just one of the issues (impact of forest fires on flood; drought, slides…)
	  ○ Cumulative impacts; systems planning
	• Shared boundaries and jurisdictions
	  ○ Need provincial partners involved
	• Not enough legislation
	• Existing development in floodplain, environmentally sensitive areas
	• Mobile home parks in floodplains (equity)
	• Balancing interests, political input
	  ○ Property owners and developers push back (costs)
	• Lack of understanding, historical data – still often reactive
	• Lack of funding
	• Expense of removing houses from floodplain
	• Governments more likely to spend money on response than mitigation (but then could face lawsuits for inaction)
		• Bring people together across sectors to talk about flood
		  ○ Develop a consistent approach for meaningful change
		  ○ Build understanding of each others' challenges
		  ○ Build understanding of the issues & solutions
		  ○ Bylaws are good, willing participants better
		• Proactive planning
		• Learn from others
		• All the great data we have collected
		• Existing tools for protection & management of floodplain areas:
		  ○ Incentives for protection
		  ○ Land trusts
		  ○ Municipal buy-back (turn into parks)
		  ○ Emergency flood storage on ag lands
		  ○ Use park land
		• Larger setbacks

Non-Structural Option	Challenges	Opportunities
Land Use Management cont.		• Strengthen Zoning Bylaw: permitted land uses, setback distances, limiting density close to floodplains (including limiting subdivisions, secondary suites, carriage houses, etc. in flood prone areas), building siting, and flood protection regulations. • Strengthen requirements and have strong, consistent processes in place for applicants to provide/meet requirements of Development Permit Areas (specific to the Aquatic Ecosystem and Sensitive Terrestrial DPAs). • Building green infrastructure into Subdivision Servicing Bylaws. Limiting impermeable surfaces covering a property • Food Security: Consideration must be given to flood diversion onto agricultural and farm land and its impact on food production (short term and long term) due to contamination or loss or production.
Building Management 	• Building code is not innovative, slow to change • Need different strategies for high and low income properties (both tend to be in floodplain areas) • Old septic systems • Cultural norms around architecture • Need consistency across Okanagan • Resources • For existing properties close to floodplains: construction/material costs associated with retrofits	• Take an equity lens to solutions • Can reduce sensitivity to floods • BC stormwater management guidelines: they exist, but needs implementation • Learn from other countries • Innovative housing design • Flood-proofing via retrofitting for existing lots/buildings close to flood plains • Consider seeking grants to be able to reduce costs to homeowners for flood-proofing measures • Locating industrial/agricultural/etc. chemical storage away from flood prone areas

Non-Structural Option	Challenges	Opportunities
Building Management cont.	• Increased growth of population and development pressures for housing in the Central Okanagan	• Consider adding another development permit area that has more stringent requirements that provincial regulations with regards to septic close to lakes, water courses, etc. An example is the CSRD Lakes 100m Development Permit Area. • Look at density of onsite sewerage systems in a neighbourhood in close proximity to flood plains. Having less dense onsite sewerage close to water helps to reduce the potential of bacteriological contamination of water • Encourage deeper intakes that are farther away from the shore of surface water for private water systems. This can help to mitigate impacts to infrastructure, water quality, etc during regular spring freshet and if flooding were to occur • Encourage new developments which propose a private well to be located away from watercourses and outside of flood plains • Encourage developments to put in deeper top soil (under landscaping) as well as plant more vegetation to allow for more water holding capacity spread across entire urban landscape. The rationale is if there is a heavy rainfall, this would help to enhance the capacity of the soil to absorb that water so it will limit overland flow. • Being more proactive and having mitigating measures in place for regular maintenance/monitoring of culverts as well as sizing culverts appropriately. Additionally, monitoring and making changes as needed as climate change

Non-Structural Option	Challenges	Opportunities
Education & Awareness 	• Not top of mind without recent event, public is easily fatigued • English as a second language • Information changing so quickly (climate change, field is developing rapidly) • So much information – need to interpret and package to be relevant to the public • Not as powerful as making systemic changes • New residents / homeowners don't have information about floodplain, flood risk • Resources to make improvements (even if they want to) • Property owners with assumption that variance will be granted – messaging unclear	• Use emergency preparedness as a channel for raising awareness about non-emergency related flood topics • Use all the great data we have collected • Educate proactively • Share flood risk information with new buyers; buyers ask more questions to promote this as best practice • Educate about insurance – what is and isn't covered • Greater frequency of flood events due to climate change will keep it in peoples' minds – also share about historical events • Help people to understand role of public and of government • School-based curriculum, other tools developed for Okanagan • Demonstrate value of proactive planning • Educate civil servants • Education will help public to hold Councils accountable • Use existing channels (e.g. RDCO does public messaging) • Provide information on how people can protect their homes from the risks of flooding using building management techniques and any structural efforts • Provide information/education to home-owners as to what they can do after a flood re. food safety, drinking water safety, septic systems • Provide information/education to home-owners with private wells close to surface water or private

Non-Structural Option	Challenges	Opportunities
Education & Awareness cont.		surface water intakes on the significance of source protection, treating drinking water, etc. • Provide information on why remediation/restoration after a flood is important (i.e. providing the health and safety rationales) and why they should do it in the first place(value in protecting their properties and why setbacks important), where they can find information on how to remediate landscaping in flood prone areas with vegetation/landscape design to help absorb water/soil holding capacity to reduce severity of potential damage
Emergency Preparedness 	• Lack of current, future and past data • Capacity & resources (esp. for smaller communities) • Difficulty predicting from year to year • Tradeoffs of immediate response vs other values (e.g. lake levels for fish habitat vs human safety) • Taking an equity lens on emergency preparedness and planning – need more data gathering and mapping of vulnerable areas and people • Drastic changes coming due to climate change – shock for those who aren't aware • *Disproportionate vulnerability*: socially and economically disadvantaged populations (Indigenous, people with disabilities, people experience homelessness, racialized groups, low income, seniors, new immigrants, women, lone parents) shoulder a greater burden of ill health, carry a greater share of stressors and	• Emergency response capacity already strong • Getting community partners together for flood response planning • Provincial funding available (through UBCM) • Build on existing knowledge and lived experience of flood response • Existing data: in the region, provincial flood forecasting, university climate change studies • Use of technology like dashboards, apps • Shared leadership, planning across sectors • Providing opportunities for neighbours/community to connect/know each other to be able to help each other out. Enhanced community connectedness, increases neighbourhood resiliency to events and build back afterwards. Building Resilient Neighbourhoods. • *Vulnerability Mapping or Assessment:* proactive mapping of groups who may be more vulnerable because of their location (exposure), sensitivity (children/seniors/pre-existing conditions) and

Non-Structural Option	Challenges	Opportunities
Emergency Preparedness cont.	have less access to resources and opportunities in relation to climate change and events like flooding • *Communication:* Communication methods around emergencies must consider that not all groups have regular access to the internet of comparable literacy rates • Resources information on where/when/how to access support services is provided online or in written format for efficiency. However, being unable to understand resources provided in print or search online for supports and services available (due to language barriers, literacy challenges or diminished capacity), exponentially complicates and hinders individuals' ability to stabilize in the short-term and return to pre-incident lifestyles beyond the immediate aftermath timeline of a fire or flood. (equity consideration) • For existing homeowners/renters that live in flood plains - may not have the financial ability to do proactive or reactive remedial measures (ex. buy sump pumps, etc.) to deal with flooding • For existing homeowners/renters, if flooding were to occur they may not have the ability to fix their septic systems which would result in a health hazard with sewage on the ground that children, people, animals can be exposed to	adaptive capacity (income/social status, physical environment, education/literacy). Having this information up front could help inform emergency planning and where to focus efforts and supports in a time of crisis. (equity consideration) • *Communication:* Using accessible ways of getting information out to public is important of an equitable response (radio, public notices at libraries, stores, schools, service providers) (equity consideration) • *Partnerships:* Any planning around emergency response should be done in consultation with First Nations communities in the Central Okanagan • *Partnerships:* Any planning around emergency response should include social service providers who will likely be called upon to help support vulnerable populations and guide them in accessing resources • *Consultation:* Consider involving social service providers in engagement efforts, as well as people with lived experience of poverty, newcomers to Canada, those in rural or isolated locations. They will be able to speak to what they need in an emergency… this may be different from the perspectives of Local government. (equity consideration) • *Resources:* Resources provided to people must be multi-modal (Some resources: WHO Strategic Communications Framework for effective communications and OCUL Accessible

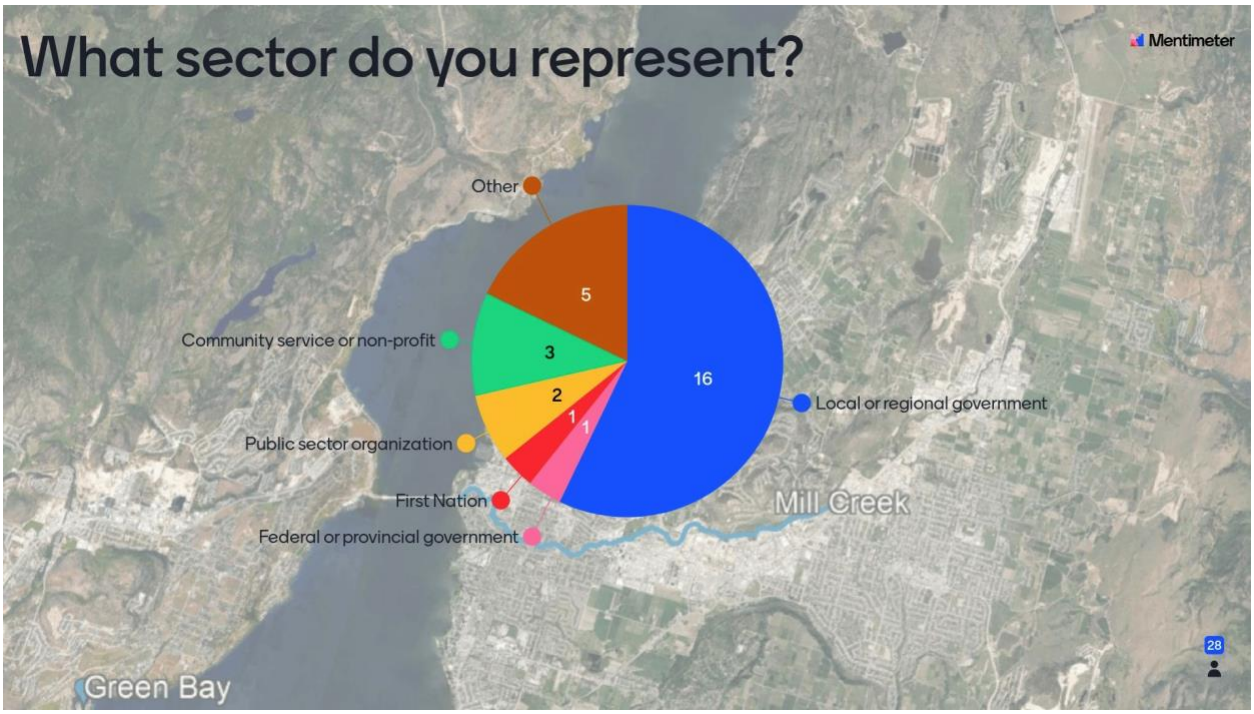
Non-Structural Option	Challenges	Opportunities
Emergency Preparedness cont.	• For socially and economically disadvantaged populations, they may not have the supports in place to help them to prepare or plan in response to flooding	Communications) so that it can be far reaching/meet needs to all community members
Insurance & Disaster Financial Assistance 	• *Concern about grouping these two tools together Insurance not available in floodplain • Increasing frequency of events • Changes in higher level government supports as risk increases • Aging infrastructure • Lack of understanding of DFA; expectation that we will continue to pay for all mitigation & recovery • Access to funds depends on scope and scale of event, declaration of disaster • *Housing Insecurity*: Research indicates that disasters like floods that destroy homes are likely to cause homelessness among those with precarious housing pre-disaster. Finding suitable homes in a hurry and in a housing market with limited supply is exceptionally challenging for these groups • *Less able to recover:* Folks living with lower income or in poverty are less able to recover from flooding events: minimal or no insurance, inability to remediate damage, displacement with nowhere else to go during a crisis event, unable to replace lost or damaged property, permanent displacement due to uninhabitable home, have limited	• Lower income households insured at lower rates • Insurance for buy outs rather than repairs? • Build back better • Lack of insurance discourages building in floodplain • Education (increasing frequency, risk, what supports available/not) • Buy back programs

Non-Structural Option	Challenges	Opportunities
Insurance & Disaster Financial Assistance cont.	funds to pay for new deposits (equity consideration) • *Employment:* Individuals with low socioeconomic status are less likely to be employed or are precariously employed and many of these folks are unable to take time away from work without penalty or be positioned to continue going to work as normal in the days, weeks or months following a personal disaster. The inability to maintain stable employment is directly linked to poverty and poorer social and health outcomes • *Financial Assistance:* Most emergency services and support models (following provincial legislation) provide 72 hours of financial assistance for community members in the event of a displacement. These funds are generally insufficient for groups living at or below the poverty line	

3. Stakeholder & Partner Engagement Session #2

a. Overview

In total, approximately 32 people attended the second session. Participants were very similar to those described for Session #1 – the chart below shows a slightly different distribution of represented sectors:



This session gathered input on three main topics:

- Exploring WHAT and HOW to apply non-structural flood mitigation strategies and actions (across all six types of options) to two specific case examples
- Key issues requiring a region-wide approach
- Preferred options

b. Summary of Results

i. Exploring Possible Flood Mitigation Options for Two Case Examples

To support discussion of flood mitigation options and strategies, participants were asked to consider one of two case examples: Mill Creek, Kelowna and Green Bay, West Kelowna. A basic profile of each was provided, with the assumption that there would be additional knowledge of these areas, in each group. With reference to a handout that summarized possible actions under each of the six categories (land stewardship, land use management, building

management, education & communication, emergency preparedness and financial tools), participants discussed strategies that could be considered for each case example.

Land Stewardship

Ideas for ways to maintain / restore

- Changing the purpose of parks to more explicitly function as flood management tool. This may translate into different choices, such as restoring wetland functioning or other natural assets.
- Protect natural areas, increase setbacks, explore land acquisition
- Formalize use of some farmland for water storage / flood mitigation purposes (where this is compatible; provide incentives / pay for this use; flood tolerant crops)
- Incentives for homeowners to restore/provide natural flood areas
- Where possible, consider protecting upper watershed (e.g. for Mill Creek?)
    - Combined with dams/reservoirs

Strategic considerations

- In areas that are risk hotspots, focus on retreat and/or restoration first
- Ecosystem restoration has multiple benefits outside of times of flooding
    - Far more value for the whole community and environment when we focus on ecosystem restoration
    - Need education & awareness so people better understand the true value

Local examples

- Parkinson Rec Centre – example/model: want to use this area to enhance riparian areas, enhance ecosystem, widen creek, create pools for fish, etc. See if salmon will come back up
- 2017 highlighted some weaknesses along riparian corridors. When we have opportunity now, with things like bridges, we're trying to look beyond minimum design levels and trying to enhance natural area around it. Move trails back from directly along Creekside – designing more for nature than for humans.
- 2018 lots of trails lost along Mission Creek, so this provided an opportunity to re-route trails and restore the natural floodplain
- A natural asset management inventory is available

Land Use Management

Setting priorities

- What are we trying to protect? Where should funding be directed? (e.g. does it make sense to protect or buy out homes if/when people have chosen to live there? Do we only protect critical infrastructure, or homes as well?)
- Property – by – property decisions, or more strategic?

- Level of service conversation
- Need longer term thinking around land use management
- Some suggested priorities:
    - Avoid first; where that's not possible, consider other options
    - In areas that are risk hotspots, focus on retreat and/or restoration first
- Need to include infrastructure (sewer) – environmental and fiscal components

Many tradeoffs and interdependencies involved.

- Retreat is a politically challenging option
- Consider needs / interests of different actors in the mix
    - E.g.: Developers, Property Owners, Elected Officials, Regulators
- Education and awareness building needs to go hand in hand with advancing land use management approaches

Providing a rationale

- Should be able to explain why a certain strategy is being taken or not (e.g. why we did / didn't buy out properties in the floodplain), and how one approach is chosen over another
- Avoid
    - Shouldn't be allowed to build in floodplain area any longer
    - "Avoid" policies set stage for other steps (e.g. buy-out policies)
- Retreat
    - Buy-outs may be cost effective in long term (relative to costs of protection)
- Redistribute
    - In an area like Mill Creek, it's already densely developed with diverse land uses. Redistributing density and land uses around the area makes sense.

Building Management

Important option to reduce risk in already developed areas, in combination with other approaches

- There is already an expectation that taking steps to protect your property is the responsibility of the home owner themselves. Mitigating flood risk is part of that.
- Appropriate in already developed areas where it is desirable to maintain development/density and therefore land use management tools are limited (e.g. Mill Creek, Green Bay)
    - Where we've missed the chance to avoid or to design appropriately for floodplain, these tools are a way of reducing existing risk
    - Still need to use a combination – e.g. use building management tools until opportunity for redevelopment / buy-outs arises
- Importance of education and awareness building to promote floodproofing choices

Specific Tools

- Raise buildings
    - Current flood construction levels don't work
- Floodproof for wet flooding
- Also include infrastructure (sewer, septic and other infrastructure that can be designed to manage flood conditions).

Resilience-Building Options

Education & Awareness

- Acknowledge & disclose is important – role of province to require this
    - May influence how people think about lakefront properties
- People need to be aware they are in a floodplain, and what some options are. This is precursor to taking actions to reduce risk.
- Climate change modelling and information is important to inform future planning
- Use awareness and momentum from recent flood events to make progress and put policies in place now

Emergency Preparedness

- 2017 & 2018 floods: people develop an expectation that the City & Army can protect peoples' homes (with millions of sandbags, and millions of dollars)
- Experience with flooding means flood response is "down to a fine science" in areas prone to flooding

Insurance

- Crop insurance
- Possibility of not being insurable in areas prone to flooding

HOW To Approach Non-Structural Flood Mitigation In The Region

Take a systemic view of the situation

- Account for tradeoffs across other values (e.g. densification; desirable areas to live; walkability; recreation; tax base)
- Address equity at all stages (who can afford to pay / move, etc) – some suffer more than others, from floods or from policies to reduce risk
    - City of Kelowna has done equity mapping – need to look at who's going to be most impacted and using an equity lens.
    - Need more deliberate efforts to include most vulnerable populations
- Take into account the current implications of historical legacies (e.g. colonizing systems put FN reserve lands in floodplains; other areas developed prior to regulations)
- Cost-benefit analysis could inform the analysis
    - E.g. properties subject to repeated flooding may be higher priority for buy-outs; save money in longer term
- Think both short term and long term, and at both personal and regional scales

- How will climate change predictions come into play with long-term thinking? Limitations of being able to imagine what the future holds.

Engage broadly

- Trying to get planners, developers, politicians, etc. to understand that existing properties shouldn't set the precedent – this is a tough political challenge.
- Participatory management: engage stakeholders throughout the process. Having input of actual residents is really important.
- Consider needs / interests of different actors in the mix
    - E.g.: Developers, Property Owners, Residents, Elected Officials, Regulators
    - Developers have different incentives than homeowners

Create another category of non-structural options for "Leadership & Governance"

- How do we tackle this wicked problem? Who takes on leadership of addressing this?

Practice strategic decision-making

- Use a combination of non-structural mitigation options
- Guidance for which strategies to consider under what circumstances
- Consider timing and sequencing of options / decisions
- Include as part of long-range planning:
    - Municipal master plan for flooding
    - Integrate into OCPs

Provide consistency across the region, especially on certain options such as:

- Retreat:
    - establishing standards and precedents regionally that provide clear expectations going forward
    - policies for buying land when it becomes available
- Avoid:
    - some municipalities still open to development in floodplain

AND, customize for particular contexts

- E.g. Mill Creek
    - highly developed, now going through quite a lot of redevelopment / renewal. Opportunity is there to ensure new development meets forward-thinking goals (not standards of the past)
    - Benefits of building management as key strategy in already highly developed areas where land use management tools are more limited.
    - Types of building stock may influence which tool is most appropriate

ii. Region-Wide Approaches or Considerations

At the end of the session, we asked participants to complete this statement: “At a regional scale, it is important to…” By far the most responses related to developing a consistent and coordinated approach across the region, along with a few other suggestions:

- Cultivate consistency across the region*
    - Develop shared goals and agreement on the basic data / science.
    - Have a lead coordinator
    - Collaborate, communicate, and take leadership together
    - Carefully weigh our trade offs
- Collaborate with other jurisdictions
- Have respect for the power of water
    - Recognize that floods serve many ecological functions and are an important part of our environment
- Take an ecosystem focus for natural capital, aesthetic and flood value

In addition, small group discussions generated a number of other insights into what needs to be considered or approached from a region-wide perspective:

Consistent policies could enable bolder action

- Retreat and buy-outs--an important option--needs a regional approach
- Policy consistency across the region, rather each muni having their own regulations--even for public education--makes it easier to be bold and aligned in policy and messaging
- Regional scale collaborative framework could help municipalities - e.g., to defer to higher level policies to not allow things like variances to build in floodplains. Gives municipalities/smaller groups backing to make tough choices
- Inconsistencies between different municipalities is extremely frosting, should not be complaint driven but enforced on bylaws.
- Provincial/regional leadership is super critical - if we continue to allow certain areas to develop (e.g., along Mill Creek), there’s no doubt that those developments will be flooded. Can’t just keep diverting water elsewhere

Approach this with everyone at the table

- Regional approach as overarching strategy is good, but how would municipalities respond to blanket policies? hard to enforce regionally
- Everybody would need to be at the table to put together a regional plan; it’s not about telling municipalities what to do. Getting everyone on board from the start will help with implementation.
- Lessons learned and what works well should be shared and consistently applied
- Need more voices at the table - especially from up and down the valley - take back control from the senior levels of government.
- Opportunity - the politicians need to be actively brought into the conversation - “here's what your legacy is going to be” - need to stop passing the buck

Watershed Approach

- Watershed protection - look at watersheds and plan at a regional level. Broader guidance could have positive impact on the management of creeks in the area. Could do this better in the interior
- Some of the issues are above and beyond one person or one agency, so many players
- Protection of the upper watershed in terms of who is responsible for those areas

Natural Assets Approach

- Natural assets as infrastructure
    - Collaboration across sectors (agriculture, ALC, regional government, water utility purveyors etc.)
- We are looking at flood as a threat, but can look at it as an opportunity, i.e.,: how can it bring positive values. A different perspective could bring about collaboration.

Managing "transfer of risk" across properties or jurisdictions

- Region-wide, inter-regional approach on lakeshore properties, sharing lake levels, stream flooding can also cross jurisdictions.
- Secondary hazards (erosion, avulsion) - happen throughout the region. Homeowners on private property will do something on their land that transfers the flood risk to their neighbour.
- Component of monitoring and response is needed, pay attention to small scale changes to hydrology at a smaller property level. Thinking about small creeks that have a big impact at a site level.
- Look at small site level hazards. Not sure of role of municipal government in this, but monitoring and response is an option.

Relationship to other levels of government

- Collaboration starts at national, provincial, regional, local--all layers of government
- Certain level of province passing the buck to local government, it would be nice to get everybody together to clarify roles and take a similar stance and approach on how things are dealt with.
    - If we wait for the Province or the Feds to take the lead it may never happen – it's up to us as local and First Nations governments to say "this is how we are doing it", after all, it is the local communities that are the most affected by floods - come together as a region
- For all levels of government, how does the govt want to deal with these increased risks.
    - If you as local government know there is a flood risk issue, and you have not done due diligence to reduce the flood risk, can say someone is not eligible for funding because they haven't reduced risk. If the province pressed that button, what is it that the local government could reasonably do to address that question. This will likely become more front and centre in the future.

Limitations of Existing Policies

- We are limited by the existing policies and legislation that governments are not prepared to change.
    - Restricted by the BC building code
    - At the local level the greatest opportunities might be structural. If we are going to see the change it may need to be dictated from the Province.
- Need significant changes by Province around lake water level management. We're already thinking in terms of best case scenarios

Funding

- Need funding to have a mechanism to buy land
- Work together to lobby governments for funding
- So much funding is infrastructure funding (b/c of job spin-offs), but should be buying property for retreating

iii. Preferred Options

When asked to choose their top two options of the six non-structural options at the end of the second Stakeholder & Partner Engagement Session, 21 out of 24 people chose Land Use Management. The second choice was Land Stewardship with 9 of 24.

Many of the proposed strategies (within each type of option) were considered to be necessary in the long-term, with these ones receiving the strongest support:

- Building Social Resilience (20)
- Public Education (18)

- Maintain Natural Assets (17)
- Avoid Development in Flood Hazard Areas (17)
- Controls for New Builds (16)
- Retreat (15)
- Restore Natural Assets (15)
- Flood Response Planning (14)
- Acknowledge & Disclose (14)

Participants were also asked to suggest actions that they see as "low-hanging fruit" or obvious "win-wins" in the short term. Responses included a wide range of actions, including:

Land Stewardship (5)
Upper watershed protection
Flood as an opportunity
Maintain & restore floodplains, natural areas

Retreat & restore natural areas (5)
Restore natural areas, retreat where practical
Buyout mobile home parks in vulnerable areas
Retreat and establishing natural assets in areas retreated
Redistribute

Setbacks & FCLs (5)
Increase setbacks and raise floor elevations

Education & Awareness (4)
Educating homeowners, realtors, builders on risks and retrofit options

Avoid (3)
Avoid development -- no build zones moving forward
Set aside floodplain

Emergency Preparedness (3)
Better coordinated emergency management
Build Social/Neighbourhood resilience
Flood response planning

Coordination (3)
Coordinate municipal response to bylaw infractions along lakeshore
Develop regionally consistent approaches together with clear guidelines
Aligning bylaws on flood construction levels for the lakeshores

Other
Ensuring functionality of existing flood protection works
Using existing assets to set priorities (mapping)
Focus on the most vulnerable areas for risk reduction
Taking the lead
Local government to implement requirements for building resiliency.
Use opportunities to build resilience when opportunities present themselves
Consider the groups most at risk and prioritize their needs.
Building management
Bylaw and regulation change
Adoption of new (updated) Design Flood Lake Levels
Floodplain mapping and land use management

4. Community Conversations

a. Overview

Two rounds of Community Conversations were hosted to invite members of the public to engage in this project. The first two sessions (Round 1) were held on May 26th (12pm) and 27th (5:30pm), and the third (Round 2) was on June 24th, 2021. Originally Round 2 was going to include two sessions, but they were combined due to low registration. Each session was one hour long and took place online through "Zoom" videoconferencing.

The purpose of these sessions was to engage and inform community members and residents of the Okanagan to:

- Learn about non-structural flood mitigation options for this region
- Collaborate with others to build understanding and develop great ideas, together
- Share knowledge and experience to help shape the recommended strategies

For each session, information was provided by the project team (about flooding in the region, risk, and climate change, and what the RDCO is doing about in response), and a series of questions were asked to participants to build project, flood, and climate change awareness, as well as elicit values to support decision making around flood mitigation options.

Seven participants joined for Round 1; Round 2 saw six new participants, and one return participant. Participants included:

- Residents living directly in the floodplain
- Residents living beyond the floodplain who have interests in it (e.g., favourite parks)
- Community members whose work and/or professional interests are relevant to flooding

Advertisements and invites for community members to attend the sessions were shared across various platforms including multiple Facebook and Instagram posts, local online news (Castanet) ads, notification on the RDCO website, City of Kelowna and RDCO e-Newsletters, as well as posters, sandwich boards, and a digital truck sign placed in key neighbourhoods, parks, and streets within the floodplain.

When asked how they heard about the sessions, the most common response was through word of mouth.

Figure 1 Project advertisement in Mill Creek Park

Round 1 focused on the question *"what do you care about with flooding and your home and community?"*. Participant feedback on values, later combined with input from other project engagement sessions (e.g., stakeholder and advisory committee workshops), helped shaped decision criteria that will be used to evaluate non-structural options. Participants were given a brief introduction to types of non-structural options and invited to attend Round 2 to learn more.

Building on feedback from Round 1, Round 2 centred on the question "*which flood mitigation options do you want to see in your community?*". Round 2 participants were given an overview of what was heard during Round 1 and asked if the decision criteria covered all their values. Round 2 participants were then given a more in-depth overview of types of non-structural mitigation options and asked to respond.

b. Summary of Results

i. Experience with Flood

Participants were asked about their experience with and concern for flooding. Some participants lived in the floodplain during the record-setting floods of 2017 and 2018 and were directly affected. Others spoke to the impact of flooding within their respective professional roles, ranging from emergency management, strata council management, home building, and real estate appraisal.

Other participants have not been directly affected by flooding but have watched flooding take place year after year in areas they pass through often, visit for recreational purposes, or have friends.

The level of concern around the impact of flooding ranged from 'somewhat' to 'extremely.' When asked to rate their level of concern on a scale of 1 (not at all concerned) to 10 (extremely concerned), the average response was above 8. No participants indicated that they're not at all or only a little bit concerned.

ii. Values and Impacts

During Round 1, participants were asked to discuss the following two main questions.

1. What matters to you most about flooding in the Okanagan?
2. Which of these types of impacts [Environment, Affected People, Local and Regional Economy, Infrastructure Disruption, Health and Safety (Mortality), and Culture] are most important to consider for the Central Okanagan?

Participant responses focused on the following key themes:

- Economics
    - Some residents within the floodplain are unable to obtain flood coverage insurance, and worry about the potential costs of covering flood damages (e.g., rising strata fees)
    - Indirect impacts for those beyond the floodplain but who will be impacted as taxpayers
- People and Equity
    - Some folks will be more able to withstand financial burden than others
    - Elderly residents are particularly at risks and unable to place sandbags
- Environment
    - Concern for disappearing wetlands, ponds, wildlife habitats, not just during flood events but as a result of human/engineering decisions that don't consider environmental impacts
    - Destruction of land and natural water cycles (e.g., burying streams) is what has led to increased flooding/climate impacts
- Responsibility
    - Individual home owners, builders, and buyers vs. municipal and provincial responsibility
    - Question of who should pay for disruptions
- Disruption
    - Ablity to move around during/following flood events (e.g., with roads washed out)

During Round 2, participants were given a brief summary of the Round 1 discussion around impacts and concerns, and then shown the Decision Criteria (e.g., homes and neighbourhoods, human health and safety, environment, culture, etc.) which the Project Team developed using community values and concerns. Participants were asked whether they think the criteria capture what is important to consider in flood mitigation, or if anything is missing. Participants responded affirmatively, confirming that these Criteria align with what they think is important.

iii. Non-Structural Mitigation Options

In Round 1, participants were provided with a high-level introduction to the six types of non-structural mitigation options,[2] and asked to respond in terms of which options they were most drawn to or curious about.

During Round 2, more detail was provided on the options, particularly land stewardship, land use strategies, and building management. Participants were asked which options they are most drawn to, which options they see as 'win-wins' in the short-term, and which options they see as necessary in the long-term.

Discussion from both Rounds focused on the following:

- Land Stewardship
  - Would like to see more emphasis on options that enhance, rather than harm, our environment (e.g., wetland restoration, renaturalization, encouraging beavers to build dams in strategic locations)
  - We should learn from and incorporate Indigenous knowledge and the type of land stewardship First Nations have historically practiced in this region
  - Need more policies and incentives (more than just encouragement) for residents/builders to implement nature-based solutions such as green roofs, mandatory downspout rainwater collection, limits on lawns, etc.

- Education and Awareness
  - Better data and flood maps need to be provided to and used by decision makers to address risk
  - People (e.g., home buyers, developers) need to be made more aware of flood risks and what makes sense to build where
  - Question around what residents at risk can do – who do they talk to, who do they ask for for support during a flood event (e.g., sandbags, aquadam)?
  - Eduction needs to be paired with enforcement (e.g., not allowing watering on off-days)

- Land Use Management
  - Need for municipalities to have the tools, resources, data, etc., to prevent developing in floodplain

- Building Management

[2] The other non-structural mitigation option that was not specifically discussed by participants was emergency response.

    - Need more education around what is possible for homeowners, as well as policies and bylaws that enable green options (e.g., that permit turf lawn as an alternative to grass)

- Insurance and Disaster Financial Assistance
    - Worry around obtaining insurance – some residents already cannot get insurance or their coverage is extremely low

5. Online Survey

a. Overview

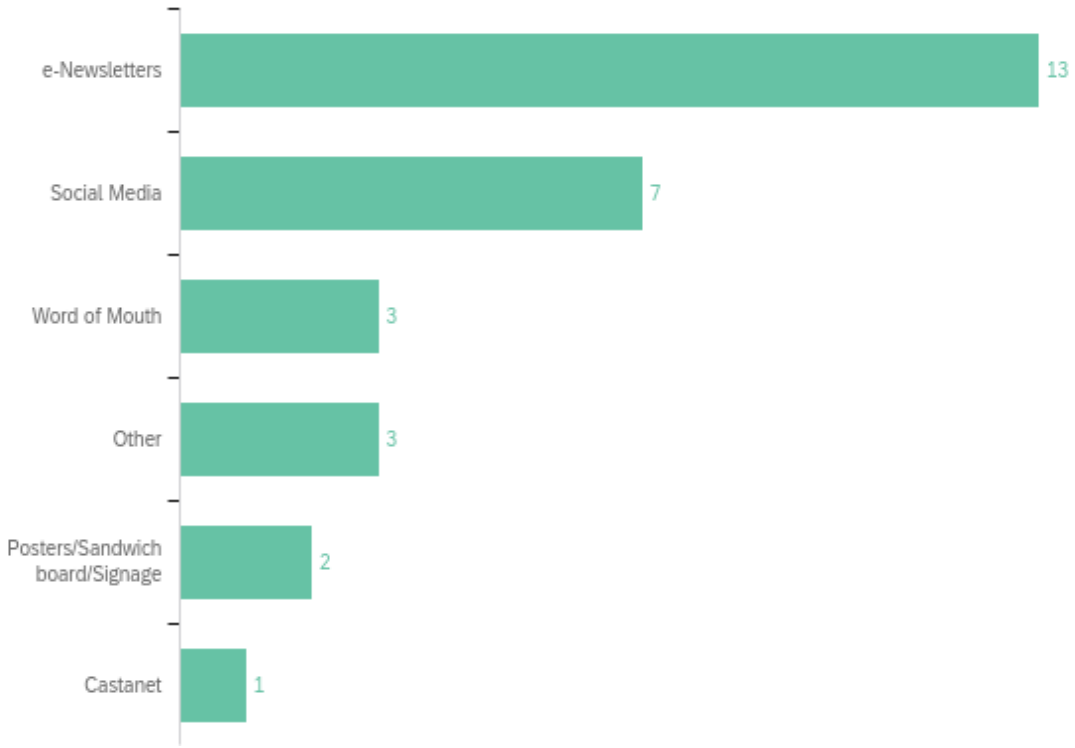
As part of the Regional District of the Central Okanagan's Flood Mitigation Planning project, an online survey was distributed as an opportunity for community members and stakeholders to provide input. The survey included a condensed version of the information that was presented during the two rounds of public-facing Community Conversations and offered an alternate opportunity to provide input.

The survey was available on the RDCO project webpage, and was promoted through Facebook and Instagram posts, RDCO and City of Kelowna e-Newsletters, a Castanet ad, and at project engagement events.

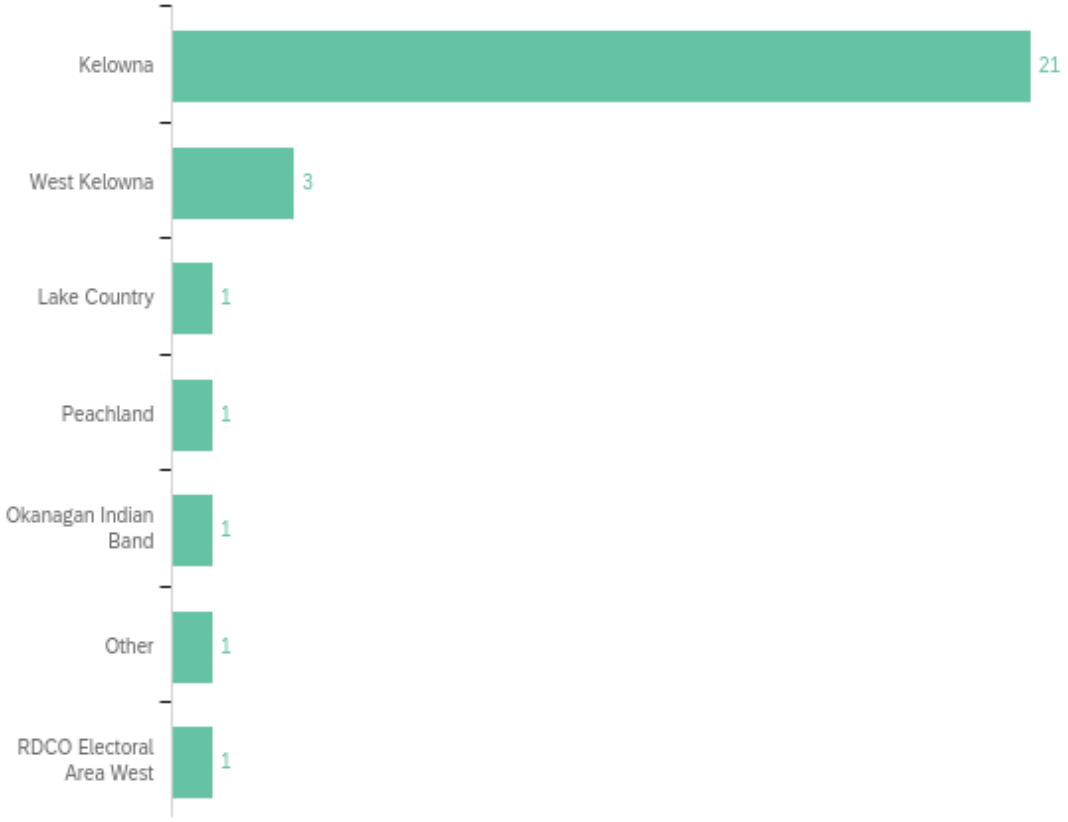
The survey was open from May 27th to June 25th and received a total of 39 responses.

b. Summary of Survey Responses

Question 1: How did you hear about this survey?
The most common channel was e-Newsletters, followed by social media. 'Other' options included through a friend's email and as an RDCO employee.



Question 2: Which community do you live in?
A majority (72%) of survey respondents were from Kelowna. The one who selected 'Other' wrote they were from Penticton; no respondents selected RDCO Electoral Area East, Westbank First Nation, Okanagan-Similkameen region, or North Okanagan region.



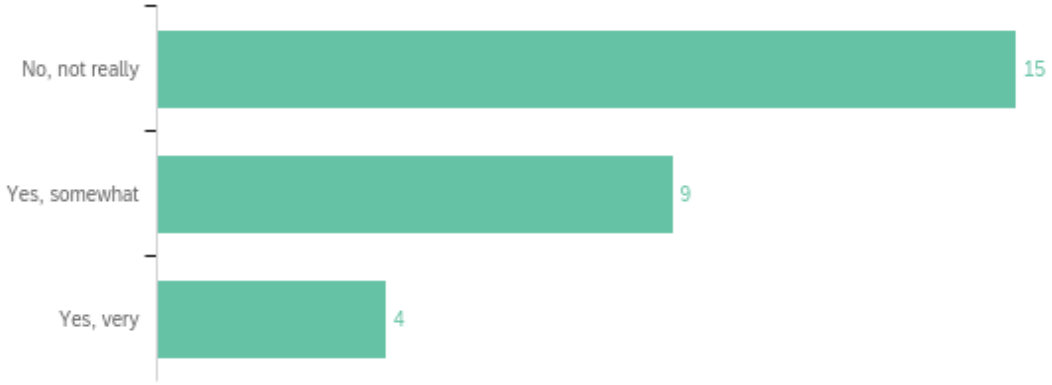
Question 3: Are you a member of the Syilx Nation? (e.g., Elder, community member, leadership)
One respondent identified as a member of the Syilx Nation.

Question 4: What do you value most about living among the lakes and creeks of the Okanagan?
Asked as an open-ended question, the main themes amongst responses were outdoor recreation and lifestyle; and nature, wildlife, and beauty. Full responses are listed in the Appendix.

Question 5: How concerned are you about flooding in the Okanagan?
Overall, participants indicated a high level of concern around flooding. Two thirds of respondents said they were either "Very" (34%) or "Extremely" (31%) concerned. Another third said they were "A little bit" concerned (31%) of respondents, and only one respondent selected "Not at all."

Question 6: Were you here for 2017 and/or 2018 floods?
Most respondents (83%) had experienced the 2017 and/or 2019 floods.

Question 7: Were you impacted by the 2017 and/or 2018 floods?
A majority (54%) indicated they were not really affected by the 2017 and/or 2018 floods. 32% of respondents said they were somewhat affected, and 14% said they were very affected.



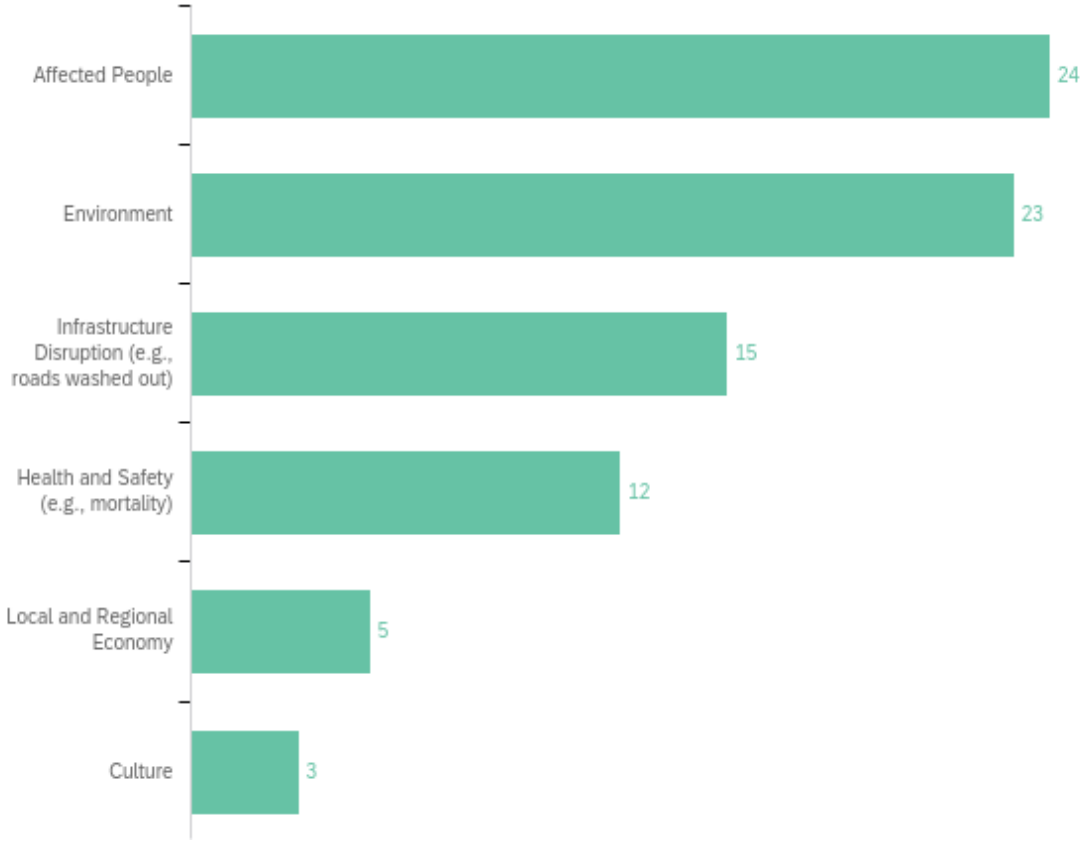
Question 8: What matters most to you about flooding in the Okanagan?
Asked as an open-ended question, the main themes amongst responses were (in no particular order):

- Damage to properties, infrastructure, key community assets (e.g., hospital) and cost of repairs
- Pollution/impact on water quality
- Human health and quality of life concerns (e.g., stress)
- Environmental health and impacts on wildlife/biodiversity
- Preference for nature-based solutions
- Need to recognize flood as a natural process
- Uncertainty around how future flooding will worsen with climate change

Full responses are listed in the Appendix.

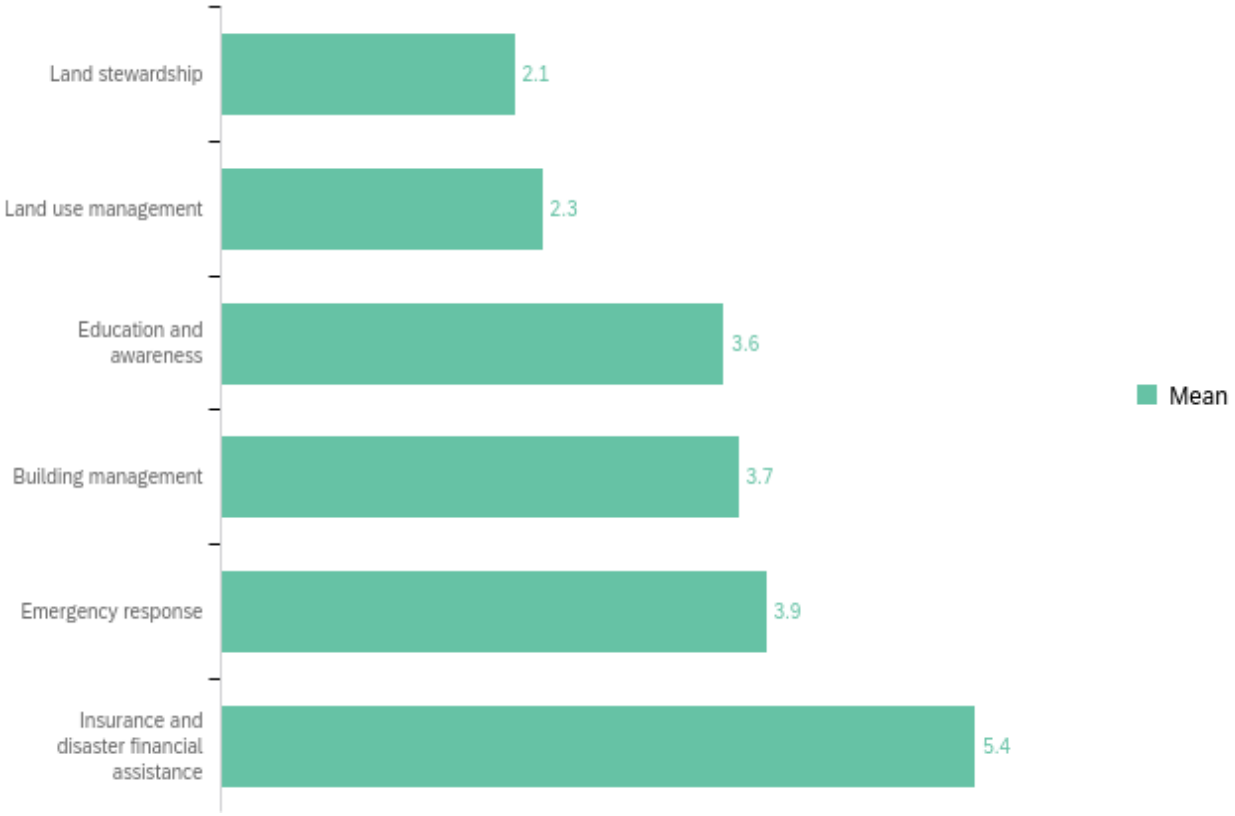
Question 9: Flooding can impact many different aspects of social, environmental, and economic systems. Which of these impacts are most important to consider? (Choose your top 3)

The most common choice for this question was "Affected People," selected by 80% of respondents, closely followed by "Environment," selected by 77% of respondents. Infrastructure Disruption was third, selected by 50% of respondents, followed by Health and Safety (40%), then Local and Regional Economy (17%). The least popular choice was Culture, selected by 10% of respondents.



Question 10: Effective flood management requires implementing a range of mitigation options, rather than relying solely on traditional structures such as dikes or dams. So called non-structural options play an important role in reducing risk and improving flood resiliency and include: Which non-structural options are you most drawn to, to help mitigate risk and build resilience to flood in the Central Okanagan? (Rank all 6 options by moving them up or down the list with 1 being the highest preference, and 6 being the lowest)

Land stewardship ranked the highest, chosen as number one by 38% of respondents. Land use management ranked second highest, chosen by 33% of respondents as number one. Insurance and disaster financial assistance was nobody's top choice, and was 67% of respondents lowest ranked choice.



Appendix: Open-Ended Question Full Responses

Question 4: What do you value most about living among the lakes and creeks of the Okanagan?

- Outdoor activity opportunities, landscape values, sense of well-being
- The habitat and water it provides for all living things, animals & plants.
- Recreational opportunities and biodiversity
- preserving them
- Biodiversity of ecosystems; access to water for cultural practices; access to fish/foods/medicines along water bodies; having the limited places that are intact and don't have any development.
- visiting the lakes
- Clean air and clean water!
- Their beauty
- It's so beautiful!
- Wildlife, shade, beauty
- Nature, beauty
- Access to nature and wildlife - wide open spaces
- The calmness
- To be near nature. Swimming in summer
- They provide a beautiful contrast with the relatively arid hillsides and forests.
- Recreation
- The beauty of the area
- The lifestyle options (swimming, walking along creek trails, etc.) and beauty they provide to the region.
- The super beautiful water
- Recreation, scenic beauty, WATER
- Aesthetic and recreational value. Supportive habitat for many local aquatic and non-aquatic organisms.
- Nature and privacy!
- Close proximity to City centre and the lake
- The diverse ecosystems

Question 8: What matters most to you about flooding in the Okanagan?

- Flood damages to properties and structures, and environmental damages to the lakeshore and creeks.
- Impact on water quality.
- Water pollution and impacts on human and ecological health
- That we could be mitigating some of it with nature-based solutions and yet we are not doing that
- Flooding has its role in ecosystems prior to settlement on the flood plains. It provides the necessary ephemeral habitat for terrestrial and aquatic plants and animals. Provides recharge to Okanagan Lake.
- Water infrastructure damage
- It's going to get worse with climate change and we are in no way prepared.
- Avoiding property damage
- Resiliency, how properties are affected, how to manage going forward
- Fish have more rights than people - dredge Mission Creek
- Learn from it and stop building on what were flood plains

- Protecting the foreshore and critical infrastructure/impact to personal homes
- Hospital & Home
- It's getting worse, presumably due to climate change, growing local population (which increases costs of damage), rising insurance rates
- Protection of life and infrastructure
- Damage to homes, plants, fish. Concerns that too much diking upstream.
- That it is a dynamic and beautiful natural process that gets unfairly vilified.
- Stress, cost, life on hold to sandbag
- Lack of long-term mitigation plans by homeowners
- The damage that it causes, the clean-up, the stress for people living in the area; the fact that it is a result of climate change.
- If the land I am on might slump or slide
- Property damage, cost of repairs
- An understanding of how the community is likely to be impacted from climate change (i.e., what to expect over the coming years/decades). And with an understanding of the likely impacts, how can we reduce risk.
- The fact that the levels of OK Lake was arbitrarily raised and the person in charge said he would do it again to protect fish. It didn't protect fish, but it did kill wildlife, especially young waterfowl who were swimming in sewage from flooded septic tanks, rotting vegetation, and dead animals. It took three years to see more than one or two ducks outside my lakeshore property when dozens were present the year of the flood. I am still trying to clean up after all the destruction.
- Financial and Emotional impact on residents
- We can't overlook the ecological value of floods and floodplains. I hope to see more nature-based solutions that actually embrace floods and store extra water where ecosystems need it, such as Woodhaven Nature Conservancy which has suffered from extensive water control methods.


Regional District of
Central Okanagan

Appendix F Options Table with Scored Simplified Criteria

		Effect of option during flood event						Effect of option itself							
		Risk Reduction Criteria				Resilience Criteria		Externalities				Implementation Criteria			
		People	Structures	Disruption	Economy	Emergency Response	Climate	Community		Environment	Culture	Obstacles		Cost	
		Reduce risks to health and safety of people	Reduce damage to structures	Minimize disruption of services and mobility (electricity, gas, communica-tions, etc.)	Minimize damage to local economy including agriculture and tourism	Increase the effectiveness of response	Increase adaptability of option to multiple climate futures	Housing	Social connectedness and supports	Habitat health (aquatic, wetland, riparian and water quality)	Recreation and outdoor lifestyle	Regulatory	Political and public will	Implemen-taion cost	Mainte-nance cost
Land Stewardship	1. Protection of Upper Watershed	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Ineffective	Highly effective	Neutral	Neutral	Very positive	Very positive	Relatively easy	Relatively easy	$$	$
	2. Protection of Lower Watershed	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Ineffective	Highly effective	Negative	Positive	Very positive	Very positive	Moderately challenging	Relatively easy	$$	$
	3. Protection of Riparian Areas and Lakeshores	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Ineffective	Highly effective	Negative	Positive	Very positive	Very positive	Relatively easy	Relatively easy	$-$$	$
	4. Constructed Wetlands	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Ineffective	Highly effective	Negative	Positive	Very positive	Very positive	Relatively easy	Relatively easy	$$	$
	5. Dike Setbacks or Removals. Daylighting of Creeks	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Ineffective	Highly effective	Negative	Positive	Very positive	Very positive	Moderately challenging	Moderately challenging	$$$	$
Land Use Management	6. Land use controls to limit all development	Highly effective	Highly effective	Highly effective	Highly effective	Highly effective	Highly effective	Very negative	Neutral	Very positive	Positive	Very challenging	Very challenging	$$	$
	7. Land Use Controls to Limit High Consequence Development	Moderately effective	Moderately effective	Highly effective	Moderately effective	Moderately effective	Highly effective	Neutral	Neutral	Neutral	Neutral	Moderately challenging	Relatively easy	$$	
	8. Acquisition - Undeveloped Land	Moderately effective	Ineffective	Ineffective	Ineffective	Ineffective	Highly effective	Neutral	Neutral	Very positive	Positive	Relatively easy	Moderately challenging	$$$	$
	9. Acquisition - Post-disaster Buyouts	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Ineffective	Moderately effective	Negative	Negative	Positive	Positive	Moderately challenging	Very challenging	$$$	$
	10. Acquisition - Developed Dand (Pre-disaster)	Highly effective	Highly effective	Highly effective	Highly effective	Moderately effective	Highly effective	Very negative	Very negative	Very positive	Positive	Very challenging	Very challenging	$$$	$
	11. Life-Rights Agreements (Acquisition over time)	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Neutral	Neutral	Positive	Neutral	Very challenging	Moderately challenging	$$$	$
	12. Relocation - Property	Highly effective	Highly effective	Moderately effective	Moderately effective	Moderately effective	Highly effective	Negative	Negative	Positive	Neutral	Very challenging	Very challenging	$$$	$
	13. Relocation - Infrastructure	Moderately effective	Highly effective	Highly effective	Moderately effective	Moderately effective	Highly effective	Neutral	Neutral	Positive	Neutral	Relatively easy	Very challenging	$$$	$
	14. Transfer of Development Potential	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Neutral	Negative	Positive	Neutral	Relatively easy	Very challenging	$	$
	15. Rolling Easements	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Negative	Negative	Positive	Neutral	Very challenging	Moderately challenging	$-$$$	$
	16. Density Redistribution	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Moderately effective	Negative	Negative	Positive	Positive	Moderately challenging	Very challenging	$	$
	17. Right to Flood	Ineffective	Ineffective	Ineffective	Ineffective	Ineffective	Moderately effective	Neutral	Neutral	Neutral	Neutral	Very challenging	Very challenging	$	$
Building Management	18. Elevate Structures (New Builds)	Ineffective	Highly effective	Highly effective	Highly effective	Highly effective	Ineffective	Negative	Neutral	Neutral	Neutral	Relatively easy	Relatively easy	$	$
	19. Elevate High Consequence Structures (New Builds)	Highly effective	Moderately effective	Moderately effective	Moderately effective	Highly effective	Moderately effective	Neutral	Neutral	Neutral	Neutral	Relatively easy	Relatively easy	$	$
	20. Dry Floodproofing (Permanent)	Ineffective	Highly effective	Ineffective	Moderately effective	Moderately effective	Moderately effective	Neutral	Neutral	Neutral	Neutral	Very challenging	Relatively easy	$	$
	21. Dry Floodproofing (Temporary)	Ineffective	Highly effective	Moderately effective	Moderately effective	Moderately effective	Highly effective	Neutral	Neutral	Neutral	Neutral	Moderately challenging	Relatively easy	$	$
	22. Wet Floodproofing (New Builds)	Ineffective	Highly effective	Ineffective	Moderately effective	Moderately effective	Highly effective	Positive	Neutral	Neutral	Neutral	Very challenging	Relatively easy	$	$
	23. Elevate Structures (Existing Builds)	Ineffective	Highly effective	Ineffective	Moderately effective	Highly effective	Highly effective	Negative	Neutral	Neutral	Neutral	Relatively easy	Moderately challenging	$$	$
	24. Dry Floodproofing (Permanent)	Ineffective	Highly effective	Ineffective	Moderately effective	Moderately effective	Moderately effective	Negative	Neutral	Neutral	Neutral	Very challenging	Moderately challenging	$$	$
	25. Dry Floodproofing (Temporary)	Ineffective	Highly effective	Ineffective	Moderately effective	Moderately effective	Highly effective	Neutral	Neutral	Neutral	Neutral	Very challenging	Relatively easy	$	$
	26. Wet Floodproofing (Existing Builds)	Ineffective	Highly effective	Ineffective	Moderately effective	Moderately effective	Highly effective	Positive	Neutral	Neutral	Neutral	Very challenging	Moderately challenging	$$	$
Education and Awareness	27. Covenant on Title	Ineffective	Ineffective	Ineffective	Ineffective	Ineffective	Highly effective	Neutral	Neutral	Neutral	Neutral	Relatively easy	Moderately challenging	$$	$
	28. Public and Accessible Flood Mapping	Moderately effective	Ineffective	Ineffective	Ineffective	Moderately effective	Highly effective	Neutral	Neutral	Neutral	Neutral	Relatively easy	Relatively easy	$-$$	$
	29. Public Education (Multi-media)	Moderately effective	Ineffective	Ineffective	Ineffective	Moderately effective	Highly effective	Neutral	Positive	Neutral	Neutral	Relatively easy	Relatively easy	$	$
	30. Serious Gaming	Moderately effective	Ineffective	Ineffective	Ineffective	Moderately effective	Highly effective	Neutral	Positive	Neutral	Neutral	Relatively easy	Relatively easy	$	$
	31. Public Art	Moderately effective	Ineffective	Ineffective	Ineffective	Moderately effective	Highly effective	Neutral	Positive	Neutral	Neutral	Relatively easy	Relatively easy	$	$
	32. Media Education	Moderately effective	Ineffective	Ineffective	Ineffective	Moderately effective	Highly effective	Neutral	Neutral	Neutral	Neutral	Relatively easy	Relatively easy	$	$
Emergency Response	33. Warning System	Highly effective	Ineffective	Ineffective	Ineffective	Highly effective	Highly effective	Neutral	Neutral	Neutral	Neutral	Relatively easy	Relatively easy	$-$$	$
	34. Flood Response Plan	Highly effective	Ineffective	Ineffective	Ineffective	Highly effective	Highly effective	Neutral	Neutral	Neutral	Neutral	Relatively easy	Relatively easy	$-$$	
	35. Flood Response Plan Maintenance	Highly effective	Ineffective	Ineffective	Ineffective	Highly effective	Highly effective	Neutral	Neutral	Neutral	Neutral	Relatively easy	Relatively easy		$
	36. Flood Response Training	Highly effective	Ineffective	Ineffective	Ineffective	Highly effective	Highly effective	Neutral	Neutral	Neutral	Neutral	Relatively easy	Relatively easy	$	$
	37. Flood Response Resources	Highly effective	Ineffective	Ineffective	Ineffective	Highly effective	Highly effective	Neutral	Neutral	Neutral	Neutral	Relatively easy	Relatively easy	$	$
	38. Neighbourhood Resilience Building	Highly effective	Ineffective	Ineffective	Ineffective	Moderately effective	Highly effective	Positive	Very positive	Neutral	Neutral	Relatively easy	Relatively easy	$	$
Financial Strategies	39. Insurance (Private)	Ineffective	Highly effective	Ineffective	Highly effective	Ineffective	Moderately effective	Neutral	Neutral	Neutral	Neutral	Moderately challenging	Moderately challenging	$	$
	40. Insurance (Public)	Ineffective	Highly effective	Ineffective	Highly effective	Ineffective	Moderately effective	Neutral	Neutral	Neutral	Neutral	Moderately challenging	Relatively easy	$	$

Most preferred

Neutral

Least preferred