Appendices

Appendix A: Case Studies

Case Study A1: Characteristics in hypocenters of microseismic events due to hydraulic fracturing and natural faults, A Case Study in the Horn River Basin, Canada (Woo et al., 2017).

This study has been carried out in the Horn River Basin, Canada with the aim of identifying how hydraulic fracturing and the existing natural fractures can affect the temporal evolution and spatial occurrence patterns of microseismic events. Two shale gas formations, i.e., Muskawa formations and Evie formation was studied (Woo et al., 2017). The researchers have applied automatic phase-picking to waveform data recorded at 98 three component geophones, shallow-buried in three distinct locations. An iterative linear inversion algorithm was used to determine initial hypocenters of events, which were then relocated using a double-difference algorithm. Relevant travel time measurements were obtained for these hypocenters with the waveform cross relation. Microseismic events were grouped into many clusters based on fracking stages and their hypocenters, which has helped in defining best fitting hypocenters for each cluster (Woo et al., 2017).

It was observed that most strikes of the best fitting planes are consistent with the direction of local horizontal stress maximum, which indicated that most microseismic events might have been induced by hydraulic fracturing. Nevertheless, it was also observed that best fitting planes of several clusters have strikes which are similar to those of pre-existing faults, indicating that generation of microseismic events are also affected by them. The study has observed specific migration patterns of microseismic events in and around the existing faults of the area (Woo et al., 2017). The Figure A1.1 below illustrates the layout of hydraulic fracturing wells in the study area. The observed microseismic events with their durations and the spread of pre-existing faults are illustrated in Figure A1.2.

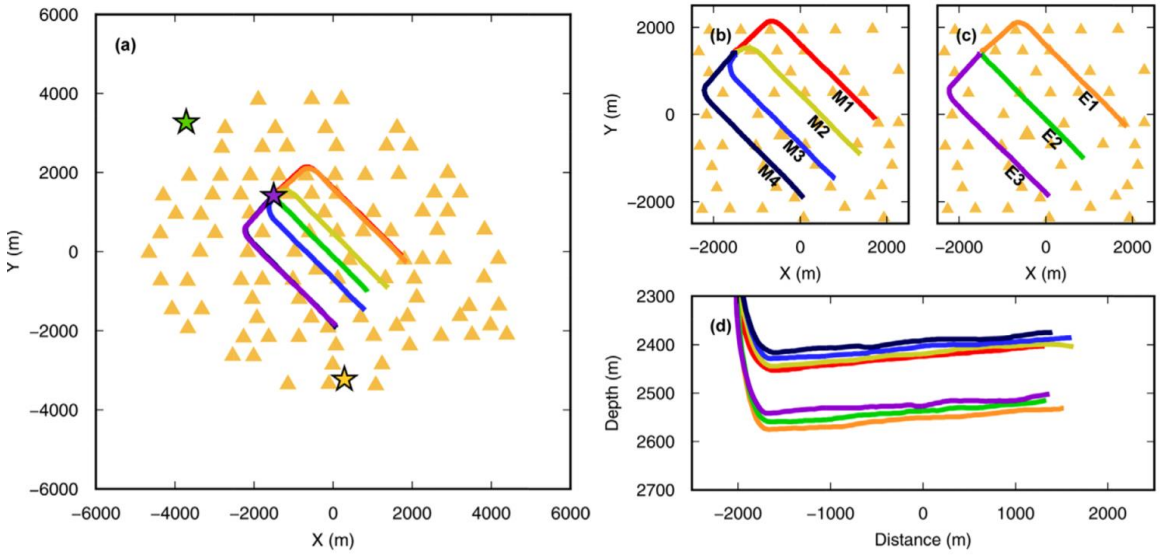

Figure A1.1: Layout of shallowly buried array (a–c) and hydro-fracturing wells (a–d) (Source: Woo et al., 2017).

The description adopted from the original source - "The coordinate origin is at the center of hydro-fracking wells. Location of subsurface array is marked as triangles and the lines of horizontal hydro-fracturing wells are distinguished by different colors. Well log data for making the one-dimensional (1D) velocity model were obtained from the three regions, marked by purple, yellow, and green stars in panel (a). Locations and names of hydro-fracking wells in the Muskawa and Evie formations are shown in (b) and (c). Note that the locations of M1 and the M4 are the same as E1 and E3 on the map view, but the Muskawa Formation is at shallower depth than the Evie Formation. Panel (d) shows the depth profile of the seven hydro-fracking wells. It is projected along the E2 line, located at the center of the seven wells" (Woo et al., 2017)

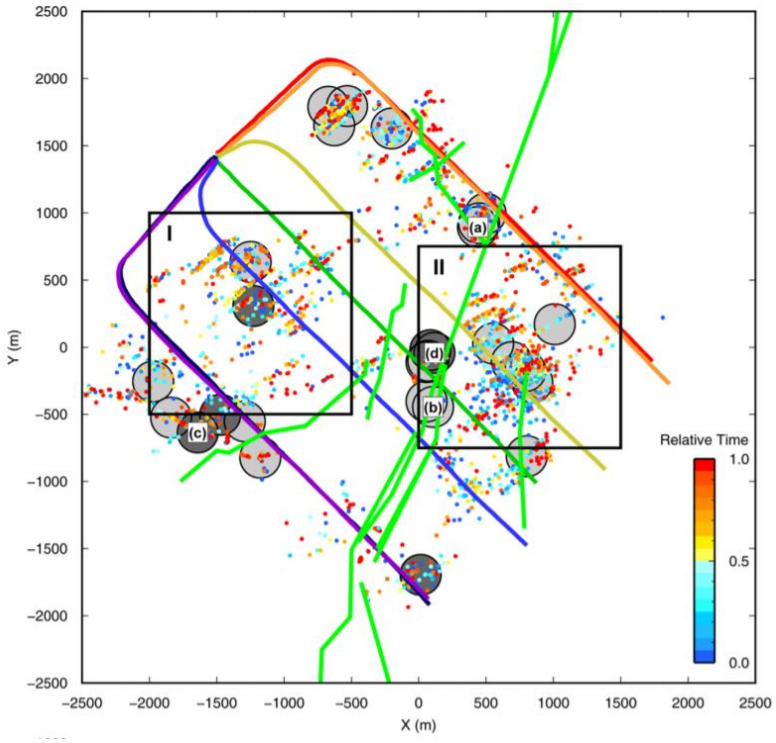

Figure A1.2: Map view for the relative origin time in each cluster.

For every cluster, the event origin times are linearly normalized based on the first and last event origin times. All the basic symbols are equal to those in Figure A3. Clusters with unilateral- and bilateral-propagating migration patterns are indicated as light and dark circles, respectively (Woo et al., 2017).

Case Study A2: Socio-economic Impacts of Hydraulic Fracturing in Williston, North Dakota (Stangeland, 2016).

The City of Williston, ND, is situated near the Bakken Formation, a large oil and gas reserve that has seen development in the 1950s, 1970s, 1980s, and most recently in the 2000s with the emergence of hydraulic fracturing technology (Stangeland, 2016). Before the most recent development, in the year 2000, the population of Williston was 12,512, and mean household income was USD $36,672 (Stangeland, 2016). This is comparable to the Town of Amherst, NS, which, as of 2016, had a population of 9,550 and a median household income of CAD $46,635 (Statistics Canada, 2017). Table A2.1 compares various indicators of social well-being before and after development, including a peak year for each indicator.

Table A2.1: The City of Williston's Population, Employment, Income Levels & Housing (Stangeland, 2016).

City of Williston			
	Pre-Boom (2000)	**Peak (Year)**	**2016**
Population	12,512	26,977 (2016)	26,977
*% Of Population Employed in Oil Industry**	8.5	20.1 (2005–2009)	19.4
*Mean Household Income	$36,672	$104,161 (2010–2014)	$104,161
*Housing Units	3,360	5,349 (2010–2014)	5,349
*Rental Units	1,895	2,944 (2010–2014)	2,944
*Homeowner Vacancy Rate	1.9%	0.0% (2010, 2011, & 2012)	1.1%
*Renter Vacancy Rate	17.0%	1.4%* (2010–2014)	5.7%

* Data Retrieved from the U.S. Census Bureau, 2005–2009, 2006–2010, 2007–2011, 2008–2012, 2009–2013, 2010–2014 American Community Survey 5-Year Estimates

**Includes the industries of agriculture, forestry, fishing and hunting, and mining (which includes oil and gas)

A lack of rent control in the City of Williston resulted in the rent of some residents to rise from $300 to $900/month, and at one point in development, the “going rate” for a one-bedroom apartment reached $2,394/month, displacing some long-time, fixed-income resident (Stangeland, 2016). In response to the pressure on local infrastructure, the City built a number of apartment complexes; however, as population numbers declined from 2012 onwards, renter vacancies rose and local businesses, such as hotels, suffered. While unemployment rates were reduced in the region (Figure A2.1), filling jobs outside of the oil and gas industry became challenging, putting pressure on local schools, medical industries, and police and public works amongst others (Stangeland, 2016). A number of non-oil and gas related industries had to offer incentives to retain employees, and some businesses closed as they could not afford to compete with oilfield wages (Stangeland, 2016).

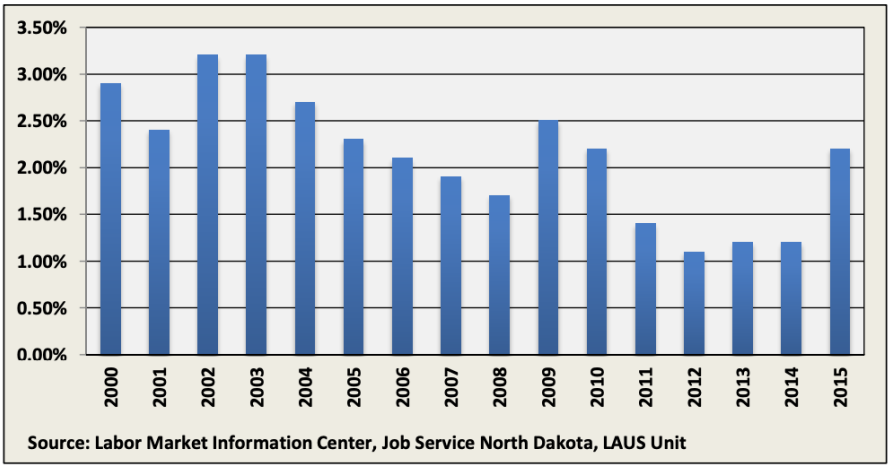

Figure A2.1: Unemployment Trend in Williams County, North Dakota (Stangeland, 2016).

Local police in the City of Williston, ND, observed an increase in call volumes in association with the rise in population, many of which were pertaining to alcohol, traffic problems, and domestic violence (Stangeland, 2016). Crime rate data from the Federal Bureau of Intelligence (FBI) indicates that from 2005 to 2012, larceny-theft, aggravated assault, violent crime, and property crime increased by 275%, 232%, 218% and 202% respectively (Stangeland, 2016). Further crime statistics are provided in Table A2.2.

Table A2.2: Williston Crime Rate (Stangeland, 2016).

Year	Violent Crime rate	Murder and Manslaughter rate	Rape rate	Robbery rate	Aggravated Assault rate	Property Crime rate	Burglary rate	Larceny/ Theft rate	Motor Vehicle Theft rate
2005	122.6	0.0	24.5	8.2	89.9	1,536.6	212.5	980.8	343.3
2012	390.9	6.1	73.3	12.2	299.3	4,641.8	268.7	3,682.9	690.2
% of CHG	**218.8**	**600.1**	**199.2**	**48.8**	**232.9**	**202.1**	**26.4**	**275.5**	**101.0**

The case study of Williston, ND, exemplifies the costs and benefits of oil and gas development to local communities. Stangeland (2016) suggests that a full understanding for the lifecycle of an oil and gas project is imperative to help prevent, prepare for, and mitigate adverse effects on communities. Stangeland (2016) suggest that when determining the consequences of permitting development, policy-makers must account for the boom-and-bust cycles of economic activity that are associated with oil and gas development.

Case Study A3: The Marcellus Shale Impacts Study: Chronicling Social and Economic Change in North Central and Southwest Pennsylvania (Brasier et al., 2014).

The Marcellus Shale is a natural gas bearing formation that underlies parts of the States of Pennsylvania, New York, Ohio, Maryland and West Virginia (Brasier et al., 2014). Between 2005-2013 development of the Marcellus Shale increased rapidly with 6,833 unconventional wells being drilled. The impacts of USGD in four Pennsylvania Counties (Bradford, Lycoming, Washington, and Greene) were studied by Brasier et al. (2014) (Figure A3.1). The study had four specific goals, one of which was to "describe the experiences of critical populations and institutions in relation to level of activity" (Brasier et al., 2014).

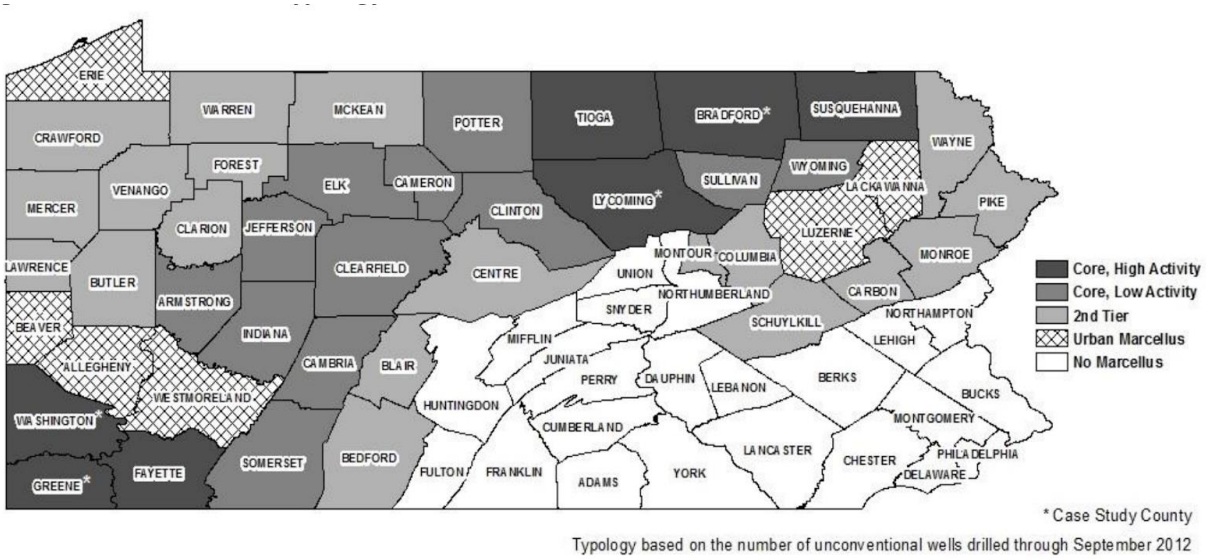

Figure A3.1: Typology of Marcellus Shales by County (Brasier et al., 2014).

Previous research on communities exposed to USGD suggests that critical populations, including youth, low-income residents, and new residents, have negative experiences with rapid natural resource development, due to their inability to influence projects, or benefit directly from their development (Brasier et al., 2014). Through interviews with focus groups, and other forms of data collection, the authors attempted to capture the impacts on social indicators of well-being, in four Pennsylvania Counties that were heavily impacted by USGD. The results of the study are summarised in Table A3.1.

Table A3.1: Social indicators from the Marcellus Shales (adapted from Brasier et al., 2014).

Counties	Bradford	Lycoming	Washington	Greene
Population				
Post-Development (2010)	62,622	116,111	207,820	38,686
Percent Change (2000-2010)	+1%	-3.3%	+2.3%	-5%
Other	Aging population. Out-migration of families with children and youth.	Out-migration of those aged 15-24, relative increase in male population.	Fewer adults left the county (compared to other counties).	Population of men age 15-24 grew faster than that of young women.
Health – Pre-development (2000) to Mid-development (2008)				
Inpatient Hospitalization	+6%	+4%	+<0.4%	+2%
No. of Federally Qualified Health Centers	-1 (from 1 to 0)	+1 (from 0 to 1)	+2 (from 5 to 7)	+3 (from 5 to 8)
Education – 2005/06 – 2010/11				
Net School District Enrolment	-8%	-4%	-2%	-8%
Dropout rate	Decreased	Increased slightly	Increased slightly	Increased slightly
Youth				
Views on Oil and Gas Industry	Indicated fear about driving on roads, concerned about accidents (due to industry traffic). Complaints about noise and light pollution, uncertain about economic costs/benefits.	Uncertain about the benefits and costs of industry development, particularly regarding traffic, road safety, and the environment.	Only County where students seemed to believe industry brought positive net economic gain.	Uncertain about positive and negative impacts of development. Concerned about traffic, wildlife, noise and light pollution.
Housing				
Housing Stock	+5%	No change	+5%	Small net loss (no data provided).
Vacancy	+5%	+1%	+3%	No data provided
Housing Value	+16%	Increased (no % change given).	+25%	+21%
Crime – 2001-2010				
Civil Cases Filed	Increased significantly from 2006-08, decreased in 2009, increased again in 2010.	Increased in years prior to well development 2005-07, then declined following development 2007-10.	Steady decreased throughout the decade, one spike in 2010.	Steady increase from 2001-06, spiked in 2007, and again in 2010.
Economics – 2007-2010				
% Change in Taxable Income	+19%	+7%	Declined (% not specified)	Declined (% not specified)

Appendix B: PESTEL Analysis of Cumberland County

1.0 Executive Summary

Cumberland County, unofficially known as the gateway to Nova Scotia, is bordered by Colchester County, the Northumberland Strait, the Bay of Fundy and the province of New Brunswick. This report aims to develop further insight regarding the Municipality of Cumberland through the use of a PESTEL analysis which discusses the external Political, Economic, Social, Technological, Environmental and Legal forces impacting the Municipality. These forces generate both opportunities and threats which the local government must capitalized on and manage in order to best serve the local communities.

The major threats identified through this analysis involve the social demographics and economic situation in Cumberland. The Municipality's population continues to decrease in size while increasing in age as skilled and educated workers chase more profitable job opportunities outside of the Cumberland region. Additionally, the economic burden placed on Cumberland after the merger with Springhill and Parrsboro, combined with the job loss in local industries has left the Municipality unable to support itself financially without outside investment.

The Municipality of Cumberland is currently working to set the standard of leadership in local government through the development of Cumberland's abundance of renewable energy resources which are currently being capitalized on as alternative energy opportunities. The continued development of, and investment in, renewable energy will continue to be a major opportunity for Cumberland moving forward. Capitalizing on their platform as 'green-energy leaders' within the province should help to overcome some of the Municipality's economic and social threats by creating more jobs and encouraging further education.

2.0 PESTEL Analysis

2.1 Political

There are multiple factors that contribute to the political environment within the Municipality of the County of Cumberland (henceforth referred to as the Municipality). For the purpose of this analysis, the focus will remain primarily within Cumberland County, but as the Provincial and Federal governments affect the smaller communities within the province, there will be some reference to political factors beyond the scope of the Municipality.

2.1.1 Government

The Municipality is comprised of 13 electoral districts, each represented by an elected councillor to act on behalf of their citizens to mediate conflict, make decisions, prioritize resources, and enact local policies and by-laws (Councillors, 2018). The County is further divided into the larger electoral districts of Cumberland North and Cumberland South. The Member of Legislature (MLA) of Cumberland North is presently Progressive Conservative (PC) representative Elizabeth Smith-McCrossin, who replaced incumbent Terry Farrell of the Nova Scotia (NS) Liberal Party (Elections NS, 2017). The MLA of Cumberland South is presently PC representative Tory Rushton, who replaced Jaimie Baillie, also a member of the PC party, after his resignation in 2018 (CBC News).

2.1.2 Elections

The 40th General Provincial Election occurred on May 30th2017. The district of Cumberland North is the 20th largest polling district by geographic size (1,050km^2) in NS and has 38 polling stations (Elections NS, 2017, p. 1-29). For the Cumberland North district there was a 53.3% voter turnout (Elections NS, 2017, p. 2-52). This was .01% lower than the 2017 average provincial voter turnout of 53.4% (Elections NS, 2017, p. 1-39). PC candidate Elizabeth Smith-McCrossin was elected with 3,632 votes, or 51.7% of the 7,027 accepted ballots cast (Elections NS, 2017).

The district of Cumberland South is the 5th largest polling district by geographic size (3,247Km^2) in NS and has 31 polling stations (Elections NS, 2017, p. 1-29). For the Cumberland South district there was a 62.4% voter turnout (Elections NS, 2017, p. 2-55). This was 9% higher than the 2017 average provincial voter turnout of 53.4% (Elections NS, 2017, p. 1-39). PC candidate Jamie Baillie was elected with 3,536 votes, or 59% of the 6,867 accepted ballots cast (Elections NS, 2017). The 40th General Provincial Election saw a 5% drop in voter turnout across NS (Mulligan, 2017). This decrease represents a continuation of a downward trend that has been steadily occurring since 1960. The Municipality maintained the average in the North electoral district and surpassed it by 9% in the South.

2.1.3 Government Controversy

Political controversy arose for the elected PC party in January 2018 when Jaime Baillie was accused of “inappropriate behavior” by a female staff member of his caucus (CBC News, 2018). Baillie soon resigned and a June 19, 2018 By-Election was scheduled to elect a new MLA for the district. Tory Rushton, the PC candidate, won with 3,417 votes, or 59% of the 5,772 accepted ballots (Nova Scotia Legislative Library, 2018).

2.1.4 Dissolution

The geographic area within the Municipality has been expanding since 2015 with the dissolution of Springhill on April 1, 2015 and Parrsboro on November 1, 2016 (Nova Scotia Department of Municipal Affairs (NSDMA), 2018). Both locations dissolved their town status and became part of the Municipality. Springhill's amalgamation was a response to financial constraints that has caused the town to charge the second-highest property taxes in the province at $2.52 per $100 assessment (Taber, 2014). Similarly, Parrsboro reached a dissolution agreement with the Municipality in 2016 that would provide the town with $5.3 million over five years to assist with financial pressures and the costs incurred by a new wastewater treatment system (Williams, 2016).

2.1.5 Budget - Taxes

The debt incurred by the amalgamation of Springhill with the Municipality and any associated post dissolution costs have led to a reported deficit in 2015/16 (NSDMA, 2017, p. 5). Similarly, the town of Parrsboro is projected to be in a deficit following their dissolution, but this had been accounted for in the 2017/18 Cumberland budget and was funded by adjustments to the Parrsboro area rate (Municipality of Cumberland, 2017, p. 2). These reported deficits are a high-risk indication that the Municipality may be struggling to meet services and maintain revenue (NSDMA, 2017, p. 13).

Thirty-three percent of the Municipality's reported 2017 revenue was acquired through taxation (NSDMA, 2017, p. 1). With a residential tax rate of $1.04 per $100 of assessed value, and a commercial tax rate of $2.64 per $100 of assessed value, the Municipality is above the average NS residential and commercial property tax rates of $0.97 and $2.08, respectively (NS Municipal Property Tax Rates, 2017).

2.1.6 Population

With a reported 2016 population of 30,005 (Statistics Canada, 2017) the population has been steadily decreasing within the Municipality despite the amalgamation with Springhill and Parrsboro. There was a reported 4% drop in the population between 2011 and 2015, as well as an increasingly aging population, with a 4% decrease in residents under the age of 14. (Community Foundations of Canada, 2016, p. 1-2). These demographic shifts are happening at a rate greater than the provincial average (Town of Amherst and Municipality of Cumberland, 2014, p. 1).

2.1.7 Development and Sustainability Plan

The Cumberland County Integrated Community Sustainability Plan (ICSP) outlines priorities for community sustainability investments that allow for gas tax revenue from the Federal government for infrastructure that reduce environmental impact and contribute to efficiency, as per the Municipal Funding Agreement for NS (Merrill, Zwicker, & Bruce, 2010, p. i). Through consultation with the Municipality, the ICSP has recognized areas for government focus and budgeting, including green energy needs, climate change, water, and demographic changes (2010, p. i).

The Municipality's 2014 Community Economic Development Strategy (CEDS) recognizes areas of tourism, agriculture, and energy for further investment and development, and as the mean to help to provide economic stability (p. 1). Additionally, the recent 2018 – 19 Business Plan, released by the NS Department of Energy continues to highlight these provincial economic opportunities for their potential to capitalize on NS's renewable energy resources, as well as their environmental benefits towards fighting climate change (p. 2). The 2018 – 19 Mandate and Platform Commitment (Department of Energy, 2018) outlines provincial initiatives focusing on the support of tidal energy, solar energy (p. 4), greenhouse gas emission reduction, and offshore oil and gas industry growth (p. 5).

2.1.8 Cumberland Energy Authority

Having recognized the energy sector as a potential means for sustainable income and work, "the Cumberland Energy Authority (CEA) was formed in 2012 through an Inter-Municipal Agreement between [the Municipality], the Town of Parrsboro, and the former Town of Springhill to promote regional energy development" (About, 2018). Through this partnership many green energy (solar, tidal, and wind) initiatives have been undertaken. Additionally, in October 2018 three new solar energy projects have been announced in the Municipality, and an interest has been expressed by Warden Al Gillis to create the "greenest municipality in the province and to be an example of sustainable planning worldwide" (Municipality of Cumberland, 2018c, p. 30).

These outlined forces have the potential to influence the Municipality in a number of ways. Higher than average voter turnout can signify a politically engaged public and provides the citizens of the Municipality with the opportunity to democratically elect the best possible candidate to support the political, economic, environmental and social needs of the community. Political controversy, higher than average taxes, population loss, and debt incurred from the dissolution of Springhill and Parrsboro act as threats to the Municipality and can create mistrust and economic uncertainty. However, the recognition of, and investment in local resources, tourism, and green energy initiatives provides the Municipality with the opportunity to combat forces affecting population loss and economic stability.

2.2 Economic

An economic overview of Cumberland County is needed to analyze the current financial climate. A few of these topics include the state of the economy, economic development, regional industries, and average household income. These topics are important as they tell the past and current story of Cumberland County, while analyzing areas of strengths and weaknesses in the region.

2.2.1 State of the Economy

The state of the economy in Cumberland country is not as optimal as other regions in the country. The employment rate in Cumberland Country is 49%, lower than the provincial average of 57% (Community Foundation of Nova Scotia, 2016). From this we can see that the 51% of the citizens in the county are not involved in the workforce. The unemployment rate in Cumberland county is 12% (Community Foundation of Nova Scotia, 2016). Although this isn't directly unemployment, it does tell a highlight the fact that there is a majority of the population that is not involved in the workforce. This employment rate in Cumberland county is something to note as it is vastly different to that of the rest of the province. The Nova Scotian provincial average employment rate is 57% (Community Foundation of Nova Scotia, 2016). As we can see, there is a difference of 8% between Cumberland County and the province of Halifax with regards to their employment rate. In terms of employment insurance rates, ~1000 people in Cumberland County received employment insurance (Refer to BI figure).

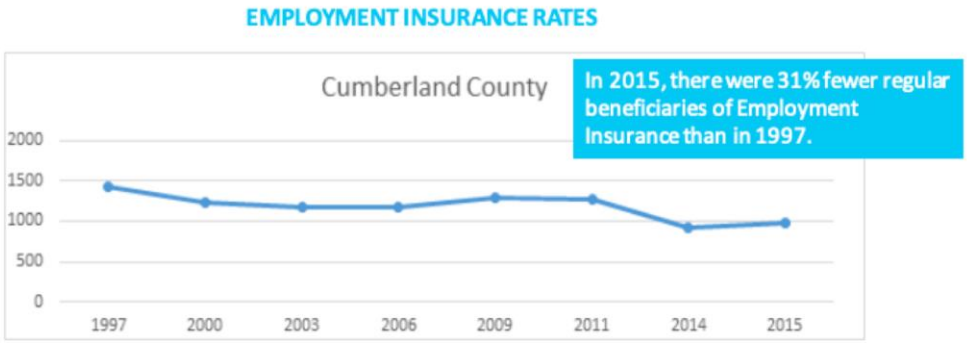

Figure B1: (Community Foundation of Nova Scotia, 2016)

This is down from ~1,200 in 2010. Overall, there has been a steady decline in employment insurance rates since 2009 in Cumberland County (Community Foundation of Nova Scotia 2016). This is a positive sign for Cumberland County due to the fact that as EI rates drop, it can be inferred that employment rates are rising. There is a cascading effect that occurs in regions when there is a rise in employment rates. Salaries begin to creep up as employment demand increases. This, in turn, helps the residents of Cumberland County as there will be more cash-inflows into their economy because of the job creation and higher salaries.

2.2.2 Economic Development

Taking a look at economic development, establishing growth for Cumberland county is needed. When looking at the year 2015, Cumberland County had some of the lowest hourly wages in all of Canada (Community Foundation of Nova Scotia, 2016). When further analyzing these wages, it is important to note the income distribution in terms of dollar amounts, as well as demographic differences. The median income for all of Cumberland County is $22,968, but differences are noted between male and females. The median income in 2011 (refer to median income figure B2) for males in the County is $30,945 and is $19,195 for females (Community Foundation of Nova Scotia 2016).

	Cumberland	Nova Scotia
Individuals		
Total	$22,968	$27,570
Male	$30,945	$34,073
Female	$19,195	$22,347

Figure B2: Median Income (Community Foundation of Nova Scotia, 2016).

As we can see, there is a difference in median wages between males and females of $11,750. There is an obvious wage gap that is occurring in Cumberland County. This gap needs to be addressed to help women enter the workforce at a more even playing field. If the wage gap is addressed, economic prosperity can be achieved faster if we can solve the wage gap issue between men and women. There is also a wage gap between age ranges in Cumberland County in comparison to that of the rest of Canada. The median hourly earnings for vacant positions in Cumberland County was $14.85. This hourly wage was among the lowest in all of Canada. Although these wages are based on pure competition and supply and demand of the market, if the County can address this issue, economic growth can be stimulated in the region.

2.2.3 Regional Industries

A breakdown of the labour force industry are segmented into several categories. The five most employed labour force industries in Cumberland Country are heath care & social assistance, manufacturing, retail trade, public administration, and educational services (Community Foundation of Nova Scotia, 2016). Heath care & social assistance account for 13.3% of the total labour force and is the most in terms of

percentage basis in all of Cumberland County. Manufacturing is the second most employed industry in Cumberland Country with 12.9% residents working in this sector. Within Cumberland County, 12.8% of the population worked in the retail trade business. This is just shy of the amount of people working in the manufacturing business. The remaining two sectors are the public administration and educational services sectors, which account for 8.9% and 7.3% of the population in Cumberland Country (Community Foundation of Nova Scotia 2016).

Overall, it can be seen that there is a wide range of industries and sectors that the residents of Cumberland County are employed in. As can be seen from the statistics above, there is a fairly even mix between public and privatized working sectors within the region. It is important to note that the public-sector employment can be seen as a safer employment option. This is due to the fact that there is government backed funding for all public based work sectors. Although there are varying degrees of funding for certain government backed operations, the fact that there is a so-called "safety net" for some of the of the residents of Cumberland County provides peace of mind. This safety net is important to bring up, as industries are consolidating, the risk of working in the manufacturing and retail trade is ever growing. It can be seen all over the province, that large multi-scale operations are closing in rural areas of the province due to mass consolidation. This consolidation is due to undercutting costs from competing global manufacturing companies in more cost-effective countries.

2.2.4 Average Household Income

It is important to analyze annual salaries when looking at a region to better understand the economic climate they are in. In Cumberland County, 44% of workers earn a salary below $20,000, and this was considerably higher than provincial national wages (Community Foundation of Nova Scotia, 2016). Although this may seem very low in terms of an annualized salary, to put it into perspective, the average cost of a single-family home is $78,600 in Cumberland County (Community Foundation of Nova Scotia, 2016). As these prices for houses are significantly lower than that of other regions in Nova Scotia and the rest of Canada as a whole, the near average salary of $20,000 does allows for residents in Cumberland County have reasonably priced housing accommodations.

2.2.5 Conclusion

In conclusion, Cumberland County has some strengths and weaknesses with regards to their economic state. Although there is an employment rate differential in Cumberland County that is 8% less than that of the rest of Nova Scotia, there is a downward trend in employment insurance rates which could potential signal that more people are entering into the work force. There is a wage gap issue in Cumberland County as well as in Nova Scotia between men and women. If Cumberland Country could focus on closing the wage gap and match the salaries of that of the male gender, potential economic prosperity could be

achieved by encouraging more women to enter the work force. Cumberland County is well diversified with multiple industries for members of the County to work in. It is important to have a variety of options for sector specific work to mitigate market fluctuation risk and to be able to survive through recessions in certain industries. Strengthening these areas of employment rates, wage gap, and diversifying employment options will allow for Cumberland County to accelerate economic prosperity.

2.3 Social Factors

The municipality of the County of Cumberland is influenced by a number of social factors, including an aging population, numerous public health concerns, a lack of public transport, income disparities, and limited employment opportunities. That being said, there are a number of opportunities that the Municipality can leverage to their advantage, including above-average access to health professionals, a well-educated population, and a low crime-rate.

2.3.1 Population Statistics

In 2014, the Municipality of the County of Cumberland released a Community Economic Development (CED) Strategy. In this strategy, it was noted that county demographics were a cause for concern, as it was becoming increasingly challenging to maintain a critical mass of people, programs and services, infrastructure and economic opportunities needed to sustain the community (CED Strategy, 2014). The report indicated that the local economy would not be able to support itself indefinitely without new investment, and more people of employment age with skills that align with opportunities in the county were needed.

The CED report notes that between the 2001 and 2011 census, the county population had declined by 3.8%. Population decline remains a challenge to Cumberland County, as the 2016 census indicates that since 2011, the population has declined by 4.3% (31,295 to 30,005) (Statistics Canada, 2017). Not only is population declining in the county, it is also aging. At the time of the 2016 census, the average age in the county was 47.0 (6.0 years older than the national average), and the median age was 51.1 (9.9 years older than the national median) (Statistics Canada, 2017).

2.3.2 Health

The Nova Scotia Health Authority reports on indicators of health across broad regions of the province. Cumberland County is included in Health Zone 3, along with Pictou County, Colchester County and East Hants. Ninety-six percent of the population within Health Zone 3 have access to regular medical doctors, which is 5% higher than the provincial average (Community Foundation of Nova Scotia, 2017).

Aside from access to health care, wellness indicators in Cumberland County are below those of the national rate. Compared to the national rate, residents of Cumberland County are less active, consume fewer fruits and vegetables, have a higher prevalence of daily or occasional smokers, and have a higher rate of heavy drinkers. Additionally, residents of Cumberland County have a higher prevalence of overweight or obese residents, a higher prevalence of disability, and a shorter life expectancy. Cases of cancer, including colon/rectum, breast, bronchus and lung, and prostate cancer, per 100,000 people, are higher in Cumberland County than national rates. Chronic diseases in Cumberland County, such as arthritis, mood disorder, diabetes, high blood pressure, and chronic obstructive pulmonary disease (COPD) are also higher than the national rate (Community Foundation of Nova Scotia, 2016).

Table B1: Wellness Indicators in Cumberland County and Canada (Community Foundation of Nova Scotia, 2016).

Wellness Indicator	Cumberland County	Canada
Active or moderately active in leisure time	52%	54%
5+ daily servings of fruits and vegetables	28%	40%
Daily or occasional smokers	21%	18%
Heavy drinkers	23%	18%
Overweight or obese	65%	54%
Disability	27%	14%
Life Expectancy	76/82 (M/F)	79/83 (M/F)
Cases of Cancer (per 100,000 people from 2005-07)		
Colon/Rectum Cancer	63	50
Breast Cancer (women only)	110	98
Bronchus and Lung	58	57
Prostate (men only)	130	124
Chronic diseases		
Arthritis	31%	17%
Mood disorder	10%	9%
Diabetes	12%	7%
High blood pressure	29%	18%
COPD	6%	4%
Mental Health		
Self-reported mental health “very good” or “excellent”	65%	71%
Self-reported feelings of stress	17%	23%
Self-reported feelings of “satisfied” or “very satisfied” with life	92%	92%

2.3.3 Transportation

Commuters in Cumberland County are almost entirely reliant on cars to get them to and from work. Without a publicly funded transport service in the county, 92% of commuters drive to work, while only 5% walk (Statistics Canada, 2017). The Cumberland County Transportation Service Society is a not-for-profit service for residents of the county who are transportation disadvantaged. The Society helped 60 people commute to work in 2016 (Community Foundation of Nova Scotia, 2016).

2.3.4 Income

Income generation is another challenge facing the county, as 22.8% of the population falls below the Statistics Canada low-income measure (7.6% higher than the national rate). In 2015, the median annual income of the county's 24,265 total income recipients, was $27,622, which was 19% lower than the national median. Total household incomes were also 29% lower than the national median, at $49,883 (Statistics Canada, 2017). Government transfers accounted for 22% of the population's total income, which is nearly double that of the national rate (11.7%) (Statistics Canada, 2017).

2.3.5 Employment

The unemployment rate in Cumberland County was 11.4% in 2016, 3.7% higher than the national average at the time (Statistics Canada, 2017). Sales and service occupations, alongside trades, transport and equipment operators and related occupations, were the two most-employed occupations in the county. Gender distribution is a concern in some industries, notably the mining, quarrying, and oil and gas extraction industry, which employed 225 people (91% of which were men), and the construction industry, which employed 980 people (88% of which were men) (Statistics Canada, 2017).

2.3.6 Educational Attainment

Nearly 55% (8,240) of the working-age population of Cumberland County (age 25-64), has a postsecondary certificate, diploma or degree (Statistics Canada, 2017). A high school diploma or equivalency certificate is the highest degree held by approximately 30% (4,485) of the population, while approximately 15% (2,375) do not have a certificate, diploma or degree. Approximately 60% of those with a postsecondary certificate, diploma or degree, have academic backgrounds in either (1) business, management and public administration, (2) engineering and related technologies including mechanics and construction trades, or (3) health and related fields (Statistics Canada, 2017). Postsecondary certificates, diplomas or degrees were largely earned from Canadian institutions (96.4%), approximately three-quarters of which were earned in Nova Scotia.

2.3.7 Crime and Safety

The Royal Canadian Mounted Police (RCMP) are responsible for policing Cumberland County, with the exception of the Municipality of Amherst, who have their own police department. The 2015 Amherst Police Survey indicated that residents were not particularly concerned about local crime. The survey reported that only 18% of residents believed that crime would increase in the coming years, 39% of whom attributed the anticipated rise to declining economic conditions such as job loss (Community Foundation of Nova Scotia, 2016). Similar to national trends, crime severity in Nova Scotia has been

declining over the past decade; however, Cumberland County has seen a much different trend (Figure D3). That being said, in 2015, the Cumberland County crime severity index rating was still lower than provincial and national ratings, at 53.6, compared to 61.9 across Nova Scotia, and 69.7 across Canada (Community Foundation of Nova Scotia, 2016).

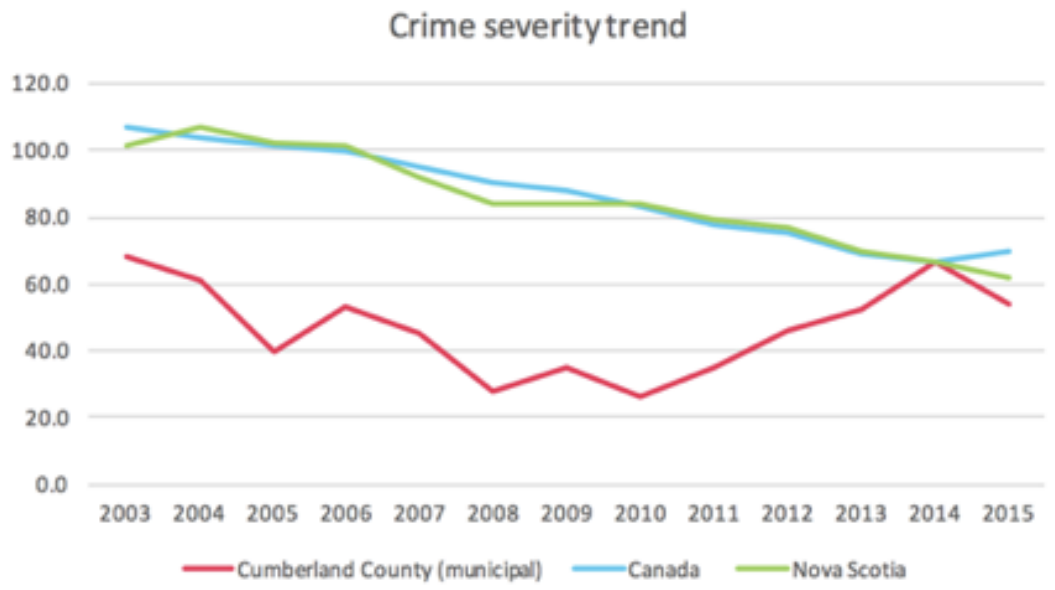

Figure B3: Crime severity index trend (Community Foundation of Nova Scotia, 2016)

2.3.8 Threats and Opportunities

The Municipality of the County of Cumberland is mandated to provide a number of fundamental services, including community economic development, recreation funding, and police protection (CREMA, 2008). To effectively manage the provision of these services, it is important that the Municipality understands the capacities and vulnerabilities of the community. Social factors contribute to the vulnerabilities and capacities of the community and should be incorporated into decision-making.

Many of the Municipality's vulnerabilities stem from social factors such as an aging and declining population, a high unemployment rate, and a lack of new investment in opportunities that align with the skills of the local workforce. These vulnerabilities threaten the strength and sustainability of the regional economy, which in turn, limits the Municipality's capacity to provide mandated services such as recreational funding. Inadequate resources to offer affordable recreation opportunities could be one of the factors contributing to the health concerns identified in the analysis; however, more research is required.

A number of opportunities can be drawn from the social factors outlined above. The majority (55%) of the population in the county have achieved a postsecondary diploma, certificate, or degree, suggesting the Municipality has a skilled workforce that would be responsive to new economic opportunities. The

findings from the Amherst Police Survey, that residents are not particularly concerned about local crime, and a favourable crime severity index rating, suggests that the county is quite safe. The municipality may have an opportunity to leverage public perception and favourable crime statistics to redirect municipal funding away from police services, towards attracting economic investment and addressing other more pressing social concerns such as public transport, recreation, or health services.

2.4 Technology

During the brainstorming activity, technology was given a lot of attention due to its significance in the 21st century. However, due to an ever-changing nature, it was difficult to capture the most recent news on modern technology. Therefore, certain information necessary to this PESTEL were drawn from grey literature and news reports. Surprisingly, information on technology in Cumberland was not readily available and does not seem to be a point of emphasis in municipality literature, compared to traditional measures of a municipality such as economy and socio-culture.

2.4.1 Social Media Marketing and Campaigning

Social media is a new technological factor being increasingly investigated in PESTELs (Dockalikova & Klozikova, 2014). Social media data in Cumberland through literature was not readily available; however, a brief audit of three social media outlets Facebook, Twitter and Instagram was done. It was found that organizations and individuals create accounts primarily for the purposes of marketing. On Facebook, a search yields 40+ groups on the front page, devoted to tourist attractions, retailers, sports organizations, and local amenities such as museums and libraries. On Twitter and Instagram, accounts can be found yielding similar results.

From a search engine optimization (SEO) standpoint, organizations within Cumberland are lacking progression (Horovitz & Kamvar, 2010). Often, when searching “Cumberland, or Cumberland County” without including “Nova Scotia”, Cumberland County in Pennsylvania New Jersey both outrank Cumberland County, Nova Scotia. The lack of SEO from social media users and organizations can be viewed as a threat to the county, as they do not appear very easily in search engines (Xiang & Gretzel, 2010). This is a point of opportunity that was recognized by Nova Scotia Minister of Business, Geoff McLellan: annual revenue from tourism in Nova Scotia during 2017 was $2.7 Billion, a number which the minister believes can increase to $4 Billion by 2027, if often overlooked tourist destinations such Cumberland increase their social media and digital marketing presence (Tourism Nova Scotia, 2018; Cumberland News Now, 2018).

2.4.2 Investment in Technology

Natural Resources Canada (NRCAN) runs a program which funds various developments around Canada (Natural Resources Canada, 2018). Currently there are 132 projects listed under "energy and technology" across Canada, 9 of which are in Nova Scotia; however, only one investment has been directed towards organizations within Cumberland; a tidal organization near the Bay of Fundy. Similar programs exist through NRCAN, however, as of January 2018, it does not appear that any organizations in Cumberland have been granted any funding. Major decisions have been made towards developing geothermal resources recently (Municipality of Cumberland, 2018); therefore, requests for funding may soon follow. This lack of investment is a threat to the development of new technology in Cumberland.

2.4.3 Technology in Clean Energy Industries

Amherst is considered the "tech hub" of Nova Scotia, home to large scale wind projects (Natural Forces, n.d.), solar projects (Municipality of Cumberland, 2018) as well as large geothermal and tidal energy potential coming from abandoned coal mines and the Bay of Fundy tides, respectively (Cumberland Energy Authority, 2018b). While not all renewable energy is being equally developed in Cumberland, infrastructure exists for wind, hydro, tidal, biomass and solar development (Capstone Infrastructure, n.d.). Wind energy has been given the most attention and technological resources have been diverted to erecting turbines across Cumberland, the majority in Amherst and Springhill (Cumberland Energy Authority). Cumberland is home to six major windfarms which host approximately three dozen turbines. Springhill is now progressing towards geothermal; a town once dominated by the coal industry, is adapting to new technology and recycling old and previously abandoned mine shafts for geothermal energy purposes (Gooding, 2015; Cumberland Energy Authority, 2018a; Patil, 2015). As part of Cumberland's mandate to become the greenest municipality in Nova Scotia, their shift to emerging green technology appears to be a major opportunity and the most significant technological force on the area.

2.4.4 Willingness & Rate of Change of Technology

There is clear opportunity and willingness to adapt to emerging technology, especially with clean energy. We are in an era in which technology is advancing quicker than we can adapt (Caliskan, 2015). This remains true for Cumberland; however, Cumberland has made great strides already. Once home to significant coal mining operations, the county is able to re-open the deep mines for geothermal purposes (Cumberland Energy Authority, 2018a). Further, Cumberland has access to plentiful natural shale gas potential, and is choosing instead to comply with the global movement of clean energy (Nova Scotia Department of Energy, 2017). When considering Cumberland's goal to become a model for green technology around the world, it is evident that the county is very willing to change.

2.4.5 Other Important Technological Factors

The following factors were identified as being important during the brainstorming activity: affordability of technology; education in technology; and employment in technology (Yuksel, 2012). These three factors did not have readily available information, however certain inferences can be made using Statistics Canada data.

Affordability

It is difficult to determine the affordability of technology without data supporting the cost of emerging technology in Cumberland, and without evaluating the excess income that Cumberland and its resident are able to spend on emerging technology. However, using income data, it is possible to make interpretations that there is a lack of affordability. The median household income in Cumberland is $43,385 vs. the national median income of $70,336 (Statistics Canada, 2016; Community Foundation Nova Scotia, 2016). This lower-than-national-average income, compared to the rest of Canada, when considering adaptation to new technology, indicate that the interest in new technology apart from green energy development is likely not great, and the affordability of new technology is not a priority.

Education and employment in technology

Post-secondary education in technology appears to be equally important in Cumberland as the rest of the country. Of the 25,260 respondents who have acquired post-secondary education, 1405 (5.6%) respondents have education in a technology-related fields (Statistics Canada, 2016). This is greater than the 5.2% national average of respondents who had post-secondary education in the same fields (Statistics Canada, 2016). Therefore, it appears that local residents have both an understanding as well as an appreciation for technology at a similar level to the rest of Canada.

While residents in Cumberland share a similar level of post-secondary education in technology-related fields as the rest of the country, there is no evidence that the existing industries in Cumberland provide enough employment opportunities for all degree-holders to fill technology-related job. In the Community Foundation Nova Scotia (2016) report, there are 20 listed labour forces/industries in Cumberland, none of which are directly described as being technology-related. Some examples of the industries reported include: manufacturing, transportation, mining/quarrying/oil and gas extraction, and waste management and remediation. These industries likely have technology-related positions within them, so an audit was done of employment opportunities in Cumberland using search engines indeed.com, simplyhired.ca, and wowjobs.ca. As of November 2018, there are very few direct technology-related jobs currently available, some key ones being “Aerospace Component Fabricator”, and “Software Engineer”. Most of jobs listed on these search engines require little to no technology-related skills such as retail worker positions, accounting positions, or administrative assistant positions.

2.4.6 Conclusion in Terms of Opportunities and Threats

The Community Foundation Nova Scotia (2016) report does not place any emphasis on technology in Cumberland, nor does it indicate that technology is a major topic of interest. However, there is at least one evident field in which technology is important in the county: clean energy. The county's goal of becoming the greenest municipality in the province creates many opportunities for emerging technology in Cumberland to advance the clean energy agenda. However, the greatest threats may also be attributed to the mandate to go green: although Cumberland has the drilling and mining technology from its days of the coal industry, the municipality may forgo some major economic growth by revoking the potential shale gas which is available to them. Another threat which exists is that currently, the majority of technology resources are being used on wind and tidal energy, causing a slower development of geothermal, solar and biomass energy. The advancement in clean energy and green technology is a great opportunity for Cumberland to bring in educated workers, greater investments, and increase revenue to the municipality. Apart from the clean energy aspect of Cumberland, other opportunities and threats exist. A great opportunity for Cumberland is to capitalize on social media and digital marketing to promote its already strong tourism industry and increase revenue from tourism. The greatest threats are that the municipality does not currently have the financial ability to support advancement of technology, and it does not appear to be a priority to the average resident. Conversely, the municipality is home to many educated workers, ready to fill job opportunities as they are created on the back of the green energy and tourism industries.

2.4.7 Opportunity/Threat matrix

Table B2: Description of forces found to the left are evaluated as either a threat, or a potential opportunity for Cumberland County. Some forces are not described in the full analysis, as these were flagged as potential forces during the brainstorm but were later found to be of no significance to the Municipality.

Technology Force	Threat/Opportunity	Justification or Note
Social Media	Opportunity	Room to increase marketing.
Affordability	Threat	Lower income, debt in Cumberland.
Rate of change	Threat	Can't keep up with emerging technology.
Existing technology and infrastructure (existing tech)	Opportunity/Threat	Technology exists but being focused on 1-2 energy sources, forgoing others.
Willingness to adapt	Opportunity	
Education in technology	Opportunity	Educated population available.
Employment in technology	Threat	Not enough employment to tech workers.
Accessibility to technology	Insufficient information	
Investment in technology	Threat	No current funding from local/foreign groups.

2.5 Environmental

External factors influencing the Municipality of Cumberland County from the natural environment can be broadly categorized as climate change impacts, natural resource base pertaining to energy extraction, air and water pollution, land use, and environmentalism. Each of those factors are described in detail below.

2.5.1 Climate change

Drastic climate change is bringing out a number of natural hazards worldwide. Being a coastal region, Cumberland county is at no exception. It is at the risk of facing a number of natural hazards including flooding, erosion, storm surges, and sea level rise. These hazards may have significant impacts on tourism sites, agricultural land, energy and transportation infrastructure, and also the homes of Cumberland County residents (Municipality of Cumberland, 2018c). Thus, natural hazards pertaining to climate change can be identified as significant threats affecting the Municipality of Cumberland.

Inland Flooding

Even though flooding is actually a natural phenomenon in a river's annual cycle with important benefits including recharging groundwater and enriching soil, it can present significant risks for human livelihoods and infrastructure built within the floodplains. This scenario applies to Cumberland County which holds the floodplains of river Hebert, river Phillip and Wallace river. Nevertheless, climate change may affect annual average temperatures and precipitation patterns of the region leading to increased severity and frequency of inland flooding (Municipality of Cumberland, 2018c).

Sea level rise and storm surges

Being surrounded by the sea in three directions, Cumberland County possess a coastline of over 850 kilometers, which is home to a range of coastal communities. These coastal areas continue to experience a varying level of coastal flooding, especially during storms. The worst instances are when storm surges occur during high tide pushing water levels rather higher (Community Foundation of Nova Scotia (CFNS), 2016). Due to climate change, frequency and severity of these events have increased and average sea level is on the rise due to the increase of global water levels. It has also been implied that the landmass of Nova Scotia is slowly sinking resulting in a relative rise in sea level in Cumberland County too. According to the available evidence, water levels are estimated to reach 3.5 meters on Northumberland coast and 14.1 meters in the Bay of Fundy (Municipality of Cumberland, 2018c).

Coastal erosion

Coastal erosion is another prominent risk imposed upon the coastal belt of the Cumberland County. Soft shores of Northumberland strait are facing a severe threat of coastal erosion (CFNS, 2016). When considering the above implications of climate change, it is evident that climate change is a prominent environmental factor that acts as a threat on the Municipality of the Cumberland County.

2.5.2 Energy reserves and potential

Wind energy

Being a coastal region with a relatively flat terrain, Cumberland county has a significant potential for wind energy production. As of now, there exist three large scale wind farms and the municipality have identified the land areas in which wind farms can be established further. Cumberland County has a comparative advantage for wind energy production especially due to the high wind speeds around Cape Chignecto, Advocate Harbour, Northumberland Strait, and the Cobequid Mountains (CFNS, 2016).

Solar energy

Moreover, the average amount of sunlight received by Cumberland County is relatively higher compared to other regions of Nova Scotia. This abundant solar resource can be considered as an opportunity to Municipality of Cumberland as there exist a potential for capturing and converting solar energy into electricity or heat energy for domestic heating purposes (Municipality of Cumberland, 2018c).

Tidal Power

The Bay of Fundy is a rich source of tidal energy. It has been estimated that 100 billion tonnes of water ebb and flow is available in the Bay of Fundy each day (MacDougall, n.d.). According to Karsten et al. (2008), channeling of the water in the Minas passage, a narrow 5 km strip between Cape split, Kings County, and Cumberland County, has the potential of generating 7000 megawatts of extractable power, from which 2500 megawatts can be generated without a significant impact on the marine environment using the tides. Thus, availability of a significant tidal flow can also be considered as an important environmental factor that impacts Municipality of Cumberland as an energy opportunity as it has the potential to be a consistent source of revenue, energy, and employment for the County (CFNS, 2016).

Geothermal

Another important energy opportunity Cumberland County possesses is the geothermal energy that is recoverable from abandoned mines in Springhill. Mine wells after abandonment have filled with ground water and has been naturally heated by earth. This warm water can be pumped out to extract heat energy using heat pumps and can be effectively used for space heating with significantly low cost. Several businesses in Springhill are taking advantage of this geothermal energy and there exist further investment opportunities for new businesses (Municipality of Cumberland, 2018c).

Natural Gas

Recently Nova Scotia released that large reserve of natural gas is available under Cumberland County. It was estimated that this onshore gas reserve will worth around US$ 60 billion (Cole, 2018). However, extraction of this shale gas requires hydraulic fracturing or fracking, which is a banned practice in Nova Scotia due to its environmental implications. When Municipality of Cumberland County is considered, availability of natural gas reserves can be considered as a significant environmental factor that poses an economic opportunity as well as an environmental threat due to its controversial nature.

2.5.3 Point and non-point pollution

In any municipality, point and non-point pollution can result in a number of human health, social and economic impacts. Air pollution is considered as the most prominent form of pollution generated from burning of fossil fuel for electricity and transportation (Environment Nova Scotia, 2009). Air pollution can lead to human health impacts such as heart and respiratory ailments, and also contributes to global scale implications such as climate change and ozone depletion. Nevertheless, water pollution is commonly caused by the contamination of ground and surface water bodies due to trash, oil spills, sewage spills, and run off from agricultural fields, construction sites and industrial sites. Polluted water can also cause serious human health problems in the community (Gillespie, 2018). Cumberland County has more than 80 lakes, and all of them are likely to be impacted to some scale due to human activities. For instance, in the recent past there were significant concerns about the water quality in Blair Lake and Mattatall Lake, two lakes in Cumberland County (Municipality of Cumberland, 2018c). Thus, water and air pollution can also be considered as significant environmental factors that can impact Municipality of Cumberland in their functionality.

2.5.4. Environmentalism

Environmental activism is leading to increased awareness of environmental concerns and adverse impacts of anthropogenic activities on the environment, while playing a major role in pushing governments to produce legislations and frameworks to help preserve the environment (Britt, 2012). There are several active NGOs in Nova Scotia, that can directly or indirectly influence the decisions of the Municipality of Cumberland, including Ecology Action Centre, Clean Nova Scotia, Nova Scotia Environmental Network, Nova Scotia Nature Trust, and local community groups such as Community of Amherst.

2.5.5. Land use

According to the Municipal Planning Strategy of Cumberland, 63.41% of total land area is woodlands and wetlands, and 23.42% is used as agricultural lands. (Municipality of Cumberland, 2018c). While seeded and natural pasture lands make up a little more than 6.2%, all other land uses are confined to 4.56% of total land area in Cumberland County. Land use patterns of a municipality can directly affect the environment, public health, economic growth, distribution of wealth, social outcomes, and attractiveness of the region. Land use changes can also have significant consequences for climate change mitigation as it has been identified as the causative factor for one third of all man-made CO_2 emissions (OECD, 2017). Hence, land use can also be identified as an important external environmental force to Municipality of Cumberland. In conclusion, most significant opportunities and threats faced by the Municipality of Cumberland due to external forces from the natural environment can be simplified as follows (Table B3).

Table B3: Opportunities and threats posed to the Municipality of Cumberland from the external natural environment.

Opportunities	Threats
1. Rich and diverse natural resource base pertaining to energy production • Coastal, flat terrain; wind energy • High tidal flow; tidal energy • Abundant sun light; solar energy • Abandoned mills in Springhill • Geothermal energy • Availability of natural gas 2. Environmentalism that leads to increased awareness 3. Positive land use changes	1. Impacts from topography and drastic climate change • Inland flooding • Storm surges and sea level rise • Coastal erosion 2. Availability of natural gas; negative impacts due to hydraulic fracturing which is a banned practice in NS 3. Air pollution due to fossil fuel burning for electricity and transportation 4. Surface and ground water pollution due to agricultural and industrial activities 5. Negative land use changes

2.6 Legal

There are several legal factors at play within the Municipality of Cumberland County which give rise to an assortment of opportunities and threats. To further analyze these factors, the legislative authority, bylaws, dispute resolution processes and legal services within the Municipality have been discussed.

2.6.1 Legislative Authority

The legislative authority and realities of the Municipal Council are relatively standard for all Municipal governments throughout Nova Scotia. As such, there are no unique opportunities or threats associated with the legal structure of municipalities. Regardless, it is important to understand how Municipal governments are empowered by the Province to regulate on a local level, and what this means in reality for Municipal Councils.

Authority Rooted in Statute

The Nova Scotia legislature enacted the *Municipal Government Act* of Nova Scotia ("the *MGA*") in 1998 to recognize that municipalities have legislative authority and responsibility with respect to a variety of matters that impact Nova Scotian's on a day to day basis. These include the administration and management of things like sewers, solid-waste resource management, streets and highways, electrical services and fire and emergency services. The *MGA* gives broad authority to Municipal Councils, including the authority to enact bylaws, while respecting their right to govern their jurisdiction.

Realities of the Municipal Council

The Council governing the Municipality of Cumberland County is responsible to represent the views of citizens while mediating conflicting interests in the community, making choices between tax rates and levels of services and determining priorities for the allocation of resources (Municipality of Cumberland, 2018a). All Council decisions in the exercise of its powers and duties are made by resolution, and the powers and duties of the Municipality (its jurisdiction and mandate) are specifically assigned in the *MGA* (Municipality of Cumberland, 2018a). Council also acts as an advocate on other public issues of community interest that may not be within their formal mandate (Municipality of Cumberland, 2018a).

2.6.2 Bylaws

Section 172 of the *MGA* gives the Municipal Council the power to create bylaws in order to regulate local communities. The Municipal Council has exercised their authority by enacting 92 bylaws and policies which are made available to the public online (Municipality of Cumberland, 2018b). After the 2015 merger with the Municipality of Springhill, several additional bylaws were also published under a "Community of

Springhill" sub file (Municipality of Cumberland, 2018b). Within this sub file there are 7 documents including a 172-page document detailing the entirety of the Springhill Municipality's bylaws and policies (Municipality of Cumberland, 2018b).

This structure raises several concerns for the Municipality of Cumberland County. Having multiple bylaws to regulate within the same jurisdiction will result in significant uncertainty in the law. As a result of the hodgepodge of bylaws it will be difficult to identify where the Municipality of Cumberland's bylaws have authority and where the Springhill bylaws have authority. This places a huge risk for any municipal planning projects that involve land use policies, septic treatment or any other regulated services provided by the municipal government. Recent reports have indicated that the Municipality is aware of these issues and that it has been working proactively to reconcile any differences and overlap to ensure that the bylaws are clear (Cumberland News Now, 2017; Municipality of Cumberland, 2018c).

Additional issues posed by the current state of the Municipality's bylaws include the inconsistency resulting from the different drafting styles of various Council members as well as the existence of bylaws which were drafted and enacted in the 1900s based on a very different standard of living (Cumberland News Now, 2017; Municipality of Cumberland, 2018b). Although some work has begun in terms of updating and reviewing the existing bylaws, there is still a need for the Municipality to undergo an overhaul project bringing all of the bylaws and policies into alignment, and into the 21st century (Municipality of Cumberland, 2018c). This type of project would help to ensure consistency, relevance and validity of the current bylaws.

2.6.3 Dispute Resolution

There are multiple avenues for the resolution of legal disputes within Cumberland County. These include litigation proceeding through the local Court system as well as alternative dispute resolution mechanisms including mediation and arbitration. These avenues provide minor opportunities and threats for the Municipality to consider.

Litigation & Local Courts

The Cumberland County Court system involves 5 levels of Court including the Supreme, Provincial, Family, Small Claims and Probate Courts (The Courts of Nova Scotia, 2018). Generally, the Judges who sit in the Amherst courthouse also preside in the Truro courthouse and vice versa (The Courts of Nova Scotia, 2018). An Adjudicator presides over Smalls Claims Court and the Registrar presides over Probate Court (The Courts of Nova Scotia, 2018). In order to pursue any litigation, Cumberland County residents follow the same Civil Procedure Rules dictated for the entire province. These rules are also very similar to most provinces in Canada providing some sense of consistency for possible litigants.

The various levels of Court in Cumberland sit less frequently compared with more densely populated areas in Nova Scotia. As a result, there are often longer waiting times when a litigant attempts to go to Court. This poses a relatively low-level threat, in that the residents of Cumberland may not be able to resolve their disputes as quickly as they would in another region. Additionally, if for some reason a high number of legal disputes arose, the Court dockets may quickly accumulate a significant backlog.

The local Court system, in particular the local courthouse provides a minor opportunity for the Municipality to capitalize on tourism as the Amherst courthouse represents a beautiful piece of Cumberland's history. When the courthouse was built in 1889, it solidified Amherst's position within the province as a major manufacturing centre (Courts Nova Scotia, 2004). The red sandstone courthouse was recognized as a historic site in 1983 and still remains in use (Parks Canada, 2018).

Alternative Dispute Resolution

The Cumberland County Bar Association ("CCBA") was formed in 1901 with the purpose of promoting education, fellowship and ethics among local lawyers and to foster public awareness of the legal system as well as an individual's rights and responsibilities in the law (Cumberland County Bar Association, 2009a). The CCBA now offers an Alternative Dispute Resolution program to attorneys, businesses and other members of the community (Cumberland County Bar Association, 2009b). The program was developed with the participation and support of the judiciary and offers two alternatives to litigation; mediation and arbitration (Cumberland County Bar Association, 2009b).

Mediation is a process in which a neutral or impartial third person acts to encourage and facilitate the resolution of a dispute without prescribing what the resolution should be (Cumberland County Bar Association, 2009b). Arbitration is an evaluative process that is similar to litigation but with less formality (Cumberland County Bar Association, 2009b). Alternative dispute resolution is a relatively modern concept that has been increasing in popularity over the last several years. The facilitation of mediation and arbitration by the CCBA is a definite strength for the Municipality of Cumberland. By providing these alternative avenues, the CCBA is working to overcome the risk associated with the local Court system by providing Cumberland residents with other avenues that can be used to resolve their legal disputes.

2.6.4 Legal Services

Within Cumberland there are several communities without any practicing lawyers. These include Advocate Harbour, Parrsboro, Pugwash, River Herbert and Tidnish (Nova Scotia Barristers' Society, 2018). Even in areas with practicing lawyers, they are few and far between (Figure B4). The fact that there are less than 40 lawyers within the Municipality, combined with the likelihood that many of those lawyers are close to retirement, if there is not already a gap in the provision of legal services, there will be in the near future

(Nova Scotia Barristers' Society, 2018). This provides an opportunity for the Municipality to invite young legal professionals to move to Cumberland.

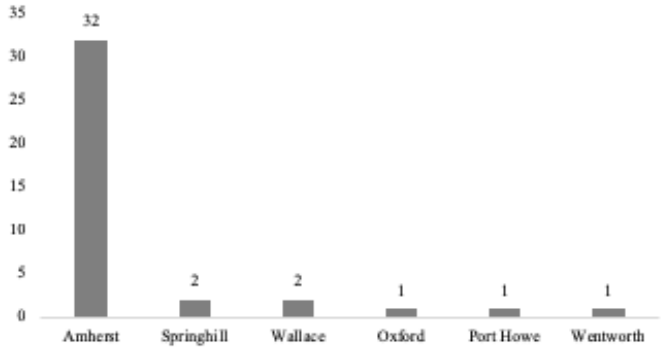

Figure B4: Lawyers in Cumberland County by community (Nova Scotia Barristers' Society, 2018).

The population of Cumberland is aging and declined by more than 3,000 people between 2011 and 2015 (Community Foundation of Nova Scotia, 2016; Amherst & Cumberland, 2014). As a result, the demand for legal services within the Municipality is evolving. As the population continues to decrease, the demand for legal services will likely decrease proportionately. However, in 2015 the population of Cumberland was comprised of 25% senior citizens, residents aged 65 and up (Community Foundation of Nova Scotia, 2016). As a result, there is likely an increased demand for end of life planning legal services. Combined with the low number of legal professionals in the region, there is an opportunity for the Municipality to advertise the economic potential for young lawyers who could develop a busy wills and estates practice servicing the various communities in Cumberland.

2.6.5 Conclusion

The legal factors impacting the Municipality of Cumberland County are not unique, particularly in comparison to other more rural areas in Nova Scotia. As such, the legal factors do not have a significant impact on the Municipality and result in only minor opportunities and threats. There is an opportunity for the Municipality to encourage an influx of young families by advertising the potential within the legal services industry, particularly for those interested in wills and estates law.

Additionally, the implementation of the CCBA's alternative dispute resolution program represents an opportunity for Cumberland to step into a leadership role in terms of providing citizens in rural areas with alternatives to litigation. The alternative dispute resolution program also serves as a neutralizing factor that should help to mitigate the risks posed by the infrequent Court sessions. The only major threat imposed by legal factors in Cumberland involves the current state of the Municipality's library of bylaws. These bylaws need to be updated, organized, consolidated where needed and formatted in a consistent and professional manner to overcome the risk of competing legal authorities.

3.0 Synthesis

To gain more insight about the government and leadership in Cumberland, a PESTEL analysis has been carried out with the aim of identifying the Political, Economic, Social, Technological, Environmental, and Legal forces that have impacted the Municipality of Cumberland. This synthesis aims to provide an integrated discussion of these findings in order to identify any significant opportunities and threats that could potentially impact the Municipality.

The municipalities of Springhill and Parrsboro dissolved and merged with the Municipality of Cumberland in 2015 and 2015 respectively. As a result, Cumberland incurred significant debt and generated legal uncertainty through the multitude of additional, repetitive and in some instances contradictory bylaws. The Municipality's bylaws, which now include those from Springhill and Parrsboro represent a threat to the Municipality, particularly considering any future planning or developments. There is a recognized need to ensure these bylaws are up-to-date, consistent and clear and a project focusing on reviewing all land-use bylaws has already commenced (Cumberland News Now, 2017). However, the remaining collection of bylaws still include some ineffectual and confusing policies.

The town of Amherst is considered to be a green-energy technology hub within Nova Scotia which is evident by the wind farm that welcomes visitors to the province. Amherst is a provincial leader in sustainability and green technology, leading the charge in windfarm development, in addition to the other solar and tidal energy opportunities in the area (Natural Forces, n.d.). The town of Amherst truly reflects Cumberland's commitment to green energy and provides an important example of how to use green energy development as an opportunity to create jobs and increase the demand for education and skilled labour.

Despite making significant steps in the right direction, Cumberland is not immune from the impacts of climate change which has resulted in an increased frequency of natural hazards worldwide. In particular, Cumberland's proximity to the ocean creates many environmental threats in the form of flooding, hurricanes and sea level rise (Municipality of Cumberland, 2018a; CFNS, 2016). Even so, natural resources including the energy associated with tidal flow and high wind speed near the Bay of Fundy represent an excellent opportunity for green energy generation through tidal and wind energy projects (CFNS, 2016; MacDougall, n.d.).

Al Gilis, the Warden of Cumberland County recently voiced his ambition to "become the greenest municipality in the province and [to] set a standard for the [rest] of the world" (Municipality of Cumberland, 2018b). In pursuit of this goal, the municipality has been diverting their focus towards tidal, solar and wind energy, largely through the addition of manpower and investments to these initiatives (Merrill, Zwicker, & Bruce, 2010; Department of Energy, 2018).

The hope is that these investments will keep skilled laborer's in the municipality while attracting new skilled youth to the area (Town of Amherst and Municipality of Cumberland, 2014). This is a great opportunity for young families to migrate to the area, particularly when combined with Cumberland's low housing costs which average to $78,000 per home (CFNS, 2017). However, the push for green energy technology is accompanied by some criticism based on the ignored energy and economic potential of the gas-rich shale in the area (Hayes & Ritcey, 2014). Despite these criticisms, the Municipality will not be able to develop these resources unless the ongoing moratorium on hydraulic fracturing in Nova Scotia is lifted.

These economic concerns are bolstered by the fact that the local economy cannot currently support itself without outside investment (Community Economic Development Strategy, 2014). The twelve major industries existing in Cumberland, including healthcare, manufacturing, retail trade, public administration and education are all facing significant downsizing and job loss (CFNS, 2017). As a result, the unemployment rate in Cumberland is 11.4% which is slightly higher than the national average of 7.7%, despite the fact that 55% of the workforce has some form of post-secondary education (Statistics Canada, 2017). These factors pose a significant threat to the Municipality of Cumberland as the number of jobs available continues to decrease forcing qualified workers to migrate to more opportunistic areas. Combined with the aging population, this will likely result in demographics issues including senior care availability in the near future.

In response to pressure from job loss, an aging population, the outward migration of people and incurred municipal debt, Cumberland is committed to supporting the progressive energy industry and the encouragement of a sustainable future for local communities. This commitment is highlighted by the fact that homes in Amherst are powered by wind turbines, homes in Parrsboro are powered by tidal energy generated by turbines in the Bay of Fundy and geothermal energy powers the Springhill Community Centre as well as several Springhill businesses.

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Appendix C: Supporting Data for Environmental Impacts

Table C1: Sampling Results for Individual VOCs (Maskrey et al., 2016).

Site A individual VOC Sampling results								
Compound[a]	Baseline conc. (ppb)		Fracturing conc. (ppb)		Flaring conc. (ppb)	Post-flaring[b] conc. (ppb)	PADEP background concentration ranges	
	11/17/2011	11/18/2011	11/30/2011	12/9/2011	12/28/2011	1/11/2012	Florence[c]	Charleroi[d]
1,4-Dioxane	<0.13	<0.16	0.17	<0.14	<0.16	<0.15	–	–
2-Butanone	<0.66	<0.80	<0.67	0.90	<0.82	<0.76	0.28–0.56	0.19–2.6
2-Propanol	5.4	<0.80	<0.67	<0.72	<0.82	<0.76	0.31–0.60	–
Acetone	7.4	2.8	2.0	1.0	0.84	2.1	7.0–99	7.2–29
Benzene	0.16	<0.16	0.19	<0.14	0.20	0.22	0.092–0.25	0.12–0.36
Chloromethane	0.36	0.35	0.50	0.34	0.45	0.42	0.59–0.68	0.010–0.64
Cyclohexane	<0.17	<0.16	<0.13	0.22	<0.16	<0.15	–	5.7–14
Dichlorodifluoromethane	0.40	0.44	0.46	0.38	0.47	0.48	0.55–0.65	–
Ethanol	7.6	1.6	1.2	0.79	<0.82	1.1	–	–
Hexane	0.13	<0.16	0.28	<0.14	0.25	<0.15	0.034–0.035	0.59–1.5
Methylene chloride	<0.26	<0.32	<0.27	<0.29	<0.33	0.38	–	–
Toluene	0.23	<0.16	<0.13	1.8	<0.16	0.17	0.068–0.16	0.27–0.67
Trichlorofluoromethane	0.32	0.22	0.22	0.18	0.21	0.22	0.25–0.30	–
m,p-Xylene	0.14	<0.16	<0.13	<0.14	<0.16	<0.15	–	0.091–0.24
Site B individual VOC sampling results								
Compound[a]	Baseline conc. (ppb)		Fracturing conc. (ppb)			Flaring conc. (ppb)	PADEP background concentration ranges	
	11/17/2011	11/18/2011	11/30/2011	12/9/2011	12/27/2011	12/28/2011	Florence[c]	Charleroi[d]
Acetone	9.0	4.2	1.7	<0.64	1.6	1.1	7.0–99	7.2–29
Benzene	<0.17	<0.13	0.21	0.27	0.19	0.34	0.092–0.25	0.12–0.36
Chloromethane	0.32	0.29	0.49	0.14	0.42	0.41	0.59–0.68	0.010–0.64
Cyclohexane	<0.17	<0.13	0.20	<0.13	<0.15	<0.15	–	5.7–14
Ethanol	10	1.1	0.92	<0.64	0.82	<0.74	–	–
Dichlorodifluoromethane	0.32	0.32	0.46	0.18	0.48	0.50	0.55–0.65	–
Heptane	<0.17	<0.13	<0.17	<0.13	0.23	0.28	0.06	2.7–8.8
Hexane	<0.17	<0.13	0.28	<0.13	0.40	0.60	0.034–0.035	0.59–1.5
Toluene	<0.17	<0.13	<0.17	<0.13	0.16	0.22	0.068–0.16	0.27–0.67
Trichlorofluoromethane	0.21	0.14	0.22	<0.13	0.20	0.21	0.25–0.30	–

– not included in analytical methodology

Table C2: Comparison between Regional Screening Levels (RSL) and 24-h sampled value for individual volatile organics (Maskrey et al., 2016).

Volatile organic compound	Maximum detected concentration (ppb)	Site at which maximum occurred	RSL (ppb)	Risk ratio RSL:Max
1,4-Dioxane	0.17	A	15.8	93
2-Butanone	0.90	A	1380	1500
2-Propanol	5.4	A	11,600	2100
Acetone	9.0	B	52,600	5800
Benzene	0.34	B	11.4	34
Chloromethane	0.50	A	5910	12,000
Cyclohexane	0.22	A	21,200	96,000
Dichlorodifluoromethane	0.50	B	821	1600
Ethanol	10	B	–	–
Heptane	0.28	B	–	–
Hexane	0.60	B	2300	3800
Methylene chloride	0.38	A	113	300
Toluene	1.8	A	5390	3000
Trichlorofluoromethane	0.32	A	723	2300
m,p-Xylene[a]	0.14	A	93.5	670

[a] The RSLs for m-xylene and p-xylene are both 93.5 ppb for the selected exposure parameters

Appendix D: Supporting Data for Health Implications

Table D1. Summary of empirically supported literature review findings on fracking and psychosocial health (Hirsch et al., 2018).

Author(s)	Year	Sample type	Methodology	Main finding
Brasier et al.	2014	Students, low-income residents, institutions, agricultural and healthcare representatives	Policy review, focus groups, and survey	Worry and anxiety about self and community
Drummond and Grubert	2017	Community members	Interview	Tension, loss of trust in the government and industry
Evensen and Steadman	2017	Community members	Interview	Acknowledged potential for flourishing via fracking benefits, with fears of disruption and non-flourishing
Filteau	2014	Oil/gas workers	Interviews	Perceived stigma and hostility
Lai et al.	2017	Community members	Survey	Negative perceptions of fracking related to negative emotions; positive perceptions related to positive emotions; loss to self and place more salient than gain
Maguire and Winters	2016	Community members	Survey	Poor life satisfaction; more work days missed for mental health reasons
Mauro et al.	2014	Community members, organizations, and industry	Secondary analysis of public comments	Concerns and worries about pollution and traffic and their impact on mental and physical health
McDermott-Levy et al.	2016	Community members	Qualitative and descriptive	Stress, powerlessness
Morgan et al.	2016	Australian farmers	Survey	Concern about fracking impact to health, farm, and communities; greater depression, anxiety, and stress reactivity
Morrone et al.	2015	Community members	Interviews and survey	Disrupted social cohesion, erosion of community pride, feeling exploited, breakdown of shared community values Changes in social interactions, altering history and memories, sense of loss and sadness
Powers et al.	2015	Community members	Secondary review of letters to the editor	Concern about changes to rural "way of life," competition for resources, fear of pollution
Sabari et al.	2014	Primary care patients	Survey	Anxiety, sleep disturbances
Sangaramoorthy et al.	2016	Community members	Focus groups	Disrupted sense of place and social identity, changed relationships, social distress including uncertainty, anger, fear, and anxiety
Short and Szolucha	2017	Community Members	Ethnographic, interviews and observation	Stress, worry, collective trauma
Szolucha	2016	Community members	Ethnographic and interviews	Stress, strain, fear, anxiety, mental anguish, sleep disturbances
Weber et al.	2014	Social Service Directors	Focus groups	Increased homelessness, domestic violence, and food insecurity

Table D2: Human health and environmental risk management options for shale gas hydraulic fracturing hazards using the REACT framework (Larkin et al., 2018).

Risk Management Option				
Regulatory	**Economic**	**Advisory**	**Community-based**	**Technological**
Approvals and approach				
Single body lead for regulatory responsibilities Comprehensive regulatory protections with performance monitoring, inspection, enforcement Life cycle environmental risk assessment Comprehensive gas development plans; regional planning Industry best practices Combined federal/state risk governance and land management Associated enforcement resources	Bond and insurance protections (people and environment) Royalty/benefit sharing with communities Aboriginal support	Industry codes of conduct or centres of excellence Full and transparent access to information by all stakeholders	Joined-up engagement of local communities (including First Nations) in work of single body lead for regulatory responsibilities Community participation in environmental risk assessment Develop criteria for community permission to proceed/consent Regional, potentially inter-provincial review committee on watershed basis Risk reduction and benefit sharing, including equity lens for when, where and to whom benefits and harms may accrue	Baseline (environmental, socio-economic, socio-ecological) data Early risk assessment and risk management process (health, social, environmental) Re-assessment of risk management options Enhanced monitoring systems Equipment design, use, maintenance Safety management of equipment and processes

Environmental monitoring				
Follow principles of Framework for BC Air Monitoring Network RA enforced through monitoring and inspections		Consider goals of monitoring programs Make publicly available - ambient data for air, water, soil, vegetation, food	Add locations	Expand mapping - ambient (baseline monitoring) data for air quality, water, soil, vegetation, food, chemicals of potential concern Study groundwater and surface water interactions Monitor methane leakage
Air quality				
Ambient air quality objectives - NO2 and SO2 Link venting, flaring, and fugitive emissions to air quality objectives Reporting Risk management audit		Learn from operational and regulatory best practice internationally - WHO, Health Canada	Community panel for air quality monitoring and objectives Determination of "safety hazard"	
Water quality				
Baseline, integrity test data provided to regulators and used to inform (evidence-based) policy and regulatory requirements Establish wellhead protection areas Well integrity tests and inspections Setbacks Regulator disclosure – public e-database	Industry fees or payments for analysis and public consultation Fines for under-reporting	Baseline, monitoring data publicly available Online access to investigative reports of contamination	Water safety planning	Baseline groundwater and surface water tests and surveys Regional groundwater monitoring Pre- and post-drilling water samples

Fracture fluid composition				
Well stimulation materials disclosure Flow-back chemical disclosure Duty to inform Use of most benign fluids and/or prohibition		Full disclosure on emergency basis		
Seismicity				
Suspend operations at 4.0 M or greater event Establish induced seismicity monitoring and reporting at magnitude 2.0 M Require submission of micro-seismic reporting Implement regulatory scrutiny for disposal wells including permit conditions Cradle to grave measurement, characterization and tracking of waste		Research relationship between HF parameters and seismicity Data sharing, publication, awareness Traffic light system	Determine buffer zones near subsurface disposal or storage facilities	Collect baseline data Identify pre-existing faulting Establish induced seismicity monitoring and reporting at magnitude 2.0 M Enhance Canadian National Seismograph Network Install ground motion sensors Use portable, high resolution dense seismograph array
Human health surveillance				
Make publicly available - ambient data for chemicals of potential concern Review, revise, standards for exposure	Funding for public health studies	Public access to ambient data	Coordinated research agenda for human health Health care forum	Baseline assessments (those living, working, at school, recreation, playing) Disease rate and birth outcome surveillance Monitor standards for exposure

Worker and public safety				
NIOSH and OSHA controls for operation Management of NORMs Setbacks	Workplace inspection resources Employers provide employee assistance programs		Emergency planning Community outreach to transient workers	Safety management of equipment and processes Emergency shut down Setback calculation tools
Information management				
Government and industry accessible data sharing Reporting of well failures Disclosure - post inspections, cases of contamination, violations, impacts		Objectives and use of databases reviewed to make systems more accessible and user-friendly; including access by researchers Federal role for information collection and dissemination (industrial, regulatory, public)	Improve public engagement and transparency	
Legacy sites				
Standards and rules for permitting and liability	Performance-based taxes and fees Liability coverage Well closure and environmental restoration bond Impact fee, distributed to community	Use of site classification tool and framework for management of contaminated sites		Monitor abandoned wells