

CLIMATE CHANGE VULNERABILITY IN THE TOWN OF PELHAM: A BASELINE STUDY

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Table of Contents

Acknowledgements.....	2
Citation.....	2
List of Figures	4
Executive Summary.....	5
1.0 Introduction	6
1.1 Vulnerability to Climate Change in Niagara	6
1.2 Climate Change Adaptation Planning	8
2.0 Methods.....	9
2.1 Development of Vulnerability Indicators.....	10
Indicator Rankings.....	11
2.2 Data Collection.....	11
2.3 Data Analysis.....	11
3.0 Results.....	12
3.1 Household Survey Results.....	12
Demographics	13
Experiences with Climate Change Impacts	13
A. Flooding.....	13
B. Changes in temperature	15
Public Awareness, Concerns, and Other Sources of Adaptive Capacity	16
3.2 Vulnerability Analysis.....	18
Critical Values and Missing Data	22
4.0 Where do we go from here?.....	23
References	24
Appendix A.....	25
Appendix B.....	30

List of Figures

Figure 1. Climate impacts in the Niagara Region	7
Figure 2. What does climate change adaptation mean to you?	8
Figure 3. Steps of the research process.....	9
Figure 4. Dimensions of Climate Change Vulnerability.....	10
Figure 5. Indicator Rankings.. ..	11
Figure 6. Social sensitivities in Pelham.	13
Figure 7. Residents experiencing flooding, and consequences of the floods.....	13
Figure 8. Responses from household survey on experiences with flooding	14
Figure 9. Assets for household and community flooding	14
Figure 10. Residents experiencing extreme temperatures.	15
Figure 11. Responses from household survey on experiences with extreme temperatures.....	15
Figure 12. Where do most people receive information about climate change?	16
Figure 13. Dimensions and Sub-dimensions of vulnerability to climate change.	19
Figure 14. Indicators of exposure and sensitivity.	20
Figure 15. Indicators of adaptive capacity.	21
Figure 16. Critical and Missing Data.....	22

Executive Summary

The impacts of climate change are already being experienced in the Niagara Region. It is anticipated that these impacts will only intensify in frequency and severity in the future. Understanding vulnerability to climate change is, therefore, a critical component of effective climate change adaptation planning.

Vulnerability refers to the susceptibility of a given region, municipality, social group or sector to harm arising from climate change impacts. Vulnerability is understood as a function of exposure, sensitivity and adaptive capacity to climate change impacts.

In the fall of 2019, a vulnerability assessment was implemented in Pelham. Based on an extensive literature review and expert opinion, a set of 50 indicators specific for the Niagara Region was developed. Indicators were subsequently ranked for their importance to Pelham. Secondary and primary data were collected from multiple sources including Statistics Canada, Niagara Region Public Health, municipal input by Niagara Adapts partners, and a community survey. For Pelham, 147 members of the public completed the survey.

The results from the survey provide critical insights into how people in the region are experiencing climate change as well as their potential capacity to adapt. For example, 71% of respondents believe climate change is creating impacts in their community, and 82% of respondents support municipal

resources going towards adaptation planning in Pelham.

Findings from the analysis revealed a final vulnerability index value of 0.509 for Pelham, where 0 represents highly vulnerable and 1 represents highly robust. Exposure and sensitivity indicators from the assessment determined that extreme heat and cold temperatures, along with senior residents and/or individuals with pre-existing health conditions within Pelham are highly vulnerable to climate change. Adaptive capacity indicators determined that parks and forest and wetlands ranked high in vulnerability, along with political leadership for climate action, flexibility in institutional decision-making, and the level of community participation in decision-making processes.

The results provide data on the current state of vulnerability in Pelham, highlight potential opportunities to build adaptive capacity, and shed light on areas of missing data that may be useful to collect in the future. These findings provide critical data to inform the ongoing climate change adaptation planning process.

This report therefore provides an introduction to climate change and vulnerability assessments in Pelham, describes the methods implemented, and summarizes the findings. The report concludes by highlighting what this information may mean for the Town of Pelham going forward.

1.0 Introduction

1.1 Vulnerability to Climate Change in Niagara

Climate change refers to shifts in climactic patterns driven by increasing emissions of greenhouse gases from human activity (IPCC, 2014). In Canada, the climate is warming at twice the global average (Bush and Lemmen, 2019). This means the impacts of climate change are already widespread in Canada, bringing growing costs to governments, businesses, and ultimately all Canadians (Moudrak and Feltmate, 2019). For example, the average cost of a flooded residential basement is more than \$40,000 (Moudrak and Feltmate, 2019). In Niagara, the impacts of climate change are already being experienced (Figure 1).

In 2019 alone, the Town of Pelham has experienced the growing effects of climate change. In late February, a heavy windstorm inflicted irreparable damage to the Town's iconic arches, resulting with temporary closure of Town roads and later removal of the structure. In early spring, the Town encountered high levels of Gypsy Moth infestations, leading to the development and administration of an aerial spray program in order to control serious outbreaks. During mid-summer, particularly when the Town's famous annual summer festival, Summerfest, had taken place, extreme heat temperatures and an evening electrical storm caused a decline in the number of event attendees compared to the previous year. Though such impacts pose negative effects to Town-owned assets, services, and day-to-day operations, they are also recognized as a need to forecast and thoroughly understand future climatic threats. Specifically within Pelham, climatic threats such as increased winter precipitation (i.e. freezing rain), record heat temperatures (i.e. >30°C), and more extreme weather events (i.e. thunder, hail or wind storms) are expected to become more frequent and intense over the coming decades. Such threats may enhance existing impacts, or bring forth unprecedented challenges to the Town, however, through the development and implementation of a Corporate Climate Change Adaptation Plan, the Town has taken the initiative to increase the adaptive capacity and resiliency of Town-owned assets and services to current and future climate impacts, while also integrating climate change adaptation practices into day-to-day operations.

As climate change impacts continue to rise in Canada, so does climate vulnerability. Vulnerability to climate change refers to the susceptibility of a given region, municipality, social group or sector to harm arising from climate change impacts (IPCC, 2014). Vulnerability of a system is understood as a function of the exposure and sensitivity of that system to hazardous conditions and the capacity in which the system can adapt to the effects of those conditions (IPCC, 2014, Smit and Wandell, 2006, p. 286).

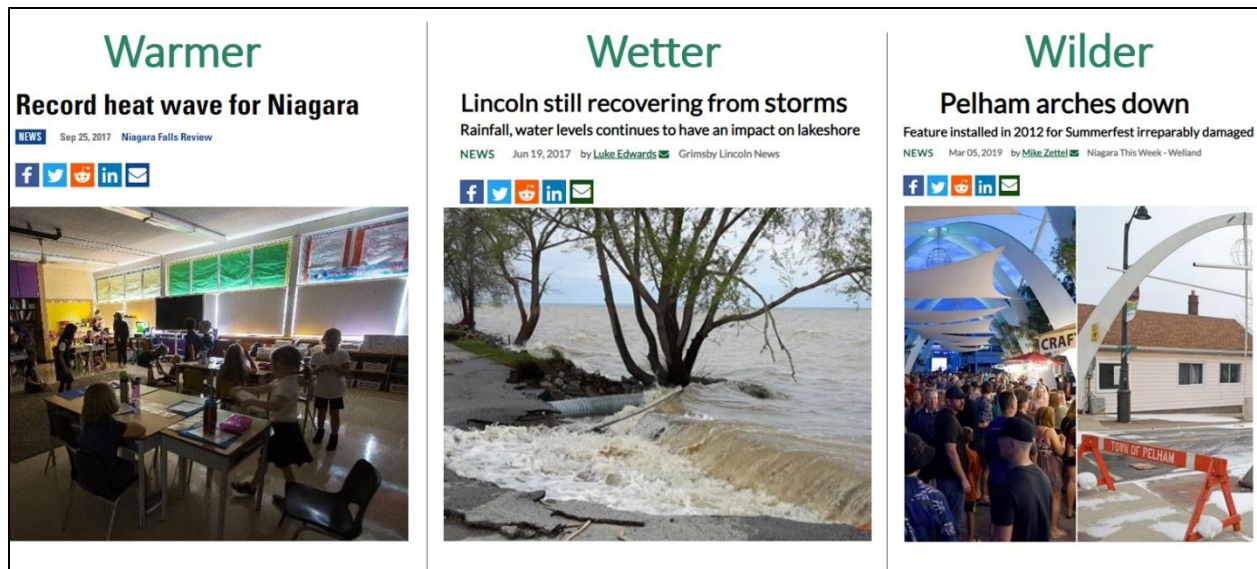


Figure 1. Climate impacts in the Niagara Region have included record heat waves, lakeshore flooding, and extreme weather events (Niagara Falls Review 2017, Niagara This Week 2017, 2019).

1.2 Climate Change Adaptation Planning

It is anticipated that the impacts of climate change will only intensify in frequency and severity in the future (Bush and Lemmen, 2019). Fortunately, Pelham is engaged in climate change adaptation planning. Adaptation is defined as actions taken to minimize the harm, or exploit the opportunities, of a changing climate (IPCC, 2014, Figure 2a). Adaptation planning is the process of analysing, prioritizing and implementing actions to minimize the harm, and capitalize on opportunities, presented by climate change (Figure 2b).



Figure 2. a) What does climate change adaptation mean to you? Before the first Niagara Adapts workshop, a short survey was sent to representatives from the seven participating municipalities, asking them what climate adaptation meant to them. This word cloud represents their responses (the size of the word is proportional to the number of times it was identified by survey respondents). b) Climate change adaptation planning cycle.

Municipalities play a critical role in adapting to climate change and developing sustainable communities. Municipalities are on the front lines of preparing for climate change and have a responsibility to respond through strategic planning. Understanding vulnerability to climate change is, therefore, a critical component of effective climate change adaptation planning. Understanding vulnerabilities is one essential component for the development of robust adaptation actions. Additionally, vulnerability data should be considered in combination with climate impact data, and climate projections data.

2.0 Methods

Vulnerability assessments involve the systematic collection and analysis of information about exposure, sensitivity and adaptive capacity relevant to a system of interest. Vulnerability assessments can be conducted for any system and at any scale. We aimed to conduct a vulnerability assessment that captured a range of relevant systems and scales for Pelham. Taking a holistic approach, the vulnerability assessment encompassed biophysical and socioeconomic determinants of vulnerability and adaptive capacity.

Typically, vulnerability assessments characterize the vulnerability of a system through a vulnerability index (IPCC, 2014; 1775). A climate vulnerability index is a metric that is derived by combining, with or without weighting, several indicators assumed to represent vulnerability. A vulnerability index can also identify which dimensions (e.g. exposure, sensitivity and adaptive capacity) and sub-dimensions of a particular system are the most vulnerable.

Figure 3 provides an overview of the steps that were implemented in the vulnerability assessment.

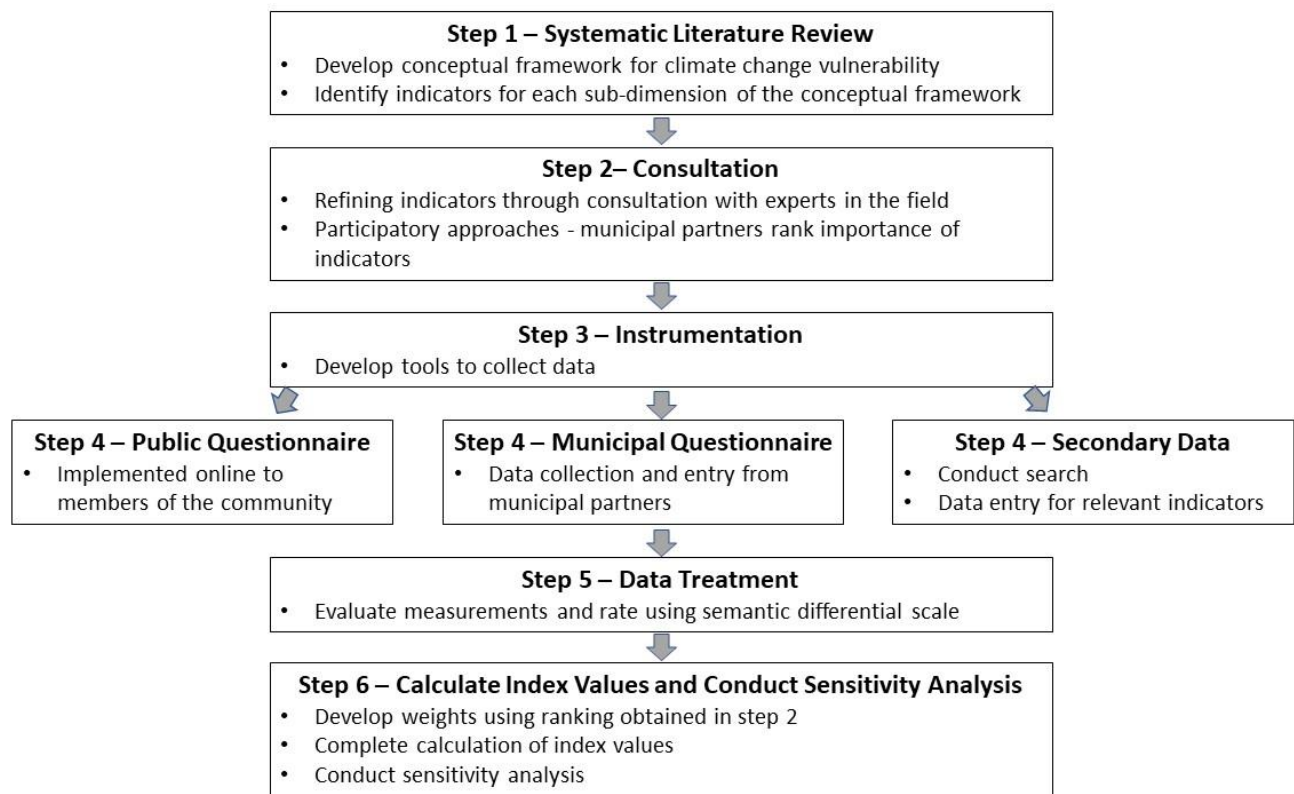


Figure 3. Steps of the research process.

2.1 Development of Vulnerability Indicators

An indicator is a gauge or measure of the state of something. Using peer-reviewed best practices for vulnerability assessments, indicators for exposure, sensitivity, and adaptive capacity were identified through a scholarly literature review and consultation with experts in the field (Figure 3). This process led to the selection of 50 indicators. These indicators provide insights into both the social and the bio-physical elements of vulnerability to climate change. Indicators covered the three dimensions of vulnerability (Figure 4).

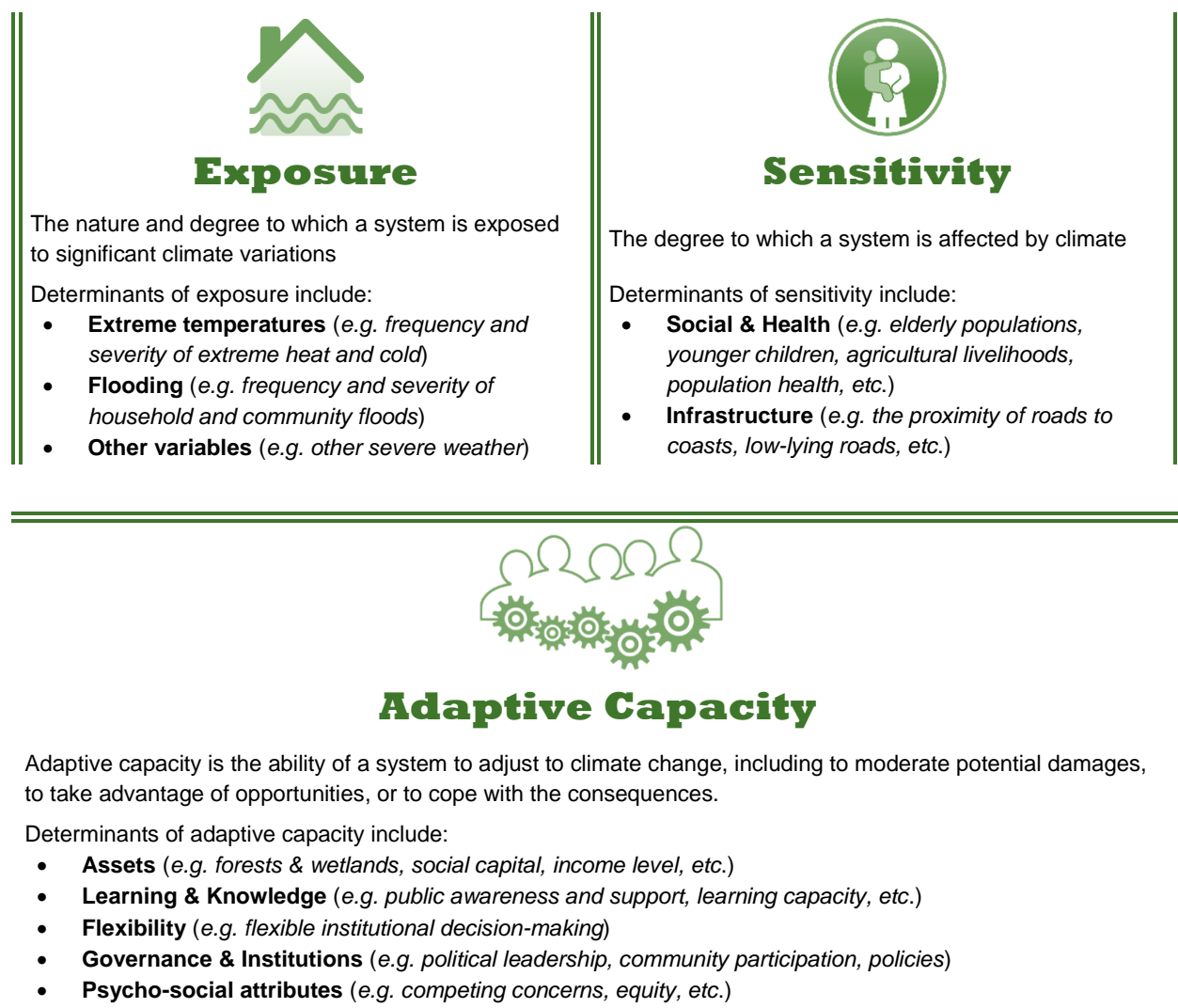


Figure 4. Dimensions of Climate Change Vulnerability. Subdimensions are presented in bold. Examples of indicators are provided in italics.

Indicator Rankings

To ensure that the 50 indicators were highly relevant to Pelham, municipal partner(s) from Pelham prioritized the indicators, from most to least important (Figure 5). These rankings, specific to Pelham, were then used to develop weights which were applied during the vulnerability analysis.

Figure 5. Indicator Rankings. Representatives from Pelham prioritised the 50 vulnerability indicators, from least important (left hand side) to most important (right hand side).



2.2 Data Collection

Data included primary as well as secondary data. Secondary data was collected from sources including *Statistics Canada*, *Environment Canada*, *climatedata.ca*, *Niagara Region Public Health*, and others. In order to capture potential vulnerabilities at both the municipal scale and at the household scale, two survey instruments were implemented at the respective scales. At the municipal scale, partners collected relevant materials and consulted members of municipal staff in order to collect information on specific indicators.

Data at the household scale was collected through a public survey. Surveys were completed online and in person by 1,087 individuals across the participating seven municipalities in the Niagara region. In Pelham, 147 residents participated. The results presented in this report represent the results for Pelham.

2.3 Data Analysis

To begin the analysis, the data was normalized. Each indicator was rated on a scale from highly vulnerable to highly robust based on thresholds identified through literature and expert consultation. Scores for data were also linearly transformed onto a scale of 0 to 1, consistent with most vulnerability indices (Plummer et al., 2013; DeGrosbois &

Plummer, 2015). This process of normalization enables analysis of different types of data (e.g. binary, continuous, ordinal).

Following normalization, data were aggregated to create the composite index. Weighted averages were used as a method of data aggregation. Weighting can reflect local context and importance of certain indicators. As described above, municipal partner(s) from Pelham ranked the indicators for the relative importance for Pelham. These rankings were converted to weights (see DeGrosbois & Plummer, 2015 for full method followed), and these weights were then applied when aggregating the sub-dimensions and dimensions.

Critical values were also taken into consideration. Critical values are indicators that are below a threshold, indicating moderate or greater vulnerability. It is important to consider critical values due to the compensatory nature of linear aggregation in an index (Plummer et al., 2013; DeGrosbois & Plummer, 2015). Therefore, indicators were aggregated, taking into account the critical values (for full description of the process including equations, please see DeGrosbois & Plummer, 2015).

Finally, it is common that data is unavailable for certain indicators. Missing data should be accounted for in the calculation of an index. In instances where data was missing, the vulnerability index was also calculated assuming a pessimistic scenario (in which case, missing indicators was assigned the lowest possible vulnerability rating) and an optimistic scenario (in which case missing indicators were assigned the highest possible vulnerability rating). These scenarios allow for more informed climate change adaptation planning when full data are not available.

3.0 Results

The results for Pelham are subdivided into summaries of the household survey results and the overall vulnerability results.

3.1 Household Survey Results

Respondents of the household survey were 36% male and 64% female. 57% were between the ages of 18 and 54, and 43% above the age of 55. Respondents completed 50 questions pertaining to demographics, their experience with climate change impacts, and their opinions on climate change adaptation. Select results are presented below.

Demographics

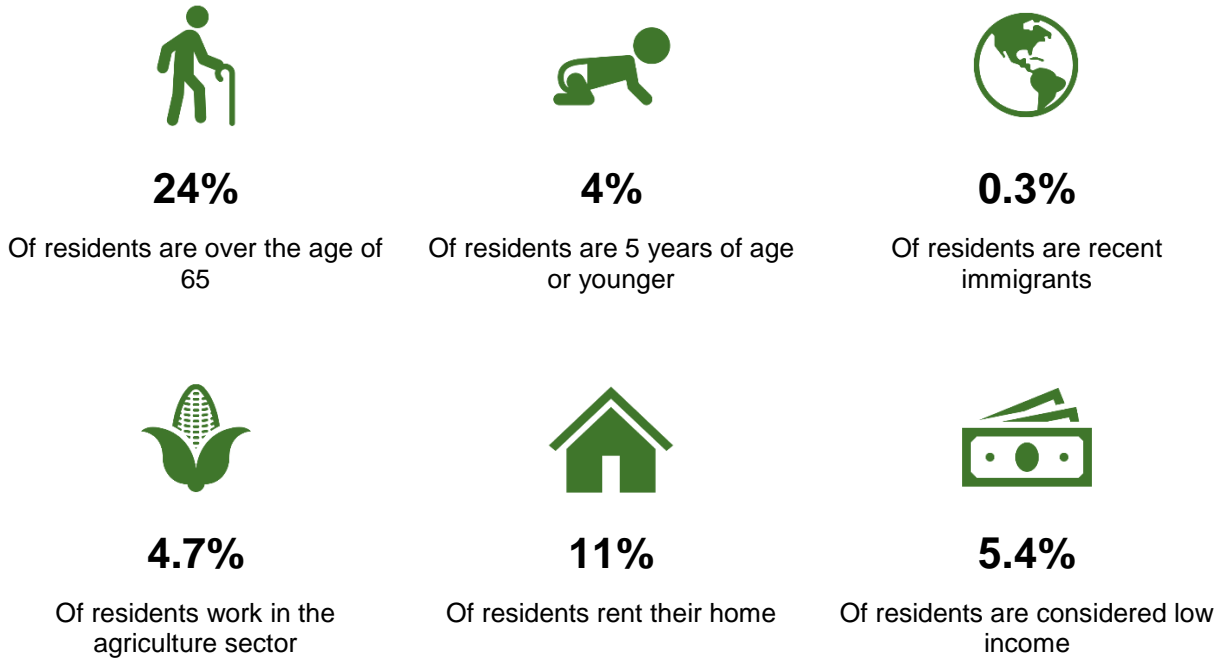


Figure 6. Social sensitivities in Pelham.

Experiences with Climate Change Impacts

A. Flooding

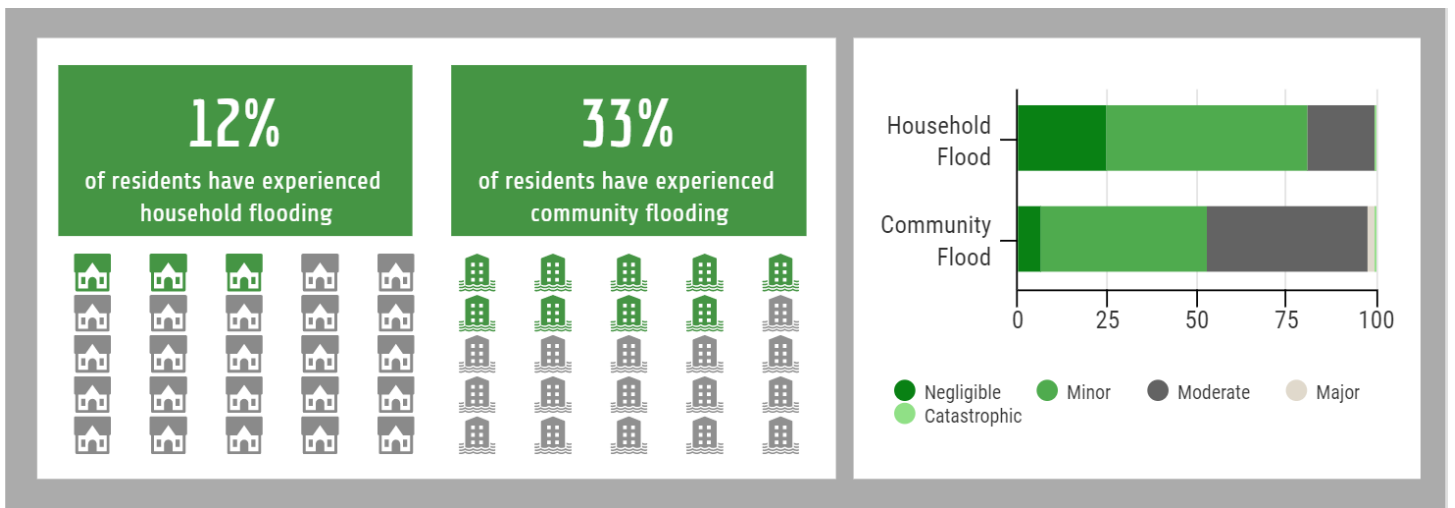


Figure 7. Residents experiencing flooding, and consequences of the floods

Experiences with Floods

For full list of responses, see Appendix A.

Please briefly explain the consequences of the flood:

"Road inaccessible. Fields and lawns saturated and unusable – late crops and gardens, lower yield. Higher mosquito infestations."

"agricultural fields flooding resulting in loss of crop, inability to plant new crop in spring, loss of income due to unplanted agricultural acres."

"Damage to odds and ends in the basement as well as my mother slipping and hurting herself."

Please briefly explain how you coped/responded:

"We had to quickly remove the laminate flooring and dry the area, we were able to rely the existing laminate flooring back down as we caught in time to dry everything..."

"Asked neighbour to divert downspout, put cover on window well, diverted our downspout which was close by."

"Avoided roadway while flooded."

Figure 8. Responses from household survey on experiences with flooding

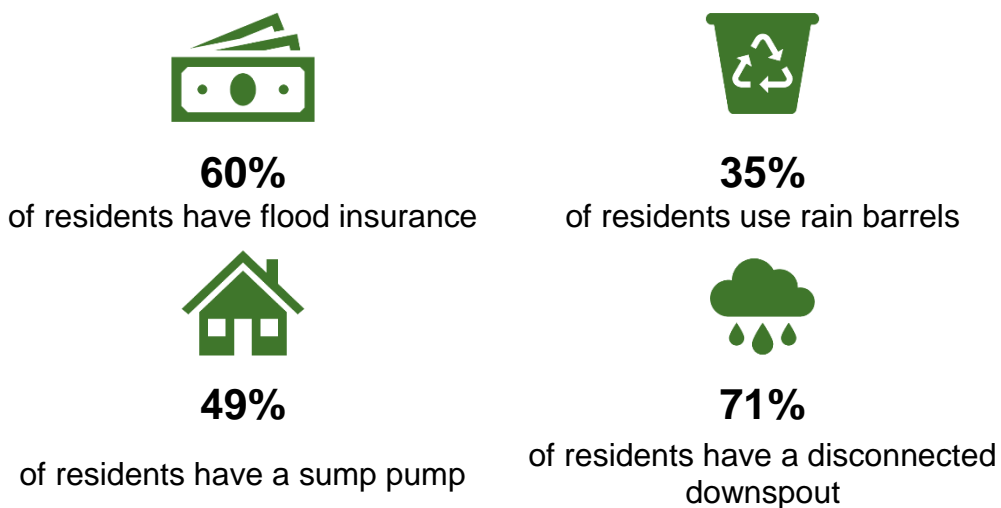


Figure 9. Assets for household and community flooding

B. Changes in temperature

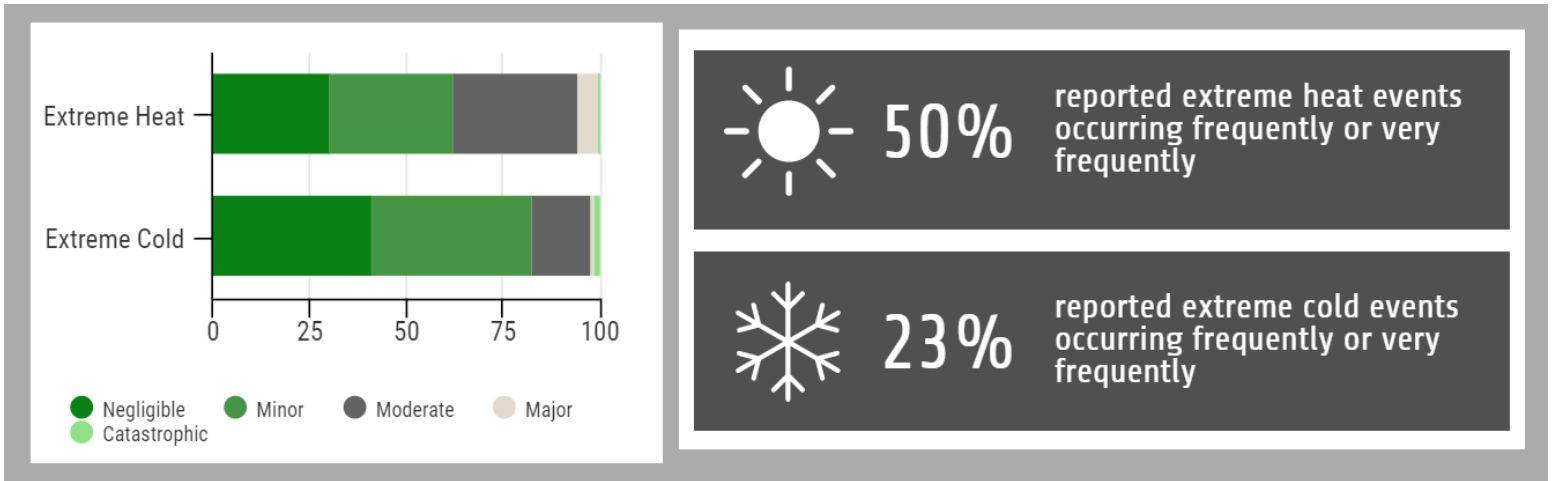


Figure 10. Residents experiencing extreme temperatures, and consequences of these events.

Experiences with Extreme Temperatures

For full list of responses, see Appendix A.

Please briefly explain the consequences with the extreme temperatures:

- "Extreme heat... no rain... severe drought for crops... could not do manual labour from 1 to 5 pm."
- "Some in the house experience cold sensitivity (reynauds) and do not tolerate the cold."
- "Unable to go outside, damage to crops...."
- "I am a stroke survivor extreme heat is dangerous for me so I cannot go outside..."

Please briefly explain how you coped/responded:

- "Stayed inside, sunscreen, increased fluid consumption - this is a concern because we do not have a good source of safe water and must drink from plastic water bottles."
- "I walk a lot for exercise and have been able to use the walking track at the Meridian Community Centre."
- "Stayed indoors constantly for several days at a time (meaning worst depression, isolation, lack of food)..."
- "Stayed inside. Public pool."

Figure 11. Responses from household survey on experiences with extreme temperature events.

Public Awareness, Concerns, and Other Sources of Adaptive Capacity



16%

Are aware of an early warning system within the municipality to alert of climate-related hazards

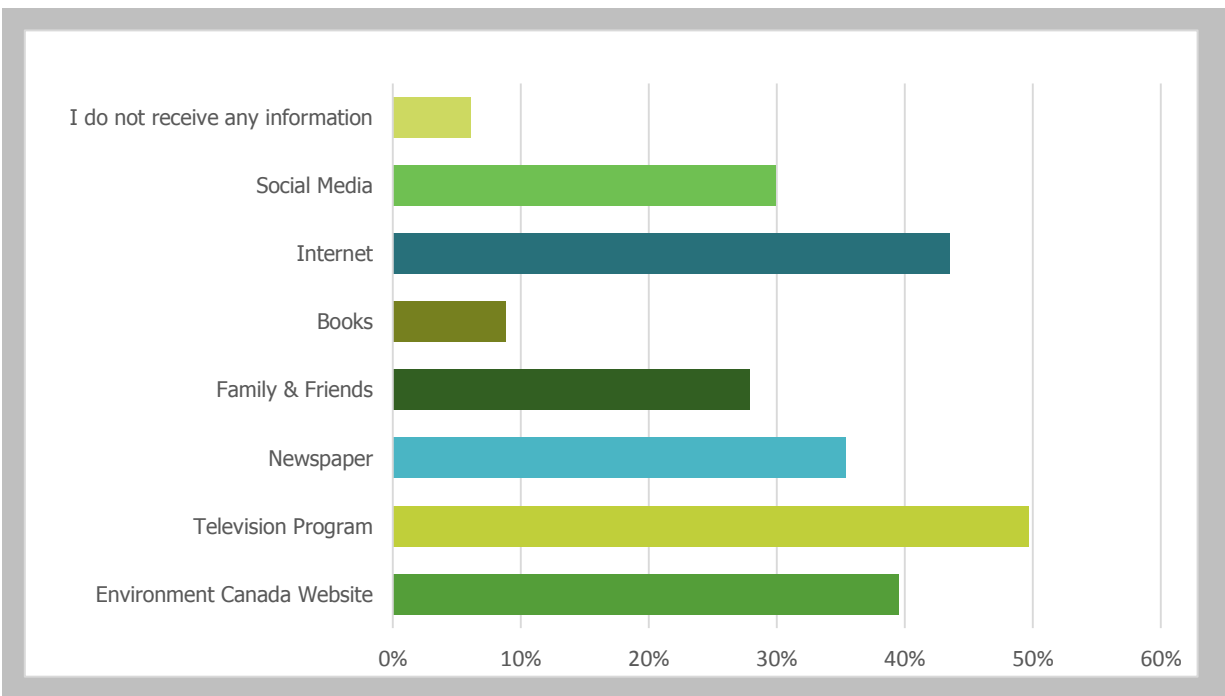


Figure 12. Where do most people receive information about climate change?

CONCERNS

- 71%** agree that climate change is creating impacts in the community
- 69%** believe that human activities are the main cause of climate change
- 26%** believe that there is unequal access to climate change resources among the community
- 26%** believe Pelham is well-positioned to adapt to future climate change impacts

SUPPORT FOR LOCAL LEADERSHIP

- 29%** have confidence in the ability of Pelham to minimize the impacts of climate change for their household
- 25%** believe that local leaders are supporting effective climate change adaptation action
- 15%** have confidence in the preparedness of local leaders to address climate change impacts
- 82%** support municipal resources being used for climate change adaptation
- 29%** agree that there are municipal resources (such as forums or groups) available to help us learn from past climate change impacts

SOURCES OF ADAPTIVE CAPACITY

- 12%** would be willing to relocate if the consequences of climate change become more severe
- 48%** say that climate change is a top priority for their household
- 23%** believe Pelham has coped effectively to climate change impacts in the past
- 55%** feel that they are able to participate in the climate change adaptation planning process
- 67%** feel confident in their personal capacity to minimize the impacts of climate change for their household
- 36%** agree that there are sufficient materials available to learn about climate change impacts
- 95%** feel that they have adequate access to information on climate change

3.2 Vulnerability Analysis

The overall vulnerability index value for Pelham is 0.509, on a scale from 0 (highly vulnerable) to 1 (highly robust). This represents a 'baseline scenario'. In the baseline scenario, the index was calculated by eliminating indicators with missing data, applying the weights for relative importance, and by taking into account 'critical values' or measurements that fall below a given threshold (Section 2.3).

Missing information may have important influences on the results and therefore multiple scenarios are constructed. As described in Section 2.3, to account for indicators with missing data, an 'optimistic' and 'pessimistic' scenario were calculated. This is represented by a confidence interval (see Figure 13). It is important to note that this is not a statistical confidence interval, but rather provides a range of possible outcomes (DeGrosbois & Plummer, 2015). The confidence interval for overall vulnerability in Pelham is 0.445 (pessimistic scenario) to 0.517 (optimistic scenario).

Findings at the subdimension and indicator levels provide important information on the biophysical and social vulnerabilities, as well as areas with lacking information. The subdimensions of vulnerability and adaptive capacity are displayed in Figure 13. The circle represents the value found for the subdimension based on available data. The bar represents the range from a 'pessimistic' scenario to an 'optimistic' scenario in cases where there is missing data. The baseline scenario for the sub-dimensions and the corresponding indicators are presented in Figure 14 and 15.

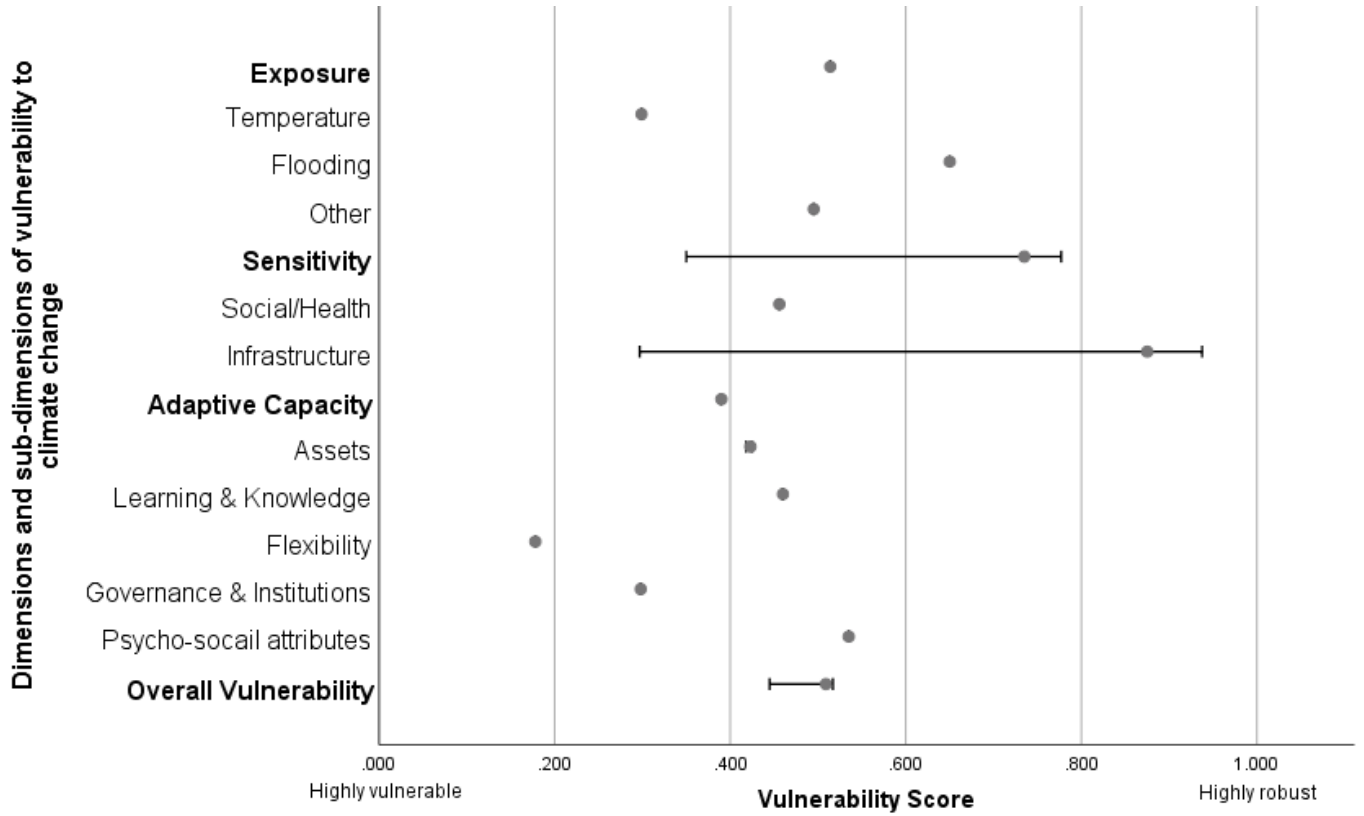


Figure 13. Dimensions and Sub-dimensions of vulnerability to climate change across dimensions and ten sub-dimensions for Pelham. The grey dots represent the baseline scenarios. The confidence intervals represent the possible range from pessimistic to optimistic scenarios in cases where there is missing data.

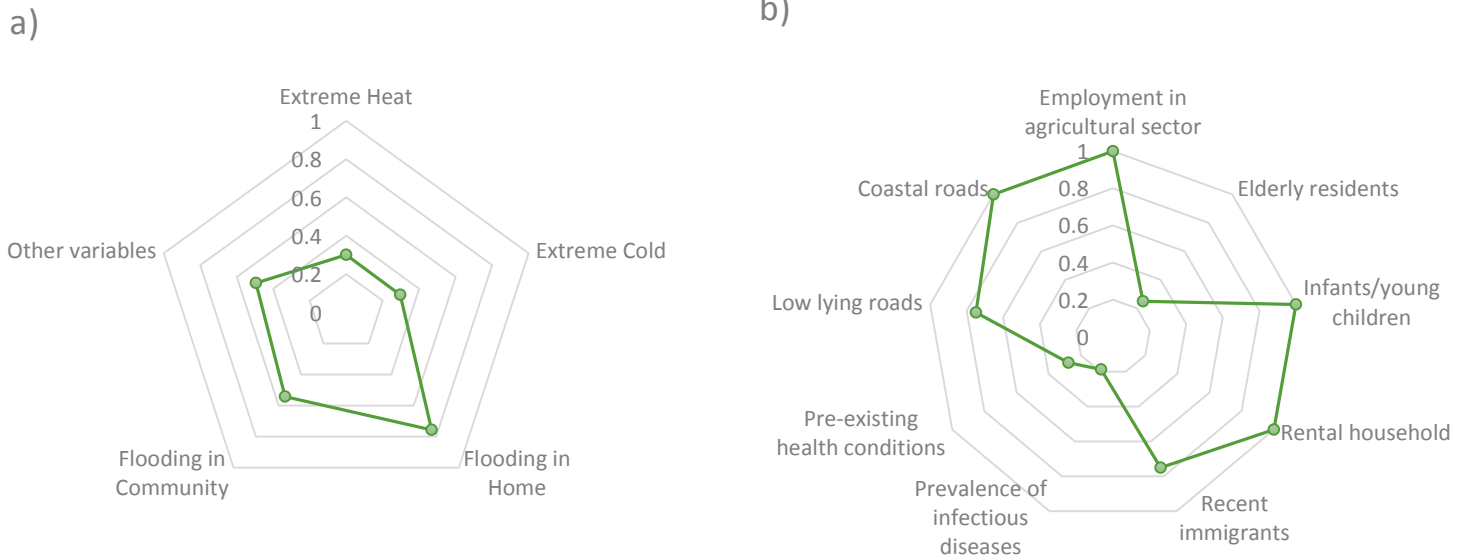
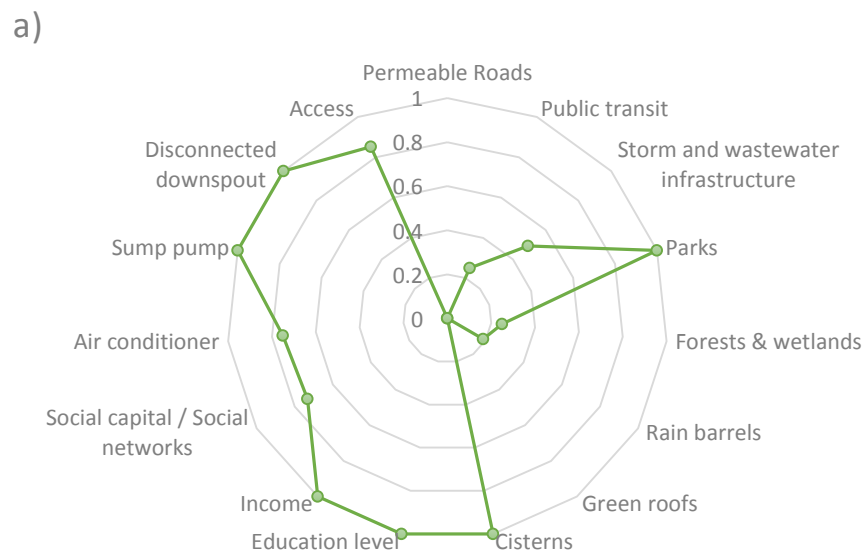
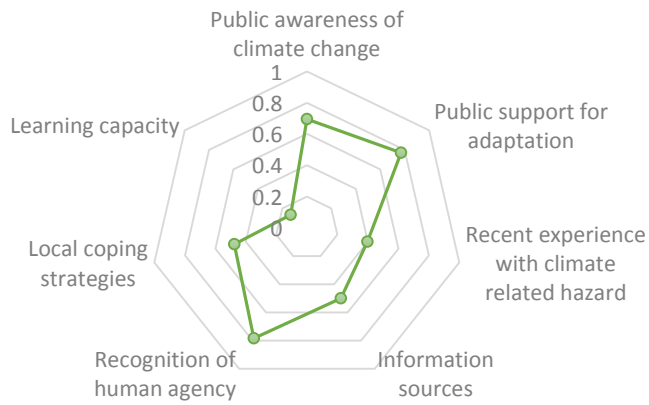


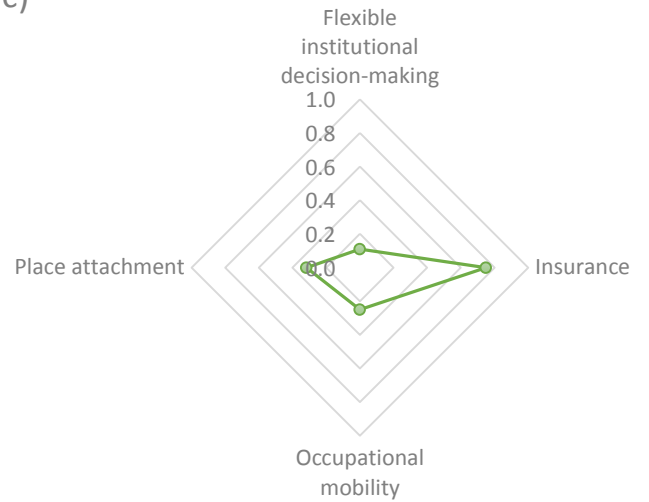
Figure 14. Indicators of exposure and sensitivity (located above). Ratings from high exposure (0) to low exposure (1) for the five indicators of exposure (a) and from highly sensitive (0) to highly robust (1) for the nine indicators of sensitivity (b).



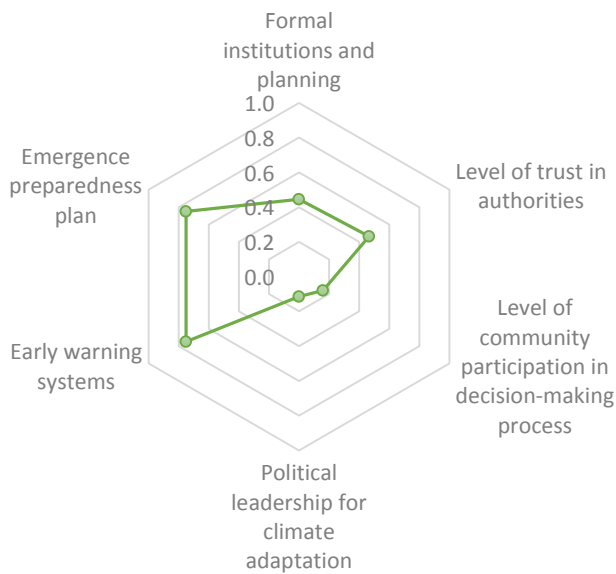
b)



c)



d)



e)

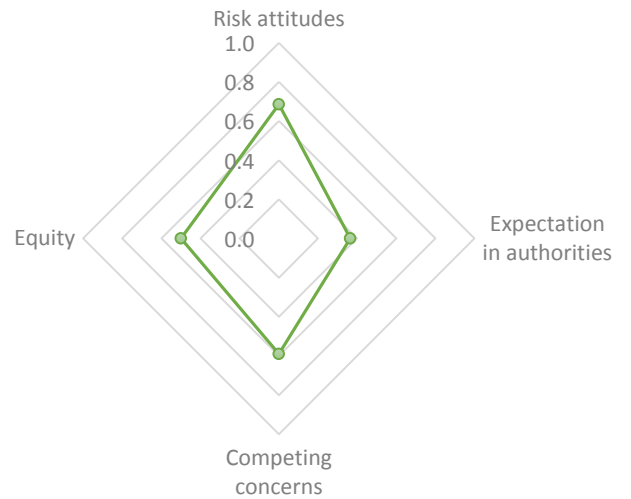


Figure 15. Indicators of adaptive capacity (located above). Ratings from low adaptive capacity (0) to high adaptive capacity (1) for indicators for the five subdimensions of adaptive capacity: assets (a), learning and knowledge (b), flexibility (c), governance and institutions (d), and psycho-social attributes (e).

Critical Values and Missing Data

Critical values were identified in the data for Pelham. In addition, data was not available for all indicators. Understanding areas where data is lacking is important for future monitoring and planning. This is especially important in cases where these subdimensions may be vulnerable and include critical values (i.e. have values that have fallen below a given threshold). Figure 16 shows subdimensions with missing data and that may be more vulnerable.

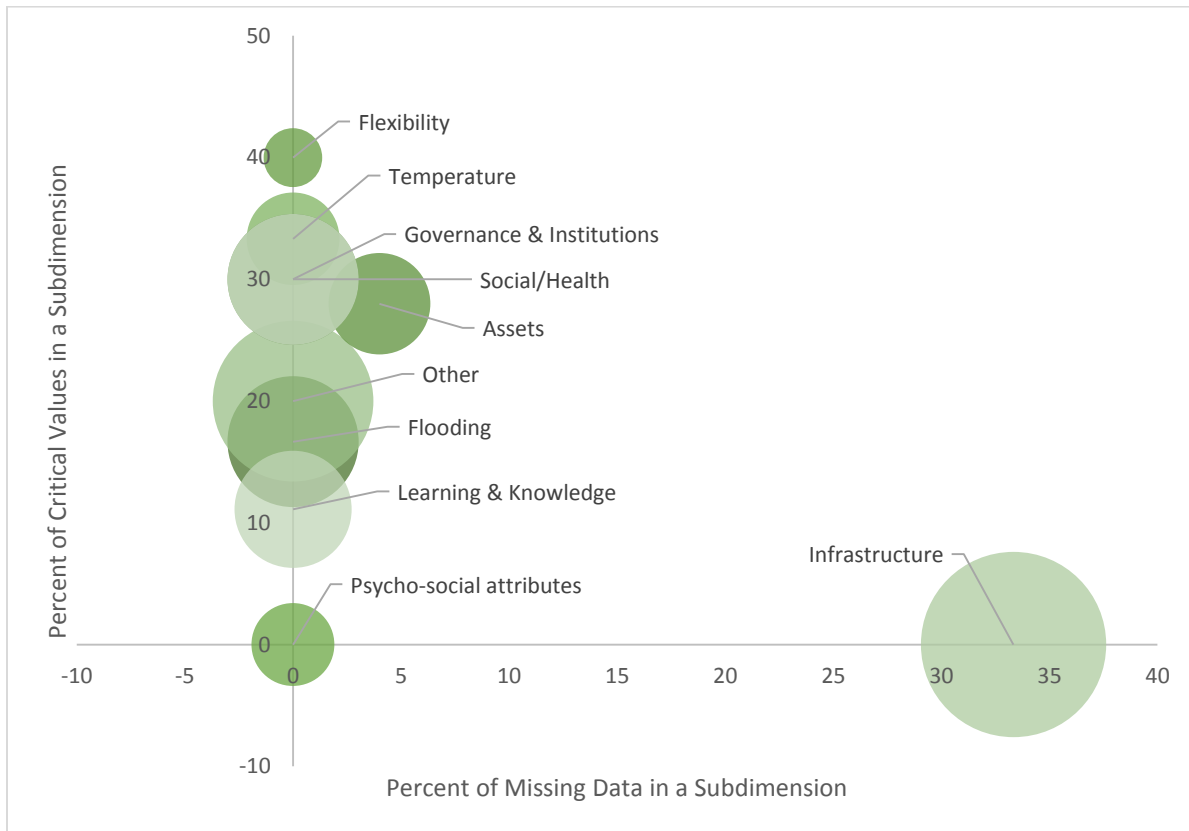


Figure 16. Critical and Missing Data. Size of the bubbles represents the relative expert weights of the subdimensions.

4.0 Where do we go from here?

In March 2020, the Town's Climate Change Coordinator administered a second workshop with the Town's internal Adaptation Steering Committee (ASC). Consulting with the ASC is a crucial step for the developmental stage (i.e. Phase I) of the Town's adaptation plan in reason that the input from the committee ensures that all municipal sectors are included in the planning process. The second workshop finalized a series of unique climate impacts that are likely to affect municipal sectors in various ways, while also identifying the municipal department(s) that would be responsible for the respective impact.

In May 2020, the ASC will conduct a vulnerability and risk assessment on the identified climate change impacts, where sensitivity and adaptive capacity, along with the consequence and likelihood of each given impact will be thoroughly assessed. These results, in partnership with the results from Brock University's Niagara Adapts survey, will collectively determine the set of impacts that will need to be prioritized into "items of action" for the adaptation plan. Once a set of prioritized actions have been identified, an implementation schedule will be created in order to determine how each action item will be completed. The implementation schedule is forecasted to be completed in the third quarter of 2020.

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Appendix A

Table A.1. Public Responses – Experiences with Household Floods

<p>Please briefly explain the consequences of the household flood.</p> <p>Replaced door and drywall and trim</p>
<p>Basement flooded, all contents and finished rec room lost</p>
<p>Water inside the east side of the basement. Caused by a down spout that was going right into the ground from the eaves. We have since removed and overflow goes out to the grass. This was how the house was when purchased. we have since changed.</p>
<p>Please briefly explain how you coped/responded to the household flood.</p> <p>Cleared downspout and replaced door, drywall and trim</p>
<p>During the build the sump pumps were installed but not hooked up and during a severe rainfall the basement filled. Loss of the furnace and 2 ft of lower walls. Builder replaced all that needed to be fixed</p>
<p>We had to quickly remove the laminate flooring and dry the area, we were able to rely the existing laminate flooring back down as we caught in time to dry everything. This was all complete by me and my husband over a couple of days.</p>

Table A.2. Public Responses – Experiences with Community Floods

<p>Please briefly explain the consequences of the community flood.</p> <p>Some roads were inaccessible. A number of families had severe basement issues.</p>
<p>Parks and sports field closed for a couple days to weeks (NOT catastrophic flooding)</p>
<p>Road inaccessible. Fields and lawns saturated and unusable - late crops and gardens, lower yield. Higher mosquito infestations.</p>
<p>I believe some basements were flooded. There was a river flowing down Pelham Street.</p>
<p>Please briefly explain how you coped/responded to the community flood.</p> <p>Business as usual - drove through the water. Tennant's car flooded trying to do the same. Had to wait to use my property, to plant. Less food, meant I had to buy more food from suppliers. Less enjoyment of property. Careful of mosquitoes - no night time enjoyment because of this. More indoor activity. Purchased and installed bat house. Utilised mosquitos water donuts.</p>
<p>Avoided roadway while flooded.</p>
<p>Moved to in-laws for a couple of nights.</p>

Table A.3. Public Responses – Experiences with Extreme Heat

<p>Please briefly explain the consequences of the extreme heat.</p> <p>Less outdoor activities - increase in sunscreen use, but sunscreen sometimes not enough. Sunburns. Careful for heat exhaustion - increase in water intake, careful not to overdo it. Kept dog inside more - have to put sunscreen on her. Headaches. Sad about environment around me - wildlife and plants.</p>
<p>Change job plan to match temperature and sun direction intensity and maintain adequate hydration</p>
<p>Difficulty Sleeping /Children mid Day naps. Sun exposure (burn) and over heating.</p>
<p>I was pregnant this past summer so the heat affected me differently - exhaustion, overheated, swelling</p>
<p>Children who were referees were unable to work.</p>
<p>Extreme sunburns and heat-stroke are becoming increasingly common during the summers in Pelham because of the number of scorching hot days.</p>
<p>Please briefly explain how you coped/responded to the extreme heat.</p> <p>Stayed inside, drank lots of water, delayed outdoor work to occur early morning and later in evening</p>
<p>stay indoors, use public places</p>
<p>Stayed inside, bought several fans, bought cold food and ice, suffered</p>
<p>Staggered activities according to time of day. Moved sleep area to cooler basement rooms</p>
<p>We did chose to stay inside on extremely hot days or go out in the evening to work.</p>
<p>I walk a lot for exercise and have been able to use the walking track at the Meridian Community Centre</p>

Table A.4. Public Responses – Experiences with Extreme Cold

<p>Please briefly explain the consequences of the extreme cold.</p> <p>Kids waiting for bus or bus not running</p>
<p>House bound, unable to get outside for fresh air and exercise</p>
<p>Neighbours had pipes burst</p>
<p>Minor frostbite from extended time spent outdoors.</p>
<p>Had to cancel several sessions of an outdoor preschool program in response to cold days.</p>
<p>Roads being really bad cause of the weather, work gets closed cause the power goes out.</p>
<p>Please briefly explain how you coped/responded to the extreme cold.</p>

On very cold winter days, if I didn't need to go out, I stayed inside.
Stayed indoors. Dressed appropriately for conditions
Stayed inside ... ran the gas fireplace during power outages
Stayed indoors constantly for several days at a time (meaning worst depression, isolation, lack of food), bought heavy duty clothing, made rounds checking on others to make sure they were okay since I and they did not have proper heating and were surviving off space heaters from giant tiger which could easily start fires.
Stayed inside, or went to an indoor playground

Table A.5. Public Responses – Experiences with Severe Weather/Storm

Please briefly explain the consequences of the severe weather/storm.
Power outages from windstorms resulted in us having our kids come stay with us with their baby as we have has fireplace to keep warm. We could use gas stove and BBQ for cooking. We had to cut down our big ash in the backyard to avoid risk of it falling on the house during a major windstorm at a cost of over _2K
Cancellation of daycare, inability to go to work.
Community damages ... eg. trees downed by ice on them Services, including schools, closed Power outages
The line from our house to our septic tank froze 5 years ago. We experience power outages about once a month. The road on the Centre Street hill overflows regularly - the slope on Cream St at Memorial has flooding issues. Our neighbours lot has flooded and septic system failed
Tree branches down on property. Trees down across roads (road closed). Temporary power outages. Fonthill arches partially blew over in windstorm and had to be fully dismantled due to damage.
Please briefly explain how you coped/responded to the severe weather/storm.
Bought a generator
Stayed indoors
We had an emergency kit with candles but when the house started to get so cold, we went to stay with family that had power.
Used candles for light and blankets for warmth when the power went out, stayed home and couldn't go to work as the highways were closed due to wind
Have candles, outdoor BBQ, camping equipment to keep warm in case power is out. Snow shovels in car, sand bags in car and lot in garage if needed for ice. I know BC sells sand bags at the gas stations preparing for the winter.

Table A.6. Public Responses – Experiences with Other Climate Events/Impacts

<p>Please briefly explain the consequences of any other weather events or impacts you have experienced that are associated with climate change.</p> <p>The moths are killing trees in neighbourhood making them more susceptible to windstorm damage</p> <p>Extra caution needs to be exercised when heading out into the sun.</p> <p>Power outages might become more frequent.</p> <p>Tick check protocol with the kids/pets</p> <p>Higher heating and cooling costs</p>
<p>Please briefly explain how you coped/responded to these other climate events/impacts.</p> <p>We are trying to find ways to manage the caterpillars and trying to educate our neighbors</p> <p>Decrease laundry, short showers, save grey water for garden,</p> <p>The changing intensity of the sun does concern me. I wear sunglasses more frequently.</p> <p>Stayed in air conditioning</p> <p>Brownouts and power outages are not as frequent now in our area but I still would like to rely less on the grid. I am also planning to retire, so prices of utilities are quite important in my budget.</p> <p>Tick check protocol/ educating the kids about it and myself about it</p>

Table A.7. Public Responses – Additional Comments

<p>Is there anything else you would like to add?</p> <p>We need more leadership, action and response. Governments need to take a strong lead in this urgent matter.</p> <p>I am seeing more and more natural habitats being turned into housing that does not support green spaces. We need more trees, and we need more green energy resources that are affordable for everyone. I have little faith in a government that has not provided sewage and safe water for all citizens to solve this major issues. Power lines should be underground instead of above. Urban development needs to be green. Incentives should be given as should rebates.</p> <p>Climate change is a top priority in our household. I strongly support any encouragement to local and provincial governments to take action to mitigate climate change. Thanks for this :)</p> <p>I don't feel very confident that our current Mayor and Council have put climate change high on the agenda of things to address. Personally, I drive an electric vehicle, replaced my home with a high-efficiency home, use water barrels in summer for yard water. I would like to see initiatives put in place by municipalities such as fast-charging electric vehicle stations, grey water recycling systems for residential homes and businesses, and businesses paying carbon taxes for their CO2 emissions.</p> <p>There are many volunteer agencies at work that address the effects of climate change on the natural environment but there is little co-ordination between them and little attention given to</p>
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their efforts. I see articles from time to time on efforts to mitigate the effects of climate change and development on Twelve Mile Creek, for example, but the efforts seem to be one-offs and not supported by the Town or Region. Elected councils might do well to follow the lead of such volunteer organizations and use their expertise and experience.

I would love to see a community that tries to prevent climate change by going with green initiatives, planting more trees and green spaces opposed to building more polluting houses. Air quality is problem. Let Fonthill be a model about how we can live. We need trees to breathe!!

There are numerous incentives that municipalities can use to help the fight in climate change. Provided rain barrels to residences at low cost. Provide access to low cost trees for residences to plant on their properties, allow for the use of outdoor clothes lines with purchase incentives. Provide incentives to convert to LED lights and upgrade insulation/retro fit homes.

little to no info has been given to us from our town as to what procedures are in place in the event of a catastrophic weather event ie tornado, flooding, wind storms etc.

I have noticed over my lifetime, so far, a great decrease in the number of birds and insects and fish all over Ontario. I attribute this , in my opinion, to pesticide use which may be found , one day, to also have an impact on the climate.

I feel the Town of Pelham has an exceptionally strong leadership in place which can/will deal with the effects of climate change

I appreciate the effort towards this move and support all positive changes

Appendix B

Table B.1

	Expert weight	Pessimistic scenario	Baseline scenario	Optimistic scenario	Lack of data	Critical data
Overall Vulnerability		0.445	0.509	0.517		
Exposure	0.5	0.514	0.514	0.514		
Temperature	0.167	0.299	0.299	0.299	0	33.33
Flooding	0.33	0.650	0.650	0.650	0	16.67
Other	0.5	0.495	0.4952	0.4952	0	20
Sensitivity	0.167	0.350	0.735	0.777		
Social/Health	0.33	0.456	0.456	0.456	0	30
Infrastructure	0.667	0.296875	0.875	0.9375	33.33	0
Adaptive Capacity	0.33	0.389	0.390	0.390		
Assets	0.2	0.418	0.423	0.425	4	28
Learning & Knowledge	0.267	0.460	0.460	0.460	0	11.11
Flexibility	0.067	0.178	0.178	0.178	0	40
Governance & Institutions	0.33	0.298	0.298	0.298	0	30
Psycho-social attributes	0.13	0.535	0.535	0.535	0	0

Key:

Expert weight: the weight derived from ranking of indicators (Section 2.1)

Pessimistic Scenario: Calculated by applying expert weights, accounting for critical values, and assuming the lowest possible score in cases where data is missing

Baseline Scenario: Calculated by applying expert weights, accounting for critical values, and eliminating indicators with missing data

Optimistic Scenario: Calculated by applying expert weights, accounting for critical values, and assuming the highest possible score in cases where data is missing

Lack of Data: Percent of missing indicators in a subdimension

Critical Data: Percent of indicators in a subdimension that are identified as critical values