Mining for Sustainability: Examining the Relationships Among Environmental Assessments, Mining Legacy Issues, and Learning

by

Morrissa Boerchers

A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfilment of the requirements of the degree of

MASTER OF NATURAL RESOURCES MANAGEMENT

Clayton H. Riddell Faculty of Environment, Earth, and Resources

Natural Resources Institute

University of Manitoba

Winnipeg

Abstract

Mining has left many long-lasting effects, often negative. Mining continues to this day and questions persist; "what are the legacies of mining, to what extent do our approval and assessment processes consider these effects, are we learning from our past experiences and how can we amplify our learning?" To answer these questions I interviewed people from the mining community of Snow Lake, Manitoba as well as mining and assessment experts from across Canada.

Data collected though document analysis and semi-structured interviews with 24 participants were analyzed using mining legacy, EA, and transformative learning frameworks. Results reinforce a suite of negative legacy effects identified in the literature. EA may be the best tool we currently have for long-term planning but data show it is unable to fully consider legacy effects. Learning is important for moving towards sustainability; however, a community's economic dependence and mining friendly culture can act as barriers to learning.

Acknowledgements

Conducting research and writing a thesis has been a great experience and I have learned much. There are a number of people to whom I am indebted and would like to thank. Their support and encouragement truly made this document possible.

First, I would like to thank my research participants both in northern Manitoba and across Canada. I would have no data and no project if it weren't for your kindness and willingness to sit down and talk. Thank you, to the people of Snow Lake who welcomed me into their community, shared their lives with me, and showed me the friendliness and charm of 'the North'. Thank you, to the mining and assessment experts from across the country who made time to talk with me on the phone and share their considerable knowledge and experience. I am glad to have met each one of you.

Second, thank you to my tireless advisor, Dr. John Sinclair. You have been a fantastic guide and invaluable mentor along my research journey. Your thoughtful and timely comments on innumerable drafts have made this thesis what it is. The members of my thesis advisory committee: Dr. Norm Halden, Dr. Bob Gibson, and Dr. Trish Fitzpartick, also deserve a great deal of thanks. Each one brought a special skill set and point of view that expanded and improved my research. My thesis has been greatly improved because of your careful review and thoughtful insight throughout the process.

Third, the administrative staff at the Natural Resources Institute have been incredibly helpful and supportive. Time and time again they have saved me from temperamental printers and paperwork nightmares. They keep the department running smoothly and I'm fairly sure that I would not even be registered yet if it weren't for them!

Forth, thank you to all my friends, family, and colleagues who not only supported me through this process but also helped me achieve some balance in my life outside of school. You all make me a better person and I am incredibly thankful to have you in my life. I promise I will stop talking about mining and edits now!

Last, I would like to acknowledge and thank the Social Sciences and Humanities Research Council of Canada and the University of Manitoba for the financial support they provided.

Table of Contents

List of Tables

List of Figures

List of Photos

Glossary of Terms and Acronyms

ARD – Acid Rock Drainage

CEAA – Canadian Environmental Assessment Act

EA – Environmental Assessment

ENGO – Environmental Non-Governmental Organization

FIFO – Fly-in/Fly-out

MMSD - Mining, Minerals and Sustainable Development

MOU – Memorandum of Understanding

SA – Sustainability Assessment

SSHRC – Social Sciences and Humanities Research Council

Chapter 1: Introduction and Context

1.1 Background

Mining is a necessary human activity that has been practiced since the beginnings of human history; however, it clearly has extensive socio-economic and ecological ramifications (McAllister and Fitzpatrick 2010; Worrall et al. 2009). Technological advances as well as improvements to mining regulations and management practices have lessened the difficulties associated with mining to some degree and provided great benefits. Even with these improvements mining is still a temporary and often uncertain activity that has potential to lead to long-term environmental issues and regrettable legacy effects (Sandlos and Keeling 2013).

The non-renewable nature of mineral resources and volatile mineral prices mean that all mines will eventually end production and close (Natural Resources Canada et al. 2006). Mining companies' interests in the land are tied to the mineral resource and are therefore limited in nature as well. Mine closure is inevitable and as such needs to be considered thoroughly in the planning and licensing stages so that sustainable decisions can be made so that mines can provide positive net sustainability benefits. The federal, provincial, and territorial, governments regulate the mineral industry in Canada and have created legislation and regulations to govern mining activities and mine remediation (e.g., MacKasey 2000; Natural Resources Canada et al. 2006). In recent years, the once growing and improving body of Canadian environmental regulation has been weakened (Gibson 2012a). Many wonder if current regulations are sufficient and mines are truly being planned and operated in a way that not only avoids negative mining legacy effects but also promotes long term sustainability (Gibson 2012a; Johnston 2014).

Since the popularization of "sustainable development" in the late 1980's, the mining industry has been endeavoring to embody the concept in mining operations (Azapagic 2004;

Hilson and Murck 2000; Worrall et al. 2009). Mining creates both positive and negative sustainability effects (Worrall et al. 2009). Unfortunately, the negative long-term and local effects can outweigh the positive short-term and local effects so the ideas of "mining" and "sustainability" still often seem to be at odds with each other (Cater and Keeling 2013; Durucan et al. 2006; Gibson and Robinson 2014; Sandlos and Keeling 2013). If mining is to be a sustainable practice and lead toward greater regional sustainability then a number of steps must be taken. For example mine operators must work to minimize adverse ecological effects throughout the lifecycle of the mine by using effective environmental management techniques and adopting cleaner mining technologies (Hilson and Murck 2000; Warhurst and Mitchell 2000). As well, mine revenues and employment opportunities must be used wisely to build solid foundations for sustainable local livelihoods that persist well after the mine has ended production (e.g., Gibson et al. 2005; Hilson and Murck 2000; Worrall et al. 2009). Also, mine infrastructure, built to facilitate mineral extraction, should be planned and constructed in a way that maximizes local use and service of post-mine interests (Gibson et al. 2005). Further, if we truly wish to ensure sustainable futures, companies must remediate their mine sites according to the completed environmental assessments and closeout plans.

Many mining activities result in severe and significant adverse environmental effects, both natural and social (Worrall et al. 2009). Effective mine remediation is an essential component of ensuring such ecological legacy effects are properly managed. Land must be returned to its pre-developed state or, if that is impossible, land must be remediated to a suitable state that allows for future use and local development (Bradshaw and Chadwick 1980; Hilson and Murck 2000). Effective and timely remediation also ensures that negative legacy issues of this sort do not persist and plague the local community after the mine has closed and the

proponent has left (Worrall et al. 2009). Legacy issues of this type are usually barriers to sustainability and "represent real or potential threats to the natural environment and to human health and safety" (Worrall et al. 2009, 1429). In this regard, sustainability assessment suggests not only that mining activities should avoid enduring negative legacy issues, but also that mining activities should lead to positive mining legacies such as employment training, community investment, and beneficial infrastructure, and any residual trade-offs should be well justified.

Sustainability assessments, the next generation of environmental assessment, are viewed as an essential tool in the move towards sustainability (Gibson et al. 2005; Pope et al. 2004). Sustainability assessments are absolutely necessary in the world today because dominant human actions have been and continue to be mostly unsustainable (Gibson et al. 2005). This new approach to assessment may be a way to ensure that all stakeholders' interests and the lasting viability of the area are considered (Gibson et al. 2005; Gibson 2006b). Sustainability assessments are better suited to deal with legacy issues because the focus on overall net sustainability means that potentially significant projects are designed to produce long term positive inputs to sustainability (Gibson 2012c). Lasting damages such as adverse mining legacy effects are therefore limited using this next generation assessment approach.

One hope for moving towards greater sustainability is learning from past experiences and mistakes. Learning is at the centre of sustainability assessment (Bond and Morrison-Saunders 2012; Gibson et al. 2005). As established in the literature (e.g., Petts 1999; Sinclair and Diduck 2001; Webler et al. 1995) opportunities for learning and building community capital through environmental assessment are essential. Sinclair et al. (2015) also reveal the importance of individual and social learning to sustainability assessment, especially when considering legacy

effects and tradeoffs. Sustainability assessments could, therefore act a mediating process to deal with mining legacy issues while also leading to participant learning and greater sustainability.

1.2 Purpose and Objectives

The research considered sustainability effects of the mining industry in Canada. The purpose of the research was to inform next generation sustainability assessment in terms of the incorporation of legacy effects, and improving the way that such effects are considered in assessment activities. The specific objectives of this research were to:

1) Identify and confirm the suite of legacy effects from mining in Canada
2) Examine the degree to which mining approval processes, such as environmental assessments, consider mining legacy issues
3) Establish how learning from past experience with mining approvals and development can inform the consideration of legacy effects for future decisions; and,
4) Establish how learning approaches can be incorporated into development decision-making processes to help ensure such legacy effects are considered.

1.3 Methods

The research followed a qualitative approach utilizing a case study research strategy (Creswell 2013b). Employing this format, I investigated Snow Lake, Manitoba, a mining community in Canada with a long history of mining in the region as well as recent environmental assessment activities and current mining. I conducted a focused study in Snow Lake and collected data from local residents, environmental non-governmental organizations, civil society groups, mining corporations, and government officials through a series of semi-structured interviews. Additionally, I interviewed mining and assessment experts from across the country. Questions were designed with the aid of relevant literature (e.g., Foddy 1994) and focused on environmental assessments, mine legacy, and sustainability. Data were managed and analyzed

using the QSR NVivo software, broken down into data segments, coded, and placed into meaningful categories to show themes and key ideas (Marschke and Sinclair 2009). The methods are described in detail in Chapter 3.

1.4 Contribution to Knowledge

This research tests common legacy effects of mining identified in Gibson and Robinson's work (2014) and assesses the efficacy of EA for considering these effects. It also adds to thinking on transformative learning literature and offers insight on how people learn from past experiences and how to better incorporate learning outcomes in decision-making processes for more sustainable futures. Hopefully, the results will also influence and improve the way mineral projects are planned for in the future (e.g., in Northern Ontario's Ring of Fire area) and add to the growing body of literature associated with the next generation sustainability assessments.

1.5 Organization of Thesis

This thesis is organized into six chapters, including this introduction chapter. The second chapter consists of a literature review of several pertinent topics and works including: a brief history of mining, effects of mining, environmental assessment and sustainability assessment, and learning for sustainability. Chapter two concludes with a framework for analysis informed by the literature. The third chapter outlines the research design and describes the methods used in the thesis. It describes the data and justifies the use of a case study method. Data collection methods, as well as analysis methods, are presented in this chapter, including participant selection and coding of the semi-structured interviews. The third chapter also details the ethical steps taken to protect participants in this research. Chapter four describes the case study, and offers discussion on the suite of legacy effects. Chapter five examines current EAs' consideration of legacy effects and discusses their strengths and weaknesses. Chapter six deals with the learning objectives, offering results and discussion of learning outcomes and approaches. Last, the seventh and final

chapter proposes a conclusion to the thesis and a gives a brief summation of the research findings, discuss their significance and implications for the literature and for practice, and report areas for further research.

Chapter 2: Mining, Assessment, and Learning

Topics canvased in this literature review chapter include mining, legacy effects of mining, environmental assessment and sustainability assessment, and learning for sustainability. At the end of this chapter, I outline the analytical framework inspired by the literature.

2.1 Introduction

Mining is not a new human activity, nor an activity that is likely to end in the near future. Mining is the process of obtaining desirable mineral and metal resources from the earth (McAllister and Fitzpatrick 2010). This process has been occurring since humans began using stones and metals for tools and minerals for jewelry and trade (Rees 1985). Mining has been an important industry in Canada since before it was a country, and its importance and dominance continues to this day. According to the Mining Association of Canada (2014), over 418,000 people are employed in mining and mining related activities across the country. Approximately 20% of the value of Canadian exported goods in 2012 came from the mining industry, and mining contributed $52.6 billion to Canada's Gross Domestic Product that same year (The Mining Association of Canada 2014). The industry also pays taxes and royalties that benefit the provincial and federal governments. Clearly mining has been and continues to be a very significant industry in Canada.

Industrial mining in Canada's North has also produced extensive negative social, economic, and environmental effects on the surrounding area and nearby aboriginal communities since before the beginning of the twentieth century (Keeling and Sandlos 2009). Though mining can lead to much wealth and prosperity for some, the benefits of mining are often experienced in large southern cities (like Toronto and Vancouver) where the companies and many of their shareholders are located (Worrall et al. 2009). As the industry expands and globalizes, the wealth

gained from mining is even being syphoned into other countries. Some argue that the wealthy mining companies grow richer by exploiting a region's mineral endowments and the region itself suffers socially, economically, and environmentally (Keeling and Sandlos 2009). There must be a better way of mining so that local communities benefit from their resources and have the opportunity to improve and sustain their community after the mining industry has left and the mine has closed.

2.2 Negative Mining Legacy Effects

Under current technological circumstances most minerals and metals are considered to be non-renewable resources (Dicken 2011). Minerals and metals exist in a fixed overall quantity on the earth and when consumed become irreplaceable. Many metals and minerals are recyclable; however, recycling is often not carried out to its full potential (Moody 2007). People inhabiting modern societies depend on metals and minerals for power, housing, transportation, infrastructure, and consumer goods. Mineral and metal resources are invaluable to modern-day living, but as finite resources it is imperative that they are managed properly and developed in a way that their mining positively contributes towards sustainability (Gibson and Robinson 2014; McAllister and Fitzpatrick 2010; Rees 1985). The history of Canada and the building of nation, provinces, and territories has been inextricably linked to mining and the natural resources sector, "so much so that resource development was once considered synonymous with public interest" (McAllister 2004, 348). Mining activities in Canada, especially historic activities, have benefited the public in many ways and it is not unreasonable to say that a large portion of the government's investment in our country's transportation and communication infrastructure is due to mines (McAllister 2008). Without mining and other geographic specific extractive industries, the investment would not be present. That being said, we must weigh and consider the long-term legacies of mining. Gibson and Robinson present a framework of mining legacies (2014) in

which they assert that there are five key types of mining legacy effects residual environmental effects; residual effects on communities, boom and bust cycles, remaining infrastructure, and resource depletion; all of these legacy effects categories should be considered and addressed at the assessment stage in order to ensure a mining project leaves positive legacy effects and if at all possible, no significant adverse legacies (Figure 1).

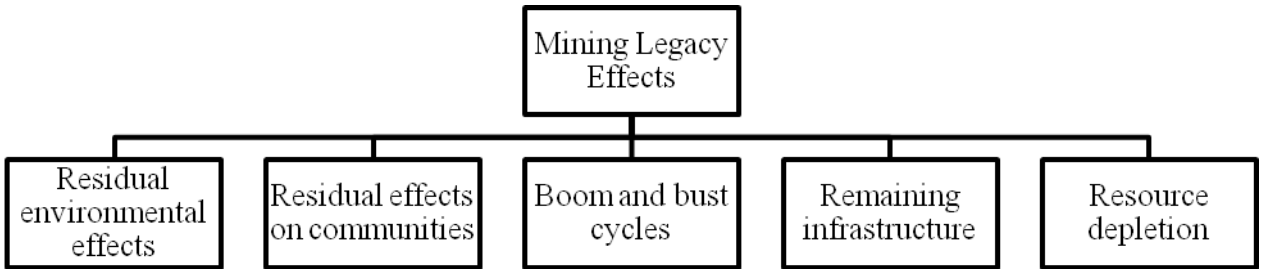

Figure 1: Mine Legacy Effects. Adopted from Gibson and Robinson 2014.

2.2.1 Residual Environmental Effects

The main root of mining's environmental impact is the movement of vast amounts of earth. This movement of earth can take many forms and includes: open pits, slag mounds, waste rock piles, and tailing ponds. Typically, only a small percentage of the desired mineral ore is found in the total rock excavated. This fact has led to the adage that mining is primarily a waste management industry (Gibson and Klinck 2005). Mineral and metal processing is a separating process through which the mineral is removed from the mined rock (waste rock). Approximately 42% of the excavated material is rejected immediately as waste rock in an average Canadian mine; another 52% is rejected from the mill as tailings, and a further 4% is rejected as slag from the smelter (Crowder et al. 1995; Sandlos and Keeling 2013). Only the remaining 2% of the total material mined contains the minerals or metals for which ore is mined. Solid waste from

mining accounts for the largest proportion of industry waste on a global scale (Sandlos and Keeling 2013). Though waste management makes up a large portion of total landscape modifications, landscape modifications are not limited to the relocation of earth. Infrastructure built to support and accommodate mining activities such as roads, power sources, stacks, smelting complexes, and head frames all have effects of the natural landscape (Bridge 2004).

Mining and related activities such as processing and smelting also often generate toxic by-products from process chemicals such as cyanide and arsenic to heavy metals (Sandlos and Keeling 2013). These pollutants are released into the environment by way of the atmosphere, water systems, and onto the land (Bridge 2004). The type and amount of pollution and waste depends on the range of minerals extracted and the diversity of environments that extraction takes place in so it varies from mine to mine. Besides being voluminous, waste from mining activities is often chemically reactive and becomes more concentrated with each stage of ore processing. Because of their high level of processing and pollutant concentration, tailings can be the most detrimental to the environment (Moore and Luoma 1990). Tailings are the finely-ground resultant residue from the mining process that consists mainly of gangue (commercially worthless) minerals, process water, process chemicals, and unrecovered minerals (Younger and Wolkersdorfer 2004). These mine generated tailings, spoil heaps, and mineral stockpiles require careful management lest they contaminate local water resource through runoff of water with excessive dissolved minerals, and other suspended solids (Younger and Wolkersdorfer 2004). Recent tailings disasters (e.g., Mount Polley in BC and Fundão in Brazil) illustrate that there is a real threat of dam failure both during and after mine operations (Hunter and Hume 2015; Eisenhammer 2015; Johnston 2014). Dust from drying tailings (non-vegetated) also causes issues as the toxic particles can be blown by the wind to nearby ecosystems and to communities

causing potential health problems and indirect effects through contamination of harvested wildlife, etc.

Acid rock drainage (ARD also known as acid mine drainage) can also pose major environmental risks (Bridge 2004). ARD may be the biggest environmental issue facing the mining industry (MEND 2014). ARD is created when sulfides (many metallic ores are found as sulfides – nickel, copper, lead, etc.) oxidize to form sulfuric acid as they are exposed to oxygen and water (Bridge 2004). The generation of sulfuric acid from sulfide ores, if not properly managed, can generate ARD and can negatively affect the health of waterways and biodiversity (Bridge 2004). Presently, there is no easy technical fix for ARD (Akcil and Koldas 2006; Sandlos and Keeling 2013). Depending on the type of mine, other problems such as radioactive tailings may also persist well into the future (Abdelouas 2006).

Unfortunately, mining in Canada has a very checkered history of dealing with these concerns and many long-term ecological threats have persisted after mine closure or mine abandonment (Sandlos and Keeling 2013). Toxic effects have endured and continue to threaten ecological and human health in many old mining areas. Clearly this is not an acceptable outcome. To combat these negative outcomes, government regulations have been steadily evolving through the twentieth and twenty-first centuries (McAllister and Fitzpatrick 2010). Both Federal and Provincial governments enacted regulations that ensure proper planning through environmental assessment, pollution emission standards, remediation bonds, mine closure plans, and other such mechanisms. This leads to better planning and reversing, where possible, the negative environmental effects of mining (Sanchez 1998). Remediation is extremely costly and only partially effective in many cases. As much as possible, mines must be planned to minimize and manage these negative environmental issues. The mineral and mining industry began

adopting environmental policies and protocols in the 1980s since they experienced an increased amount of "pressure to improve its social, developmental, and environmental performance" (McAllister and Fitzpatrick 2010; Mining Minerals and Sustainable Development 2003, 4).

2.2.2 Residual Effects on Communities

Mining activities can have both positive and negative lasting effects on communities and regions (Gibson and Klinck 2005). The mining industry boasts the highest wages in the resource sector in Canada; this can lead to comparably wealthy communities (Gibson and Klinck 2005; Gibson and Robinson 2014). New mining activities come with new opportunities for both direct employment and contract work.

Many mining companies tout preferential local hiring and local purchasing practices in an attempt to increase community benefits (see for example Rio Tinto Alcan 2015).,However, many mining companies in Canada and around the world have employed a fly-in/fly-out (FIFO) model of operation for the last several decades (2001, 135; HudBay Minerals Inc. 2015). According to Storey,

> fly-in/fly-out mining operations are those which involve work in relatively remote locations where food and lodging accommodation is provided for workers at the work site, but not for their families. Schedules are established whereby employees spend a fixed number of days working at the site, followed by a fixed number of days at home (2001, 135)

From one perspective, the FIFO model can be helpful and ensures that new resource dependent communities are not created in remote mining situations were there is no community nearby (Storey 2010, 1163). The FIFO model is more complicated when a community already exists. On one hand FIFO can be disastrous in situations where a community already exists in close proximity to the mining operation. In this situation,

> resource development companies which operate in rural regions benefit from the resources in those regions but, by accessing their workforces and buying supplies and services from the larger metropolitan centres, they give little back to the regions. These — 'fly-over' effects are

> perceived to harm rural regions by failing to provide employment or training opportunities for people in those regions (Storey 2010, 1163).

On the other hand FIFO, though undoubtedly a frustration to a local community by limiting the boom period, may reduce a community's dependence on mining and soften the bust effects when a mine eventually closes. A community may be better off in the long term if they are able to diversify economically using mine revenues instead of building heavy reliance on mining during a boom period.

2.2.3 Boom and Bust Cycles

The cyclical expansion and contraction of the economy is known as the boom and bust cycle and is common in resource dependent regions (McHugh 2009; Putz et al. 2011). Global demand for a natural resource drives up development and production of the resource, leading to economic growth (boom) through the growth in jobs, increase in taxes and royalties, additional construction etc. (Freudenburg and Gramling 1998; Gibson and Robinson 2014). A drop in demand or availability of these natural resources leads to an economic decline (bust) in the regions as jobs, revenues, population and taxes drop (Putz et al. 2011).

Rapid economic growth can lead to unhealthy economic dependencies on a single resource sector (Gibson and Robinson 2014). This problem is exacerbated by the fact that many mining communities are geographically remote and therefore removed from other viable economic opportunities. All aspects of community existence can become enveloped in the dominant sector so, for example, house prices in the community rise and fall with mineral prices. In bust times the whole economy of a community could contract, leaving the community's future in question. The ultimate dependency issue occurs when a mine closes down for good, after dependencies have been developed.

2.2.4 Remaining Infrastructure

Preparing for mining exploration and production in remote areas leads to a flurry of construction in order to extract the resource. Mining roads and the related infrastructure may better connect remote communities but mining needs often take precedence (Gibson and Robinson 2014). This infrastructure is often built with extraction in mind rather than community use during mining or or use after the mine closes (for example see Ring of Fire transportation corridor discussion in Porter 2015). More positive infrastructure legacies are possible with regional planning initiatives and planning partnerships with surrounding communities. Some also see increased connection between remote areas and major centres as negative since it opens these areas up to more influence and destruction both culturally and environmentally (Reed and Miranda 2007).

2.2.5 Resource Depletion

Since mineral orebodies are nonrenewable, mineral reserves offer a one-time opportunity for both the mining company and the community (Gibson 2014). This opportunity has potential for great conflict between parties as short-term gains may lead to long-term loss and preclude future use of the resource (Gibson and Robinson 2014). Immediate economic gains and the long-term viability of a region should both be encouraged and planned for. It is possible to use tools such as impact benefit agreements, income sharing, and heritage funds in order to increase long term benefits of mining and use ‘mines as bridges’ to more sustainable futures (Gibson and Robinson 2014)

2.3 Environmental Assessment and Sustainability Assessment

Environmental assessment (EA) has been growing in use and developing scope and ambition since its inception in the US *National Environmental Policy Act* of 1969 (Gibson et al. 2005). An EA is a process that attempts to take into account potential socioeconomic and ecological consequences of a proposed project, preferably in project conception and planning as well as in

approval deliberations (Morrison-Saunders and Arts 2004). EA is accepted and practiced in nearly all countries of the world (Morrison-Saunders and Retief 2012). The purpose of EA is to choose the best options for serving public interest. Attention to social and ecological considerations is in the public interest and should therefore be incorporated into deliberations and decision making on mining and other undertakings (Gibson et al. 2005). The proliferation of EA has certainly helped us to make more sustainable (or at least less unsustainabile) decisions that benefit present and future generations.

The ideas of sustainability and sustainable development have also grown in popularity in the last 30 years, though it can be argued that sustainability has ancient roots (Shmelev and Shmeleva 2012). For the last couple hundred years, humanity has spiraled towards unsustainability in the pursuit of progress and comfort (Gibson et al. 2005). This idea of progress and accumulation replaced "old sustainability", which focused on continuing or sustaining and existed throughout the world since the beginning of human history. In the late 1960's there was a resurgence of sustainability thinking and a fear that unfettered growth is damaging and harmful to long-term human and ecological well-being. Three key trends highlight the unsustainability of the "progress" mentality: a) increasing demands on ecosystem carrying capacity, b) economic growth generally benefiting the already prosperous (the increasing divide between the rich and poor), and c) the growing probability of increasing "tensions, conflicts and cascading system failures" (Gibson 2012c, 6). In order to address this sustainability renaissance and the overwhelming unsustainability of society, the Brundtland Commission (World Commission on Environment and Development) formally proposed sustainable development in their 1987 report, *Our Common Future* (Brundtland). The report defines sustainable development as development that

> meet[s] the needs of the present without compromising the ability of future generations to meet their own needs. The two key concepts of sustainable development are: • the concept of "needs" in particular the essential needs of the world's poorest people, to which they should be given overriding priority; and • the idea of limitations which is imposed by the state of technology and social organization on the environment's ability to meet both present and future needs (Section I. 3. 27.).

Contributions to sustainability have often been an important ambition of EA, but unfortunately contribution to sustainability as a purpose in EA practice has been lacking (Audouin and de Wet 2012; Hilson and Murck 2000). EAs have potential, because of their wide use and legal standing, to be a valuable tool in moving towards sustainability (Morrison-Saunders and Retief 2012). EA may be flawed in its narrow consideration of sustainability; however, in some jurisdictions, EA is the only somewhat sustainability-focused tool used (Lawrence 2013; Morrison-Saunders and Retief 2012; Sinclair and Doelle 2010) As leading edge EA, sustainability assessment (SA) developed out of more traditional EA as a way to consider the full suite of interactive social, economic cultural and biophysical effects, and compare alternatives in light of their potential contribution to sustainability goals and the long-term benefit to an area (Hacking and Guthrie 2008; Gibson et al. 2005). Defined simply, SA is a process that guides decisions and projects towards greater contributions to sustainability (Gibson 2012c; Morrison-Saunders and Hodgson 2009). A project undergoing SA should not be approved if it does not make a positive step towards sustainability – the lasting social, ecological, and economic wellbeing of a region (Bond and Morrison-Saunders 2009; Hacking and Guthrie 2008; Gibson et al. 2005).

In order to ascertain whether a project will make a positive net contribution to sustainability, a set of criteria must be drafted to help guide the assessment (Hacking and Guthrie 2008; Gibson et al. 2005). Leaders in the SA field, Gibson et al. (2005), identified eight generic criteria categories to consider when undertaking a SA (see Table 1). This list was created after

years of debate, deliberation, practice, and synthesis and incorporates aspects of many fields such as "ecological systems theory, corporate greening initiatives, growth management planning, civil society advocacy, ecological economics, community development, and a host of others" (Gibson et al. 2005, 95). The generic criteria need to be specified for particular cases and contexts. If the project contributes to meeting all the requirements for sustainability (Table 1), then it should have a positive overall legacy contribution at all levels, achieve multiple gains in sustainability, and minimize negative outcomes.

Table 1: Requirements for Sustainability. Adapted from Gibson et al. 2005.

Requirements for Sustainability	**Explanation**
Socio-ecological system integrity	*Humans exist within and rely on the biophysical system for existence. It is essential that human actions build strong human-ecological relations that promote the long-term completeness of socio-biophysical systems. Therefore protecting the indispensible life support functions that all humans and ecology depend on.*
Livelihood sufficiency and opportunity	*Ensure that every community's needs for a decent life are met and that they have opportunities to seek improvements in a way that does not jeopardize future generations' possibilities for sufficiency and opportunity.*
Intragenerational equality	*Ensure that choices made today make a positive legacy, based in efficiency and sufficiency, reduce opportunity and sufficiency gaps between the rich and poor.*
Intergenerational equality	*Choose actions that create positive legacies by giving future generations more opportunities and capabilities for sustainable living.*
Resource maintenance and efficiency	*Reduce extractive damage, minimize waste, limit energy and material use per unit of benefit. This will provide more sustainable livelihoods and also reduce threats to the long-term integrity of socio-ecological systems.*
Socio-ecological civility and	*Strengthen and build the capacity, motivation, and*

democratic governance	*ability of communities and other decision making bodies to consider and apply sustainability principles through more transparent and informed deliberations, greater attention to fostering reciprocal awareness and collective responsibility, and more integrated use of administrative, market, customary, collective, and personal decision making practices.*
Precaution and adaption	*Admit the existence of uncertainty, avoid risks of serious or irreversible damaging legacies that disrupt the foundations of sustainability even when poorly understood. Learn from every decision, design for surprise, and manage for adaption.*
Immediate and long term integration	*Try to incorporate all sustainability criteria together as a set of interdependent parts, seeking mutually supportive benefits and a positive legacy.*

There is no formal SA regime or standard set of sustainability criteria for assessments in Canada at this time (Gibson 2012b). Instead, a history of *de facto* SAs exists, and promises a future where sustainability is considered in all decisions. SA in Canada, like SA in other countries, grew out of the recognition that unsustainable practices are extremely damaging and need to be avoided. Canadian examples of SA come from many different groups and decision-making bodies. Very few SAs in Canada took place through existing EA legislation; most have been *ad hoc* and designed to meet the needs of specific projects and communities. Three examples of mining related SA exist in Canada, Whites Point quarry and Kemess North, which were not approved, and Voisey's Bay, which was approved.

Voisey's Bay SA offers an example of an approved SA in Canada. In the late 1990s Inco Ltd. (now Vale) proposed a large nickel mine on Labrador's northern coast, a significant and traditional area for both the Inuit and Innu (Canadian Environmental Assessment Agency 2013). The SA conducted for Voisey's Bay mine and mill "was precedent setting in Canada and the World. It set a new standard in integrated attention to social, cultural, economic and ecological factors throughout and beyond the project's anticipated life" (Gibson 2006a).

In 1997 the federal and provincial governments along with the Labrador Inuit Association and the Innu Nation signed a memorandum of understanding (MOU) specifying how environmental effects of the proposed project would be reviewed (CEAA 2013). This MOU harmonized the federal and provincial assessment process, recognized the interest of the Inuit and Innu groups, and appointed a five-person panel to carry out the review and prepare the report. The review panel issued a set of guidelines to use as they prepared their environmental impact statement. The guidelines adopt a test for sustainability and state that "the proponent is required to discuss 'the extent to which the Undertaking may make a positive overall contribution towards the attainment of ecological and community sustainability, both at the local and regional levels'" (Gibson 2002, 155). After a series of public meetings, scoping sessions, and public hearings, the panel carefully concluded that the project should be authorized to proceed if they met the terms and conditions, focused on sustainability, which were presented in 107 recommendations.

Another Canadian example of SA in practice comes from Nova Scotia. Whites Point quarry and marine terminal underwent federal-provincial, three-member panel review in late 2004 (Gibson 2012b). The proposed project was "a large basalt quarry and associated shipping facilities" located on the very scenic peninsula of Digby Neck on the Bay of Fundy (Fonseca and Gibson 2008; Gibson 2012b, 175). A US company, Bilcon, proposed the project with a 50-year lifespan, local employment opportunities, some tax gains for the government, and a progressive remediation of the quarry. There was significant community opposition and concern that the quarry and marine terminal would have a negative impact on local tourism, nearby fishing, and would further stress the already endangered whales and other marine life (Joint Review Panel 2007; Gibson 2012b). Those critical of the project also feared that the local economic benefit

was minimal and the permanent alteration of the beautiful landscape and tranquility was too great of a cost.

The review panel adopted a sustainability mandate and assessment guidelines, based on the mandate and guidelines from a previous SA – Voisey's Bay, that measured the extent the project would improve local ecological and community sustainability (Gibson 2012b). The panel hosted a round of heated hearings then completed an analysis based on the guidelines to examine the "project viability, community sustainability, and the nature and distribution of benefits and burdens" (Gibson 2012b, 176; Joint Review Panel 2007),

The panel ruled that the proposed project should not be approved as it would not make a positive contribution to sustainability (Gibson 2012b). They found that the proponent would enjoy most of the economic benefits of the project and the legacy effects of the project would jeopardize the community's long term opportunities, especially the sustainably based tourism and fishing (Fonseca and Gibson 2008). Federal and provincial authorities took the panel's recommendation and rejected the Whites Point quarry and marine terminal project.

2.5 Learning for Sustainability

Learning from past experiences is the only real hope for a more just and sustainable future (Joint Review Panel 2007; Moyer et al. 2008). If we cannot identify and learn from our mistakes how can we hope to make better choices in the future? Participating and reflecting on environmental decision has the potential to lead to transformative learning in the participants. Transformative learning is an adult learning theory, introduced by Mezirow, which is commonly used to understand individual learning in natural resource management and sustainability (Whitelaw et al. 2003; Diduck et al. 2012).

Mezirow's theory of transformative learning proves to be an effective way to assess learning through public participation in EA (Taylor 2007). First introduced in 1978, this theory

explains how experiences, dialogue, and critical reflection can lead to cognitive development within individuals, socio-political empowerment, and ultimately social change (Mezirow 1991; Moyer et al. 2014; Sinclair et al. 2008). The focus of transformative learning is critical reflection on one's experiences that can lead to deep learning and alters an individual's perceptions and consciousness created through childhood learning and socialization (Sinclair and Diduck 2001; Mezirow 2000a). Learning occurs when a "disorienting dilemma" confronts and is not explained by the learner's understandings and assumptions (Moyer et al. 2014; Sinclair et al. 2008).

There are two essential learning processes present in transformative learning (Moyer et al. 2014; Sims and Sinclair 2008). The first is critical reflection and it includes assessing one's understandings and assumptions, comparing them to one's life experiences, and considering where they originated and how they affect one's actions. This reflection process illuminates "the reasoning and justification underlying why we apply certain meanings to reality and the validity" of these meanings (Mezirow 1991; Moyer et al. 2014). The second step is talking with others to test the validity of one's understandings and assumptions. Through dialogue, the learners defend their viewpoints using evidence and logic and seek agreement through deliberation. This process allows the learner's uncritically analyzed beliefs to be questioned and better validated (Moyer et al. 2014, 2). These stronger and validated viewpoints are then used in decision-making (Mezirow 1991; Cranton 2006).

Most scholars agree that there are two learning domains in transformative learning; instrumental and communicative learning (Diduck et al. 2012; Moyer et al. 2014). This idea of learning domains is borrowed from Habermas's (Mezirow 2003; 1984) distinction between instrumental and communicative learning and it is a key proposition of the theory (e.g., Mezirow 2003). It should be noted that, though most literature only identifies the two aforementioned

learning domains, some scholars suggest that transformative learning is a third learning domain and not the result of especially meaningful instrumental and communicative learning (Diduck et al. 2012; Fitzpatrick 2006; Mezirow 2008; Moyer et al. 2014).

Instrumental learning is often task-oriented and involves learning how to "competently cope in the external world through technical understanding and control of environmental variables " (Diduck and Mitchell 2003, 345). Subsequent work on the theory in the natural resources and environmental management field has acknowledged four subcategories of instrumental learning; (a) scientific and technical knowledge, (b) legal, administrative and political processes, (c) social and economic knowledge, and (d) potential risks and impacts (Diduck and Mitchell 2003, 345; Diduck et al. 2012; Moyer et al. 2014). According to Sims and Sinclair (2008), instrumental learning has a number of defining characteristics including "(a) obtaining skills and information, (b) determining cause–effect relationships, and (c) task-oriented problem solving" (156). These characteristics have also been used as subcategories in some literature (e.g., Mezirow 1995; Sims and Sinclair 2008). Other researchers prefer to create their own instrumental learning subcategories grounded from their data (e.g., Moyer et al. 2014). Whatever subcategories are used, the intent is that they help researchers to unravel and identify learning themes within the instrumental domain.

Communicative learning pertains to social interactions (Diduck and Mitchell 2003). It deals with making oneself understood and understanding others; what they mean when they communicate as well as realizing their intentions, values, and purposes (Diduck et al. 2012). Learning that is communicative "centres on changing one's approaches to situations or points of view" (Moyer et al. 2014; Mezirow 1991; Fitzpatrick and Sinclair 2003, 3). Four subcategories of communicative learning are often used in the literature. These subcategories include: (a)

insight into one's own interests, (b) insight into the interests of others, (c) communication strategies and methods, and (d) social mobilization (Diduck and Mitchell 2003, 351). Other researchers have used a selection of communicative learning characteristics, identified by Mezirow, as subcategories for this domain (Fitzpatrick and Sinclair 2003; Mezirow 1995). Useful characteristics include "(a) understanding values and normative concepts and (b) understanding others' points of view" (Sims and Sinclair 2008). Some researchers opt to analyze their data and create emergent and grounded subcategories for communicative learning (e.g., Moyer et al. 2014). Subcategories, whether identified in the literature or grounded in the data, are helpful tools for deciphering themes within the communicative learning domain.

Learning that occurs in the instrumental and communicative domains may be considered transformative if it is learning that leads to a shift in meaning structure (Mezirow 2008). Typically, communicative learning has been seen as more important and more likely to lead to transformative learning outcomes. Some authors, including Mezirow, appear to view instrumental learning as less important to transformative outcomes than communicative learning and it therefore has prominence in the literature. More recently, scholars in the field of natural resources and environmental management have been examining the role that instrumental learning plays in transformative learning and social action (Moyer et al. 2014). These researchers found that instrumental learning is important and can lead to profound transformation (Kerton and Sinclair 2010; Moyer and Sinclair 2015; Moyer et al. 2014; Sims and Sinclair 2008).

Transformative learning and adult education are extremely valuable for effective natural resource management and the move towards sustainability (Fitzpatrick and Sinclair 2003; Moyer and Sinclair 2015). Learning from past experiences is the only real hope for a more just and sustainable future (Diduck et al. 2012; Moyer et al. 2008; Sims and Sinclair 2008).

Participating in environmental decisions and management as well as reflecting on these choices has the potential to lead to transformative learning in the participants.

The benefits of public participation in decisions concerning the management of natural resources are emerging in the literature (Moyer et al. 2014, 3; Whitelaw et al. 2003). Some even believe that an environmental assessment process is not legitimate if there is no opportunity for meaningful public participation (Diduck et al. 2012; Mezirow 1991; Sims and Sinclair 2008; Sinclair et al. 2008). Existing research shows that public involvement in resource management, particularly environmental assessment, leads to better management decisions and opportunities for adult education and learning (Diduck et al. 2012; Gibson 1992; Roberts 1998). Public participation can also result in transformative learning and adoption of more sustainability focused meaning structures.

All learning first occurs in the individual but the learning process is necessarily social in nature. Individual learning is "often facilitated in a collective setting, dependent on concerted inquiry and action, or deeply embedded in specific socio-cultural practices" (Diduck 2010, 202-3; Fitzpatrick and Sinclair 2003). Individual learners acting on their transformed meaning structures can create social action. These transformed meaning structures and social action can be scaled up past the individual level to the collective. Using the concepts of collective learning, transformative learning occurring in individual members is shifted to the organization as an entity (Keen and Mahanty 2006). In this way, groups can adapt and develop according to the environment and the experiences of the individuals comprising the group. Collective learning will prove to be essential in the transition towards sustainability as learning is moved up from the individual to the collective and then to the societal level (Fitzpatrick and Sinclair 2003; Sims and Sinclair 2008; Sinclair et al. 2008). Transformative learning through participation can lead

to better decision-making and actions that support more sustainable futures.

2.6 Conceptual Framework

Examining the above literature allowed me to identify major relevant themes and construct a parent node framework for each of the key concepts central to my work. Figure 1 captures the key nodes from the literature for considering the legacy effects of mining. It is built around Gibson and Robinson's (2014) work on mining and sustainability and the five key legacy issues associated with mining that they identify. Several key EA issues such as triggering, screening, scoping, public participation, timelines, tradeoffs, and cumulative effects emerged as important concepts for considering legacy effects in the literature (e.g., Gibson 2012a). Jack Mezirow's work on transformative learning theory is foundational (e.g., Doelle 2012; Gibson et al. 2016; Mezirow 1991). The key constructs of instrumental and communicative learning provide a useful basis for understanding adult learning. Figure 2 is the conceptual framework adopted for this research and depicts the connection between the three bodies of literature discussed above. It shows first a linear process. Mine legacies are the issue that needs to be explored and considered, EA is the mediating process by which the effects of mining can be considered, and individual learning is the outcome of reflecting on legacy issues (especially through the EA process). Interconnection exists between all three categories. Learning can happen without involvement in an EA process. Effective EA process can help with the consideration and improvement of legacy effects. Learning can also help improve our understanding and consideration of legacy effects as well as improve EA practice

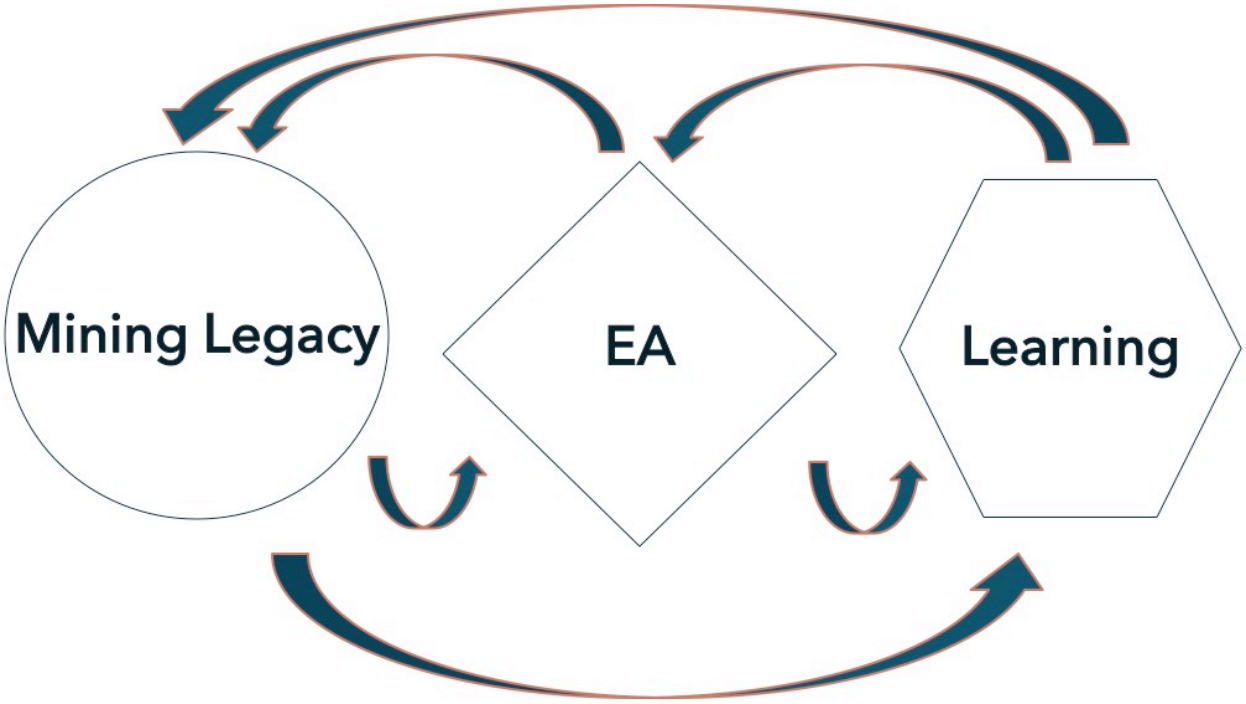

Figure 2 - Conceptual Framework: Shows the connection and interactions among the three bodies of literature. Mining legacy is the issue, EA is the mediating process, and learning is the outcome. Arrows also exist between mining legacy and learning because reflecting on mining legacies may result in learning even without the aid EA. An arrow goes from EA to mine legacy as a good EA process can help the consideration of legacy effects. Resultant learning may also lead to improvements in EA and mining legacy, hence the arrows from learning.

2.7 Summary

In relation to legacy effects it is clear from studying the literature as presented in this chapter that some mining is extremely necessary but there is a rather negative environmental history associated with such mining and mixed legacy outcomes. Great environmental strides have been made towards less unsustainable and damaging outcomes through worker and community pressures, regulations and corporate policies in the last 30 years; however, we are still not at our goal of sustainable industry, community, and societal outcomes. Adoption of innovative assessment methods such as sustainability assessment that includes rigorous follow-up and monitoring programs may allow for more public participation and input into resource

management may result in improving the sustainability and legacy outcomes. Public participation can also lead to transformative learning within the individual participants that leads to transformations in behavior of individuals, organizations, and hopefully – society as a whole. As established above, learning is essential to helping us move towards greater sustainability for individual communities as well as larger society.

Chapter 3: Research Design and Methods

This chapter explains my worldview and the details of the research design and strategy of inquiry implemented in this study. It also explains and rationalizes the data collection methods and analysis techniques, data validity, research ethics, and dissemination of results.

3.1 Worldview and Design

Sustainability is a much-debated topic and one of the major issues facing my generation. I feel that communities should be actively participating and involved in decision-making concerning development in their area. Sustainability focused learning for individuals is the only real way to initiate enduring positive change, individual learning may then be scaled up and transferred to larger social bodies but learning is first an individual accomplishment. Not only does participation benefit the individual participants, effective participation improves decision-making, including both the quality of what is decided and the participants' capacities for effective engagement in the process. Ensuring that projects are approved based on their long-term benefits is essential if we wish to transition to a more sustainable society.

Since I hope that my research will make a lasting difference in how mining projects are considered and approved, I will operate within a participatory/advocacy worldview. According to Creswell (Mezirow 1995; 2013a), participatory and advocacy based researchers believe that research should not be divorced from the civic climate that it occurs in. This worldview believes that research should not be undertaken simply to gain knowledge about a situation but to change (for the better) the way things are done. I hope that my research will promote sustainability in mining and assessment processes. Due to tight timelines, I was unable to use a truly participatory approach, where the participants define the research goal and objectives, but I worked with my advisory committee to broaden my considerations.

Research design is understood as a broad framework that aids in the collection and analysis of data. The research design is influenced by the goal of the study and the objectives that one wants to address (Bryman et al. 2009). A qualitative approach was the most appropriate approach for my research because I was most interested in understanding and exploring people's experiences and the meaning that they make from their experiences (Creswell 2013b). My research focuses on communities, how they deal with mining and legacy issues, and the learning for sustainability that they experience. Qualitative research explores the meaning and understanding that groups or individuals make to explain problems, social or human such as those that are the focus of my work (Creswell 2013a).

3.2 Case Study Strategy of Inquiry

Within the larger qualitative approach, my research employs a case study as the strategy of inquiry. A case study is empirical research that involves detailed examination of an issue explored through the perspective of "one of more cases within a bounded system" (Creswell 2013a, 73). Case studies are examined by gathering in-depth data from a variety of information sources using multiple collection procedures (Creswell 2013a). Using case studies allows for a manageable research scope. This strategy of inquiry is especially useful when the researcher wants to consider contextual conditions because they are believed to be important to the studied phenomenon (Creswell 2013b; Yin 2003).

The case study strategy of inquiry is not a data collection scheme but a complete research strategy (Yin 2003). This particular research strategy is adjustable and there are a number of accepted case study variations including single -case studies and multiple-case studies. This variation is dependent on the purpose of the research. My research includes a single case study augmented by interviews with mining and assessment experts from across Canada.

Case studies are bound by time, activity, and scale (Creswell 2013b). A bounded system that makes up the case can vary in scale from as small as an individual, single family, lone community, specific organization, a single event or as large as a province or even a country (Bryman et al. 2009). I studied a specific activity, mining assessment and decision-making, in a mining community for a sustained period of time. My research focused on a bounded system and the appropriate strategy of inquiry is case study research (Creswell 2013b).

My research also possesses the five components of a case study. Yin outlines these essential elements in his book on case studies (Yin 2003, 21):

1. Study questions
2. A theoretical framework
3. Unit(s) of analysis
4. Logic linking the data and the framework
5. Criteria for interpreting the findings

3.2.1 Case Study Selection

The development of the criteria for selection of a case mining community was a major focus of the early research. To decide which Canadian community to study I applied the criteria listed in Table 2.

Table 2: Evaluation Criteria. Criteria used to select an appropriate case.

Evaluation Criteria	**Reason for Including Criterion**
Canadian Case	• Mining in Canada has a long history. • It will be helpful to understand if current assessments of mines in Canada give attention to mining impacts. • - SA needs to be studied and evaluated more in a Canadian setting.
Mine underwent an EA within the last 5-10 years	• Environmental effects should not just be from historic mining activities.

	• EAs within the last 5-10 years can be considered "recent". • There will still be participant recall of the assessment process and mine development and operations.
Community close to the mine	• Community members who are directly affected by a nearby mine will have knowledge of legacy effects. • Some will have participated in the mine approval processes.
Historic mining in the region	• Historic mining in the region could shed more light on legacy effects
Accessibility	• Easy access to assessment documents • Reasonable access to the community • English as the dominant language for easy communication

While preparing for research I contemplated five mining communities as the case for my research. The list of possible cases was generated through consideration of recent EA cases as well as suggestions from my committee. Though these cases met many of my evaluation criteria, Snow Lake, MB was the best fit. Snow Lake was the best option for a case study because it is a community with a long history of mining in the area and recently underwent two EAs for local mines. All the EA documents were available on the Government of Manitoba Department of Conservation and Water Stewardship online public registry. There is a community of 723 people, who are directly affected by mining operations. Practically, the community was accessible by car from southern Manitoba and the residents spoke English as their first language. Additionally, the mines in Snow Lake are underground (hard rock). This was not a direct criteria but it was beneficial as I have some experience with underground mining and am generally more familiar with underground mining than surface or open pit mining (Boerchers 2013). As noted in Table 2, I chose a community with historic mining as I believed that a long history of mining activities in the area would mean that community members would be well versed with mining practices and

the various legacy issues associated with mining. Having a community present also meant that I had an easily accessible pool of knowledgeable participants. These considerations proved to be true, and were essential for my data collection; however, it means that my case study community, Snow Lake, is a rather atypical mining phenomenon. Mines that come and go with little or no regional continuation are arguably more common in Canada than regions with continuous mining like Snow Lake. Results of my thesis are therefore specific to existing mining communities with a history of mining over many decades and not generalizable to all mines in Canada.

3.3 Data Collection Methods

Case studies rely on multiple sources of evidence (Berg 2010; Yin 2003). In my research, I gathered data from multiple sources using different collection methods including document analysis and semi-structured interviews. The combination of these collection methods allowed me to address my stated objectives through a more robust and in-depth examination of my cases. Multiple data sources also allowed for data triangulation and helped to ensure that all collected data are in agreement, accurate, and valid.

3.3.1 Document Review

Many government and company documents and reports are made available to the public. These documents provide important information in a time and cost effective manner (Bowen 2009). They were especially important in the early stages of my research and supplemented other data sources. Document collection and analysis began before entry to the field. I accessed publicly available EA documents from selected mines in the research area, mainly from the recently opened Lalor mine. Analyzing these documents allowed me to become more familiar with the mining projects in the area and the level of assessment and community involvement in the approval process. Some of the questions in my community interview guide were informed by

these documents. As well, information gained through the EAs allowed me to ask better follow-up questions and generally understand the mining operations and EA process better.

3.3.2 Semi-Structured Interviews

I used semi-structured interviews to obtain qualitative data from a total of 24 participants. Semi-structured interviews exist in the middle ground between totally structured interviews and totally ad lib or unstructured interviews (Berg 2010). This kind of interview includes a number of predetermined interview questions on a series of topics; however, the interviewer has the freedom to stray away from predetermined questions digress into interesting and relevant topics that surface during the course of the interview. This flexibility allows the interviewer to explore and probe topics that are not addressed in the predetermined questions but have some bearing on the research question. This method allowed me to adjust the order or the wording of the questions so that they naturally fit into the flow of the interview, like a conversation. Another benefit of the semi-structured interviewing was that it allowed me to omit and skip any questions that are not relevant to the specific participant being interviewed, which I did from time to time. For example, when talking to a community member who was not directly involved in the recent EA but was involved in other governance processes such as town meetings I would ask questions about those experiences. This kind of interviewing technique also allows the researcher to create new questions and topics that emerge in the interviews and apply them to subsequent interviews. This was very helpful especially when I was in Snow Lake doing interviews. Through talking to community members and conducting interviews I learned things about the mine, company, and community that I could not have before entering the field. These conversations allowed me to fine tune my interview guide to reflect the emerging questions. The whole process is more free-flowing than a structured interview and the results are still recognized as legitimate data. The strength of a semi-standardized interview is that it is designed to give the interviewer directional

control of the interview but leaves enough freedom for interviewees to introduce valid topics that were not considered until that point (Bryman et al. 2009).

I designed two interview guides – sets of predetermined questions – for data collection. One guide was created for community members and one for mining and assessment experts. Both were designed to touch on a number of topics related to the objectives set and encouraged the participant to speak candidly about sustainability, mining, and legacy issues in their area (Please see Appendix A for both interview guides). To ensure best results, I tested the guides for effectiveness as a data collection tool before I used it in the field. I conducted interviews in-person when possible and when in-person interviews were impossible, as was often the case with the mining and assessment experts as they were located all across Canada, I interviewed participants over the telephone. I recorded the interviews with a digital voice-recorder, after receiving consent from the participants to do so. Interviews lasted from 45 minutes to over 2 hours in length with most interviews approximately 1 hour in length.

3.3.3 Participant Selection

I used purposive sampling, sometimes called judgmental sampling, which is a form of nonprobability sampling (Berg 2010). In this technique the researcher chooses participants to represent the views and interests of larger groups. I identified major stakeholder groups such as industry, ENGOs, government, and community. I tried to ensure that I interviewed individuals from each group so that the group's interests and views were represented accurately in the research. Participants are broken up into two categories, "expert" participants from across Canada who generally spoke about EA and legacy effects of mining and "community" participants from Snow Lake and Northern Manitoba who spoke specifically about EA and mining legacy issues pertaining to the community of Snow Lake (see Figures 3 and 4 as well as Table 3 for an affiliation and geographic breakdown). Snowball sampling, asking participants to

identify and suggest more people to participate, also improved the robustness and quality interview group as I began data collection. There are no participants representing an Aboriginal point of view from the Snow Lake area. I reached out to several Aboriginal leaders and community members in the area; however, I was unable to interview any of them.

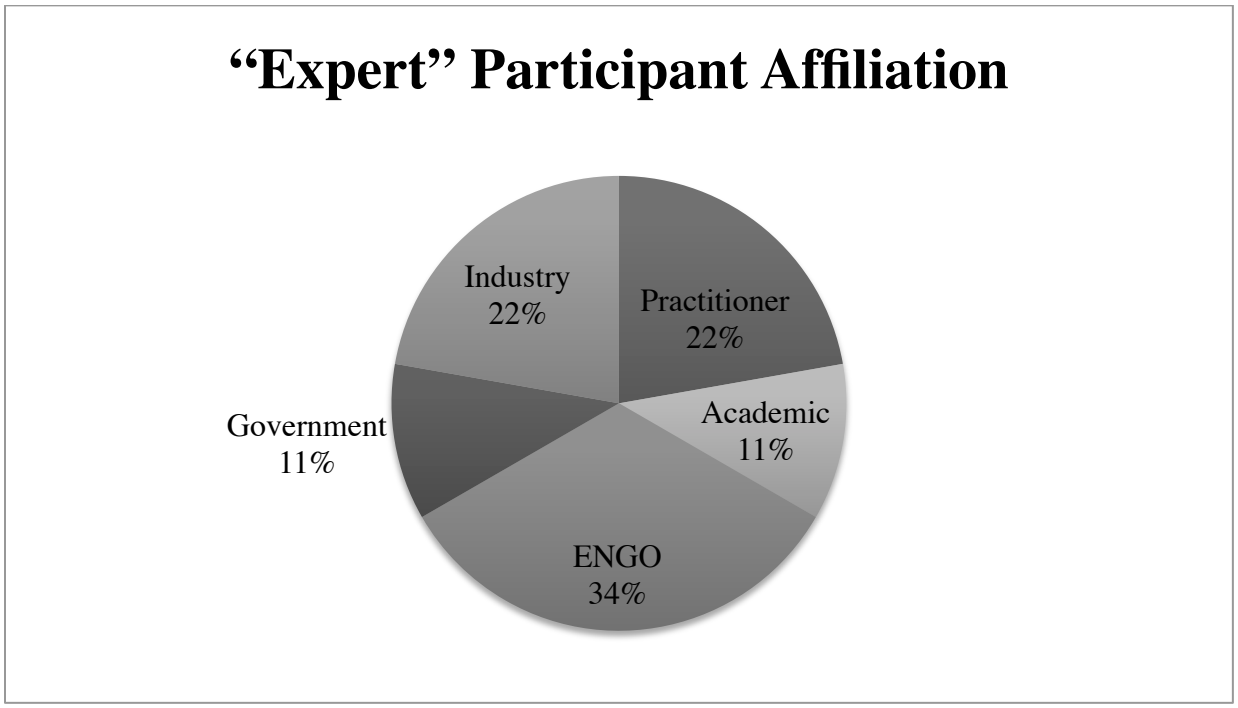

Figure 3: "Expert" Participation Affiliation. Displays the general affiliation of the expert participants.

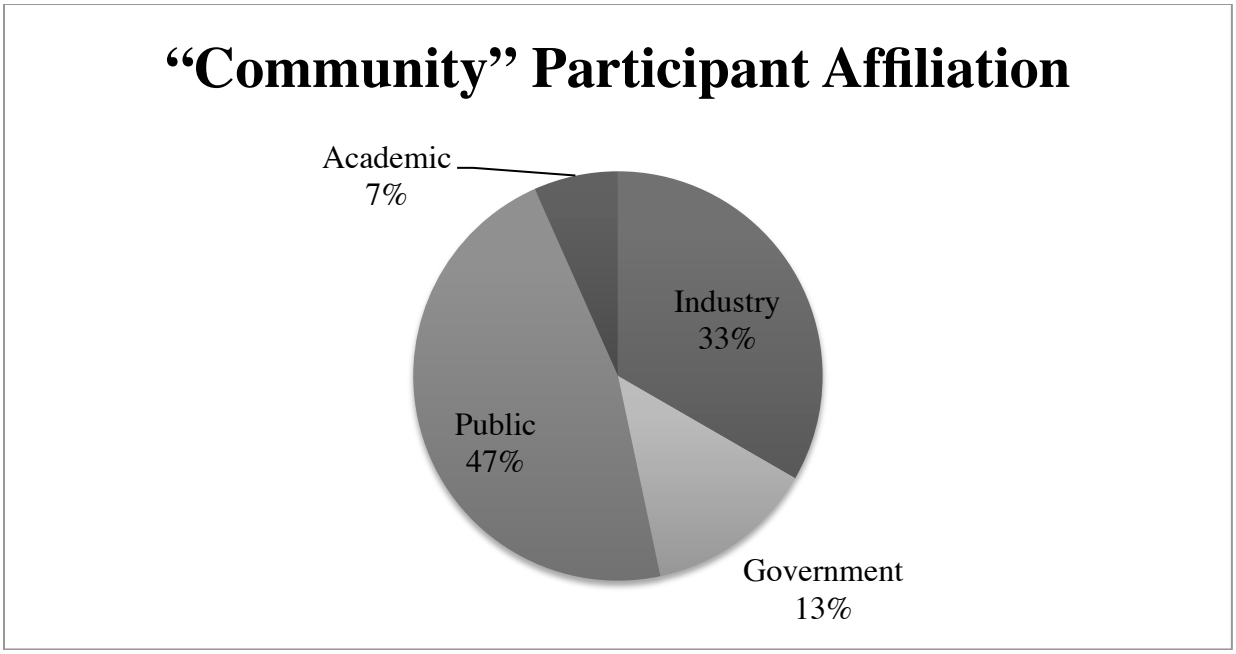

Figure 4: “Community” Participation Affiliation. Displays the general affiliation of the community participants

Table 3: Participant Location. Displays the geographic location on participants.

Geographic Location	Number of Participants
British Columbia	3
Northern Manitoba	15
Southern Manitoba	3
Ontario	2
Maritimes	1

3.4 Data Analysis

Before data analysis began I transcribed the semi-structure interview recordings. This process allowed me to become more familiar with my data and the transcribed interviews were more conducive to coding. I coded the transcripts using the qualitative data analysis software program NVivo for Mac (QSR International 2014). This program supports both qualitative and mixed methods research. It facilitates the management and analysis of data. It allows the researcher to store and organize multiple kinds of primary data such as interviews and open-ended questionnaires together with secondary data such as articles and web pages all on one program.

NVivo10 is a powerful analysis tool, it allows the researcher to dissect the interview data into themes and group these data pieces together (Bryman et al. 2009). This process is known as coding and allows the researcher to group "items that share a similar theme, seem to be of potential theoretical significance, and/or appear to be particularly salient within the social worlds being studied" (Bryman et al. 2009, 253). In NVivo, coding is accomplished through nodes that act as containers, holding information of the same theme and becoming the basic categories of the findings.

I used selective coding to analyze the qualitative data in this research project. Selective coding is "the procedure of selecting the core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further development" (Strauss and Corbin 1990, 116). I coded around the core constructs (nodes in NVivo) apparent in the interviews and present in the EA/SA, legacy, and transformative learning literature as indicted in section 2.6 of this thesis

When referring to results of my analyzed semi-structured interviews I use the terms 'some', 'many', and 'most' to indicate the number of participants who supported an idea. This is a qualitative study and the terms are meant to indicate participant support and not necessarily the importance of a theme. It is important to know that an idea only presented by one participant can still be significant. The term 'some' indicates between 6 and 39 percent of participants, 'many' indicates between 40 and 89 percent of participants, and 'most' indicates over 90 percent of participants. On occasion I separate the community and expert participants and use the above terms for each group.

3.5 Ensuring Validity

Internal validity deals with causality and is the degree of certainty that one variable causes another to change in the research observations (Bryman et al. 2009). There are several strategies

used to ensure validity (Creswell 2013a). Internal validity in qualitative research projects is reflected in the triangulation of findings from multiple sources. I used triangulation in an attempt to increase internal validity (Creswell 2013a). I compared findings from one data source to findings from other sources in an attempt to find agreement between the two. Additionally, I triangulated the research findings with the existing literature in the discussion portion of this thesis. I also sent participant's transcribed interview to them so that they can review it if they wish and verify that it accurately represents their views. This is called member checking and allowed participants to add to their interviews and clarify their responses.

3.6 Ethics

This project underwent ethics review at the University of Manitoba before I began contacting and interviewing any participants. Participation was totally voluntary and confidential. Potential participants were informed of the research project and asked to contribute. Participants were required to fill out and sign the consent form that explained the study and indicated that they both understood the nature of the study and agree to participate, have the interview recorded, and allowed anonymous quotations to appear in this thesis and any publications resulting from the research. The participant had the ability and right to decline to answer any question, pull out of the interview, or withdraw from the study completely without any negative consequences. None of my participants; however, chose to exercise these rights. Full confidentiality was given to participants, to protect confidentiality the signed consent forms were stored in a locked office at the Natural Resources Institute and in five years (2019) both the data and the consent forms will be destroyed. The audio recordings and transcripts are password protected on a computer.

3.7 Dissemination

Research results and findings are included in this thesis document. A summary of major research findings will be sent to all participants. I intend to create a poster detailing my research and will

send it to the community involved as well as use it at a conference. Finally, I intend to publish a condensed version of my research report and findings in a suitable academic journal such as *EIA Review* for further dissemination.

Chapter 4: Mining Legacy Effects

This chapter describes and discusses mining legacy effects and EA in Canada. First, I present a portrait of the case study, Snow Lake, MB, where I describe the community's history and mining experiences. I then examine mining legacy effects using Gibson and Robinson's (2014) framework.

4.1 Case Study Description

Snow Lake, Manitoba

The town of Snow Lake (See Photo 1) is located in northern Manitoba at the end of Provincial Road 392, approximately 700 km north of Winnipeg, the provincial capital. With a population of 723 (Statistics Canada 2011), Snow Lake is a mining community on the eastern section of the Greenstone mineralization belt (MMM Group Limited 2009). The municipal area of Snow Lake is 1212 km^2, nearly three times as large as Winnipeg, with lakes covering approximately 15% of this area (182 km^2). The town exists because of its geology. Mining is the largest employer and the community's population fluctuated greatly over time as old mines closed and new mines opened in the area (Participants C-6, C-7, C-8, C-10, C-11, C-12, C-14, and C-16).

Photo 1: 'Downtown' Snow Lake. Photo by M. Boerchers (2014).

At the turn of the century, prospecting and exploration for gold began in the Snow Lake area and over five gold mines were established along the East shore of Herb (Wekusko) Lake (Parres and Jackson 2009). The gold mining company, Howe Sound, established the town of Snow Lake in 1947 as a company town (Participants C-6, C-9 and C-10; Parres and Jackson 2009; Town of Snow Lake 2011). Howe Sound operated the Nor-Acme Gold Mine and constructed a dormitory and dining hall, a staff house, 43 residences, a four-room school, an eight-bed hospital, the community hall, and a curling rink (MMM Group Limited 2009; Town of Snow Lake 2011). In 1958 Howe Sound closed down the Nor-Acme Mine and the town's future seemed uncertain (Participants C-6, C-9, and C-10; Town of Snow Lake 2011). Participant C-6 briefly sums up the community's mining history;

> The company was called Howe Sound at the time – the mine was started and ran until it was depleted and then shut down. As they were closing down, this was in 1958, Hudson Bay Mining and Smelting from Flin Flon was in looking at base metal which is copper, zinc, and a whole bunch more - sulphide ore bodies as opposed to gold ore bodies. They have run several mines in the area and in fact, the newest mine is called Lalor Lake. Lalor is a 20 or 25 year mine. It is a very rich mine so they are ramping up again right now and things are looking good.

A new era of base metal mining began in the 1950s in the Snow Lake region (MMM Group Limited 2009; Parres and Jackson 2009). Hudson Bay Mining and Smelting Co. Ltd. (HBM&S), known as HudBay Minerals Inc. (referred to as HudBay throughout this thesis), became the dominant employer in the late-1950s with the establishment of Chisel Lake Mine on the rich and "seemingly inexhaustible conglomeration of massive sulphide lenses known as the Chisel Lake basin" (Parres and Jackson 2009, 66; MMM Group Limited 2009). HudBay purchased a number of Howe-Sound's community assets in 1958 after the Nor-Acme Gold Mine closed (Participants C-6 and C-9; Town of Snow Lake 2011). Since the 1950s five zinc and copper mines have operated and closed on the Chisel Lake basin: Chisel Lake, Ghost Lake, Lost

Lake, Photo Lake, and Chisel North Mine (Parres and Jackson 2009). HudBay currently operates one mine on the Chisel Lake basin, Lalor Mine, which began limited production through a ventilation shaft in 2012 and production through the main shaft in 2014 (HudBay Minerals Inc. 2014). Additionally, six base metal mines – Stall Lake, Anderson Lake, Dickstone, Osborne Lake, Rod Mine, and Spruce Point – located on deposits in the Snow Lake area operated and closed since the 1950s (Parres and Jackson 2009). HudBay also currently operates Reed Lake Mine in a joint venture with VMS Ventures (VMS Ventures 2015). Reed Lake Mine began production in 2013 (Parres and Jackson 2009; VMS Ventures 2015). According to the Snow Lake mining museum there have been 19 producing mines in the surrounding region (see Photo 2). Some of these mines, especially the very old mines, are a burden to the community, company, and citizens of Canada as monitoring, maintenance, and water treatment may continue in perpetuity. Table 4 lists these mines according to the date of first production.

Photo 2: The "Mine Sign" in Snow Lake. It points to all producing mines within 60 KM of the town. Optimistically and ambiguously, the sign points to "The Next Mine". Photo by M. Boerchers (2014).

Table 4: Snow Lake Mines. Producing mines in the Snow Lake area listed by the date of first production.

Snow Lake Area Producing Mines	
Ballast/Moosehorn	1917
Rex Laguna	1918
Bingo	1921
Ferro	1932
Nor-Acme/New Britannia	1949
Ferguson	1950
Jack Nutt	1952
Chisel	1960
Stall	1964
Osborne	1968
Anderson	1970
Dickstone	1971

Ghost/Lost	1972
Spruce Point	1981
Rod	1984
Photo	1995
Chisel North	2001
Lalor	2012
Reed	2013

As mining technology improves and mineral prices climb, some closed mines and previously unprofitable ore deposits become feasible again. The town's original Nor-Acme Gold Mine, after 40 years of closure, reopened in 1995 with a joint venture between High River Gold and TVX Gold (Participants C-7 and C-14; Parres and Jackson 2009). This mine, known as New Britannia Mine (now Snow Lake Mine) operated from 1996-2005. The Nor-Acme Gold Mine, a low grade and high tonnage ore body, was bought, renamed, and sold many times (Jackson 2015; Town of Snow Lake 2011). Participant C-9 explains the history of the mine;

> I worked for Howe Sound until they shut down in 1958. They were mining for gold and it was low-grade gold and there wasn't a lot of it. It was hard to make a go of it. They were getting a subsidy from the government to keep the place going and even with the subsidy they still couldn't make money. That was the original mine then that shut down for a while and opened again and operated for another 10 years. That head frame that you see in town - that was built when the second go happened and I think they called it New Britannia. There is still gold to be had but it gets iffy.

Most recently, HudBay bought the mine on May 4, 2015 (Parres and Jackson 2009; Jackson 2015). Though there is still an estimated 5 years of mine life at the mine, the base metal mining company HudBay likely bought the old Nor-Acme mine for its gold circuit, mill, and tailings impoundment area, not the gold.

With Snow Lake's close economic ties to the mining industry, the town experienced significant booms and busts (Parres and Jackson 2009). HudBay's base metal mines continued to expand production from the late sixties to the eighties. This boom in mineral production directly

led to growth in the town. In the mid-seventies HudBay built a concentrator to partially process the ore from the surrounding mines (Participant C-11). At the same time, contractors built a new school, apartment buildings, residences, and a new trailer court (Town of Snow Lake 2011). Businesses in town boomed and housing prices peaked (Parres and Jackson 2009).

This boom reached its apex by the late 1970's plateaued for a period, and then steadily declined until the nineties when mineral prices bottomed out (Parres and Jackson 2009). The failure in the mining industry led to drastic cuts in exploration and project development so as mines closed in the area there was no new development to reemploy the laid off workforce (Participants C-6 and C-11). Many of the HudBay employees viewed this bust as temporary and chose to stay on with the company and transferred to the Flin Flon mines, causing many families to live apart and support two households (Participant C-11).

Renewed exploration around the old Nor-Acme Gold Mine began in 1994 and by 1995 the old property began production again under the name New Britannia Mine (Parres and Jackson 2009). New Britannia's rebirth helped turn the town's bust around as many HudBay employees working away from home in Flin Flon were able to take jobs at the gold mine and move back to Snow Lake. HudBay recommenced exploration activities in the mid-nineties and the Photo Lake deposit was quickly found and also entered production in 1995 (Participants C-6, C-7, and C-11; Parres and Jackson 2009).

The town again entered a low period in 2005 when New Britannia Mine ceased production and their entire workforce was laid off (Parres and Jackson 2009; Town of Snow Lake 2011). With fewer jobs, Snow Lake's population dropped significantly and the town suffered (Participant C-11). Diamond drill exploration proved successful in 2007 when HudBay found the Lalor Lake deposit, which could be the company's biggest mine yet (Parres and

Jackson 2009). In the same year, a junior exploration company, VMS Ventures, found significant copper deposits on their Reed Lake property (HudBay Minerals Inc. 2014; VMS Ventures 2015). To this day Snow Lake's economy is heavily dependant on the mining industry. Participants estimate that currently between 80% and 90% of the town population relies directly or indirectly on the mining industry (Participants C-6, C-8, C-14, C-15 and C-17).

As mentioned earlier, HudBay began limited production at Lalor in 2012 (HudBay Minerals Inc. 2014; Parres and Jackson 2009). Reed Lake, a joint venture between HudBay (70%) and VMS Ventures (30%), began first production in 2013 (Jackson 2014). In 2010 HudBay obtained a permit to build and operate a 200-person camp in the town of Snow Lake to house workers during the construction and early production stages of the Lalor mine (Cash 2013). The original camp permit lasted for four years and in 2014 the Snow Lake Town Council contentiously agreed to extend the camp's licence to operate for another two and a half years, half of the company's preferred five-year extension.

Snow Lake in located in Treaty 5 territory and there are a few First Nation communities in the area including Cross Lake and Mathias Colomb (Pukatawagan) though both of the noted communities are more than 250 km from the town of Snow Lake. Mathias Colomb Cree Nation and HudBay have a bit of a stormy relationship that takes root in a disagreement over 'ownership' and land rights (The Council of Canadians 2013). On January 28, 2013 and March 5, 2013 community members representing Mathias Colomb and Indigenous activist group, Idle No More, rallied outside the Lalor Mine and presented a stop work order to HudBay stating that the mine is located within their ancestral territory and the company did not attain their consent to begin the project (CBC Manitoba 2013). The relationship was stressed further when HudBay

received an injunction from the court to keep Mathias Colomb people from protesting at their mine sites (VMS Ventures 2015).

4.2 Legacy Effects

Mining has a long history in Canada, dating back to before Canada was even a country. Mining activities have certainly had many positive legacy effects including wealth generation, employment, skills acquisitions etc. Unfortunately, not all long-term consequences are positive. History has demonstrated that, long after wealth and employment opportunities diminish, negative legacy effects may persist. Negative legacy effects can include tailings issues, economic dependencies, mine footprints etc. This section examines mining legacy issues in Canada as described by research participants. The legacy effects framework; presented in Table 5 was informed Gibson and Robinson's work (2014). The primary categories are theory based and the secondary categories are grounded in the data from both the community and expert participants, unless otherwise stated. Many of the specific examples highlighted are from community participants and pertain to the Snow Lake case.

Table 5: Mining Legacy Framework. Depicts the theory based and grounded categories used for analysis.

Primary (theory-based) Category	**Secondary (grounded) Categories (or themes)**
Residual Environmental Effects	• Water health • Mine site footprint
Residual Effects on Communities	• Job training and experience • Wealth generation • Economic dependencies • Changes to town culture • Land rights and community relationships
Boom and Bust Cycle	• Dependence on the mine and mining company • Diversification • Population and the housing market
Remaining Infrastructure	• Ageing town infrastructure • Roads and connectivity
Resource Depletion	• Heritage funds

	• Taxes and royalties

4.2.1 Residual Environmental Effects

When asked about mining legacy issues participants most commonly identified the long-term environmental ramifications of mining. Of the 24 participants interviewed, 21 spoke about environmental impacts of some sort. Instances and examples of residual environmental effects provided by participants were all negative. Two sub-themes associated with residual environmental effects emerged in the data: water health and mine site footprint.

4.2.1.1 Water Health

Both expert and community participants noted the importance of clean water and the dangers of water contamination (see Photo 3), especially with relation to mine waste and tailings impoundment areas (tailings ponds) (Participants C-11, C-14, C-18, E-1, E-3, and E-22). There is a fear, common with many mining operations and echoed in the interviews, that improperly stored acid generating mine waste will oxidize and create acidic runoff and ARD (e.g., Akcil and Koldas 2006). Incautious milling and tailings operations also threaten water quality as elevated levels of heavy metals and other contaminants could enter the environment.

Photo 3: Lake. The Town of Snow Lake is built on the shores of the Lake of the same name. Photo of Snow Lake by M. Boerchers (2014).

Participant E-22 noted the dangers to water quality and the potential for long term negative legacy issues on mining areas,

> The environmental problems are mostly water related and have to do with the physical disturbance and the waste materials. Approximately 90 percent of the material is moved but not removed as part of the mining process and now there are mobilized potentially acid generating sulphides, heavy metals, arsenic, all kinds of nasty things.

Participant C-8 comments on how the mining community of Snow Lake deals with ARD because of historic improper storage of acid generating mine waste.

> This community is built upon waste. A lot of the piping around town is backfilled with acid generating mine waste and it just eats the pipes away and that is why we have so many problems. I don't know if they just didn't know any better or they just didn't care or if they thought it was just a community that was going to not be there very long. A lot of the mines around have acid generating rocks.

Some participants also identified and criticized the practice of perpetual water treatment in Snow Lake and in other mining areas, "what about water treatment in perpetuity? How is that okay and yet it is something that we accept as a society" (Participant E-2). As noted in the literature there is a danger as well as an intergenerational injustice that comes with perpetual care such as water treatment (Gibson and Robinson 2014; Johnson and Hallberg 2005).

> Our pond water is high in arsenic so we need to have a way of removing arsenic from the system. The hope is that once they put a cover on the existing tailings then there won't be any more runoff water leaching into the pond itself. But there are still those high levels of arsenic that will keep on cropping up. The arsenic levels are pretty high in some places because it just has been adding up over the years. […] To be able to walk away from here you have to be able to allow for continual discharge and if it is high in arsenic then that isn't going to be very good for the environment. So right now as it stands we only have to discharge once a year unless we have a major catastrophic hundred-year flood. Every two years we discharge enough water so that we have room for another two years. It is only a one-month period where we discharge but because our water is high in arsenic we have to treat it with ferric sulphate - that precipitates the arsenic in the water […] the system that we are using now is working very well for us but this is going to be forever. I can't see a way of not discharging so whoever buys this property … It is a bit of a liability (Participant C-14).

> There is, I think, a general growing mood that any operation that might require water treatment in perpetuity should not be contemplated. If you are not pretty sure that any waste disposal will be permanently self-contained then it shouldn't be done. That is a problem because there isn't actually a lot of certainty attached to many of these projects and especially if there are large tailings dams and the potential for gravity and thermodynamics to move things downstream - that will eventually happen in a large enough timescale (Participant E-22).

Associated with water quality, some participants spoke about their concern for fish health as well as drinking water.

> There are people who live up there and you still want to fish, hunt, hike, boat, and to be able to drink the water out of the stream. And they also want to be able to work in traditional economies. They want to be able to farm, have fishing and guiding operations (Participant E-1).

> Humans make errors too. [HudBay's] tailings pipe broke two winters ago so their tailings ran right into the ditch and then into the water. Stuff happens and unfortunately one midgrade mistake from them could directly affect our business and our livelihood. I don't know. I'm just glad that we don't get our water from their water bodies - except for Reed Lake now drains into our water but there isn't a mill or anything so they just haul the ore straight to Flin Flon for processing (Participant C-18).

Some participants note that many of our current water related legacy issues are from historic mines, before more stringent environmental regulations came to pass. These participants suggest that current regulations will limit future legacy issues, including water quality.

> Mining is one of those industries that has had very damaging effects and the response from governments and communities and stakeholders has been to try and manage that so it has been sort of more of a reaction. But that is good because the reaction has led to incorporating or improving legislation to protect the environment (Participant E-3).

> So for example, I don't know if you are familiar with the environmental effluent regulations that are required as part of the metal mining effluent regulations. So we have to do field studies every three years and our studies have concluded that impact is primarily associated with historical sites. So when releases from the tailings facilities were not controlled in those early 50 or so years there are deposits in the sediment essentially that can and do still get back into the water column and so obviously it affects the benthic community as well. But the current water, according to the MMER regulation - you could drink the water out of the discharge of the tailings facility today and you would be fine (Participant C-16).

Others believe that current environmental regulations limit the environmental damage caused by mining but they are not sufficient. According to some participants there are still ample opportunities for proposed mining activities to leave lasting environmental destruction. Often, financial benefits are taken at the cost of environmental safety. Expert participant E-24 describes his general concern with current mining activities in Canada,

> No we aren't doing very well at all and there are some places … Dry stack tailings are difficult in coastal weather but most of the mines that are being proposed in the

> Northwest [of British Columbia] are in the interior so they are dry and cold which is a perfect situation but it is going to cost more. I think that Red Chris is going to cover their capital costs in four and a half years and the mine that they have planned going to last 25 to 30 years and there are low-grade deposits around there so they could be mining for 100 years. If they can recover their costs in the first four and a half years then why can't they spend a little bit more money on doing a better job - it drives me nuts.

4.2.1.2 Mine Site Footprint

Community and expert participants also noted the environmental legacy effect of mine site footprint. Mine site footprint, the total area affected in some way by mining activities, is created when huge amounts of mine waste are brought to the surface (Canadian Geographic; Gibson et al. 2005). Mine footprint can be a problem for both open pit and underground mines as well as exploration. Typically, mine footprint includes waste and tailings impoundments, the areas covered by buildings, transportation and power infrastructure, as well as exploration residuals such as seismic lines and boreholes.

Participants recognized that mine site footprints and lasting effects vary greatly throughout history. They suggest that historic mines, before modern environmental regulations, exhibit larger and longer lasting footprints (see Photo 4).

> Certainly there are long-term effects in the Flin Flon area. Most of them appear to be from historical and not current mining - although current mining has an effect as well. It is a matter of significance levels. Since the mine was established in the 1920s and environmental regulations came into place in the late 60s or early 70s so for 50 or so years there was essentially no environmental regulation so things were operated in that fashion. So some of the effects of that are still present to this day (Participant C-16).

> Visually at least, there are some old mine sites that were operated in a different era by our grandparents and there was just not as good of a regulatory background and the standards of the day were different – not as robust or stringent. So you see these old sites that were closed down many years ago using the best-known information at the time. You might look at it and say oh that is really ugly and there are some impacts like water quality and things like that. The best example in Manitoba would be Sherridon - to be honest I haven't been there in two or three years so maybe it looks awesome now but when I was there it really looks like it needed a whole bunch of TLC decades earlier (Participant C-13).

Photo 4: The Blue Mine. The New Britannia Mine (once the Nor-Acme gold mine that made the town) still sits in Snow Lake, including the head-frame (on the right) and tailings areas (not pictured). Photo by M. Boerchers (2014).

Many community participants believe that the citizenry is well aware of the environmental effects of mining and, while they would not accept the mine footprints associated with historic mines, they are comfortable with current impacts. As captured in the words of a community participant, they believe that the economic and social benefits of mining outweigh the environmental costs:

> While I think Snow Lake is mining friendly I don't think that people would tolerate [historic environmental legacy effects] these days. I think that we have gotten a little wiser in that regard. On the other hand, I think the people are quite comfortable with the current effects. Where people wouldn't put up with the same effects that happened 50 years ago, people are willing to say ‘we know that there is going to be a cost but it is improved and the process is better’ (Participant C-17).

Some participants express satisfaction with new mining practices and their footprint and suggest that a combination of improved technology, stringent regulations, and societal will leads to smaller mine site footprints.

I have been very impressed with some of the environmental work. Like what they've been doing on the Reed Mine – to put that mine in that small of a footprint …. Right down to they are cutting down branches of trees instead of taking out the trees so that they can get their satellite service a bit better (Participant C-8).

To me the footprint that mining leaves in northern Manitoba is relatively small - it is pretty large and pretty intense where that footprint is but in the overall province it is relatively small and it is done with the best of technology that we have right now, which may not be the best that we will ever have but it is the best that we have right now and it is a heck of a lot better than most places in the world. When we are talking globally I think that we have a responsibility to do this in the best way that we can and keep that footprint as small as we can. There are not very many mining companies that I know that don't think that way (Participant C-23).

4.2.2 Residual Effects on Communities

The advent of mining activities in an area can drastically affect communities in the region. In the case of Snow Lake, and many other single industry towns in Canada, the community was created to support mining in the area. Simply, Snow Lake would not exist without local mineral extraction (see Photo 5). Mining, therefore, has and will continue to exhibit a dramatic influence on the community. Most participants noted that mining in the region has both positive and negative residual effects on the community and this finding lines up with the literature on legacies (Gibson and Robinson 2014). Themes are associated with residual community effects included job training and experience; wealth generation; economic dependencies; changes to town culture, land rights and community relationships.

Photo 5: Welcome to Snow Lake. A sign welcoming visitors to the town of Snow Lake, Manitoba. A mine head-frame is central to the town seal. Photo by M. Boerchers (2014).

4.2.2.1 Job Training and Experience

Community members can experience the positive effect of mining through employment in the mining industry (Gibson and Klinck 2005; Sandlos and Keeling 2013). Local businesses, contractors, and community members can also gain job training and experience that not only

qualifies them for mining related jobs but also makes them more valuable in the broader provincial or national job market after mining activities in the area cease (Gibson and Klinck 2005). Participant C-13 explains the possible benefits of working for a mining company:

> But where the industry, and not just our industry but lots of industries, have done is with corporate social responsibility we're trying to be a good corporate citizen and provide local folks with training opportunities and start-up assistance so that when the mine disappears the community has some sort of ability to carry on and make money – a skill that they are able to then use for future potential opportunities […] Communities and businesses and individuals should have gained skill level while the mine was operating. So if you are out in the boonies and you are basically underemployed are unemployed when the mine is operating, maybe you aren't a miner or an electrician or a mechanic or a mine manager or something like that, but maybe you are able to work at the camp as a cook and you are able to gain some sort of skill – or maybe just the fact that you have a job now you actually have a resume that says something other than just subsistence living or fishing on occasion – if you have an employer and you have a track record then maybe it is easier to get it next job with another employer.

Some participants stated that this opportunity for job training and experience is especially valuable in Northern remote areas since there are limited employment opportunities in these areas and this idea corroborates other literature on the topic (e.g., Gibson and Klinck 2005; Gibson 2014).

> In the far north, very often you have communities with no experiences of wage employment and relatively low skill level. So building up, even in the EA, building up that skill base is very important. Helping the community develop the skills that they can translate into long-term employability (Participant E-4).

Besides on the job training, mining companies may partner with other organizations to offer training and skill development in the community. This education is often directly linked to jobs related to the mining industry. The Northern Manitoba Mining Academy in Flin Flon, Manitoba is one example of this kind of educational partnership (HudBay Minerals Inc. 2015). The Mining Academy is a joint partnership between HudBay, the University College of the North, Northern Manitoba Sector Council, the Government of Manitoba, the Government of Canada, the City of Flin Flon, and the University of Manitoba (Cecilia Jamasmie 2010).

> Well it can be as simple as the Mining Academy is on land that belongs to HudBay and received several hundred thousand dollars from them. [HudBay is] putting money back into the community and into infrastructure and education (Participant C-23).

Participant C-6 explains that education and training may be focused on trades and industries not associated with mining, as a way of transitioning the work force to alternative employment, if mines in the area were closing and no new ones were being developed.

> [The mining companies] have [offered education and training programs] in the past when they shut a mine down and there were a lot of guys out of work. They have partnered with some form of government and guys went back to school and went on to other trades. But this only happens when it is a major closure. Normally they would move guys from mine to mine. Guys from Snow Lake would go into Flin Flon and work in one of those mines. Now guys from Flin Flon are coming here and working in this mine. They move people around as much as they can but they also do some new job training (Participant C-6).

4.2.2.2 Wealth Generation

The mining industry is one of the highest paying industries in Canada (HudBay Minerals Inc. 2015; Gibson and Klinck 2005). Mining jobs and the associated wages certainly benefit the community.

> The metrics are that the average mining job is about $100,000 a year - it's the highest in the industrial sector in the province. It comes down to can you maximize the local employment in the region. Does it make business sense to bring people from other provinces to work here? - no (Participant E-21).

Some participants stated that these high paying mining jobs (See Photos 6 and 7) allow community members to live in a community they love and give a better life to their children through higher education.

> The fact is that the community is only here because of mining. My dad worked underground for 35 years. There are four kids in our family and we all went to university and college and we grew up fine and the mine paid for that. Same with my wife's family - her dad worked underground for 30 years and it paid for university and it paid for everything. When you look at the community, you have the highest per capita income in the province and that is based on mining. So there is no two ways around that fact. The benefits - that is just talking personally (Participant C-17).

Others, like Participant C-23 note that wage generation improves community members lives in an indirect fashion,

> If you alleviate poverty [through mine wages] then you start to deal with healthcare and you start to deal with the other education issues and a lot of the other issues that we have in communities in the North. Alleviating poverty is a major thing there. How do you do that? You do that through wealth generation and not just transfer of payments. How do you generate wealth? You have to produce something. What can we produce in the North? Well we have water and rocks and trees. We can produce hydro, minerals, and fibre. Until such time as someone starts to pay us for environmental processes, these are the only options that we have for a lot of these communities (Participant C-23).

The province, as a whole, also benefits greatly from the wealth that is created through mining activities. This wealth is then used to maintain services and infrastructure across the province.

> The other thing is, you will hear this from some people in the North, 'I know that there is a mine in Thompson but I have never gotten anything from it.' Meaning that no one has ever come to see them with the chequebook like my Manitoba Hydro does. At the same time, mining is a big contributor to the coffers of the province of Manitoba. Our roads and hospitals are built, in part, with royalties gained through mining activities. We all do benefit from it and that is one of the legacies of mining (Participant C-23).

Photo 6: Hardhats. Photo taken inside the New Britannia Mine (Snow Lake Mine) building by M. Boerchers (2014).

Photo 7: Work Gear. Photo taken inside the New Britannia Mine (Snow Lake Mine) building by M. Boerchers (2014).

4.2.2.3 Dependence on Mining

A negative community legacy effect of mining is that communities often form a deep dependence on mining (Living in Canada 2013; Putz et al. 2011). This dependence proves to be a problem especially when mining activities cease. Mining dependent communities often do not have the economic robustness and diversification to exist long after the mineral resource is depleted or the mine closes (McAllister et al. 2014b). Their reliance on mining means that they often have an uncertain future after mining activities ultimately end.

> So whose responsibility is it [to keep the town alive]? I don't know. It can't be up to the town people because they are already stretched to the limit – I don't know I think it is actually just a lose situation in the long-term, I really do. But I don't tell townspeople that at all. But I just can't see a long-term future. No place has really made it after mining (Participant C-18).

> When the mine leaves and the resource is depleted – now you have a town whose only method of funding is taxing its residents. It is very difficult to tax people when they have walked away from their house or there is no house or they have moved. Even if

> somebody retains their property but has moved their house down to Winnipeg you can't tax them very much so you have less money to pay for the upkeep of the community and that sort of thing. So then the community is basically sitting there destitute. They have no means of collecting revenue or taxation or anything like that (Participant C-13).

4.2.2.4 Changes to town culture

Many community participants noticed changes in their community that they attributed to modifications in mining practices and policy. Chiefly, participants spoke of the introduction of more intense shift work and a camp in Snow Lake for employees to stay at for a minimal cost during their shifts meaning that they were more likely to stay in camps than settle. Storey (2010) also notes how mine camps can discourage employees from permanently moving with their families and becoming part of the community. In the same paper Storey (2010) states that mining companies do not necessarily want to build camps to house workers, they may even promote local housing. Employees may, however, refuse to relocate, and force the company to establish a camp, as was the case in Voisey's Bay (Storey 2010). Participant C-19 explains her view of the camp:

> There are more people - well sort of. Through the camp you notice some more bodies in town but there aren't necessarily more permanent residents. It has been sort of a slow rise. If there has been much of a rise [in population since Lalor's opening] it has been hard to notice.

Civil life and community activities are on the decline in many small towns and many participants attributed their demise, at least in part, to the advent of more intense shiftwork including 12-hour shifts with no uniform "weekend".

> For many years we operated on a five and two schedule. Everyone had the weekend off. Curling was full, hockey teams are full, the arena - which they contributed a lot towards - was busy. It was only when they shifted to a 12 hours schedule two shifts a day 5-4-4-5. They are forever changing shifts. The guys like the longer hours because then they have longer weekends but it really disrupted the social life schedules. Curling teams had a really hard time because guys never knew when they were going to be off or on nights or whatever. It made a lot of subtle changes to the community. Even to this day there are

> very few curlers, and mind you that is a reflection of the population as well (Participant C-11).
>
> There used to be weekends. Now weekends don't mean anything. They work a number of days. It is harder to have a social life in the community. It is hard, almost impossible for the people who work in the mines to be part of the recreation in the community (Participant C-10).
>
> It hurts the community because the guys on days off, if they have four days off, they often leave the community even though they live here - four days off is the perfect amount of time to go to Winnipeg or Saskatoon or wherever. The community doesn't have a weekend anymore. A lot of the guys don't have weekends at all. They work odd shifts too, four and three, three and four, four on and four off, so it has changed substantially. It shuts the mine down sooner because where they worked five days a week before the mine lasted longer because they were only expected to get so much production a month. Now they are expected to work every single day so of course the mine runs out more quickly. So that has changed substantially. So is it better to run longer? I think it is better for the worker and for the community. Doing it all at once and as much and fast as you can is better for the shareholder. So I don't think there is a better - I guess it depends on who you are (Participant C-6).

Other participants do not blame the new shift schedule, but rather see it a symptom of modern life as the following quote exemplifies:

> A lot of people say that going to 12-hour shifts with four on and four off or whatever, has killed a lot of social clubs in the community - things like a Elks club or a Lions Club. A lot of people say that that has killed volunteering in the community and things like that but I don't know if that is true. We've definitely seen a decrease in membership in that kind of thing, Elks club, our Lions Club, but so has everywhere else. We have seen less volunteers in the community but so has everywhere else and we also have a smaller population in the community so you will have less volunteers. You hear that a lot but I'm not 100% sold on that - what do you base it on? They say it about all kinds of different things, curling, hockey - my wife is in tae kwon do. As parents in this community a lot of people put their younger kids into a lot of these activities. You're very active five, seven, eight-year-olds in the community and then the kids hits 10 or 12 and a lot of things die off. Again, I don't know what the cause of that is. I am not sold (Participant C-17).

4.2.2.5 Land Rights and Relationships

Some of the participants in this research, especially the EA and mining experts, identified land rights and relationships as a major lasting effect on the community. Mining activities, because they are so high stakes and oftentimes have the ability to make or break a community, can lead to strained relationships and conflict between communities, First Nations, and mining companies

(Aur Resources Inc. 2006; Gibson and Robinson 2014). As noted in the case description, there are several First Nations in the vicinity of HudBay's Snow Lake operations. I was unable to speak to community participants from those areas and therefore chose to not delve into the local territorial and 'ownership' issues without representation from the involved First Nations. Instead I present here the general comments on this subject from the Expert participants.

> The one big one that I feel like the mining industry, in terms of legacy is community relationships. Because there is a somewhat gray area in terms of land rights and to what extent community should be involved I think that it is a tricky area but I think it's one of the areas that we see projects and industry struggling with all the time because they don't have buy-in from the community. That is an issue that I feel continues to be important (Participant E-3).

These relationships can be further strained when local communities hold different development ideals. Participant E-4 explains this situation:

> It is something that as a society we will always struggle with. Who makes the decisions? Is it the province, the region, the individual, individual communities, and what if two neighbouring communities have differing opinions? And when you come to mining and the North - and when I say the North I don't mean just the territories but also the north of the provinces - the local community might be 500 miles away so you may have very different perspectives. You can look at a number of different projects and you might have an aboriginal group that says, 'we have more than enough employment and we don't want impact that this will bring to our traditional land-use.' Where a local non-aboriginal community in the area might say, 'oh we want jobs and this will help our local retail and supply companies - so let's go!'

4.2.3 Boom and Bust Effects

There is an extreme volatility associated with the mineral industry. The profitability of a mining company, and therefore the prosperity of a community, are tied to the fluctuating market price of mineral commodities as well as the availability of a limited resource (Putz et al. 2011). This close connection to the economic cycle of a resource means that a community acutely feels the booms and busts of the mineral industry and this can cause a lasting legacy effect. Boom and

bust themes identified in this research include dependence on the mine and mining company, mine life cycle, diversification, as well as population and the housing market issues.

4.2.3.1 Dependence of the Mine and Mining Company

This theme of dependence was canvased, in part, in the previous subsection "residual effects on the community" but I will elaborate on the topic here because it is a major legacy effect of mining. Simply put, the majority of participants believe that small single industry communities like Snow Lake, Manitoba are too economically tied to mining activities to exist long after the mines close permanently. Without mining and the well-paying jobs it creates, these towns, especially northern remote towns, have a bleak future. They are too dependent on the mining company and the mine for their existence.

> One legacy effect that I'm aware of is the ghost town that is left after boom and bust cycles. When mines open up they generate lots of jobs and infrastructure is created and the local economy thrives then the mine closes out and the whole economy dwindles (Participant E-1.)

This means that, unless the situation drastically changes in Snow Lake, the community will not exist long after mining in the region ceases. Participant C-13 explains the situation.

> Let's use Snow Lake for an example. If there were no mining activities in the town of Snow Lake then there are 500 to 1000 people without reasonable or good paying jobs. You can only have so many people running fishing lodges and doing that kind of work. So it is a bit of a struggle to maintain some sort of industry after the miners leave. If you don't have 500 to 1000 miners in town buying groceries and gasoline then maybe the gas station lays off half of their employees or the grocery store only stocks half of the supplies or maybe it gets to a point where it is just not economical and so the store shuts down. Incidentally, I believe that is what happened to the Northern Store. Almost a decade ago it closed down in Snow Lake because there was a bust cycle and everyone was enamoured with shopping at Walmart in Flin Flon so the local business sort of just closed its doors. Every time a business closes its doors then you have less people working and maybe you have fewer kids in school and it is sort of just a death spiral.

The boom and bust cycle might be weaker if there are multiple companies operating in the same area, even if they are within the same industry, as Participant C-15 notes,

> Yes, being dependent on HudBay or on one particular company [is negative] - they aren't the only one, there were other companies in town and that is always healthier - to have more than one company. Having one company is a very negative thing. The town is very actively trying to diversify and bring in supply companies in the mineral sector or whatever. The boom and bust cycle has been very traumatic. It is very positive now that they have 40+ years of mine life [at Lalor] and hopefully that will be seen in town.

Participant C-10 reminisces about how a bust in the mineral industry affects all aspects of community life, including a local restaurant that she and her husband owned.

> All of a sudden three of the mines were closing down. I think that it was in the late 80s. The new owner [of the restaurant] had never missed a payment and had had it for two or three years then all of a sudden everyone stopped buying. No one was buying anything from the stores - it was amazing. She just came and gave us the keys. For the first time we didn't have any mortgage. We paid off the mortgage so we didn't owe any money. So we took the restaurant back and ran it. We used to sit at 3 o'clock in the afternoon and there wasn't even a car running. It was really eerie. The other stores were the same of course. That didn't last very long until New Britannia was a definite go. Then of course when New Britannia came everyone was excited and started buying again. That period was a little bit scary but we knew we didn't owe any money so that was good.

Snow Lake's dependence on the mining industry is severe as it is in many single resource communities (e.g., McAllister and Fitzpatrick 2010; McAllister et al. 2014a). The ultimate bust has yet to happen but there have been several close calls where the community's future seemed certainly doomed. Participants living in Snow Lake held no romantic idea that the community could exist long-term without an active mine in the region. Sustainability for the community, paradoxically, is finding another mine in an attempt to stave off the inevitable ultimate bust – the death of the town.

4.2.3.2 Diversification

Those who participated in this research noted that diversification, or the lack of it, is closely related to mining's boom and bust cycle. They indicated that the community has little interest and incentive to aggressively pursue diversification away from mining when the industry is booming.

> It can be very difficult to get people to understand the need for [a robust sustainability plan], especially with the announcement of a new mine it seems like any work is put off for another 20 years. Lalor has a very long life ahead of it so probably Snow Lake is content to rely on the mining industry for their revenue until the end of its life (Participant C-16).

> I think that people are more forward-looking than they used to be just because they have gone through [the boom and bust cycle] a couple times. I think that people are getting a much better sense that you have to do something or else we are going to continue through the boom and bust cycle. On the other hand, when people make a lot of money and you see a mine with a long future it is hard to hold that discussion with people. I think it is an agenda that needs to be continued and an agenda that needs to be pushed because I think that you can convince people of it but it needs to be sold. It needs to be something that is evangelized upfront with people. You need to say to people, 'even though we have X we still have to be working on this other stuff' (Participant C-17).

> The town has gone through several rebirths over the years and it's usually when things are going rough and there is talk about the mines shutting down and then everyone says, 'but we have to do something to diversify.' That homework should have been done years ago. Instead they are just thinking about it when they need it. That is always the case. That is the case right now, they aren't thinking about anything in regards to diversifying the community - they want to build the community so you will have more to worry about in the future when things go down. It seems like people keep on making the same mistakes. They aren't learning from their mistakes (Participant C-8).

When the mining industry goes through a bust cycle then the community seems more interested in diversification. Diversification is, of course, less possible when the community is faltering, haemorrhaging jobs, and loosing people. Participant C-13 explains the difficulties associated with diversifying a single industry town, "Well, look at the downtown - it is so sad. It is hard to get companies to come in here. They drive around and say, 'woah, once the population starts to increase then we will consider it.'" These actions bolster the already damaging boom and bust cycle. Some participants believe that there is a way out of the boom and bust cycle, but this escape requires careful planning and strategizing before the excitement of a boom period hits.

> There are those kind of discussions but there are also discussions around diversification […] What we are looking at is that some of the skills are transferable between multiple industries. Even if it is slow right now in mining we could still be training power engineers because we could be using them in fibre or in manufacturing or something like

> that. There is a core of people in the North were looking at diversification and not just a resource extraction (Participant C-23).

Some participants, as well as EA scholars, suggest that strategic planning could alleviate the problem of community dependence on a single industry.

> Then there is sort of the range of dependency and I think probably there have only been a few EAs, that I know of, that have tried to tackle that – the Mackenzie Valley Pipeline and Voisey Bay standout in terms of actually looking at economic dependency with an eye towards sustainability over the life of a project – what can be done to build a diversified economic base that will at least have a chance of withstanding the end of operation. That is the tricky part. For smaller or shorter-term projects it is more or less impossible – it takes a really long time to build those linkages and make sure that they're strong enough and to find other economic bases because in many cases they don't exist or they are much weaker. Certainly, providing mine site services or drilling or explosives are pretty specific and you aren't going to be able to do that without a mining operation to feed. You know, some of the more generalized services could apply to other things, if they existed. Yeah, so that is a definite problem (Participant E-22).

> The people of Snow Lake obviously want to keep their town alive, as I'm sure you have caught on. What we are also seeing is I think that we have learned some lessons from Leaf Rapids. They came in and built a gorgeous community in the center of the wilderness, mined it out, then they left, they dumped it. There are a number of us trying to swim against the stream right now and say, 'let's not continue to make the same mistake.' Even right now with Lalor we are swimming upstream against the people in Snow Lake – I have had this conversation with the Mayor and other people up at Snow Lake. We should be putting our infrastructure into our major urban centers and building transportation links back and forth. Whether the next big mine is in Snow Lake, or Ponton, or Grand Rapids, we can still continue to move but we also have our infrastructure like hospital in schools and all of that stuff at our major urban centers so that people will come and move their and bring their families and turn it into their community but one or two of them might have to work in a FIFO situation somewhere in the North. That is becoming the desired way of handling it now for most miners. They want FIFO. They don't want to have to keep on moving and buying houses (C-23)

4.2.3.3 Population and the Housing Market

The population and housing market of a mining community are also tightly connected to the economic boom and bust cycle. In boom times the population of the town increases as new jobs are created in mining and supporting industries. During this time of population increase, the housing market explodes and houses can more than triple in value in a very short time.

Conversely, during a bust period houses can lose nearly all their value. Participant C-6 explains how the housing market is tied to the boom and bust cycle,

> Being a mining community, we have gone through boom and bust cycles. We've had houses here that were $60,000 one year and $10,000 the next and some were just walked away from. Now with Lalor starting up again and new employees coming and employees coming back prices are jumping up again. Now everything is in the $200,000 range again. The prices will do that. It's an interesting place to live simply because of that.

Some participants note that the new Lalor employee camp has greatly changed both the population and housing dynamics in the community. Employees working for the company have the option to stay and eat at the camp during their shifts for a nominal fee. This option means that there are fewer people looking to buy houses in the community right away.

> Yes, since they got the new mine the town was supposed to be booming but it is not booming because no one wants to come up to heer for work and if they do then they stay at the camp for their shifts. And why wouldn't you stay there? It's free, you get all of the food you want, you don't have to clean, so there isn't a lot of incentive to move out. All you don't get is you don't get is an extra $2.50 for every hour you work. So really for $30 a day you get a room and all of the food you want so that is a pretty good deal (Participant C-12).

> We expected a boom when Lalor came back in because they were going to hire 300 people or more and they had to update infrastructure. The boom didn't really happen because they moved a big camp into town and they've got a lot of single guys, contractors who come in, stay at the camp, work at the mine, and then go home on their days off. It has improved and it has gotten busier, the school has picked up - but not to where it was, I'm hoping that it still will. As a retiree I don't mind it being quiet but it's not good for the town. We have a terrible business district. People go out to shop. They buy the groceries here but that's it, there really isn't anything else. Groceries and gas - just day-to-day stuff (Participant C-6).

Storey (2010) suggests that camps may be beneficial because

> workers who live in camps place fewer demands on infrastructure and services than those who have migrated to the area and live in the community, [though] their impacts and those of the projects where they work is not insignificant (1166)

However, Storey (2015) also asserts that camps can be detrimental and possibly a worst-case scenario when a town already exists in the region, as is the case in Snow Lake. When an existing

town and camp both exist the community foots the expenses associated with having more people in the region (e.g., medical costs, infrastructure strain, etc.) without the benefits of having more permanent residents in the area (e.g., property taxes, local business support, etc.). Camps can drain many community resources while still giving the illusion that they are bringing more people into the area and are therefore beneficial. One participant in this study strongly held the same view as Storey, that camps are not the best option for a community, in stating, "the company is not doing the right thing and the camp prohibits houses from being bought, the school from being filled, infrastructure from being repaired (Participant C-15)." Most other community participants, though not overjoyed with the camp's existence, gave in to the company's pressure to build a camp and see it as a temporary necessity of having the mine continue in their community, as illustrated by the following quote by Participant C-8:

> A lot of people don't like the camp but personally, I can see the company side of it. You can't expect people to come to Snow Lake and buy houses. They have never seen the community and they are going to come into a small town and buy a house where there is a history of markets that go up and down […] I can see the company wanting the camp to get people into town - and the company has explained it this way, you want to get people into town and to establish themselves and then they will buy a house. At some future date they say that they will shut that camp down. It costs them a lot of money to run it and if they have people living in the community then that is less money that they have to put up. I would sooner see that camp here in town than out at Lalor. At least the people who are living at the camp are putting a little bit of money into the town economy. I would like to see that maybe when you hire on at HudBay there is a stipulation that you are in that camp for a year and then after that you are on your own.

4.2.4 Remaining Town Infrastructure

Both the literature and participants in this study suggested that remaining town infrastructure is a legacy effect of mining (Gibson and Robinson 2014). The research found that the legacies associated with remaining town infrastructure can be both positive and negative and includes; ageing town infrastructure and also roads and connectivity.

4.2.4.1 Ageing Town Infrastructure

Since the town of Snow Lake did not exist before mining began in the area and was created to support the mine, the mining company built most of the town (as discussed in the town overview section). Mining operations have uncertain lives and never last forever; therefore mining companies plan and build town infrastructure with materials and designs that will wear out and need to be replaced. Participant C-15 gives an example of the negative legacy of ageing infrastructure:

> A lot of the infrastructure in Snow Lake was substandard so instead of half-inch lead pipes or whatever they used in the day that they thought was best, in Snow Lake's case they used quarter inch culverts - you know those corrugated things that they use that aren't expected to last very long. In Snow Lake pipes in the ground are now just little lacy bits of metal in some cases. Basically, just water is being pushed through holes in the ground. They are substandard and because of the terrain here they used a lot of mine waste for fill. There is a theory that if you add water and oxygen to that waste you will get an acidic environment.

As Participant C-17 explains, though the company built most of the town originally, they have no interest in updating or building new infrastructure in the town:

> When you look around Snow Lake basically the mining company built everything originally. I mean, most of the houses were built by the mining company, the arena, the curling rink, the community hall - all of that was financed by the mining company. When we talked to HudBay as part of our grant in lieu negotiations we talked about these kind of things and Hudbay was point-blank in the fact that, for example, they told us that they were a mining company and not a housing company. So when we looked at expanding the community and building a new subdivision they wanted no part in that.

This means that the town has to deal with, repair, and rebuild the legacy effect of ageing town infrastructure without the paternalistic help of the mining company.

4.2.4.2 Roads and Connectivity

Participants did not agree whether roads and connectivity are a positive or a negative infrastructure legacy effect – similar to Gibson and Robinson (Gibson 2014; 2014). Road and rail developments are often built to support mining operations, "[the government] generally [is not] going to do that sort of thing for the people but they will do that for the people as long as

there is also an economic benefit for it as well" (Participant C-23). All the community participants who mentioned the increased connectivity that new roads provide suggest that they are positive legacies that make it easier for them to travel and ultimately live in Northern Manitoba (see Photo 7). Participant C-7 simply states that, "Infrastructure is a benefit to the community. We get roads built that are usable."

The mining and assessment experts are more divided on the topic. Participant E-4 explains her view of roads and the connectivity they provide:

> "So you can look at building infrastructure as a positive or you can look at it as a negative. As a positive it might improve the quality of life, improve the provision of healthcare, provide a basis for additional economic development and independence for the community. You could also say that it gives more access to people therefore it will destroy the ecosystem and the environment and stress wildlife. There is not a factual answer - it is a social objective answer."

Photo 8: Connectivity. Provincial Road 392 connects Snow Lake to highway 39 and ultimately southern MB. Snow Lake is literally at the end of the road. Photo by M. Boerchers (2014).

4.2.5 Resource Depletion

The final legacy effect identified during my interviews and in the literature (Gibson and Robinson 2014) is resource depletion. This is an obvious legacy effect as mining diminishes a

finite resource; however, participants did not speak about this category of legacy effect as much as the others. Subthemes that emerged in the interviews included; heritage funds, as well as taxes and royalties.

4.2.5.1 Heritage Funds

Recognizing that mines, by nature, do not last forever, participants noted that the province or company should create some sort of heritage fund so that a certain percentage of the profits generated through the mine are reserved for community use after a mine closes down.

> In other cases it is a question of is their willingness to ensure that positive long-term impacts - so heritage funds are an obvious example. If you recognize that you are depleting a resource then that is a negative legacy impact and to make a concerted decision that you want the project to have an overall positive legacy impact then you will respond to the known and the risk of a negative legacy by taking measures to ensure that there are also positive legacies (Participant C-5).

The government of Manitoba currently has a type of heritage fund, the Manitoba Mining Community Reserve Fund, which was established in 1970 to help mining communities in economic distress due to mine closure (Government of Manitoba 2010). Provincial mine tax revenues fund the reserve.

> It is called the Manitoba Mining Communities Reserve Fund. It was set up to help mining communities that were in dire straits. There is a move afoot in Snow Lake to try to get some of that money for infrastructure. Rather than waiting for a mining town to be in the dumps and moving people out of the community - why don't you try to put a little money into helping build and improve the community (Participant C-15).

Some participants note that, while better than nothing, this current heritage fund has some issues. It is a pool of funds held for all mining communities in the province and is not community or mine specific. According to the Manitoba Mine Tax Act,

> The Lieutenant Governor in Council may order a portion of the taxes received or receivable under this Act for the year to be transferred to the mining community reserve. That portion must not exceed 6% of the taxes received or receivable for the year (Government of Manitoba 2010, 28).

Participant C-15 explains some of the flaws of the current reserve fund "it used to be 3% but it wasn't 'must' it was 'may' put 3% of royalties. The government did then increase it to 'may put in 6%' - which isn't very much really." Participant C-13 states the need for a heritage fund by stating, "once a resource is gone it is gone but you leave behind enough wealth with the province - and they fund certain things like hospitals and schools and that sort of thing."

4.2.5.2 Taxes and Royalties

Many mineral-rich countries employ a mandatory mining royalty system (Fonseca et al. 2013), Canada is no exception (Otto 2006). Mining companies pay mining royalties, meant to compensate for the use of a public resource, to the provincial, territorial, or federal governments depending on who has jurisdiction (Hart et al. 2012). Towns in which mining companies operate may also receive taxes or grants from the company.

Rresource royalties are determined by mine profit and not by the gross value of production (Hart et al. 2012; Natural Resources Canada 2014). Mine royalties vary greatly in each province and territory and vary from 5% (Ontario remote mine) to 17% (Manitoba if profit >$105 million) (Hart et al. 2012; Natural Resources Canada 2014). Some experts believe that mining taxes and royalties are low in Canada and generally do not cover the costs associated with administering, subsidizing, and promoting the industry (Hart et al. 2012). It is also notable that governments often offer tax holidays and incentives for mining operations (Natural Resources Canada 2014; Taggart 1998). In Saskatchewan, for example, new mines since 2007 receive a 10-year tax holiday and it is entirely possible that a mine could operate and close entirely within 10 years while only paying minimal taxes.

Grants in lieu of taxes can be locally important. In the Snow Lake case, HudBay pays one million dollars as a grant in lieu of taxes each year to the town of Snow Lake and many participants believe that this is low. Participant C-15 passionately explains her view:

> The thing about grant in lieu is that it is around $1 million and you have to share it with the school division and there has been an agreement in Snow Lake just like there is an agreement in Flin Flon and Thompson and Lynn Lake for years - for 50 years. Snow Lake has, in the past maybe 10 years negotiated the grant without legal counsel. They wanted to be cooperative and give the company a chance to build their infrastructure with the hope that the company would recognize their good will. Thompson gets over $10 million a year and Flin Flon gets $7 million a year and Snow Lake gets $1 million. Clearly the bar needs to be moved up. The town of Snow Lake deserves a much higher degree of support in terms of grant in lieu - there is no doubt about it.

Participant C-15 vehemently believes that the community of Snow Lake should receive more financial support in the form of taxes and royalties from HudBay.

4.3 Summary

Mining activities have the potential to leave long lasting legacy effects, both positive and negative. Unfortunately, many of the legacies of historic mining in Canada have been negative (Sandlos and Keeling 2013). The community of Snow Lake, MB proved to be a good case for studying legacy effects as it is a typical mining reliant community with nearly a century of historic mining in the area as well as current mining and, if you believe hopeful community members and geological reports, potential for future mining. Findings support Gibson and Robinson's framework (2014) and suggest that there are extensive legacy effects of mining in Snow Lake.

It is interesting to note where community and expert participants agreed and diverged concerning the legacy effects of mining activities. Both sets of participants were united in their concern of the environment, especially the health of the water. There was division; however, on whether environmental legacies are all associated with historic mining activities. Many of the community participants believed that current mining regulations and technology are sufficient to

avoid major negative environmental legacies. They see major negative environmental legacies as a thing of the past and no longer a concern. It is not necessarily that they are unaware or naïve of possible issues but rather, as some participants pointed out, they consider the positive legacies of mining as greater than the negative legacies. Conversely, many expert participants are more wary and believe that current mining activities still hold enormous potential to create long lasting environmental damage. Perhaps, not experiencing the positive legacies, they are more able to see the environmental legacies objectively.

Also, the data show that community participants were more likely to view the long-term effects on their communities in a more positive light than the expert participants. I believe this is because Snow Lake residents are very aware that their community would not exist without mining activities. They are proud of their mining history and are thankful for the opportunities that the mining industry affords them. They like their life in Snow Lake and know that they could not have the same life and live in their community without mining in the area. Perhaps some of the community participants are less able to empathize with groups set against mining development because they see them as being against their very existence. Some participants also noted that they resent it when groups or people 'not directly affected' by a project step in to shut down or slow development. Some see this as the 'South' telling them how they should live. It is the opinion of many community participants they have weighed all their options and have considered all the legacy effects and still choose to pursue mining.

Some expert and community participants agreed that the boom and bust cycle associated with resource towns is an unfortunate legacy effect of mining dependence. Both groups agree that diversification away from mining, or at least diversification away from one company, benefits the town and creates more stability for residents. Both groups, especially community

participants, also note how difficult it is for a northern remote community to diversify and move beyond a single industry based economy. Some participants from each group mentioned the need to invest in economic plans in the boom periods, not waiting for the bust periods, though this idea seems to not be intuitive to some others.

With regards to remaining town infrastructure it is unsurprising that community participants had more to say on the subject than their expert counterparts. Living in the community and interacting with the infrastructure makes them more aware of the benefits and flaws. Some community participants spoke about ageing infrastructure and the burden that upkeep and replacement puts on a small town. According to the interviews, this theme was obviously important to community members; however, experts did not acknowledge it as a major legacy effect of mining activities. Community and expert participant's views also diverged concerning the nature of roads and connectivity. All community participants who mentioned the advent of roads in the North noted that they were a positive legacy of mining that made their life in the North easier. Expert participants had differing views. Some, like community participants, saw roads as a positive benefit and some saw a more negative side of roads and increased connectivity – possible damage and more access to sensitive ecological systems and aboriginal cultures.

Only one participant, E-5, identified the final legacy effect, resource depletion, outright. Other participant, especially community participants noted the same theme in a more roundabout manner. Many community participants explained that they did not believe that the community was benefitting enough from the mineral resources mined in the area. They expressed a desire to retain more benefits locally. Some participants suggested that heritage funds are an effective way of planning for sustainability. Some others suggested that generally, increased mining taxes with

a larger proportion going to local communities would help with running a town and would offset resource depletion.

Overall, from my interviews, it is clear that all the participants had carefully considered mining and legacy effects that mining can leave behind. I was especially impressed by the extremely thoughtful insights of the community participants. They are very aware of the precarious situation that mining puts them in and they have very nuanced and sophisticated thoughts about their community and future.

As noted above, findings also generally support the literature, especially the legacy effects framework presented by Gibson and Robinson (2014). The subthemes that emerged from my data in many cases supported the current discussions on legacy effects. Differences such as exaggerated positive community legacy effects related to employment, skills training, and wealth generation present in my case can be attributed, in part to community types. There are several kinds of mining communities identified in the literature including i) established isolated mining towns reliant on a single industry, ii) a variant of the first but a company town established by the company to meet their needs, iii) established existing community with a diverse economy that becomes host to new mines, iv) fly-in, fly-out mines or mines with camps and no communities, v) temporary camps in exploration areas, and vi) major established mining cities with long term mining and mining spin-off activities (Cater and Keeling 2013; Ritter 2001). The framework was mainly established to address possible legacy effects of mining for pre-existing communities without previous mining experience (community type iii). In my case Snow Lake has a long history of mining and was, in fact, built to support mining activities (community type ii). These differences are most evident in the ‘residual effects on the community’ section. My case enriches

the literature on mining legacy effects and offers support to many of the existing framework subthemes.

Chapter 5: Environmental Assessments

When mining first began in Canada few regulations and approval processes existed to protect the environment and limit negative legacy issues while amplifying positive effects as established in some of the quotes captured in Chapter 4 as well as in the literature (e.g., Gibson 2012a). In the intervening years both the provincial and federal governments created approval processes and environmental regulations. An important question then is, "how well do these approval processes, such as environmental assessment, consider legacy issues"? When all participants we asked questions about environmental assessments and mining approvals a number of grounded themes emerged from the data. These themes can be categorized broadly as strengths, weaknesses, and future areas of improvements. The comments that follow on each of the grounded themes are not specific to one jurisdiction or EA process since the participants in my study were from across Canada, a country with many EA jurisdictions. I have noted though when the participants were referring to the *Environmental Act* in Manitoba or Canadian federal EA The data below are presented in relation to these broad themes and it is worth noting at the outset that proponents mentioned weaknesses in EA process as those relate to legacy effects more than three times as often as they noted strengths. Figure 5 depicts the framework that emerged from the data and relevant literature. Note that EA jurisdictions in Canada vary greatly so the identified strengths, weaknesses, and opportunities are generalizations that cover major differences between jurisdictions and even cases. Nearly all participants stated, for example, that EA is in imperfect tool for considering mining legacy effects. Unfortunately, EA is probably the most useful planning/regulatory tool we currently have for activities like mining. I will first present the identified strengths of EA, then the weakness, and finally some hopeful observations concerning future opportunities for EA.

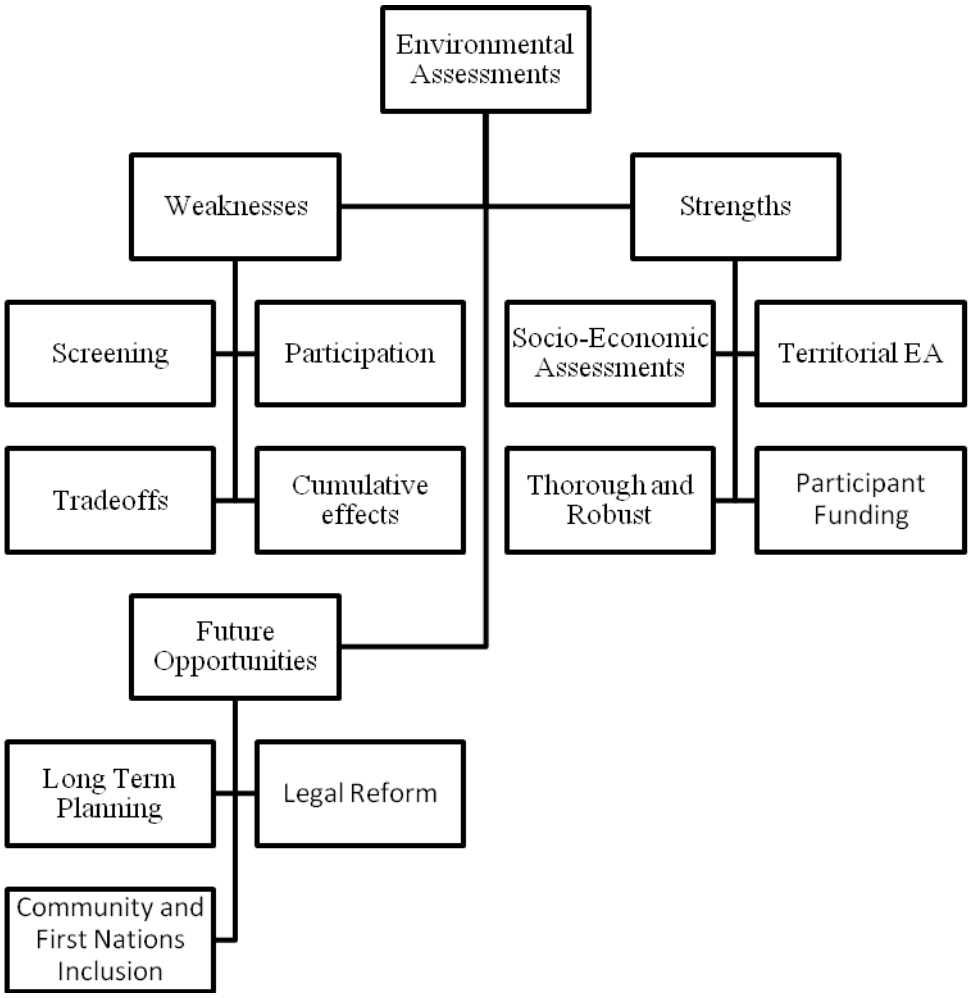

Figure 5: Environmental Assessment Framework. Grounded in data and informed by literature. Generalized from many jurisdictions in Canada (Doelle 2012; Gibson et al. 2016; Government of Manitoba 1987).

5.1 Strengths

Participants shared their general feeling that EA in Canada is improving and is helpful, but even when speaking about strengths participants often pointed out weaknesses that needed attention in relation to the noted strengths. The main strengths included: improved socio-economic assessments; better territorial EAs; more thorough and robust assessments; and, better public participation and funding.

5.1.1 Improved Socio-Economic Assessments

Some participants feel that EA currently does a good job of considering the socio-economic effects of a project. This is especially true when you consider early EA practice and the little, if any, attention they gave to the social and economic effects a project would have on a community. However, in both Manitoba and federal EA, socio-economic effects are examined and addressed only if they are linked to a biophysical effect of a project (Gibson 2012a; Lawrence 2013). Nonetheless, Participant E-2 explains that the consideration of socio-economic effects has been improving:

> I think that if I were to speak about something that was positive I would say that the scope and depth of the social impact assessment has changed somewhat enough that it is starting to better define and classify what a social impact is and also their attempts to identify and integrate traditional knowledge seems to be a lot better than it has been in the past.

Participant C-7 notes that though socio-economic assessments are a strength of current Manitoba EA but they are still difficult to complete and accurately predict impacts.

> I think that you might see more [of a holistic approach] on the social economic side than what there used to be. I think the social economic is the difficult one to do. You can say 'we are good and will give you this many jobs' and those sort of things but those things are dependent on things happening and it is hard to measure. In Snow Lake the Lalor benefits could be … we put a camp in because people needed somewhere to stay but it was never our goal to have a camp for the long-term. Our goal is that they become members of the community but they need to work on subdivisions and places for people to live. I think that they are doing those things. If anything I think EAs are going to include more of that but I think it is one of those ones that are kind of cloudy for me to see how they would go. You can always say how many people you are going to employ and what you plan and what the benefits are and what they could bring but it's tracking those through operations in seeing whether the benefits actually happened not (Participant C-7).

This idea is backed up by Kriegler et al. (Gibson 2012a; Morrison-Saunders and Arts 2004; 2012) who suggest that though socio-economic assessments are improving there are still a number of challenges that hold back the proper development and application of socio-economic

assessments. Put simply, " we are better than we used to be at considering the human aspect [in federal EA] but we could still improve a lot" (Participant E-20).

5.1.2 Better Territorial EAs and Regulation

The Canadian territories, with their unique jurisdictional position and focus on resources, are an example of strong and useful Canadian EA. Participant E-4 describes the strengths of territorial EA:

> Probably if you want to look at where [EA] is used probably correctly, the way it was intended or envisaged is in the territories. They have unique circumstances that are not present in the provinces so they are not a model that you can copy directly but they have some features that bring out the best in that planning. There is very strong aboriginal community component. And that is not to say that the mining industry loves them. They are hard, and the process is expensive, and time-consuming, and a pain in the neck from the proponents standpoint but it does do what it's supposed to be doing. Part of the expense and the unrealistic expectations rise from lack of experience and the challenges of that remote and sparsely populated area. It isn't because of the way that they structure the decision-making process it's because of other features so the fact that it is not considered a wonderful system by some of the proponents is not because of the way that it is set up. So with those caveats - because it is federally legislated but a regional entity and a single process there isn't a jurisdictional divide so they are able to look at all aspects of environmental health, incorporate perspectives of communities, look at long-term impacts, all in one place together. Once that assessment is done, the actual regulation is done subsequently.

Participant E-21 also explains the strength of territorial EAs:

> I would call [the Yukon EA process] more aggressive in the progressive sense but they do still have timelines in it. What was really fascinating to me is that it is cellular so you have regional offices and the regional offices can administer a YESAB application and development application at a grassroots level so it doesn't start at the central agency. If the project overwhelms the local office then it heads up to the next level and ultimately it can go to the Whitehorse office if it is a very large development. That is kind of neat and we don't have that here.

According to some participants, provincial and federal EA processes have much to learn from the strengths of territorial EA. Participant E-24 notes that another example of the superior territorial assessment in relation to mining projects is that in the Yukon Territory the government must consult with Aboriginal groups before prospectors or companies can stake land and register

for mineral claims on land within an Aboriginal group's traditional territory (Participant E-24). This is in direct comparison to the consultation protocol in the provincial jurisdictions that typically have a 'free entry' policy where exploration is permitted on all crown lands without prior consultation or accommodation. The EA process does not begin in Manitoba, for example, until exploration is complete and there is a prospective project to review.

5.1.3 Thorough and Robust

Some participants, especially the community participants, viewed EAs as extremely thorough and robust. Participant C-15 gives a positive summation of Manitoba EA, "I think that [EA] is doing excellent job. I think they are comprehensive - in terms of the physical environment and habitat and water and I think that they are rigorous and comprehensive so I think that they are pretty good."

EAs appear to encourage, or maybe force proponents, to complete comprehensive and scientifically meaningful studies because better-researched and more exhaustive assessments are more likely to receive an environmental licence from the Government of Manitoba.

> The one thing that [EA] does is that it pushes the proponent to be very thorough. The more robust and the more attention to detail that one puts into their EA the more likely that your environmental act license will be approved. […] It does push proponents to make sure that you have the information available prior to those questions and concerns being raised by either the members of the public in a public review process or by regulators (Participant C-13).

In the eyes of many community participants, EAs are acting as a scientific and legal hurdle that weeds out potentially harmful projects and improves projects that may be approved. Many community participants believe that the negative legacy effects, especially the environmental effects, of historic mining in the area would be impossible today because of increased provincial government regulations and assessments, as discussed in Chapter 4 (See Participant C-13 on pg. 50-1).

5.1.4 Better Public Participation and Funding

This final sub-theme is contested as the notion of public participation and funding also appeared as a weakness of EA. Some community participants believe that public participation opportunities are sufficient and a strength of current EA. Participant C-8 explains why he believes that public participation is adequate and even a strength of Manitoba EA,

> I do think that the company does a good job engaging the community. I think that they try their hardest to get people out to [their public consultation meetings]. They advertise them prior to them – they either put an ad in the paper put up posters around town. People are well aware that it is going on and all of the ones that I have attended they have had a good variety of people there to explain things and a good variety of people there to answer questions afterwards in case there are any. I have never seen one of them close down if there were still questions on the floor. If there was someone who needed clarification afterwards they would take them aside and talk to them more. I think that they have been operating very well.

The fact that some EA jurisdictions, such as Manitoba and the federal jurisdiction, offer funds for public interest groups to participate in the EA is counted as a strength of EA; however, as Participant E-1 notes the funding is rarely sufficient and is not available in all cases, "There is funding. We can throw the fact that there is funding available into the positive aspects of EA. That is a perk. But it's not enough. Not nearly enough."

5.2 Weaknesses

Those who participated in the research pointed out several weaknesses in current EA practice that impacts the ability to consider legacy effects properly. Scholars have noted that Canadian EA, though generally improving over time, has recently declined in effectiveness, driven by receding economies and the desire to approve projects more quickly (Gibson 2012a). Sub-themes that emerged in the data include problems with triggering; neglect of trade-offs; insufficient review; issues with consultation and participation; weaknesses in timelines and certainty; and inadequate cumulative effects consideration.

5.2.1 Triggering

Participants, especially the mining and assessment experts, noted that a major EA weakness at all jurisdictional levels is that too few projects trigger EAs. They suggest that, generally not enough projects are undergoing environmental assessments. Participant E-5 states that one of the "shortcomings would be that we are doing too few federal environmental assessments." Recent changes in federal EA have led to fewer projects being subject to assessment (Bond and Pope 2012; Gibson 2012a). Under CEAA 2012, "only undertakings covered in the new project list regulation or specially designated by the Minister of Environment are potentially subject to assessment" (Gibson 2012a, 181). Participant E-1 explains further,

> The new approach under the federal act about what projects get assessed is leaving a lot of projects falling through the cracks. The projects list approach, where they have to be on the regulations before they get assessed means that anything that falls under their fairly arbitrary threshold don't get an environmental assessment.

Participants from several Canadian jurisdictions identified triggering issues. Participant E-22 explains that, "In Ontario we tend not to even do EAs for mines, which is a real problem. Where it is done, it is not done terribly well." Unless Ontario mining companies volunteer or there is a specific regulation requiring an EA, often entire mines do not undergo EA under Ontario's Environmental Assessment Act as the Act does not apply to private companies unless their projects are specifically designated (Ontario Ministry of Northern Development and Mines 2012). A similar issue occurs in BC, "In the case of BC which uses a project list approach that can mean that some projects and expansions of projects don't get assessed at all" (Participant E-1). Projects are even more likely to leave negative legacy effects if they do not go through the assessment process. In Manitoba underground mines and related milling and smelting projects qualify as class 2 developments under the Environment Act (Government of Manitoba 1988). Proponents are required to a) involve any interested government agencies and departments, b)

consult with the public, and c) address environmental issues (Government of Manitoba 1987). They then file a proposal that is reviewed by the province and the Minister may issue or refuse to issue an environmental licence.

5.2.2 Trade-Offs

Some who participated in this research also identified trade-offs in EA as a weakness. Trade-offs are when "gains in one area come at the expense of losses in another" (Morrison-Saunders and Pope 2013, 54). Participant E-1 explains the general issue of trade-offs,

> I think that [trade-offs] are one of the major downfalls and shortcomings of EA. That projects can be understood to have fairly significant legacy effects and they are still being approved because they provide certain other benefits.

Participant E-2 further explains the weakness associated with trade-off decisions,

> When we do the socio-assessment quite often what the economic assessments do is that they identify through their report and what they believe to be long-term benefits but what they aren't doing is they aren't doing enough work showing what the costs are associated to the project. So if you look at projects like, say the Giant Mine in Northwest Territories - that is a cost to society basically in perpetuity. If you look at the Faro mine in the Yukon, that also is the cost to society. There are also a couple legacy mines in BC that are a cost to society. What I'm saying is that when we do the economic sort of socio-impacts analysis there needs to be more of a cost benefit analysis done there. There needs to be a much better balance of what the overall economic benefits are versus the long-term legacy risks.

Participant C-11 explains his experience with EA trade-offs in a Manitoba EA,

> The government never did ask the right questions [during the EA process]. When they came in the process is strongly weighted in favour of the company applying. The number of jobs and economic benefits far outweigh the science. If they can produce something that will pacify the science people then it is doable. It is very odd. This was my first experience of reading in depth into an issue and I was a little dismayed.

With a focus on sustainability, compromises and balances are not the goal and trade-offs should only be made if there is no better option (Gibson 2006b). The goal should be to engineer multiple gains that reinforce each other and promote sustainability (Morrison-Saunders and Pope 2013; Gibson 2012a). Participant E-2 explains that making tradeoffs can be detrimental to a

community's long-term health; "[being too tied to one resource and making trade-offs for economic gain] is why communities can often die without the proper planning".

5.2.3 Consultation and Public Participation

Another identified weakness of current EA is the consultation and public participation process. Consultation and public participation should be the key element of EA (Wood and Dejeddour 1992). Participants noted that Aboriginal groups are not being consulted and engaged with enough in the EA process. Participant E-2 notes problems with current EA consultation in this regard:

> I think that especially with the federal government they do not do a reasonable job in meeting their obligations to consult with First Nations. […] So one of the things that is a concern for people like myself who have been involved in EA now for about eight years is the fact that we don't see a reasonable consideration for aboriginal rights and values in an environmental assessment.

Some participants went even further to suggest that Aboriginal groups should not only be consulted during the EA process, they should be consulted before and should hold more power and weight as decision makers. Participant E-1 elaborated on her point of view:

> So starting the process much earlier on is important. Requiring dialogue before those exploratory activities occur so you can identify at the outset areas that are no-go for mining. And aboriginal group might say, 'we are not okay with mining and we don't care what the outcome of an EA is we do not want mining here because it is a sacred site. Or local ENGO might say that 'there is no way to guarantee safe mining here because it is an important watershed for some sort of endangered species. This is a terrible site.' Then the proponent might be encouraged to look for new site earlier. Having those No-go areas or situations so that activities don't take place before concerned groups have their say. I think that that is really important not only for an environmental perspective but also for the ministry perspective - they don't want to waste their time or resources […] There is no requirement that First Nation groups are decision-makers. There is a consultation requirement. But First Nations should be given decision-making power for projects that fall in their territory.

According to some participants, "there is insufficient public engagement" in EA (Participant E-5). Participant E-3 explains why a lack of public participation in Federal EA poses a problem,

> Another important shortcoming is [EA's] lack of - it doesn't really recognize the value of public participation and it doesn't recognize the importance of aboriginal engagement and those two aspects are critical to any planning process and unfortunately our legislation doesn't do much for that.

EA literature clearly establishes that public participation is essential for improving and sharing information about a proposed project as well as ensuring that a proposed project is palatable to the general public before it is approved (O'Faircheallaigh 2010). The benefits of engaging the public in the EA process dictate that EA should be designed to promote public participation.

Not only does current EA legislation not encourage robust public participation, Participant E-1 notes that it can discourage and make public participation difficult,

> We have public participation timelines on EAs now, which is making it impossible in many cases if not all cases for the public to participate in a meaningful way and for decision-makers to have all of the information that they need to make sound decisions before them.

An attempt to streamline and speed up the EA process led to restrictions in public participation opportunities, stricter timelines, and generally fewer chances for public contribution (Gibson 2012a; Petts 1999; Sinclair and Diduck 2016). These changes have a negative effect of the effectiveness of EA and their ability to usher in sustainable outcomes.

5.2.4 Insufficient Review

Both expert and community participants stated that they believe that EAs are often not reviewed sufficiently by the government. Participant C-11 explains his dissatisfaction with the Manitoba EA review process:

> The report that they submitted to get the licence to proceed was begging so many questions. I have personally submitted several which I've never received answers to, from either the government or [the company]. And the government seems to lack the power to say, 'hey [Company X] answer these questions in 30 days.' They presumably would have to answer them before they get the licence, but if they don't plan to get the licence and they aren't interested in answering questions. That whole part of the process makes you wonder who is in control […] I do not believe that the government sees it as their responsibility to adequately confirm everything that has been submitted or totally understand what has been submitted. They get so many different kinds of requests from a

> little sewage pond for a little town to a big industrial bio leaching operation. They are really expecting the company in question to be upfront and transparent and honest and give you the best information.

Some believe that efforts to streamline the EA process and make it more effective and efficient have weakened the process and lead to insufficient review of a project and potential legacy effects. E-20 notes his concerns with current review in Manitoba, "The province doesn't take a long-term view when they review EAs. I have become more sceptical of so called 'efficacy' in EA". Participant E-2 also explains that:

> [the Federal government is] trying to make the processes more efficient. They are trying to provide industry more assurances that development here in Canada is less risky but by doing so they are cutting corners and cutting pieces of the process that they shouldn't be cutting.

5.2.5 Timelines

It seems as though neither the companies that complete EAs nor the academic experts are happy with current timelines in EA, though for different reasons. Not surprisingly, proponents prefer tighter timelines as they believe, without much evidence, that a more compact process insures project certainty. "If you look at it from a company benefit sort of way you always like to have time frames that are quicker rather than slower," says Participant C-7. Proponent C-13 explains a mining company's view of EA timelines:

> In our business timing is everything, so if you submit an application and you are assuming and hopeful that it is going to be a very quick turnaround between submission of applications and actually receiving your licence - and it is quite conceivable that six months just disappears because of process time and that sort of thing. Since we work in northern Manitoba that might mean that a whole construction season has disappeared so if the regulators review the information given and say, 'you know what we really want you to look more closely at fish habitat or something like that to determine impacts on the aquatic systems' if it is wintertime we really can't do much to look at the spawning habitat or anything like that.

Conversely, many of the academic EA experts believe that EA timelines, especially timelines regarding public participation and comment are not adequate (Gibson 2012a). Participant E-1 explains this point of view:

> The timeline for public participation is often too short. The notice period for groups and participants to become familiar with the material and retain experts and their responses and actual public comments periods themselves are often too short for participants to really meaningfully provide their input.

More stringent timelines limit opportunities for public participation and input, and time for government decision makers to actually review the documents and comments submitted, which can ultimately limit the ability of an EA to consider legacy effects and sustainability.

5.2.6 Cumulative Effects

Some participants believe current EA does a poor job considering cumulative effects and this oversight negatively impacts the full deliberation of legacy effects (Weber et al. 2012). Though many jurisdictions in Canada, including the Federal jurisdiction, legally require some consideration of cumulative effects, there are issues in practice. During my research some participants noted that legislated strategic CEA requirements would improve EA and should lessen negative legacy effects. Participant E-1 discusses Federal EA and states:

> There isn't adequate consideration of cumulative effects [in EA]. In particular, the Act doesn't concretely require that the cumulative effects assessment consider the preindustrial baseline […] CEA often aren't nearly robust enough and there is an inconsistency in how they are being conducted and what the requirements are between projects.

Experts and practitioners in this research explained that a legal requirement for cumulative effects assessment in EA is the best way to ensure that proponents consider cumulative effects during the EA and planning process (Weber et al. 2012; Gibson 2012a) Participants E-3 notes:

> It is tricky because the Environment Act in Manitoba does not require consideration of cumulative effects. It really is up to practitioners to think about those things. What I've seen happen, which is positive, is that even though there isn't a requirement to do it - before the new CEAA legislation was passed - the approach that I've observed was to include cumulative effects even if you are just doing provincial EA. You would look at all these things and you would just include cumulative effects assessment. It was just something that you did. […] I have always been a big advocate for cumulative effects assessment. I bring it up in every forum.

Participant E-3 goes on to note that more robust legal requirements for CEA would encourage best practices in considering cumulative effects to be considered.

5.3 Future Opportunities

As participants spoke about the current strengths and weaknesses of EA processes in Canada, many mentioned future opportunities to improve the long-term effectiveness of EA and in turn result in more robust consideration of legacy effects. Some may believe that 'future opportunities' is just a synonym for 'weaknesses'. I believe that the idea of 'future opportunities' is more hopeful. Next generation assessment, sustainability assessment could help us to better consider legacy effects and generally improve EA and bring us towards sustainability (West Coast Environmental Law Centre 2015). Participants suggest some categories in which EA could be improved beyond addressing the weaknesses noted above: planning and long-term view, legal reform, and Aboriginal groups and communities.

5.3.1 Planning and Long-Term View

Participants pointed out that EA would be vastly improved if it incorporated more of its original roots and intentions, as a planning tool. They noted that by using EA as a planning tool, it is easier to consider the legacy effects of the proposed project and make sound decisions on whether the proposed project improves the sustainability of an area and should, therefore be approved. This point is also supported by (Morrison-Saunders et al. 2014). In this regard, the following quotes highlight the data related to using EA as a planning tool:

> To say that if EA is a planning tool then the long-term impacts and activities are part of your planning and that sort of implies a permanent engagement because there is no sense separating the initial assessment from later evaluation and adjustment and that is something that I don't know where it has been done. It is done in planning all the time, plans are created and reviewed and revised and redone all the time and that is the nature of planning. We talk about EA as a planning process but we don't really treat it as one and I think that that would be an implied and necessary part of it (Participant E-22).

> EAs should be the place, the planning stage, where we think about [legacy effects]. Well ever since CEAA was created, I think, we have collectively agitated for a strategic approach as opposed to project-based approach. So far it hasn't succeeded. It hasn't succeeded in and I don't see, at least with the direction that CEAA 2012 has taken, well it does include a mention of strategic EA - almost all the other features really do tend towards fragmenting the process rather than integrating the decision-making process (Participant E-4).

Participants felt that incorporating EA into, or using it as a regional strategic planning tool could improve the way in which legacy effects are considered as well as help address issues such as cumulative effects, broad alternatives, and long term regional wellbeing.

5.3.2 Legal Reform

Some participants explained that legal reform of EA in Canada could improve the process. Some noted that EA legislation is outdated in many jurisdictions and should be updated and reformed:

> In Manitoba, the Environmental Act in Manitoba is dated. It is obviously a very old piece of legislation. Every now and again the regulators try to update the legislation or its application but I think the legislation is really out of date. It definitely requires upgrades (Participant E-3).

As this participant indicates, Manitoba had 'tinkered' with reform over the years, but the Environment Act has never changed in a substantive way. The Act is currently being considered for reform but some feel the current initiative will not result in the sorts of meaningful change people have noted is needed, which begs the question of how much can be done about improving affects assessment in relation to legacy effects under the current regime (Lobe and Sinclair 2016).

Other participants believe that legal reform is necessary and could lead projects that contribute to sustainability being approved. Participant E-1 expressed her view that we should strive towards legal reform that focuses on the pillars of sustainability and requires a proponent to prove a project adds to overall sustainability before it is approved. Proponent E-5 also comments on the limits that current laws and regulation impose on sustainable planning;

> My sense is that the biggest barrier to doing [sustainable projects] is the mindset that essentially says that we should let the market decide what happens and regulation only sets outer parameters of what we consider to be acceptable from an environmental and social point of view. We can't seem to have a discussion about how you maximize social, environmental, and economic benefits including fair distribution of those benefits with regards to private projects - projects that are considered private even though the utilize a public resource.

Updating and improving EA legislations to include a sustainability mandate is a way to insure that EAs are state of the art and the best tools possible for planning and considering future developments and opportunities (Sandloss and Keeling 2012).

5.3.3 Aboriginal and Community Inclusion

Participants in this research study, especially the mining and assessment experts, noted that EAs would do a better job considering legacy effects if there were improvements in the ways Aboriginal groups and Communities are involved in the assessment process. The quotes below capture this sentiment:

> You know at the end of the day I think that there needs to be a piece that gives these communities more of a say or influence over the process. More than they currently have. That is one of the things that was beneficial about the panel is that that sort of influence at a community level - community members were allowed to present information. Where in more of a structured comprehensive process there is a lot of the information that is presented through reporting and technical reports. I would expect that for an environmental assessment - if each environmental assessment had a specific term of reference that saw each party playing more of an influential role in the process then that might be a step in the right direction (Participant E-2).

> What I have also noticed is that it is one area where we could use a lot more community engagement […] involving them early in the process and sharing a project before it is a project - in the planning stages. Saying, ‘these are the different options we have.’ In EA world sharing and engaging people at the alternatives evaluation stage - not at this stage when you have already chosen the project. […] If you involve people early than they will ask you all these questions. You might only be able to address 20% of them or maybe even 5% of them but it doesn't matter. If you didn’t talk to them then you have 0%. I think that involving people is very important - they will bring lots of ideas (Participant E-3).

The benefits of including Aboriginal groups and communities in the EA process is well established in the literature (e.g., Devlin et al. 2005) and canvassed, in part, in the above section. Involving the public more in the planning stages and eventual decision-making not only improves community buy-in and comfort with a project; it can also improve a project and its contribution to sustainability. Some projects simply should not be approved because they do not positively contribute to sustainability, including the public more may help us come to those decisions.

5.4 Summary

As clearly indicated through the results outlined above, there is much room for improvement when it comes to EA's consideration of legacy effects. The top three participant-identified areas of weakness in EA with regards to legacy effects are triggering, trade-offs, and consultation and public participation. Both expert and community participants noted that, in many jurisdictions, the triggering threshold for EA is set too high and therefore too few environmental assessments are being conducted. They established that if an EA is not required it is very unlikely that a project will fully consider and mediate all legacy effects. This weakness is not prevalent in very recent literature but is consistent with current EA concerns. The identification of trade-offs as a weakness by participants is also present in the literature. It has been commonly observed for example that environmental issues are often sacrificed for socio-economic gains (Morrison-Saunders and Pope 2013; O'Faircheallaigh 2010; Sinclair and Diduck 2016). Trade-offs are especially troubling when considering legacy effects because unfortunately, the socio-economic benefits of a project are often brief and short lived while the environmental ramifications are long lasting. The importance of consultation and public participation and weakness with such processes are also well established in the literature (e.g., O'Faircheallaigh 2010; Pope et al.

2004; Therivel et al. 2009), yet current EA does not adequately include provision, room, or funding, for these activities (Diduck and Mitchell 2003; Noble 2015; Stewart and Sinclair 2007). CEA is required in many jurisdictions but is not done well in practice. Part of the issue arises from the emphasis on project-based EA that is common "thinking cumulatively and regionally does not emerge naturally from a project-based perspective" (Gibson et al. 2016; Parkins 2011, 1). Strategic EA and regional planning are necessary to best consider cumulative effects as individual project proponents do not have the ability or interest to fully consider the broad cumulative effects of development in an area.

Next generation EA, that focuses more meaningfully on sustainability (often termed sustainability assessment (SA)) aims to address the identified weaknesses associated with current EA as well as incorporate many of the "future opportunity" ideas that participants in this study suggested, such as using EA as a long term planning tool, reforming current EA legislation, and including communities and Aboriginal groups more in the EA process. Implementing these will help to direct projects and decisions towards greater sustainability (Gibson 2012a; Morrison-Saunders and Hodgson 2009; Sinclair and Diduck 2016). Enlightened EA processes could also remedy the participant identified Triggering issue of the current EA through several avenues including; more mandatory and codified assessment law, applying assessments more widely, and ensuring that EAs occur earlier in the planning stage (Gibson et al. 2005; Hacking and Guthrie 2008).

SA can also help to address another of the weakness of current EA as noted by participants by making trade-off decisions a serious part of the assessment process. Trade-offs are often unavoidable; however, SA literature suggests that we should stop striving for balance between the environmental, economic, and social spheres and be clear about the tradeoffs we are

making and how decisions to make them were arrived at (Gibson et al. 2005). Gibson et al. (2005) suggest that balance is not the path towards sustainability because it assumes that the spheres are at odds with each other and gains in any means losses in the others. They suggest that rather than seeking balance "we need to recognize the interdependence of economy and environment, and find ways of making mutually reinforcing gains on all fronts" (Gibson et al. 2005, 124).

Next generation of EA also attempts to improve public participation and consultation (Bond et al. 2012). Pluralism is desired in SA, for example. The literature surrounding SA realizes that, to attain sustainability outcomes, it is essential to engage and "consider voices representing affected economic, environmental, cultural, and social values and interests" (Bond et al. 2012, 201). Effective public participation is also important in SA because it allows those most likely to feel the gains and losses of a project, local citizens, to voice their interests and concerns (Gibson et al. 2005). Public participants may bring forward new information, knowledge, or perspectives that could improve the assessment process and decision-making. Involving the public can also lend some balance and credibility to the process by involving the general public, who typically have broader goals and mandates than industry and individual government agencies. Better decisions are not the only goal of SA, the process should lead to learning and effective public participation fosters learning (Gibson et al. 2005; Sinclair et al. 2015).

Participants also noted a number of ways in which current EA could be improved to better consider the legacy effects of mining. Many of their ideas for improvement are captured in next generation thinking about SA including; long term planning tool and legal reform, and Aboriginal groups and community inclusion (Gibson et al. 2016). As noted in earlier chapters,

EA was first designed to act as a planning tool. Participants suggest that getting back to that original goal and adding an emphasis on long-term sustainability will improve consideration of legacy effects and the impacts caused by these effects. The central tenet of SA, to guide decisions toward greater sustainability, clearly acts as a long term planning tool (Bond et al. 2012).

Some participants explained that we will only get a sustainable future if we reform our current environmental laws in a way that ensures sustainability and long-term effects are considered in decision-making. Current EA legislation is still leaving us with unsustainable outcomes. Some participants as well as environmental legal organizations believe that Canada should adopt a Sustainability Assessment Act to replace current EA legislation (Gibson et al. 2005; Gibson et al. 2016; West Coast Environmental Law Centre 2015).

A final suggestion for EA improvement deals with Aboriginal groups and Community involvement in the process. Some participants stated that EA could better consider legacy effects if it involved Aboriginal groups and Communities better in the process. SA address this criticism by adopting an open process (Gibson et al. 2005). An open process is beneficial because they have "a diversity of stakeholder interests and experts who are committed to careful review (at least of matters touching their perceived interests) and typically familiar with key aspects of the relevant context."

There is always an opportunity to improve future decisions based on lessons learned from the past and EA offers ways to better consider potential mining legacy issues (Gibson and Robinson 2014). EA, a planning tool used to evaluate proposed developments, as noted in the above section is not perfect but most felt it may be the best regulatory device we currently have. If we adopt the next generation of EA, we have the potential to promote sustainability by

considering the legacy effects of mining and, in doing so, limiting the negative legacy effects and amplifying the positive effects. Perhaps, through careful planning and consideration a non-renewable resource such as a mineral or metal could be used as an opportunity to move towards sustainability on all geographic scales.

Chapter 6: Learning

In Chapter 6 I present and consider the data related to the learning objectives set for this research. First, I present the instrumental and communicative learning outcomes and discuss their importance for considering legacy effects and sustainability. Second, I examine participants' transformative learning outcomes. Third, I look at platforms/onramps that made learning easier for participants. Last, I study barriers to learning as presented by participants.

6.1 Outcomes

Individual learning is a major benefit and sometimes a stated objective of EA and the decision making process. This research uncovered a number of learning outcomes related to EAs and legacy effects. I identified both instrumental and communicative learning outcomes, according to Mezirow's work on transformative learning (Mezirow 1995)(Gibson and Robinson 2014)(Gibson and Robinson 2014)(Gibson and Robinson 2014)(Gibson and Robinson 2014) and as discussed in Chapter 2.

6.1.1 Instrumental Learning

Instrumental learning is often related to a certain task and refers to learning how to successfully achieve desired ends (e.g., how to negotiate legal and administrative procedures regarding decision processes). As noted in Chapter 2, I have chosen to use four categories of instrumental learning as defined by Diduck and Mitchell in 2003 because they worked well as organizing themes for the type of data I collected. These include instrumental learning regarding: i) legal, administrative, and political process; ii) scientific and technical knowledge; iii) social and economic knowledge; and iii) potential risks and impacts. The tertiary-grounded themes that emerged from the interviews in relation to each of these are presented in Table 6, each of which is discussed below.

Table 6: Instrumental Learning Framework. Depicts the theory based and grounded categories used in the analysis.

Primary (theory-based) category	Secondary (theory-based) categories	Tertiary (grounded) categories (or themes)
Instrumental Learning	Legal, Administrative, and Political Process	• Legislation • Political will and cycle • Company power • Decision-making • Consultation • Participation
	Scientific and Technical Knowledge	• Environmental issues • Mining operations • Remediation
	Social and Economic Knowledge	• Community benefits • Balance • Impact prediction • Mining economics • Sustainability discouragement • Central planning
	Potential Risks and Impacts	• Environmental concerns

6.1.1.1 Legal, Administrative, and Political Process

The first subcategory of instrumental learning deals with legal, administrative, and political process. Not surprisingly, participants noted that they learned about relevant legislation and regulations through their past experiences with mining approvals and EA. This learning was especially true for community participants who had little formal training in these areas. Participant C-17 explains his experience with EA and public consultation,

> At the beginning there is so much to learn - even simple legal things like what are the legalities around it and the legislation around governance and how does that happen and then simple procedures like how do you run hearings and that sort of thing - I mean I am not a politician so you need to learn how to do all those things.

Though it is a benefit that community members are learning about the legislative and EA process as the assessment process commences in their area, some participants noted that it would be

beneficial if communities had some capacity to deal with the process and get the most out of it. Some participants explained that there are ENGOs (such as Fair Mining Collaborative) that offer community workshops and classes to ensure that the community is informed about the process and how to get involved before the process actually begins (Participant E-24). Participant E-5 also speaks about learning about legal and admin processes;

> I am aware of an initiative that was in place for quite some time that was discontinued around 2008 or so - the Environmental Assessment Caucus of the Canadian Environmental Network used to put on EA workshops and they focused on areas where communities were getting ready to get involved in environmental assessments. I think that that kind of thing is critical because most people know nothing about environmental assessments until a project is proposed in their area. So any time you get any capacity in EA is when multiple projects our proposed in the same area that affects the same group of people. Otherwise, in most cases the people who have concerns about proposal our complete neophytes when it comes to engage in in the environmental assessment process.

Participants also indicated that they learned about the nature of political will and the political cycle. They noted that governments and politicians are often motivated by re-election and corporate support and not necessarily environmental protection and sustainability, as captured in the following quote:

> It's all about money, just money. The whole money and governmental elections are all geared for about four or five years. So the [government in power] wants to have those jobs online before the next election. The mining company wants quick return for its investors and then big returns after that (Participant E- 24).

Underscoring this, some participants indicated that the current political system, with elections every 4-5 years can be detrimental to long term planning and sustainability initiatives:

> As an outsider you might think, 'why doesn't the municipality just do X?' It isn't that simple. One thing is that politics is actually a long-term game and […] four years is not enough if you have an agenda to set an agenda that you want to pursue then you need to pursue that through 10 to 12 years. That was eye-opening to me because everyone's impression of politicians and politics is that they can just do what they want and if they would only listen to me then the world would be a better place but that isn't how it works (Participant C-17).

Another theme in the data related to the mining company's power. Some participants commented on how the mining companies often hold coercive power in small towns and sometimes even over governments, as exemplified in the quotes below:

> If that is what HudBay needs then they can start the mill once they get the camp in - there's nothing to say that they can't do that it would be a business decision. It would be low but it just proves that the company isn't there for the town. I'm sure that you would have talked to a few people about how low the taxes are or the grant in lieu, I'm sure that it has come up every other person that you talk to. The town has to fight for that low number and it should never have been that low in the first place. It should have never ever ever been that low (Participant C-18).

> In an industry like mining, one thing that I really learned is just how big and how global the mining industry is. Living in a small town, you don't often have an understanding of that. Until I ended up in Toronto at the Prospectors and Developers Association of Canada (PDAC) conference – there were around 30,000 people and you walk out onto the floor and there are booths for entire countries like Australia, Brazil, Peru. There are hundreds of thousand dollars spent on displays trying to get mining companies in. Then you start thinking about being from a town of 1000 people - what do you do to attract the mining company in a place like this when you have an idea of just how big the industry is (Participant C-17).

The theme of decision-making also emerged in the interviews. Some participants indicated that they learned that important decisions are nearly always made with incomplete information and unknown variables:

> I remember when we first started and we were under the impression that this boom was coming very quickly - that was the impression that the mining company gave us. So we were making very large, multimillion-dollar, decisions on very short timelines. I remember one night, all of us standing around a map of the community trying to talk about where new subdivisions might go and where water pipes are already running - we had the discussion that we needed to do things quickly but we also needed to do things correctly because 20 years from now somebody else is going to be standing here wondering, 'why the hell did they decide to do this!?' And they aren't going to have the same information that we had at the time. One thing that I learned with that is that you never have all of the information you need at the right time. You are trying to make decisions based on - you are never really sure, 80% of information? 90% of the information? You don't know and you hope like hell that the 20% of the information you don't have isn't critical […]. So I think that that is what often happens comes to things like these long-term effects - we look back and wonder why they did these things because now we have all of the information but when the decision was made that they didn't have it. Looking back at it we don't understand the pieces that they didn't have. Thinking about

> the process like EA, that is huge - the technology changes, the chemicals involved change, the process changes, the players involved change. So when we look at a project now that happened 50 years ago – like Toke Mountain, you presume that they weren't making irresponsible decisions. There were making the best decisions they could with the technology and information that they had at the time. I think that that is very interesting and I didn't understand that before. So being involved with politics, I think that in some ways it makes you more understanding of the mistakes of the past because you know damn well that you made mistakes but you don't know what those mistakes are yet (Participant C-17).

Some participants also noted that they learned that the decision-making and approval process can seem confusing and bifurcated for those applying and participating in the process.

> You have to put a lot of effort into integrating among government entities and can't depend on the government to talk to itself. It goes beyond EAs, it's the review and approval processes that appear to have been least painful and most productive are those where the company was sophisticated enough to provide the glue. The least successful are when the company expected that the process itself would actually be logical. It is this naïve thing, if you're talking to this official from Environment Canada you might assume that they would talk to their colleagues in their same department - you can't assume that. Not because they are bad people - most officials are very hard working and dedicated but they have their little job and there is not a lot of enabling of group discussion and integration (Participant E-4).

Insights into community and First Nations consultations also emerged as a learning theme in the research. Practitioners, experts, and community members all stated that they had learned the importance of engaging and participating in community consultation. Practitioners explained that engaging the public can also benefit the company:

> I have been through the process enough times that for the next submission that I ever make to the government I will have had appropriate number of public engagement sessions documented, I will have already talked to the communities involved, I will have already talked with the First Nations to get their perspective and try to incorporate into the project design. So it has been a learning process for myself and really, when it comes time for the big C consultation between the crown and the First Nations if a proponent has done all of their work ahead of time, then the consultation process should theoretically be very quick and easy because you can demonstrate that yes the First Nations has had all of the information in this had input from the beginning. They might be totally upset and disappointed but they have had the ability to voice their concerns from the beginning so when the crown shows up and says, 'okay let's take a look - yes there is an impact or no there isn't an impact.' As a proponent we have already crossed our T's and dotted our I's (Participant C-13).

Some community participants also noted the importance of participating in assessment processes, as a civic duty and concerned citizens:

> It made me aware of the importance of being involved in the process because even at the municipal level we're talking about EA permits that come up and you have to listen to people. If no one is concerned and no one shows up then the company assumes that no one has any problems so they will just do what they need to do. 'If this was our plan and we were prepared to defend it and no one shows up then I guess we can just do our plan then.' It's really made me aware of the fact that number one, people do have a voice and if you want to make a stink about something basically the process forces people to listen to you - now whether they actually change the project that is another matter but they do not listen to you and you have an opportunity for input. It has also made me realize that public engagement is important. A lot of the times when you do things you even have people come up to you two weeks later and complain about something and you'll say to them, 'well why weren't you there?' And people will just say, 'I didn't even know that there was a meeting.' So as a citizen you have a responsibility to pay attention to these kinds of things (Participant C-17).

6.1.1.2 Scientific and Technical Knowledge

The second subcategory of instrumental learning outcomes relates to learning gaining new scientific and technical knowledge. Mining projects are typically very technologically advanced so it is no surprise that participants experienced learning in this category. A major theme in this category was in regard to environmental issues. Participants stated that they learned about environmental issues through past and current experience in mine approvals and EA.

Some participants explain that mining companies have learned significant environmental lessons, often because of past experiences and mistakes:

> In stuff like acid mine drainage and metals leaching there have been fairly significant advancements in the understanding of how that all works and the prediction and modeling of that. Even just the fact that we now have computers and that sort of thing make it better. In the old days it was all done by slide rulers and guesstimates and best practices and 50 years ago they didn't have the same knowledge base about what not to do - like Faro Mine in the Yukon and Sherridon here in Manitoba you can find them on Google or whatever and people know about the issues and how things have gone wrong in the past. I think that as time goes on we have all of these tools at our disposal about how to not commit the same mistakes that we made in the past (Participant C-13).

> As we learned things obviously got more rigorous - especially through the ‘80s the whole acid mine rock drainage - there was a lot of learning from that. The late ‘70s where mine effluent treatment - that is where all of the liming treatment and all that came into play from tests at Brunswick Mining and the company was doing their own in Flin Flon at the mill, they were doing some of the same things with lime. Things progressed as more knowledge came along and then starting to understand the effects of acid rock drainage and testing the rock for its potential acid generation/neutralizing potential. Working at the ratios for sulphur content and so forth (Participant C-7).

Some participants explained that general environmental literacy has also increased in our society. People know a lot more about ecology and the environment and this new awareness creates new demands:

> What people didn't know earlier in the last century is quite significantly different than what it is today. Evolving awareness broadly as well as very specific when it comes to scientific awareness. We just know a whole bunch more now than we did in those early days and obviously public policy has changed some of that so there are regulations that we must now comply with. […] So to me the biggest difference is just awareness both scientific and general. Even a person just on the ground today understands that you can't just throw anything wherever you please anymore (Participant C-16).

Learning about mining operations emerged as an important second theme. Some participants noted that their experience with mining companies and living in a mining community led them to change their understanding of mining operations:

> I only knew news stories and they were all bad so I think that moving here has totally changed the way that I see mining - for the better. Even though we might seem sceptical and maybe even a little cynical about whether or not they are doing everything the way they should be. I think I have more respect for mining as an organization - it's not the same as gold rush on TV (Participant C-19).

This sentiment was also found in McAllister, Fitzpatrick, and Fonseca’s (2014) work on the mining town of Logan Lake, BC. The authors found that participants residing in the area viewed the mining operations favourably, especially the company’s restoration and mitigation activities, community participants in this research generally feel the same way (McAllister et al. 2014a;

Mezirow 2008; 1993). For others, associating and working with mining professionals changed their view of mining operations.

> As I mentioned before, I don't know anything about mining and I still don't know anything about mining but I have the pleasure of working with miners and other people like that and I can learn from. Part of what I have learned is the mind-boggling complexity of mining (Participant C-23).

A third theme pertained to environmental remediation. Some participants explained that mining companies have learned to remediate more effectively:

> If we knew what we know now with respect to some of our older properties we would totally design them differently and as a result have, in many cases, significantly reduced financial assurances resulted with our closure plans. Unfortunately, there is nothing that we can do about it because they were built in 1928! Our brand-new locations like Lalor and Reed, the designs for both of those mines considered all of those things that we discovered over the years and they were built to address those things up front (Participant C-16).

> I know at one time they used to just push everything into the mine when they were done and walk away. They did stuff around sites that just doesn't happen anymore. Yeah, I have seen some changes in the years and I know that there are some guys who work right around it who have seen massive changes (Participant C-8).

> So if you go to an older mine site, and people call them abandoned but most of them were actually closed down with the government approval. Most of them weren't abandoned like the company just dissolved and left the keys on the desk and that type of thing. You can see kind of a general age. For example say a mine was closed in 1930 and one was closed in 1980 you can definitely see dramatic changes between the two. As society progresses and government becomes more stringent and it becomes more difficult to get approvals for all of those things that pop-up 10 or 15 years after everyone is gone - those things are becoming less and less. If you see a mine site that was closed down 10 years ago for the most part you wouldn't realize that you were at a mine site besides the fact that you are standing in the field as opposed to a forest so you know that something has removed the trees or the trees are all 6 feet high instead of 60 so you know that something man-made happened but you just don't know what. Whereas a mine site from 1930, you're pretty aware that you are standing inside of an industrial complex (Participant C-13).

6.1.1.3 Social and Economic Knowledge

The third subcategory associated with instrumental learning is social and economic knowledge, which has six grounded sub-themes as listed in Table 6. The first two sub-themes of community benefits and balance had participants noting, for example, that through their experience that have

come to find that communities are not benefiting as much as they should from nearby mining activities:

> I know about Voisey Bay and Thompson or agreements in BC and Nunavut. I am not only living in Snow Lake so as soon as I came here I realized that Snow Lake is really getting the short end of the stick. It is completely unfair and it should be addressed. For me, I come with a bigger perspective and I think that this is outrageous. So it isn't really EA's how I understand them - it is the social stuff (Participant C-15).

Other participants explained that communities are becoming more aware of the need for balance and when a project is too risky for the economic rewards:

> I think that there is more awareness in the public at large and in remote and resource dependent communities about what the limits are […] we are talking about the idea that some things just simply shouldn't be done. That might have been the position of hard-core environmentalists but I think that it is gaining some traction more generally, 'actually we have to stop somewhere.' That also means that there is more conflict between the official direction and the more popular sentiment or understanding and that has operated up the whole discussion of the social license, which did not exist before. The idea that you might be able to get a permit but you might not be able to build your project (Participant E-22)

Some participants also indicated that they learned how difficult it is to predict impacts, especially social and economic impacts;

> But lots of times you don't actually understand what your project will impact the community and in the broad context, the community is comprised of the people who work for us as well so if they are happy in their own private lives because we are not impacting them then it's more likely that they are going to be a happier employee (Participant C-13).

> I think the social economic is the difficult one to do. You can say in those things, 'we are good and will give you this many jobs' and those sort of things but those things are dependent on things happening and it is hard to measure […] You can always say how many people you are going to employ and what you plan and what the benefits are and what they could bring but it's tracking those through operations and seeing whether the benefits actually happened or not - that is difficult (Participant C-7).

Learning around the theme of mining and the economy also appeared as an important theme. A few participants felt that society is not paying a reasonable price for metals and minerals.

> It is really driving home that we need to do a better job with our metals, especially copper because that is what we often deal with. Copper gets recycled 1.9 times and aluminum is up between five and six times. We need to pay a lot more for our metals so that mining companies can afford to dry stack instead of water tailings (Participant E-24).

Other participants were discouraged by the lack of movement towards sustainability in the mining industry. They have become more aware that an economic boom in mining actually stifled sustainability work:

> I have to say that I think it is somewhat discouraging on some levels because in 1990 there was actually more serious discussion, Post-Brundtland commission, about sustainability - including the things that we are talking about like socioeconomic and environmental legacies. With the focus on the boom in commodity prices and the focus on resource extraction, a lot of that has gone out of the window, at least on the formal level (Participant E-22).

The theme of central planning emerged as a learning outcome. One participant in particular, Participant C-23, explained that his experience with mining approvals and resource communities led him to believe that central planning and resource hubs are most practical way to avoid boom and bust affected communities (See Participant C-23 on pg. 64).

6.1.1.4 Potential Risks and Impacts

The final subcategory associated with instrumental learning is potential risks and impacts. There was only one sub-theme that strongly emerged in this subcategory, environmental concerns. Data coded in this subcategory are not mutually exclusive and were therefore also coded in the above subcategories of instrumental learning (Diduck and Mitchell 2003). Participant C-14 speaks about how his understanding of the gravity of environmental risks would lead him to act:

> There are guys here who will say something. There are some who know what it's all about - they have been in mining and they know the effects of it and if they see something they will talk to somebody about it. We have some watchdogs around here. I certainly would be too. If I see something that isn't right I would certainly say something, knowing what I know now. I have been educated anyway. Anyone who works in the industry knows that it can be nasty and we all want things to be right.

In his interview, Participant C-4 also explained that his experience in a mining community would lead him to caution others about potential environmental risks associated with mining activities:

> I would tell them that they have to be diligent about their own environment and their own surroundings because that can last forever - and the day-to-day mining stuff is just day-to-day and it is not a big deal in the big scheme of things. So my advice to a new mining community would be make sure that your foundations are secure - that you know what you're getting into.

6.1.2 Communicative Learning

Communicative learning deals with social interactions; understanding the values, intentions, purposes, and meanings of others and making oneself understood (Diduck and Mitchell 2003). I have used four categories of communicative learning as established by Diduck and Mitchell (2003): i) insight into the interests of others; ii) insight into one's own interests; iii) communication strategies and methods; and iv) social mobilization, as shown in Table 7.

Table 7: Communicative Learning Framework. Depicts the theory based and grounded categories used in the analysis.

Primary (theory-based) Category	Secondary (theory-based) Categories	Tertiary (grounded) Categories (or themes)
Communicative Learning	Insight Into the Interests of Others	• Mining business interests • Employee humanity • Government interests • Community interests
	Insight Into One's Own Interests	• Company relationships and appearances • Community future • Reliance on company
	Communication strategies and methods	• Personal relationships • Early and sustained relationships • Differing views
	Social Mobilization	• Perseverance • Teamwork

6.1.2.1 Insight Into the Interests of Others

Insight into the interests of others included the important theme of better understanding mining business interests. Many participants, especially community participants were keenly aware that

the mining company operates as a wealth generating business with expectant shareholders. The company is neither community-based nor entirely concerned with community wellbeing in the same way it historically was. Participant C-18 explains his insight into the mining company's interests:

> The company is a world-traded organization and that is what I brought up at the [camp permit] meeting. Everyone still thinks that they are community minded but they aren't the ones who write the pay checks or the shareholders dividends and that is the driving force behind the company now […] the focus isn't on the Manitoba anymore - they are a world-traded organization. I mean my dad [who lives out of province] is a shareholder and wants them to make money so that he can make money.

Participant C-17 adds his understanding of mining business interests:

> Dealing with Hudbay has been interesting because in the last few years Hudbay has had to change - and I really think that they had to. They used to be a fairly small time player - just northern Manitoba. We had to change to survive. They had to go global but on the other hand that has taken them out of their base here. Even though their office was always in Toronto they have always been a northern Manitoba company - that has changed now and it is very evident in dealing with their management. When Snow Lake used to deal with Hudbay, talking with former mayors, 20 years ago the used to be able to pull on the heartstrings a little bit and deal with them that way. These days when you do with them you have to go in with the business plan and the spreadsheets have to add up.

Somewhat paradoxically, some other participants noted that their experiences with mining companies and employees made them more aware of the humanity and the people who work at mining companies as expressed in the quotes below.

> Part of what I have learned is the compassion of the people who work within it. Part of what I've learned is their commitment to wealth generation and not just for themselves but also for corporate social responsibility perspective […] I have yet to find a pillager or, a rapist amongst the miners and executives I've met, you know the way that most of them are portrayed. I have found that nowhere. It is really incredible the passion that these people have and their commitment to always doing it better and keeping their footprint as small as possible. I think if there is anything that I have learned in my time in the North is how critical it is to get into the North and talk with people in the North (Participant C-23).

> At the end of the day we went around the table with everyone who is still there and asked if anyone still had one last comment - I am paraphrasing here but they said, 'okay, we believe what you are saying but we still don't like the fact that you are mining where you

> are mining' or 'we do not think that the government should let you mine in a park - just on principle.' At the end of the day we said, 'okay we probably didn't change their opinion but at least they knew that we were not a bunch of shysters who were trying to be evil or sneaky' (Participant C-13).

The theme of government interests emerged from the data as well. Participants noted that through their experience they have come to know that mining and the related regulations are often not a high importance for governments, "mining is not a high priority within this provincial government. It is very low and they would like it to be lower in many ways" (Participant E-24). They also note that governments are often interested in looking good and remaining popular for the next election; "the whole money and governmental elections are all geared for about four or five years. So the [government in power] wants to have those jobs online before the next election" (Participant E-24).

The important theme of learning more about community interests appeared in the interviews. Some participants noted that communities have values besides economic values. Participant E-21 explained that land can be very important to communities, especially First Nation communities, "just understanding each other's views and perspectives is important. There are certain areas that are very important to the communities and industries shouldn't go there." Some participants posited that settler communities and First Nation communities may have opposing interests; settler communities may be more interested in the economic benefits of a project and First Nation communities may be more interested in long-term health of the land and culture. Participant E-22 explains this view:

> Local communities and especially aboriginals are not the same level of stakeholders. Aboriginal peoples are actually not stakeholders they are landowners so the idea that everyone has the same level of interest in the outcome is kind of a weird one - it is convenient because then we can all sit around and discuss things and it is convenient for government because all they have to do is balance out the interests but it doesn't reflect the actual steak that people have in the outcome - for some people it is life-and-death or at least livelihoods and long-term security of their land base and water supply and things.

> For other people it is how much money they make off of it and for most of them it is just one of many investments anyways. There standing is not the same
>
> There is no requirement that First Nation groups are decision-makers. There is a consultation requirement. But First Nations should be given decision-making power for projects that falls in their territory (Participant E-1)

6.1.2.2 Insight Into One's Own Interests

The second subcategory captures insight into one's own interests. This subcategory included themes related to a mining company's insight into their own interests. Some participants mentioned that a good relationship with the public and with communities is good for business. A clean reputation and good will between companies and the public can help the company raise capital for projects; "I think over time [mining companies would improve their legacy effects], just due to public perception. It is difficult to raise money to build mines and if you aren't going to be acting in an environmentally responsible manner the need is even more difficult to get money" (Participant C-13):

> Every year it is tilting more and more towards the investors expecting certain things in your reporting. They expect certain reporting from the company to protect the environment. So we operate under the assumption that everybody - whether they all do or not. It is safer that way. Reputation is just as important as getting a permit sometimes. You have to manage it all (Participant C-16)

The theme that good environmental behaviours can also be sound business decisions appeared in the interviews as well. Participant C-16 spoke about how improving environmental knowledge and planning for closure can save the company money in remediation and assurances:

> If we knew what we know now with respect to some of our older properties we would totally design them differently and as a result have, in many cases, significantly reduced financial assurances resulted with our closure plans. Unfortunately, there is nothing that we can do about it because they were built in 1928! Our brand-new locations like Lalor and Reed, the designs for both of those mines considered all of those things that we discovered over the years and they were built to address those things up front. So as I said, sometimes spending the prevention money up front can save you oodles of money down the line - that is just a very specific example of how. So if you design a mine with closure in mind then it can save you money directly in financial assurance costs

> associated with the legally required closure plans right through to what it actually costs to do the demolition.

Participants also found that engaging the public and listening to their concerns can be beneficial to the company in many ways; they could help improve a project and help the company better prepare for an environmental licence as captured below:

> There are some very good points that people do raise that don't cost a lot of money - it's more of the sweat equity or the pain in the neck of generating another report using the information that we already have but there are a lot of really good points that the public or stakeholders to come up with and lots of times it is just perspectives and information from their experiences. So if you can't answer their questions then it probably means that you haven't done as good of a job as you should have in your environmental assessment and impact statements. It is a bit of a check and balance kind of thing […] If the community or the public is dead set against your project then the chances are that the people in the approvals branch may see that they are correct and you have missed something out or there is a sizable environmental impact and maybe you won't get your license to operate. So that is the whole legal licence and the whole social licence is another ball of wax also (Participant C-13).

The second major theme dealt with community's insight into their own interest. Community members held a number of confusing and sometimes conflicting revelations about their own interests. There is the revelation that mining cannot continue forever so it is in the community's best interest to plan for a future without mining. Participant C-8 explains, "we have to start right now trying to figure out what is going to take the place once the mine is gone. That is basically it. Like I said before, mines are born to die."

The tension that exists is due to some participants seeing growth as the only way to survive as a town,

> If you are not growing then you are dying - so I think that even though we had started some of that growth you can't just say, 'look we have 1000 people living here now we are good.' The population and economy have to be moving forward or else you lose (Participant C-17).

Some other participants believe that communities must resign to their fate and participate in regional planning with centralized locations. For example, one participant talked about the need

for planning and the competition among northern communities for infrastructure like schools (see Participant C-23 on pg. 64).

There were some participant who also recognized that the community, to a large degree, depends on the mining companies so they must maintain good relationships; however they must also look out for themselves and push for better treatment and conditions when necessary.

> I don't have anything against Hudbay at all - you need to have a very solid relationship with the mining company but you need to understand that they aren't there for you. The only one who is there for you is you. The mining company has shareholders, stakeholders, they have an agenda of their own that involves - you are only one part of their agenda. Their unions are another part, their EA process, their provincial government, their shareholders, you are only one part of their agenda and you are probably in no way the most important part. So as a small town you have to play a large role and you have to swing above your weight in any way possible - using your provincial cabinet ministers, using the mining company against itself, using anything that you can. You have to swing above your weight and that is scary (Participant C-17).

6.1.2.3 Communication Strategies and Methods

The third subcategory of communicative learning deals with learning new communication strategies and methods. This subcategory included the major them identified by many participants of emphasising personal relationships.

> It is incredibly difficult to get away from personal contact and spending time with people. Again, I think that that is one of the things that the North has taught me […] I realized that it doesn't matter if you can connect with somebody on the Internet, if you haven't sat with them and drank tea for a while and spent some time in their community then you aren't getting anywhere. You have to have a personal contact. Infrastructures like teleconferencing and Internet all help but you need to spend time with people […] I think that the people who are being successful in Manitoba, especially the North, are those who have an ability and recognize the need to do business based on relationships (Participant C-23).

The theme of early and sustained engagement also appeared in the research. Participant C-13 notes that, "early and often engagement is a good thing - I suppose if you want to live by the 'free prior and informed consent' that is pretty useful too."

Participant C-7 also explained the importance of dialoguing with people who hold differing views than you.

> Sometimes you can have tunnel vision when you're thinking about your design and [meeting with diverse stakeholders] can open up concerns that you might not have been thinking about, then that allows you to think about it and address it prior to their being a problem, so obviously it is beneficial.

Participant C-13 echoed the sentiment that engaging with differing views is beneficial to a project as it brings forward ideas and perspectives that may have been overlooked by the proponent (see Participant C-13 on pg. 104).

6.1.2.4 Social Mobilization

The final subcategory associated with communicative learning is social mobilization. This subcategory was not as prevalent as the other subcategories; however several important themes emerged. The first theme is the importance of perseverance. This theme also emerged in Diduck and Mitchell's (2008) work.

> I think - you have probably heard of the term 'disaster capitalism'? I think we need 'disaster environmentalism'. Mount Polley is going to be a gift that just keeps giving and giving to the light side, so to speak. We aren't going to let go and we're just going to keep on it. Using disasters - sounds horrible but that is when the awareness is up (Participant E-24).

Another theme is that social mobilization requires teamwork and the coming together of different groups.

> I would advise [communities with mineral potential] to collaborate with as many groups as possible, pool resources, pool efforts, really focus on messaging, retain experts, and focus [their] comments on the most impactful areas - the area that [they] and [their] allies are most likely to succeed. Just choose a few so don't spread [themselves] too thin and use media. Go outside the assessment process and try to raise as much awareness of the project in the public realm as possible […] And partner with First Nations as much as possible. Support First Nations and enable them and assist them as much as possible because, especially here in BC where much of First Nation territory is not treaty territory and now we have this Tsilhqot'in decision recognizing aboriginal title and recognizing that First Nations have much more to say than communities do over whether project should proceed (Participant E-1).

6.2 Processes

This research also provided some insight into the processes that participants felt allowed the sorts learning outcomes noted above to occur. The three process subcategories used were taken from Moyer et al. 2014 and included: i) interpersonal interaction, ii) embodied experience and activity, and iii) personal. Themes within each subcategory are grounded in the interview data

6.2.1 Interpersonal Interaction

The first subcategory, interpersonal interaction, appeared as an important learning process. The theme of discoursing with peers emerged in the interviews. Participant C-24 explains how his association with peers across the border affected his learning:

> I have worked with First Nations people a lot. Most recently, it has been working with our Alaskan colleagues in the southeast of Alaska. Most of the rivers in northeast British Columbia flow into Alaska and that is where the mines are - there are 10 mine proposals - and the water all goes downstream. Their commitment and efficiency has definitely inspired me and helped me in my work (Participant E-24).

Conversely, one participant (C-11) noted that his peers did not aid in his learning, “this was my first experience of reading in depth into an issue and I was a little dismayed. Even among my friends I couldn't find one person who is interested in this issue. I finally quit talking about it to them.”

A second theme that emerged is learning through interacting and participating in the EA process as Participant E-22 explained:

> Well, being involved in a few project assessments and a few others sort of regulatory processes [helped me to learn] like the nuclear safety commission hearings, or some of the fishery regulation things, being involved with communities that are dealing with EA's or participating in them - trying to understand the implications of the proposal and responding in a way that can be heard and incorporated into the process and maybe have some effect, and on the policy level working with there was a regulatory advisory committee on the federal level that was put in place around the original Canadian environmental assessment act (Participant E-22).

Participant C-7 adds that engaging with the public through the EA process helped him learn,

> Obviously you learn something from discussion with stakeholders and you get the concerns that they have and try to work and deal with those concerns and sometimes you change your design or take into consideration what their concerns were, so you do get something from it.

The theme of learning through interacting and dialoguing with experts presented itself in some the interviews. Participant C-11, for example, explains how scientific experts assisted his learning process:

> It was actually a very progressive thing. I used to look at things as simple and black and white but I started phoning people and I started to call environmental department in Winnipeg - I have a list of names downstairs and some of them were very helpful in responding to my questions without a lot of extra work on their part. Sometimes it was as simple as, 'you should phone this person because they could add something.' The government environmental people, some of them were very helpful […] But now, I would phone people and they help me out - somehow I even talked to some people in Saskatchewan who helped me. It was a bit of a scientific search with a great deal of benefit from people who knew where to look.

Participant C-23 also notes that dialogue with experts helped his learning journey:

> I've had the pleasure of coming as a complete idiot and learning from wonderful people. People who are very honest about the industry's problems and what keeps them awake at night. They had given me a gift by allowing me to at least have a more informed conversation with the decision-makers in the province and unfortunately most Manitobans are not given that gift, I don't think.

Learning through interacting in the local government setting appeared as a fourth theme. Some community participants explained that they attended and became involved in town meetings regarding mining decisions and these experiences led to learning.

> When we held the permit meeting this summer it was a massive issue. The town Council Chambers aren't very big, they are probably the size of this room and we had 98 people attend - that's 10% of the population of the community up there that night. We had heard around the community that people were very angry and people were coming to raise hell so I was prepared for an extremely difficult meeting. I chaired it extremely strictly, laid out the rules in advance - no one talks out of turn and if you have something to say you come up to the microphone. I think the people were kind of surprised with what happened that night because what happened is that a fair amount of people came up and said, 'we know you need the camp, we understand that you need the camp and we want the municipality and HudBay to work together. Renew the permit for the camp but make it for a shorter period of time and let's keep moving forward.' A lot of people were very

> surprised by that, including myself, because all we had heard was that people were coming to raise hell (Participant C-17).

> I had 10 minutes at a council meeting to present and I knew that the Council was in favour of this project but I did not realize that they were so dedicated to get this project going no matter what. So I got up and I presented to the Council my little spiel about how they should look at this, this, this, and this - I had a written presentation for them too. 90 seconds and I can look around the table and there was only one person that actually asked a question and expressed concern that if it is done well and done to high standards as they purport then it is a good project (Participant C-11).

6.2.2 Embodied Experience and Activity

The second important learning process subcategory is embodied experience and activity. This subcategory was not mutually exclusive so quotes in this theme were coded under the other process subcategories as well. Participants suggest that their embodied experiences lead to learning. The major theme that emerged in this subcategory is experience through work/employment:

> As we learned things obviously got more rigorous - especially through the ‘80s the whole acid mine rock drainage - there was a lot of learning from that. The late ‘70s where mine effluent treatment - that is where all of the liming treatment and all that came into play from tests at Brunswick Mining and the company was doing their own in Flin Flon at the mill, they were doing some of the same things with lime. Things progressed as more knowledge came along and then starting to understand the effects of acid rock drainage and testing the rock for its potential acid generation/neutralizing potential. Working at the ratios for sulphur content and so forth. As things progressed things got more rigorous both federally and provincially there were species at risk and all of those things started evolving (Participant C-7).

> I am First Nations and I got into this because there was a lot of activity happening in my own traditional territory. That brought me home to work. And the first thing that I started to do when there was coordinating five different environmental assessment reviews at the same time on behalf of the first nation (Participant C-4).

> Just working with it, reading the regulations, figuring out how to comply, writing our annual CSR report or contributing to it or reviewing it or collecting data for it, or answering questions on the Carbon Disclosure Project or the Dow Jones sustainability index - every time you do one of those you have to find appropriate information and they are all scored so you try to improve your scores and you wind up finding out additional information that you might otherwise not have been aware of. External reporting can actually drive improvement as well. All of these discussions can provide opportunity for continual improvement, which is obviously the benefit of doing them in the first place (Participant C-16).

> It has been a real eye-opener for me, not knowing a lot about mining and then getting involved in this not because I'm brilliant at it but because there was no one else and I've thrown myself into it - that is really what has happened. I have learned so much about mining but I have also learned so much about the people who run these things because I get the privilege of working with the entry-level people and I also get the privilege, like in Toronto of working with the very top people in these companies (Participant C-23).

6.2.3 Personal Learning

The final learning process subcategory is personal. I identified the theme of personal reflection on experiences as the foundation of learning in this subcategory:

> From a lodging example [the company] gave their per man costs at the camp but not their per man charge. So they said that their cost was $80 per man but I know that their asking price is $150. So when I hear something that is a little bit skewed it makes me a little sceptical that they aren't telling the whole truth anyways. But mind you there is only so much time in a meeting (Participant C-19).

> I think that people are more forward-looking than they used to be just because they have gone through [mine development] a couple times. I think that people are getting a much better sense that you have to do something or else we are going to continue through the boom and bust cycle (Participant C-17).

The theme of reflecting on reports also appeared in the data. Two participants explain how reading and reflecting on reports can lead to learning and sometimes even a change in behavior:

> So the actions of someone completely outside of your company can cause you to revaluate and potentially identify areas for continual improvement, which happens to fit nicely with our ISO 14001 certification as well. It is an environmental management system, international standard that we are certified to by a third-party (Participant C-16).

> I did do some reading before I went [to the Lalor EA open house] and some reading afterwards but it is interesting stuff and it takes a little while to get your head around it and understand what they're doing but I have been very impressed with some of the environmental. Like what they've been doing on the Reed Mine - to put that mine in that small of a footprint …. Right down to they are cutting down branches of trees instead of taking out the trees so that they can get their satellite service a bit better (Participant C-8).

6.3 Platforms/Onramps

Not surprisingly there are some more effective ways of getting people involved so as to encourage learning experiences. The data revealed several types of platforms/onramps that help

facilitate learning including: public meetings, classrooms/workshops, workgroups/councils, EA activities themselves.

Some participants found public meetings very helpful and informative. Participant C-19 states that, "If [the mining company] have public meetings we almost always try to be at them." C-17 adds to this, becoming involved in local politics "has also made me realize that public engagement is important" (See full quote Participant C-17 on pg. 101).

Some participants also noted that classrooms and workshops might offer platforms/onramps to learning. These participants recognized the importance of workshops and classes for learning so they decided to create workshops to enhance learning in other participants:

> We do a number of workshops. We work with the companies that draft the applications so there is a lot of teaching that happens and a lot of dialogue that happens that sort of falls outside of the regulatory process (Participant E-2).

> Our 'fair mining practices' training course. It is made for resource managers and interested community members - first, what is mine and 101, how to research claims on your territory, who has the claims and what are they doing with them, have they lapsed, who can you send letters to - really taking care of your land (Participant E-24).

Participant C-23 explains the importance of education in a classroom setting:

> [Education is important] that is why we bring 600 kids into a shop. At the end of Saturday there will be kids walking out of the school who know a lot more about mining then Wednesday came Saturday morning. They have a chance to rub shoulders with people and it is fascinating for them. They might have a perception of mining but three or four of the people that all have there are young geologists from HudBay, they are professional geologist, they are women, and they are passionate about what they're doing and they are fabulous educators.

Other participants state that workgroups and councils offered them platforms/onramps for learning.

> I think being involved with the Canadian environmental network, with the caucus, along with [experts in the field] - certainly when I started that was an education and a half. Having access to the best environmental lawyers in the country and working with them

> on principles as well as specific policy work, 'what do we want to have happen? What should it do? What do we need to be doing?' Then get into the details of how (Participant E-22).

6.4 Barriers

In the same way that there are platforms/onramps that help to encourage learning there are also barriers to learning. Barrier subcategories were taken from literature and the tertiary themes emerged from the interview data.

The first barrier subcategory was situational in nature. Participants explained that economic situations deter some community members from becoming involved in assessment and approval processes. They explained that often in resource dependent communities, like Snow Lake, a large percentage of the population either directly works for the mining company or benefits from mining activities in some way. This reliance on the mining industry may discourage community members from getting involved in EA activities and speaking out, as captured in the following quotes:

> I think that people are getting a much better sense that you have to do something or else we are going to continue through the boom and bust cycle. On the other hand, when people make a lot of money and you see a mine with a long future it is hard to hold that discussion with people (Participant C-17).

> Broadly speaking most of the community is pro-mining and mining pays the bills so they don't say a whole lot [in EA meetings] (Participant C-16).

Communication issues also acted as a barrier to greater and more effective involvement in assessment and governance processes. Participant C-17 explains;

> I've really learned that there is no benefit to sharing whatever information […] everyone is dealing with limited staff and limited time and limited budgets you have to be very careful with how you allocate those resources. For you to allocate a quarter time staff member to making connections and growing relationships - there is a real financial cost to that and in a small community with a small staff you often don't have those resources most of the time. So I think that the payoff would be huge but no one is willing to do it.

The human built environment also offered barriers to participation. For example, the theme of politics appeared in the interviews:

> Can you convince the powers that be, in this case the mayor and council in each community, that they need to have a more diverse sustainability type plan? They nod their heads when you have that discussion but it rarely translates to action that you can see that they are trying to expand and potentially draw of different businesses or whatever to diversify. It can be very difficult to get people to understand the need for it, especially with the announcement of a new mine. It seems like any work is put off for another 20 years (Participant C-16).

Participant C-11 noted that the government's involvement in the approval was lacking and was a barrier to participation. The message being that substandard oversight can make it feel like a project will occur anyways – so there is little point in getting involved in the assessment process:

> The report that they submitted to get the licence to proceed was begging so many questions. I have personally submitted several which I've never received answers to, from either the government or [Company X]. And the government seems to lack the power to say, 'hey [Company X] answer these questions in 30 days.' They presumably would have to answer them before they get the licence, but if they don't plan to get the licence and they aren't interested in answering questions. That whole part of the process makes you wonder who is in control. Manitoba government departments responded to this proposal from [Company X] - and some of it, when they put it in text it was embarrassing. They were excited and happy and overjoyed that it was going to be done […] It was inadequately reviewed by Manitoba government departments. It is so fractioned, each department looking at a little section (Participant C-11).

Community members might become involved in an EA process if they believe that the government is doing an insufficient job of reviewing and regulating a project, as was the case with participant C-11.

The last barrier subcategory is socio-cultural. Communities reliant on resources tend to have mining friendly cultures and this can discourage some community members from getting involved in EAs:

> I think that people kind of lost interest. So when we had our specific environmental meetings people already knew about the projects - and these are public meetings in mining friendly jurisdictions so there were pretty low turnouts in both Snow Lake and Flin Flon and these people weren't even remotely opposed to the project and I would say that they had minimal but legitimate concerns. They already knew about the project because they would have read up about it and because they are small communities, much

> like the human health risk assessment with Sheldon MacLeod, people already had the answers because it is such a small word-of-mouth communities where if you don't have the information you can ask your brother or your sister because they do have information - they are small towns […] the big story is that if you have a meeting about mining in Snow Lake the chances are you will have 10 people show up and they will all be in favour, if you talk about mining in downtown Winnipeg you are more likely to have people who are strong-willed and opposed to mining (Participant C-13).
>
> When HudBay had their formal public meeting as part of their EA for the mill, for example, they had it up at the community hall and they had 150 chairs set up and 12 people showed up. It wasn't a concern (Participant C-17).

When a large percentage of a community's employment is directly associated with the mineral industry an economic dependence may develop (Diduck et al. 2012; McAllister et al. 2014a; Mezirow 1991; Moyer et al. 2014). A company's procurement of local goods and services generates wealth in the community but also strengthens an economic dependence that may deter community members from being overly critical of proposed projects in the EA stage.

6.5 Summary

Learning is an important aspect and outcome of participation in assessment and decision-making processes. In my study, participants reflected on many learning outcomes. The data were replete with examples of instrumental and communicative learning. These tertiary themes, presented above, easily fell into the secondary categories related to instrumental (see Table 6) and communicative (see Table 7) learning that were established by Diduck and Mitchell (2003). None of the participants expressed learning that could be described as leading to a behavioral or transformative change, or that might be classified as a change in meaning scheme. The fact that no transformative or behavioral change took place, while slightly disappointing, is not anomalous. Especially meaningful instrumental or communicative learning that can be described as leading to a transformative change is not a common occurrence (Diduck and Mitchell 2003). The lack of behavioral or transformative change in participants could, in part, be due to the barriers to learning identified above. Barriers such as economic dependence on mining,

frustration with politics, and a mining friendly culture as noted by participants severely impede higher-level transformative learning and limit the emancipatory aspect of the theory (Diduck and Mitchell 2003; Sinclair et al. 2008).

It should be noted that Snow Lake, being a town with an extensive mining history, has a different relationship with EA and the approval process than an established region with novel mining prospects. In the case of Snow Lake, both community members and mining company employees mentioned that EA meetings in town are often not well attended by community members. This is not entirely surprising for a community with extensive mining experience and economic dependence but it does mean that much of the learning shared by community participants was facilitated through means other than EA.

Typically, greater value and more literature have been devoted to communicative learning than instrumental learning because some prominent authors (e.g., Habermas and Mezirow) believed that communicative learning led to transformative changes more often than instrumental learning. Though there were no behavioral or transformative changes reported by participants in this study, the results suggest that instrumental learning outcomes are important and should not be overlooked. Other researchers have recently noted the importance of instrumental learning outcomes in leading to participant transformation (Moyer et al. 2014).

Participants' instrumental and communicative learning outcomes as outlined above were often intertwined and not exclusive. This interconnection of the domains is consistent with the Transformative Learning Theory and literature (Kerton and Sinclair 2010; Mezirow 2000b; Sims and Sinclair 2008). The learning process can move from the instrumental domain (e.g., learning about legacies of mining) to the communicative domain (e.g., learning strategies to best communicate your concerns). Learning may also move in the other direction from

communicative learning (e.g., learning that environmental sustainability is in your best interest) to instrumental learning (e.g., learning about the legal and regulatory system to advocate for sustainability). Sims and Sinclair (2008) note that this interconnectedness of outcomes is a hallmark of adult learning.

It is worth noting that chapters 4 and 5 also contain a good deal of insight from participant learning regarding legacy effects of mining as well as the weaknesses of EA in Canada. Participants demonstrated that they had spent a significant time considering the effects of mining and the efficacy of EA. Their responses were nuanced, sophisticated, and clearly illustrated their learning outcomes and process. I chose to not highlight that learning too much in this chapter however, because I did not want too much duplication of quotes and material.

Learning outcomes and processes may be improved with the next generation of EA. Learning is a central tenant of SA that is seen as essential in moving us towards our goal of sustainability (Gibson et al. 2005; Sims and Sinclair 2008). The better public engagement that SA promises creates more room for participant learning (Bond et al. 2012; Sinclair et al. 2008). Scholars also note that "a firm legal requirement to engage in follow up is an essential way to establish sustainability assessment processes that will foster formal learning steps and opportunities" (Bond and Morrison-Saunders 2012).

Learning from past experiences is essential and should inform future decisions; learning for sustainability should hasten sustainable outcomes. There are ways that mining assessment and decision-making processes could be improved to better foster learning and therefore better decisions where sustainability is promoted.

Chapter 7: Conclusions

7.1 Introduction

Mining is an important economic activity in Canada that supports a global demand for many minerals and metals. There is an old adage that still rings true today, 'if you can't grow it, you mine it." Nonrenewable resources are removed from the earth and this action has long-lasting effects. Mining in itself is not a sustainable activity as mineral reserves are finite. Since no mine will last forever it is essential that the temporary act of mining adds as many positive long-term effects and minimizes as many negative long-term effects as possible.

This research recognizes the significance of legacy effects and had the purpose of seeking to ensure that future mines are planned and operated in a way that produces the best enduring-legacies and brings mining communities closer to a sustainable existence. I used a case-study approach and collected data using document review as well as using semi-structured interviews to interview 24-participants, 15 from the northern Manitoba mining town of Snow Lake and 9 mining and assessment experts from across the country. Data collected using the above methods allowed me to address my research purpose and objectives. The specific objectives of this research are as follows:

1) Identify and confirm the suite of legacy effects from mining in Canada.
2) Examine the degree to which mining approval processes, such as environmental assessments, consider mining legacy issues.
3) Establish how learning from past experience with mining approvals and development can inform the consideration of legacy effects for future decisions; and,
4) Establish how learning approaches can be incorporated into development decision-making processes to help ensure such legacy effects are considered.

The subsequent sections in this chapter offer syntheses and conclusions related to each objective and in relation to the three key areas of intersection established in my conceptual framework, as established in Figure 2. I end this chapter by suggesting areas for future research and offer some concluding comments.

7.2 Mining Legacy Issues

As identified in my conceptual framework (Figure 2) mining legacies are the initial problem. Mining legacy issues must be addressed in order to amplify the positive legacies and eliminate or minimize the negative in order to hasten sustainability. The data obtained regarding mine legacy issues were organized according to Gibson and Robinson's (2014) mine legacy-effects framework as outlined in Chapter 2. When I asked participants to identify mining legacy issues their responses easily fell into and were covered by the framework presented by Gibson and Robinson (2014): residual environmental effects, residual effects on communities, boom and bust cycle, remaining infrastructure, and resource depletion. Each if these is quite broad so it is probably not surprising that the general framework worked well and that it is likely an applicable frame for similar studies and captures well the legacy effects of mining.

I identified a number of legacy effects of mining grounded in my Snow Lake case study and participant interviews. These effects are identified and discussed in Chapter 4 and summarized in Table 5. Many of these legacy effects were common to others noted in the literature. For example, participants noted that AMD and water contamination through mine waste is a major legacy effect of mining and concern for communities. Tailings ponds were also worrisome to participants. They were concerned that the tailing impoundment areas may fail and contaminated tailings water may enter the natural waterway and affect lake and fish health. Studies such as Akcil and Koldas (2006) and Johnson and Hallberg (2005) similarly examine the potential environmental damages and legacies of AMD. Recent and appalling tailings breaches

such as the 2014 Mount Polley mine disaster in British Columbia and the 2015 Geronimo Iron Ore dam collapse in Brazil testify that participants have just reason to worry about water contamination (Eisenhammer 2015). Scholars and participants also voiced concerns about perpetual water care and treatment (Gibson and Robinson 2014; Hunter and Hume 2015). Many tailing impoundment areas are required in perpetuity and therefore the threat of environmental contamination persists even after the mine is shut down.

Interestingly, effects that fell into the category of "residual effects on communities" were generally more positive. Participants, particularly those living in the resource dependent community of Snow Lake appreciated the jobs that the mining industry provides. Participants also noted that they enjoy the training, skills, education, and high wages that accompany employment in the mining sector. These ideals are also captured in the literature (e.g., Gibson and Klinck 2005; Gibson et al. 2005). Unfortunately, communities can easily become (or remain) too dependent on the jobs that the mineral industry creates. This dependence can be a legacy issue.

Boom and bust cycles are another legacy issue of mining activities in Canada that were emphasized in my study and noted in the literature. Participants were very aware of the economic dependencies that are created in a community when there is only one major employer or industry, mining. The community can become reliant on the volatile mining sector for employment. This problem is exacerbated when a camp for mining employees is built in the area, as is the case in Snow Lake, so employees do not move permanently to the community nor economically contribute to the town (Storey 2001).

Mining often occurs in northern and remote regions of Canada. This means that mining activities, which require a large amount of infrastructure and connectivity, often act as the

impetus for building or improving roads to remote regions. This finding was emphasized in my research but this is not prevalent in the literature. Participants in Snow Lake saw improved roads in a positive light explaining that they made living and travelling in the North easier. Mines are still operating in the Snow Lake area. Consequently, it is hard to say if the connectivity and roads will be maintained adequately when the mines close and there is little money or incentive for road repair. This currently positive legacy may change to a burdensome negative legacy issue after the mines eventually and inevitably shut down.

The final legacy issue identified in Gibson and Robinson's (2014) framework and supported through my research findings was "resource depletion". As minerals are a finite resource the depletion of the resource should be considered a legacy issue. This was not an overly common theme in my research but participants noted that there should to be better taxes and royalties set up so that the community has some money for the future (and transitioning away from mining) once the mine closes this idea is present in recent literature on the subject as well (e.g., Gibson and Robinson 2014; Storey 2001; 2010).

Not surprisingly in terms of understanding mine legacies there are a series of priority issues related mine legacy issues that this research helps to underscore. These revealed priorities may help to inform and strengthen the mining legacy framework presented by Gibson and Robinson (2014). For example, in relation to the residual environmental effects water health and mine tailings were identified as a priority by many participants and must be thoroughly considered through provincial and federal approval processes. Tailings also directly implicate the environmental sustainability of mines. Priority effects were identified in the residual effects on communities category of legacies as well. This case presented several unique and important community legacy effects because of the presence of a local community associated with mining.

Priority legacy issues include jobs, skill training, and wealth generation. These are important positive legacies to consider but the mining industry must recognize that high paying jobs cannot be traded for negative environmental legacies like substandard tailings areas. This research also underscores the fact that infrastructure planning should be a priority issue for provincial and local decision makers. Roads and related infrastructure built to support mining activities may benefit the community during the life of the mine but steps must be made to ensure that infrastructure is taken care of and does not deteriorate and become a burden after a mine closes

7.3 Environmental Assessment and Legacy Effects

The conceptual framework (Figure 2) suggested that EA could act as a mediating process between legacy effects and learning. EA was conceived as providing the frame from which to consider the legacy effects of a mine as well as the space for participants to reflect on the acceptability of such effects. Overall, participant data reveal that environmental assessments do not do an adequate job considering the long-term legacy effects of mining. A next generation EA such as SA would be better suited to consider legacy effects and ensure that positive legacies are maximized and negative legacies are minimized and mitigated. According to the literature SA would address many of the concerns with EA raised by participants as established above. Generally participants agreed that EAs are improving and are better than no assessment at all – but this is not a very high bar to surpass and should not be our ultimate goal. They noted that the socio-economic considerations in EA have improved immensely over the past 30 years. For some, and I would agree, this creates a foundation on which to build more robust consideration of legacy effects.

Several expert participants pointed to EAs in the territories as an example of assessment processes that better includes legacy considerations. Territorial EAs are amongst the most recent EA processes in the country and therefore have the benefit of drawing from provincial EA

legislation and best practices (Bond et al. 2012; Clementino 2008; Gibson 2014; Hart et al. 2012). Further, the population of the North differs from the provinces with a lower population density and higher aboriginal population (Kwiatkowski and Ooi 2003). Some scholars suggest that the people living in Canada's north, especially aboriginals, "have a holistic view of the environment and link their observations and appreciation of the physical world with the cultural and social attitudes created and supported by close interaction between the environment, health and lifestyle" (Kwiatkowski and Ooi 2003, 434). EA in the North is perhaps better at considering legacy effects because of this unique cultural perspective (Slocombe et al. 2016). More tangibly, decision-making and regulatory processes are not limited to EA, for example in Northwest Territory there are several boards and processes under the Mackenzie Valley Resource Management Act (including the Mackenzie Valley Land and Water Board and Mackenzie Valley Environmental Impact Review Board) that perform regulatory functions and issue licences and permits (Government of Canada Aboriginal and Territorial Relations 2007). Having more than one board broadens the regulatory scope and may allow legacy issues to be considered more completely.

The data from my research suggest that it is very difficult to complete effective EA locally. Both the proponents and community members have very low expectations of public participation in EA. The community lauds the proponent's bare minimum engagement and community members tend to not participate or raise critical issues. Participants may remain unengaged and silent on critical issues because their livelihood is too tied to the proposed activities. Snow Lake, in many senses is still a mining town and the community recognizes that their future as a town is intimately tied to the future of mining activities in the area and they are not interested in people from the South saying what's good for them during an EA process.

When discussing current EA in Canada, participants pointed out weaknesses more than three times as often as they pointed out strengths. They noted many design flaws that make it difficult for the EA process to consider legacy effects fully and act in the way it was originally intended, as a planning tool. To begin, EA triggering has become too exclusive and many projects that may inflict legacy effects are not required to undergo EAs. This is obviously a problem because if potential projects are not being assessed through an EA then mitigation strategies and tradeoffs are not considered extensively. Participants also noted that current EAs do not always sufficiently consider tradeoffs. Some believe that the economic factors or a project are weighed more heavily than the social and the environmental factors. Participants, especially the mining and assessment experts, explained that EA often does an inadequate job of including public voices and concerns through consultation and participation programs. The streamlined timeline associated with EA, to provide more process certainty for project proponents, acts as a barrier for considering legacy effects as public participation processes are truncated and there is less time to consider tradeoffs and alternatives to the project. Another major weakness of current EA is the consideration of cumulative effects. Participants noted that EA in many jurisdictions do not consider cumulative effects fully and this oversight may mean that negative regional legacy effects occur.

Perhaps with a more hopeful spirit, participants noted a number of future opportunities for current EA to better consider the long-term effect of mining and ensure a sustainable future, especially for the nearby communities and region. They note that the original intent and goal of EA is ideal for considering legacy effects, EA originated as a planning tool so that the environmental and social ramifications of a proposed project are considered along with the economic benefits. Writ large, this goal can be utilized to easily consider and weigh the

persistent affects a proposed project. Some participants, mainly the mining and assessment experts suggested that EA law reform would be an effective way to include sustainability criteria into decision-making. Finally, participants explained that greater inclusion of nearby communities and Aboriginal authorities in EA processes could improve the consideration of legacy issues.

The culmination of these ideas leads me to suggest that mining proposals should trigger full EAs in every jurisdiction in Canada. The results also suggest that EA law, including the Environment Act in Manitoba, is going to need to be improved and reformed in a way that incorporates a sustainability test and a sustainability assessment framework. This means that reformed EA processes must carefully consider tradeoffs and allow for them in the context of assessing legacy effects as noted above. Also, the work suggests that EA in all jurisdictions should incorporate more rigorous and better scientific studies especially regarding water health and tailings. As well, EA participatory processes need to reach beyond 'directly effected' communities and include the general public as this research shows that that improves learning outcomes. Finally, EA should adopt learning centred approaches that allow members of the public to become involved in EA, contribute to the planning process, and undergo transformative learning. Improving EA in these ways could help ensure that mining legacy effects are fully considered and that participants encounter learning for sustainability.

7.4 Learning Outcomes and Implications

There were two objectives related to learning. The first learning objective dealt with participants' learning outcomes, both instrumental and communicative. The second learning objective examined the learning process and took a closer look at structural aspects that encouraged and acted as a barrier to participant learning.

7.4.1 Learning Outcomes

The conceptual framework (Figure 2) states that participant involvement in EA should lead to learning regarding mine legacy effects and sustainability. Though research participants did experience learning outcomes, very few were derived through the EA process. Learning occurred not primarily because of involvement in an EA process, as the conceptual framework suggested, but through general reflection on, and experience with, legacy effects and involvement in other governance processes as the secondary arrow in the frame linking legacy effects and learning suggests. The third objective of this study focused on participant learning outcomes by asking the question, "how can learning from past experience with mining approvals and development inform the consideration of legacy effects for future decisions?" First it was necessary to identify what participants had learned through their past experiences. Participants in the study experienced both instrumental and communicative learning outcomes as established in Table 6 and 7 in Chapter 6. Learning outcomes were sorted using Mezirow's (1995) theory of transformative learning and themes identified through Diduck and Mitchell's work (2003).

Experts and community members exhibit a number of instrumental learning outcomes, as revealed in Table 6 in Chapter 6. Participant's experiences with mining approvals and development led them to learn about the mining and environmental laws and regulations that govern mining activities. Participants also suggested that their experiences led them to learn more about environmental issues and legacy effects of mining activities. Community members in particular explained that they became more aware of community benefits from mining activities and the delicate balance that must be struck between development and benefits of the community

A number of communicative outcome also emerged in the data, as revealed in Table 7 in Chapter 6. Many of the participants, not employed in the mining industry, reported learning about the business interests of mining companies like the need to make money for shareholders.

Participants working for the mining company noted a number of learning outcomes related to their own interests as the mining company. They spoke about the wisdom of doing a complete and thorough EA because it was in the company's best interest (along with the public's best interest). Completing an exemplary EA could help a company get approval from the government as well as good will and a social license to operate from the surrounding communities. Participants, especially the community participants, explained that their experiences with mining approvals and developments taught them the importance of building personal relationships. Some participants noted that perseverance is important for social mobilization and even negative experiences can be used to rally people around a worthy cause.

7.4.2 Learning Approaches

The second learning objective, the fourth and final overall objective, examines how learning approaches can be incorporated into development decision-making processes to help ensure legacy effects are considered. To answer this objective, I unpacked the learning process, platforms/onramps for learning, and barriers to learning.

7.4.2.1 Learning Processes

Three are three major themes related to the learning process are found in the literature: interpersonal interaction, embodied experience and activity, and personal (Moyer et al. 2014). Participants explained that personal interactions with others helped them learn. They noted that interacting with peers was extremely helpful. Some participants noted that becoming involved in the EA process and interacting with others in that setting was helpful to their learning. Interacting with experts and government officials also helped some participants in their learning journey.

The second theme, embodied experience and activity appeared in the research. Participants explained that their experiences in work were especially helpful in their learning

process. Through their work experiences, participants became familiar with many different documents, legislations, and best practices. Work also allowed many participants to meet others, work closely with them, and learn from that experience. Participants, especially experts, mentioned that being involved in other groups, like those dedicated to best practices, helped their learning.

Personal activities, such as reflection constitute the third theme. Unsurprisingly, participants explained that reflecting on their personal experiences led to learning. Reflecting on the experiences that make up their lives, for example reflecting on a company open house presentation may lead to learning. Some participants stated that reading and reflecting on official reports such as an environmental impact statement also helped them learn.

7.4.2.2 Learning Platforms/Onramps

Participants identified a number of situations that promoted their learning experiences or acted as a platform/onramp for learning. Some participants noted that educational classrooms and workshops promoted their learning experiences. Public meetings, such as town meetings, also acted as a platform/onramp for participant learning. Finally, participants explained that workgroups/councils promoted learning. Platforms/onramps are helpful mainly because they bring participants into contact with other people with whom they can discuss the learning topic, expose them to new information, and generally encourage the learning processes explained above.

7.4.2.3 Barriers to Learning

The literature identified three themes related to barriers to learning; situational, human built environment, and socio-cultural. Sub themes emerged from the data. Situation barriers identified by participants included economics and communication. The fact that resource communities are often very economically dependent on extraction can act as a barrier to learning for community

members. Similarly, a company's imperative to make money for shareholders could act as a barrier to learning. Communication can also act as a barrier to learning. Limited communication between company and community or even between communities can limit learning opportunities.

The human-built environment can also act as a barrier. Specifically politics can act as learning impediment. Some participant felt that their mistrust in the political system was a barrier. They believed that the government was looking out for their own interests and not necessarily the community's. The feeling that a project is inevitable and will be completed no matter what the public says was also an identified obstacle to learning.

The final theme, socio-cultural, appeared in the research as well. Participants recognized that a mining friendly community culture could act as a barrier to learning. People who are more familiar with the mining process may be less inclined to ask questions about the societal need for a mine or the environmental footprint. There may be a saturation or involvement fatigue that occurs in resource communities. People may be tired of the assessment process and not get involved, which is a barrier to learning.

7.4.2.4 Reflecting on the Conceptual Framework

The conceptual framework presented in Figure 2, suggested that EA process would be a suitable approach for considering the legacy effects of mining and that through EA learning, particularly learning for sustainability, would be an outcome – ultimately resulting in more sustainable projects. Despite the fact that EA as currently practiced across Canada does not effectively act as the mediating process my conceptual frame suggested, participants still indicated that they learned through the EA, personal experience with legacy effects, and other governance processes they participated in. Learning outcomes pointed to the fact that EA does not adequately consider the long-term legacy issues such as water health and community diversification. As a result the

learning outcomes of participants are likely more narrow then they might otherwise have been. Further, some of the weaknesses in current EA are exacerbated more in small mining towns, like Snow Lake, where there are many barriers to participating in EA. If there are few participants, the EA process suffers due to the lack of diverse views presented, which the literature (e.g., Keen and Mahanty 2006) suggests negatively impacts the potential for innovative outcomes and action on sustainability. Learning regarding mining legacy effects did occur but it was precipitated primarily through reflection, dialogue, and experiences, not through involvement in an EA process (as the conceptual framework primarily suggests). I expected, and the framework depicts, a somewhat linear and stepwise learning process that really hinges on EA activities. My findings show that learning is more diffuse and are often not directly related to EA involvement at all. So, while the data shows that the conceptual framework does have potential, one would have to consider other EA process (e.g., Yukon in the Canadian context) to see if they have an impact on the framework outcomes I suggested.

7.5 Future Research

As evidenced throughout this thesis, from the perspective of my participants and as captured in the literature, current environmental assessment processes in Manitoba and Canada (the jurisdictions most often mention by respondents) are not designed to adequately consider the legacy effects of mining activities. Several theoretical and practical advances to contemporary EA, such as those promoted for sustainability assessment, could be extremely useful in considering the legacy effects of mining identified in this research. Sustainability assessments are nascent and, so far, fairly uncommon in Canada. With only three mining sustainability assessments completed in Canada, and only one that resulted in a project that received approval to proceed, there have been few opportunities to study mining sustainability assessments in action. Careful consideration of recent assessments like these should be undertaken; however,

these will be limited due to the fact that there is little legacy to assess. The Voisey's Bay Mine, for example, is still in production and less than 15 years old, meaning there has been little chance to examine the legacy issues considered during the sustainability assessment. Theoretically, the mine should create more positive legacy effects and fewer negative legacy effects than a historic mine, or a mine that underwent a traditional EA, but it will take time and careful monitoring to find this out.

As noted in Chapter 3, the case study selected for this research was a community with decades of continuous mining, which is less common in Canadian mining experience than a remote FIFO mine. Future researchers should examine the legacy effects of mines that operate and close in areas with few or no communities and no regional mining continuation. Such research would continue to shed light on the long-term legacy effects of mining in Canada.

7.6 Concluding Comments

Sustainability is a complicated goal. This research showed me that sustainability means different things to different people. Sustainability might mean no project to some groups, a strictly assessed and monitored project another group, or, in the case of Snow Lake, sustainability might mean finding the next mine. Knowing this and realizing that mining activities are unlikely to desist in the near future it is imperative that we pursue mining approvals and operations in way that fully considers the long-term ramifications of a project.

Legacy effects of mining activities are extensive in this country and there is a whole suite of long-term consequences (both positive and negative) established in literature and identified in this thesis. It is necessary to recognize that many of the especially atrocious negative legacies associated with mining in Canada are due to historic mining practices. The advent of mining regulations and EA procedures certainly lessened many of the obvious legacy effects but there is

still a long distance to go to reach our nebulous goal of sustainability. Environmental assessments, in their current state, are not perfect for considering these legacy effects of mining, however they are our best and maybe only real tool for planning and examining the long-term costs and benefits. Refocusing on planning and a sustainability mandate could help to ensure that the lasting effects are considered thoroughly. As mining continues we must champion for as many positive and as few negative legacy effects as possible.

Transformative learning is essential if we wish to learn from our experiences and not repeat our past mistakes, negative legacies. Participants in each representative group experienced learning that ranged from instrumental learning concerning the particulars of mining operations to communicative learning focused on insight into the interests of others. We should tailor our assessment processes to include more room for learning opportunities: interactions with others, embodied experiences and activities, and personal reflection. However, I learned though this research that even if there are many opportunities for involvement in the EA process and learning, barriers exist (such as town economics or mining friendly culture) that make it less likely for community members to engage meaningfully in a process that leads to learning.

While the past might be messy and less than ideal, the future is ours to mold. It is my hope that we will continually learn from our past mistakes in an attempt to not repeat them and move forward. Sustainability is the goal we are moving towards, no matter how unattainable it may seem, let us always move forward and never regress.

References

Abdelouas, A. 2006. Uranium mill tailings: geochemistry, mineralogy, and environmental impact. *Elements,* 2(6): 335-41.

Akcil, A. and Koldas, S. 2006. Acid Mine Drainage (AMD): causes, treatment and case studies. *Journal of Cleaner Production Journal of Cleaner Production,* 14(12-13): 1139-45.

Audouin, M. and de Wet, B. 2012. Sustainability thinking in environmental assessment. *Impact Assessment and Project Appraisal,* 30(4): 264-74.

Aur Resources Inc.2006. Duck Pond Mine Operations Camp. 1297. Millertown, NL.

Azapagic, A. 2004. Developing a framework for sustainable development indicators for the mining and minerals industry. *Journal of Cleaner Production,* 12(6): 639-62. doi: http://dx.doi.org/10.1016/S0959-6526(03)00075-1.

Berg, B. L. 2010. *Qualitative research methods for the social sciences*. Boston, Mass., Munich [u.a.]: Allyn and Bacon.

Boerchers, M. 2013. From Lunarscape to Landscape: Regreening in Sudbury. Bachlor of Arts (Honours), Unoversity of Winnipeg. Place PUblished.

Bond, A. and Pope, J. 2012. The state of the art of impact assessment in 2012. *Impact Assessment and Project Appraisal,* 30(1): 1-4. doi: 10.1080/14615517.2012.669140.

Bond, A. J. and Morrison-Saunders, A. 2009. Sustainability appraisal: jack of all trades, master of none? *Impact Assessment and Project Appraisal,* 27(4): 321-29. doi: 10.3152/146155109x479422.

Bond, A. J. and Morrison-Saunders, A. 2012. Better learning. In *Sustainability assessment: pluralism, practice and progress* eds. A. J. Bond, A. Morrison-Saunders and R. Howitt, 216-30. Routledge, 216-30.

Bond, A. J., Morrison-Saunders, A., and Howitt, R. 2012. *Sustainability assessment: pluralism, practice and progress*. Routledge.

Bowen, G. A. 2009. Document analysis as a qualitative research method. *Qualitative research journal,* 9(2): 27-40.

Bradshaw, A. D. and Chadwick, M. J. 1980. *The restoration of land: the ecology and reclamation of derelict and degraded land*. Univ of California Press.

Bridge, G. 2004. Contested Terrain: Mining and the Environment. *ANNUAL REVIEW OF ENERGY AND THE ENVIRONMENT,* 29: 205-60.

Brundtland, G. H. 1987. World commission on environment and development. *Our common future*: 8-9.

Bryman, A., Bell, E. A., and Teevan, J. J. 2009. *Social research methods*. Don Mills, Ont.: Oxford University Press.

Canadian Environmental Assessment Agency.2013. Voisey's Bay Mine and Mill Environmental Assessment Panel Report.

Canadian Geographic. no date. *Green mining: The Amazing Shrinking Footprint.* http://www.canadiangeographic.ca/themes/environmental_footprint/green-mining.asp.

Cash, M. 2013. Mine protest about 'ownership': First Nations group disrupts northern site as territorial dispute heats up. *Winnipeg Free Press*, January 29, 2013.

Cater, T. and Keeling, A. 2013. “That’s where our future came from”: Mining, landscape, and memory in Rankin Inlet, Nunavut. *Études/Inuit/Studies,* 37(2): 59-82.

CBC Manitoba. 2013. *HudBay granted injunction to keep First Nation from mine.* http://www.cbc.ca/news/canada/manitoba/hudbay-granted-injunction-to-keep-first-nation-from-mine-1.1301501.

Cecilia Jamasmie. 2010. *Northern Manitoba Mining Academy to Open in Spring 2011.* http://www.mining.com/northern-manitoba-mining-academy-to-open-in-spring-2011/.

Clementino, L. 2008. A Critical Examination of Sustainability Considerations in Yukon Environmental Assessment - Past and Present. Master of Environmental Studies, Wilfrid Laurier University. Place PUblished.

Cranton, P. 2006. *Authenticity in teaching*. Jossey-Bass Inc Pub.

Creswell, J. W. 2013a. *Qualitative inquiry & research design : choosing among five approaches*, Third edition. Thousand Oaks: Sage Publications.

--- 2013b. *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage Publications, Incorporated.

Crowder, A. A., Ripley, E. A., and Redmann, R. E. 1995. *Environmental effects of mining*. United States: St. Lucie Press, Delray Beach, FL (United States).

Devlin, J. F., Yap, N. T., and Weir, R. 2005. Public participation in environmental assessment: case studies on EA legislation and practice. *Canadian Journal of Development Studies/Revue canadienne d'études du développement,* 26(3): 487-500.

Dicken, P. 2011. *Global Shift, Sixth Edition. ; Mapping the Changing Contours of the World Economy*. Guilford Publications, Incorporated.

Diduck, A. 2010. The learning dimension of adaptive capacity: untangling the multi-level connections. In *Adaptive capacity and environmental governance*, 199-221. Springer, 199-221.

Diduck, A. and Mitchell, B. 2003. Learning, public involvement and environmental assessment: A Canadian case study. *Journal of Environmental Assessment Policy and Management,* 05(03): 339-64. doi: 10.1142/S1464333203001401.

Diduck, A. P., Sinclair, A. J., Hostetler, G., and Fitzpatrick, P. J. 2012. Transformative learning theory, public involvement, and natural resource and environmental management. *Journal of Environmental Planning and Management,* 55(10): 1311-30.

Doelle, M. 2012. CEAA 2012: the end of federal EA as we know it? *Journal of Environmental Law and Practice,* 24(1): 1-17.

Durucan, S., Korre, A., and Munoz-Melendez, G. 2006. Mining life cycle modelling: a cradle-to-gate approach to environmental management in the minerals industry. *Journal of Cleaner Production,* 14(12–13): 1057-70. doi: http://dx.doi.org/10.1016/j.jclepro.2004.12.021.

Eisenhammer, S. 2015. Dozens missing in Brazil mine disaster, death toll uncertain. *The Globe and Mail,* , November 6.

Fitzpatrick, P. 2006. The environmental assessment process-learning nexus: a Manitoba case study. *Prairie perspectives,* 9(1): 1-30.

Fitzpatrick, P. and Sinclair, A. J. 2003. Learning through public involvement in environmental assessment hearings. *Journal of environmental management,* 67(2): 161-74.

Foddy, W. 1994. *Constructing questions for interviews and questionnaires: theory and practice in social research*. Cambridge university press.

Fonseca, A., Fitzpatrick, P., and McAllister, M. L. 2013. 'Government and voluntary policymaking for sustainability in mining towns: A longitudinal analysis of Itabira, Brazil.' Paper presented at Natural Resources Forum.

Fonseca, A. and Gibson, R. B. 2008. Application denied: BC's Kemess North and Nova Scotia's Whites Point projects promised jobs and revenue, but the communities were looking for overall sustainability. *Alternatives Journal,* 34(4): 10-12.

Freudenburg, W. R. and Gramling, R. 1998. Linked to what? Economic linkages in an extractive economy. *Society & Natural Resources,* 11(6): 569-86.

Gibson, G. and Klinck, J. 2005. Canada's resilient north: The impact of mining on aboriginal communities. *Pimatisiwin,* 3(1): 116-39.

Gibson, R. B. 1992. Environmental assessment design: lessons from the Canadian experience. *Environmental & Resource Economics,* 2(6): 12-24.

Gibson, R. B. 2002. From Wreck Cove to Voisey's Bay: the evolution of federal environmental assessment in Canada. *Impact Assessment and Project Appraisal,* 20(3): 151-59. doi: 10.3152/147154602781766654.

--- 2006a. Sustainability assessment and conflict resolution: Reaching agreement to proceed with the Voisey's Bay nickel mine. *Journal of Cleaner Production,* 14(3–4): 334-48. doi: http://dx.doi.org/10.1016/j.jclepro.2004.07.007.

Gibson, R. B. 2006b. Sustainability assessment: basic components of a practical approach. *Impact Assessment and Project Appraisal,* 24(3): 170-82.

--- 2012a. In full retreat: the Canadian government's new environmental assessment law undoes decades of progress. *Impact Assessment and Project Appraisal,* 30(3): 179-88. doi: 10.1080/14615517.2012.720417.

--- 2012b. Sustainability Assessment in Canada. In *Sustainability assessment: pluralism, practice and progress* eds. A. J. Bond, A. Morrison-Saunders and R. Howitt, 167-83. Routledge, 167-83.

--- 2012c. Why sustainability assessment? In *Sustainability assessment: pluralism, practice and progress* eds. A. J. Bond, A. Morrison-Saunders and R. Howitt, 3-17. Routledge, 3-17.

--- 2014. Turning mines into bridges: gaining positive legacies from non-renewable resource projects. *Journal of Aboriginal Management,* 15: 4-8.

Gibson, R. B., Doelle, M., and Sinclair, A. J. 2016. Fulfilling the promise: basic components of next generation environmental assessment. *Journal of Environmental Law & Practice, Forthcoming*.

Gibson, R. B., Hassan, S., Holtz, S., Tansey, J., and Whitelaw, G. 2005. Sustainability assessment: criteria and processes.

Gibson, R. B. and Robinson, A. V. 2014. 'Mining and sustainability: a local and regional legacy effects framework for planning, assessment and related applications.' in *Mining and sustainability: a local and regional legacy effects framework for planning, assessment and related applications*, 18. University of Waterloo.

Government of Canada Aboriginal and Territorial Relations. 2007. *The Mackenzie Valley Resource Management Act.* https://www.aadnc-aandc.gc.ca/eng/1100100023530/1100100023532 - chp1.

Government of Manitoba 1987. 'The Environment Act.' in *The Environment Act* ed. Government of Manitoba.

--- 1988. 'Classes of Development.' in *Classes of Development* ed. Government of Manitoba.

--- 2010. 'The Mining Tax Act.' in *The Mining Tax Act*.

Habermas, J. 1984. The theory of communicative action, volume one: Reason and the rationalization of society. *Trans. T. McCarthy), Boston: Beacon Press*.

Hacking, T. and Guthrie, P. 2008. A framework for clarifying the meaning of Triple Bottom-Line, Integrated, and Sustainability Assessment. *Environmental Impact Assessment Review,* 28(2–3): 73-89. doi: http://dx.doi.org/10.1016/j.eiar.2007.03.002.

Hart, R., MiningWatch Canada, and Hoogeveen, D. 2012. *Introduction to the Legal Framework for Mining in Canada.* http://www.miningwatch.ca/publications/introduction-legal-framework-mining-canada - _ftn45.

Hilson, G. and Murck, B. 2000. Sustainable development in the mining industry: clarifying the corporate perspective. *Resources Policy,* 26(4): 227-38. doi: http://dx.doi.org/10.1016/S0301-4207(00)00041-6.

HudBay Minerals Inc. 2014. *Operations Lalor.* http://www.hudbayminerals.com/English/Our-Business/Operations/Lalor/default.aspx.

---.2015. 2014 Annual and CSR Report: Measured Approach Major Achievements.

Hunter, J. and Hume, M. 2015. Design failure caused Mount Polley tailings breach, expert panel concludes. *The Globe and Mail,* , January 30.

Jackson, M. 2014. 2.5 more years for Lalor camp. *The Reminder*, August 20, 2014.

Jackson, M. 2015. What's the purpose behind mine purchase? *The Thompson Citizen*, May 15, 2015.

Johnson, D. B. and Hallberg, K. B. 2005. Acid mine drainage remediation options: a review. *Science of the total environment,* 338(1): 3-14.

Johnston, A. 2014. Anna Johnston: Mount Polley mine tailings spill highlights risks of deregulation. *The Georgia Straight*.

Joint Review Panel.2007. Environmental assessment of the Whites Point quarry and marine terminal project: Executive summary.

Keeling, A. and Sandlos, J. 2009. Environmental justice goes underground? Historical notes from Canada's northern mining frontier. *Environmental Justice,* 2(3): 117-25.

Keen, M. and Mahanty, S. 2006. Learning in sustainable natural resource management: Challenges and opportunities in the Pacific. *Society and Natural Resources,* 19(6): 497-513.

Kerton, S. and Sinclair, A. J. 2010. Buying local organic food: a pathway to transformative learning. *Agriculture and Human Values,* 27(4): 401-13.

Kriegler, E., O'Neill, B. C., Hallegatte, S., Kram, T., Lempert, R. J., Moss, R. H., and Wilbanks, T. 2012. The need for and use of socio-economic scenarios for climate change analysis: A new approach based on shared socio-economic pathways. *Global Environmental Change,* 22(4): 807-22. doi: http://dx.doi.org/10.1016/j.gloenvcha.2012.05.005.

Kwiatkowski, R. E. and Ooi, M. 2003. Integrated environmental impact assessment: a Canadian example. *Bulletin of the World Health Organization,* 81(6): 434.

Lawrence, D. P. 2013. *Impact Assessment: Practical Solutions to Recurrent Problems and Contemporary Challenges*. Hoboken, New Jersey: John Wiley & Sons.

Living in Canada. 2013. *Average Salary in Canada.* http://www.livingin-canada.com/work-salaries-wages-canada.html.

Lobe, K. and Sinclair, A. J. 2016. Environmental Assessment: Manitoba Approaches. In *Environmental Impact Assessment: Practice and Participation* ed. K. S. Hanna. Oxford University Press.

MacKasey, W. O.2000. Abandoned Mines in Canada. WOM Geological Associates Inc. Sudbury, Ontario.

Marschke, M. and Sinclair, A. J. 2009. Learning for sustainability: Participatory resource management in Cambodian fishing villages. *Journal of environmental management,* 90(1): 206-16. doi: 10.1016/j.jenvman.2007.08.012.

McAllister, M. L. 2004. Canadian mineral resource development: A sustainable enterprise? In *Resource and environmental management in Canada: Addressing conflict and uncertainty* ed. B. Mitchell, 342-70. Mills, Ontario: Oxford University Press, 342-70.

--- 2008. Shifting foundations in mature staples industry: a history of Canadian mineral policy. In *Canada's resource economy in transition* eds. M. Howlett and K. Brownsey, 145-64. Toronto: Emond Montgomery, 145-64.

McAllister, M. L., Fitzpatrick, P., and Fonseca, A. 2014a. Challenges Of Space And Place For Corporate 'Citizens' And Healthy Mining Communities: The Case Of Logan Lake, B.C. And Highland Valley Copper. *Extractive Industries and Society,* 1(2): 312-20.

McAllister, M. L., Fitzpatrick, P., and Fonseca, A. 2014b. Unstable shafts and shaky pillars: institutional capacity and sustainable mineral policy in Canada. *Environmental Politics,* 23(1): 77-96. doi: 10.1080/09644016.2012.737254.

McAllister, M. L. and Fitzpatrick, P. J. 2010. Canadian mineral resource development: A sustainable enterprise? In *Resource and environmental management in Canada: Addressing conflict and uncertainty* ed. B. Mitchell. Mills, Ontario: Oxford University Press.

McHugh, B. 2009. Fly-in-Fly-out in the Noughties. *ABC Rural: Perth, Australia*.

MEND. 2014. *Mine Environment Neutral Drainage.* http://mend-nedem.org/default/.

Mezirow, J. 1991. *Transformative dimensions of adult learning*. ERIC.

--- 1993. 'A transformation theory of adult learning.' Paper presented at Adult Education Research Annual Conference Proceedings.

--- 1995. Transformation theory of adult learning. In *In defense of the lifeworld: Critical perspectives on adult learning* ed. M. R. Welton, 39-70. SUNY Press, 39-70.

--- 2000a. *Learning as transformation : critical perspectives on a theory in progress*. San Francisco: Jossey-Bass.

--- 2000b. Learning to think like an adult. *Learning as transformation: Critical perspectives on a theory in progress*: 3-33.

--- 2003. Transformative learning as discourse. *Journal of transformative education,* 1(1): 58-63.

--- 2008. An overview on transformative learning. In *Lifelong Learning: Concepts and Contexts* eds. J. Crowther and P. Sutherland, 25-37. London, UK: Routledge, 25-37.

Mining Minerals and Sustainable Development.2003. Executive Summary. MMSD.

MMM Group Limited.2009. Snow Lake Sustainable Community Plan Pt. 1. Winnipeg, MB.

Moody, R. 2007. *Rocks and hard places : the globalization of mining*. Black Point, Nova Scotia; Bangalore, India; Kuala Lumpur, Malaysia; Cape Town, South Africa; London; New York; New York: Fernwood Publishing ; Books for Change ; SIRD ; David Philip ; Zed Books ; Distributed in the USA by Palgrave Macmillan.

Moore, J. N. and Luoma, S. N. 1990. Hazardous wastes from large-scale metal extraction. A case study. *Environ. Sci. Technol. Environmental Science & Technology,* 24(9): 1278-85.

Morrison-Saunders, A. and Arts, J. 2004. *Assessing impact: handbook of EIA and SEA follow-up*. Earthscan.

Morrison-Saunders, A. and Hodgson, N. 2009. Applying sustainability principles in practice: guidance for assessing individual proposals.

Morrison-Saunders, A. and Pope, J. 2013. Conceptualising and managing trade-offs in sustainability assessment. *Environmental Impact Assessment Review,* 38: 54-63. doi: http://dx.doi.org/10.1016/j.eiar.2012.06.003.

Morrison-Saunders, A., Pope, J., Gunn, J. A. E., Bond, A., and Retief, F. 2014. Strengthening impact assessment: a call for integration and focus. *Impact Assessment and Project Appraisal,* 32(1): 2-8. doi: 10.1080/14615517.2013.872841.

Morrison-Saunders, A. and Retief, F. 2012. Walking the sustainability assessment talk — Progressing the practice of environmental impact assessment (EIA). *Environmental Impact Assessment Review,* 36(0): 34-41. doi: http://dx.doi.org/10.1016/j.eiar.2012.04.001.

Moyer, J., Fitzpatrick, P. J., Diduck, A. P., and Froese, B. 2008. Towards community-based monitoring in Manitoba's hog industry. *Canadian Public Administration,* 51(4): 637-58.

Moyer, J. M. and Sinclair, A. J. 2015. Stoking the Dialogue on the Domains of Transformative Learning Theory Insights From Research With Faith-Based Organizations in Kenya. *Adult Education Quarterly*: 0741713615610625.

Moyer, J. M., Sinclair, A. J., and Diduck, A. P. 2014. Learning for Sustainability Among Faith-Based Organizations in Kenya. *Environmental Management,* 54(2): 1-13. doi: 10.1007/s00267-014-0289-8.

Natural Resources Canada. 2014. *Tables on the Structure and Rates of Main Taxes.* http://www.nrcan.gc.ca/mining-materials/taxation/mining-taxation-regime/8886.

Natural Resources Canada, Aboriginal Affairs and Northern Development Canada, The Mining Association of Canada, Prospectors and Developers Association of Canada, and Canadian Aboriginal Minerals Association 2006. 'Exploration and Mining Guide for Aboriginal Communities.' in *Exploration and Mining Guide for Aboriginal Communities* ed. N. R. Canada.

Noble, B. F. 2015. *Introduction to environmental impact assessment : a guide to principles and practice*, Third edition. Don Mills, Ont.: Oxford University Press.

O'Faircheallaigh, C. 2010. Public participation and environmental impact assessment: purposes, implications, and lessons for public policy making. *Environmental Impact Assessment Review,* 30(1): 19-27.

Ontario Ministry of Northern Development and Mines. 2012. *Environmental Assessment. Queen's Printer for Ontario.* http://www.mndm.gov.on.ca/en/ring-fire-secretariat/environmental-assessment.

Otto, J. 2006. *Mining royalties: A global study of their impact on investors, government, and civil society*. World Bank Publications.

Parkins, J. R. 2011. Deliberative democracy, institution building, and the pragmatics of cumulative effects assessment. *Ecology and Society,* 16(3): 20.

Parres, J. R. B. and Jackson, M. 2009. *Headframes, Happiness and Heartaches: Mines of Manitoba*. James and Audrey Parres.

Petts, J. 1999. Public participation and environmental impact assessment. In *Handbook of environmental impact assessment. Volume 1: environmental impact assessment: process, methods and potential.* ed. J. Petts, 145-77. Oxford, United Kingdom: Blackwell Science, 145-77.

Pope, J., Annandale, D., and Morrison-Saunders, A. 2004. Conceptualising sustainability assessment. *Environmental Impact Assessment Review,* 24(6): 595-616.

Porter, J. 2015. Ring of Fire road proposal to get $785,000 government study. *CBC*.

Putz, A., Finken, A., and Goreham, G. A. 2011. Sustainability in natural resource-dependent regions that experienced boom-bust-recovery cycles: lessons learned from a review of the literature. *Center for Community Vitality Working Paper*.

QSR International. 2014. *NVivo for mac.* http://www.qsrinternational.com/products_nvivo-mac_features-and-benefits.aspx.

Reed, E. and Miranda, M. 2007. Assessment of the mining sector and infrastructure development in the Congo Basin Region. *Washington DC, USA: World Wildlife Fund, Macroeconomics for Sustainable Development Program Office*: 27.

Rees, J. A. 1985. *Natural resources : allocation, economics, and policy*. London; New York: Methuen.

Rio Tinto Alcan. 2015. *Careers.* http://www.riotintoalcan.com/index_careers.asp.

Ritter, A. R. M. 2001. Canada: From Fly-In, Fly-Out to Mining Metropolis. In *Large mines and the community: socioeconomic and environmental effects in Latin America, Canada, and Spain* eds. G. McMahon and F. Remy, 223-60. DRC Books, 223-60.

Roberts, R. 1998. Public involvement in environmental impact assessment: moving to a 'newthink'. *Interact,* 4(1): 39-62.

Sanchez, L. E. 1998. Industry response to the challenge of sustainability: the case of the Canadian nonferrous mining sector. *Environmental Management,* 22(4): 521-31.

Sandlos, J. and Keeling, A. 2013. Zombie Mines and the (Over) burden of History. *The Solutions Journal,* 4(3).

Sandloss, J. and Keeling, A. 2012. Claiming the New North: Development and Colonialism at the Pine Point Mine, Northwest Territories, Canada. *Environment and History,* 18(1): 5-34.

Shmelev, S. and Shmeleva, I. 2012. *Sustainability Analysis: An Interdisciplinary Approach*. Palgrave Macmillan.

Sims, L. and Sinclair, A. J. 2008. Learning through participatory resource management programs: Case studies from Costa Rica. *Adult Education Quarterly,* 58(2): 151-68.

Sinclair, A. J. and Diduck, A. P. 2001. Public involvement in EA in Canada: a transformative learning perspective. *Environmental Impact Assessment Review,* 21(2): 113-36. doi: http://dx.doi.org/10.1016/S0195-9255(00)00076-7.

Sinclair, A. J. and Diduck, A. P. 2016. Public participation in Canadian environmental assessment: enduring challenges and future directions. In *Environmental Impact Assessment: Practice and Participation* ed. K. S. Hanna, 65-95. Toronto: Oxford University Press, 65-95.

Sinclair, A. J., Diduck, A. P., and Fitzpatrick, P. J. 2008. Conceptualizing learning for sustainability through environmental assessment: critical reflections on 15 years of research. *Environ. Impact Assess. Rev. Environmental Impact Assessment Review,* 28(7): 415-28.

Sinclair, A. J., Diduck, A. P., and Vespa, M. 2015. Public participation in sustainability assessment: essential elements, practical challenges and emerging directions. In *Handbook of Sustainability Assessment* eds. A. s. Morrison-Saunders, J. Pope and A. Bond, 349-75. Camberley, UK: Edward Elgar, 349-75.

Sinclair, A. J. and Doelle, M. 2010. Environmental Assessment in Canada: Encouraging Decisions for Sustainability. In *Resource and environmental management in Canada : addressing conflict and uncertainty* ed. B. Mitchell, 462-94. Don Mills, Ont.: Oxford University Press, 462-94.

Slocombe, D. S., Hartley, L., and Noonan, M. 2016. Environmental Assessment and Land Claims, Devolution, and Co-Management: Evolving Challenges and Opportunities in Yukon. In *Environmental Impact Assessment Practice and Participation* ed. K. S. Hanna, 220-40. Don Mills, ON: Oxford University Press, 220-40.

Statistics Canada. 2011. *Census Profile Snow Lake.* http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=4621071&Geo2=CD&Code2=4621&Data=Count&SearchText=snow lake&SearchType=Begins&SearchPR=46&B1=All&Custom=&TABID=1.

Stewart, J. M. P. and Sinclair, A. J. 2007. Meaningful public participation in environmental assessment: perspectives from Canadian participants, proponents, and government. *Journal of Environmental Assessment Policy & Management,* 9(2): 161-83.

Storey, K. 2001. Fly-in/Fly-out and Fly-over: Mining and regional development in Western Australia. *Australian Geographer,* 32(2): 133-48. doi: 10.1080/00049180120066616.

--- 2010. Fly-in/Fly-out: Implications for Community Sustainability. *Sustainability,* 2(5): 1161.

Strauss, A. L. and Corbin, J. M. 1990. *Basics of qualitative research : grounded theory procedures and techniques*. Newbury Park, Calif.: Sage Publications.

Taggart, M. 1998. The Free Entry Mineral Allocation System in Canada's North: Economics and Alternatives. *Canadian Arctic Resource Committee (p 22)*.

Taylor, E. W. 2007. An update of transformative learning theory: a critical review of the empirical research (1999–2005). *International Journal of Lifelong Education,* 26(2): 173-91. doi: 10.1080/02601370701219475.

The Council of Canadians. 2013. *HudBay sues Mathias Colomb Cree First Nation over protests at Lalor Mine in Manitoba.* http://canadians.org/fr/node/9391.

The Mining Association of Canada. 2014. *Mining Facts.* http://mining.ca/resources/mining-facts.

Therivel, R., Christian, G., Craig, C., Grinham, R., Mackins, D., Smith, J., Sneller, T., Turner, R., Walker, D., and Yamane, M. 2009. Sustainability-focused impact assessment: English experiences. *Impact Assessment and Project Appraisal,* 27(2): 155-68.

Town of Snow Lake. 2011. *History of Town.* http://snowlake.com/main.asp?fxoid=FXMenu,5&cat_ID=1&sub_ID=121.

VMS Ventures. 2015. *Reed Mine.* http://www.vmsventures.com/projects/development/reed-lake-project/default.aspx.

Warhurst, A. and Mitchell, P. 2000. Corporate social responsibility and the case of Summitville mine. *Resources Policy,* 26(2): 91-102. doi: http://dx.doi.org/10.1016/S0301-4207(00)00019-2.

Weber, M., Krogman, N., and Antoniuk, T. 2012. Cumulative effects assessment: linking social, ecological, and governance dimensions. *Ecology and Society,* 17(2): 22.

Webler, T., Kastenholz, H., and Renn, O. 1995. Public participation in impact assessment: a social learning perspective. *Environmental Impact Assessment Review,* 15(5): 443-63.

West Coast Environmental Law Centre 2015. 'A Better Approach to Environmental Reviews: A Sustainability Assessment
and Democratic Decision-Making Act.' in *A Better Approach to Environmental Reviews: A Sustainability Assessment
and Democratic Decision-Making Act* ed. West Coast Environmental Law Centre, 1-6.

Whitelaw, G., Vaughan, H., Craig, B., and Atkinson, D. 2003. Establishing the Canadian community monitoring network. *Environmental monitoring and assessment,* 88(1-3): 409-18.

Wood, C. and Dejeddour, M. 1992. Strategic environmental assessment: EA of policies, plans and programmes. *Impact Assessment,* 10(1): 3-22.

Worrall, R., Neil, D., Brereton, D., and Mulligan, D. 2009. Towards a sustainability criteria and indicators framework for legacy mine land. *Journal of Cleaner Production,* 17(16): 1426-34.

Yin, R. K. 2003. *Case study research : design and methods*. Thousand Oaks, Calif.: Sage Publications.

Younger, P. L. and Wolkersdorfer, C. 2004. Mining Impacts on the Fresh Water Environment: Technical and Managerial Guidelines for Catchment Scale Management. *Mine Water and the Environment Mine Water and the Environment,* 23(S1): s2-s80.

Appendix A: Interview Guides

Interview Schedule Regarding Environmental Assessments and Mining Legacy for Case Study Community Members

Introduction

How long have you lived in the community?
Have you been involved in any mining assessment processes or mining activities?

Environmental Assessment and Legacy Issues

1. How has the mine affected the community in the long run - What are the local and regional legacy effects? (Depending on participants' responses I may use some of the following prompts)
    a. Often legacy effects relate to the boom and bust cycles of mining (alternatives: depletion of a mineral resource; residual effects on the land, waters, and wildlife; residual infrastructure) have these been a factors here?
2. How do/have these legacy issues affect the community?
3. Has the company and/or community addressed these effects? How?
4. Is the community better off because of mine development?
5. Are you aware of the EA completed by the company for project _____?
6. Were you involved in the EA at all?
7. Do you recall discussions of any of the legacy effects we have discussed during the EA process? If so, discuss.
8. Are there ways the EA might have considered legacy effects beyond what you have described above? (e.g., prolonged mine life with lower production, training for post-mining employment, multi-use infrastructure?)
9. Would you get involved in the process again? What would you do differently?
10. Do you think that the mine was developed in a way that maximizes the potential for local and regional sustainability?

Learning

11. What sorts of things about mining legacies, sustainability and/or environmental approvals did you learn while participating in EA, living in this mining community and/or working at the mine? (e.g., did you learn about the EA process, environmental management, environmental risks such as AMD and tailings, community mobilization, etc.?)
12. Have you learned about legacy issues from raring about other mine sites? How has that changed the way you act and view the mine?
13. Where did you learn the most? (e.g., during EA, reading newspaper, company reports, neighbours, etc.)
14. Was there anything that encouraged your learning or made it easier?
15. Did participating in EA – or in mining change any of your opinions, values, beliefs or behaviors?
16. Has learning about mining legacy effects made you alter your actions and caused you to seek change? (e.g. start a monitoring or advocacy group, attempt to change assessment policy or law, etc.)

17. Do you view mining, legacy issues, sustainability, and approvals the same as you did before participating?
18. What advice would you give to a community undergoing mining assessment?
19. What would you change about the mining approvals process and EA?

Sustainability

20. What is your understanding of sustainability?
21. What is your understanding of sustainable mining? Has your understanding of sustainable mining changed since mine _____ has been operating/closed?
22. In your opinion, is mining usually, sometimes, potentially or never compatible with sustainability? Why or why not? Is this true on all scales (local/regional/provincial/national/global)?
23. What actions might help to make mining more likely to make positive contributions to sustainability?

Closing

24. Is there anything else you would like to add or point out something that you think should have been asked?
25. Is there anyone you suggest I interview to learn more about this topic?

Interview Schedule Regarding Environmental Assessments and Mining Legacy for Mining Assessment Experts

Introduction

What is your current position?
What kind of work does your position entail?
How long have you been working in this position?

Environmental Assessment

1. What are the current strengths of EA in relation to mining approvals?
2. What are some shortcomings of EA in relation to mining approvals?
3. What types of mining legacy effects [enduring positive and negative consequences of mining] do you think are the most important to consider during an EA?
   (Depending on participants responses I may use some of the following prompts)
   a. Often legacy effects relate to the boom and bust cycles of mining (alternatives: depletion of a mineral resource; residual effects on the land, waters, and wildlife; residual infrastructure) have these been a factors here?
4. We have known about many of these legacy effects for some time yet they still do not appear to get meaningful attention during an EA process – why do you think this is the case?
5. How could EA's address legacy effects better? Do you see a role for new generation assessments such as Sustainability Assessment [next generation of EA where projects are only approved if they make a positive net contribution to sustainability]?

Learning

6. Are there other things you have learned about mining legacies, sustainability and/or environmental approvals that you have not shared with me above?
7. What activities helped you to learn theses things or come to these conclusions about

legacy effects, mining and/or sustainability? (e.g., community meeting, from proponents, researchers, other events or activities)

8. Was there anything that encouraged learning and made it easier?
9. Has working on mining EAs changed any of your opinions, values, beliefs or behaviors? (e.g., view of sustainability, long term care, trade offs, etc.)
10. Do you view mining, legacy issues, sustainability, and approvals the same as you did before you started working with EAs?
11. Is there anything that you would do differently next time you work on an EA?
12. What advice would you give to a community/company undergoing mining assessment?

13. How best might we learn from communities about legacy effects during an EA?

Sustainability

14. What is your understanding of sustainability?
15. What is your understanding of sustainable mining? Has your understanding of sustainable mining changed since mine _____ has been operating/closed?
16. In your opinion, is mining usually, sometimes, potentially or never compatible with sustainability? Why or why not? Is this true on all scales (local/regional/provincial/national/global)?
17. What actions might help to make mining more likely to make positive contributions to sustainability?

Closing

18. Is there anything else you would like to add or point out something that you think should have been asked?
19. Is there anyone you suggest I interview to learn more about this topic?