

The Opportunities and Challenges of Aggregate Site Rehabilitation in Southern Ontario. An
Evaluation of the Rehabilitation Process from 1992-2011.

by

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A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Master of Environmental Studies
in
Planning

Waterloo, Ontario, Canada, 2013

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Aggregate extraction has been identified as one of the most contentious land-uses in Southern Ontario. The siting or expansion of aggregate operations is often met with vehement debate from concerned members of the public, local municipalities, and additional parties who have various reasons to be opposed to aggregate extraction operations. “Aggregate wars” have now become a common planning challenge in a number of aggregate rich municipalities in Ontario. Due to a legacy of poor rehabilitation practices, aggregate site rehabilitation has been identified as one of the most serious problems plaguing pit and quarry developments. Aggregate site rehabilitation plays an essential role in preparing the land for its sequential land-use and is the primary mechanism for the mitigation of adverse environmental and social impacts caused by the extraction process. Using a mixed-methods research approach, this study aimed to determine the rate and quality of aggregate site rehabilitation occurring in Ontario for the time period of 1992-2011. This was completed using an assessment of production statistics and a sample of rehabilitation plans. In addition, interviews with representatives from key actor groups were conducted to strengthen the base for evaluating the effectiveness of the current policy framework to ensure the adequate rehabilitation of aggregate sites. Results from this study indicate that progressive rehabilitation efforts are falling short and a net gain in disturbed land is occurring each year. More research, in the form of field studies and long-term monitoring initiatives, is needed to permit a better assessment of the quality of rehabilitation occurring. Findings from this study illustrate that the current rate of aggregate site rehabilitation occurring in Ontario is not enough to moderate adverse environmental and social impacts. Changes are needed to the current policy framework in order to address this problem. Four policy recommendations are suggested: to set a maximum for disturbed areas at operating aggregate sites, to re-implement a security deposit type model, to introduce citizen advisory committees in the aggregate site management process, and to tie site and rehabilitation plans to predetermined timelines. An analysis of aggregate site rehabilitation prior to 1992 requires further research.

Acknowledgements

I would like to extend sincere gratitude to all those who made this thesis possible.

First of all, thank-you to my formal and informal interview participants for your time and willingness to be part of this study. Without you this research would not have been possible. Your interesting insights and expertise into aggregate issues in Ontario were extremely informative and provided an important pragmatic perspective for this project.

I would like to thank my supervisor, Dr. Michael Drescher for his patience while I flipped-flopped on topic ideas and ultimately decided to select one of the most contentious planning issues in Ontario. I appreciate the guidance, assistance, and honest critiques you provided me throughout the process - even if it did involve pushing me to do more. In addition, thank-you to my committee member, Dr. Bob Gibson, for poking holes in my research and helping me to produce a well-written document with concrete, meaningful findings. Thanks also to the additional faculty and staff members of the University of Waterloo School of Planning who provided me with encouragement, advice, and feedback along the way.

I am also grateful for the hard work of Whitney, my research assistant, for your outstanding job transcribing my many hours of interview data and giving 100% to every mundane task I asked you to help me with.

To my friends and family, thank-you for listening and offering me words (or beverages) of encouragement. You helped me to see the light at the end of the tunnel.

Lastly, an extra special thank-you to my partner Dave, for your unyielding support over the past two years. You have always been willing to edit my work, bring me back from the brink of a mental break-down, or help me with “the maths”.

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- Chapter 1 -

Introduction & Scope of Research

1.1 PROBLEM CONTEXT

Aggregate extraction has been identified as one of the most controversial land-uses in Ontario (Binstock & Carter-Whitney, 2011; ECO, 2011). This is largely due to the environmental consequences and the social costs associated with aggregate extraction activities (Winfield & Taylor, 2005; Kellett, 1995). In most land-use planning scenarios, aggregate developments are unwelcome by local residents and there has been a growing amount of public disdain towards proposed extraction projects. This public contempt towards the aggregate industry is largely due to a legacy of poorly managed operations and countless number of abandoned, un-rehabilitated sites that have resulted in social and environmental impacts (Environmental Commissioner of Ontario [ECO], 2005; Pichette, 1995), such as dust, noise, increased truck traffic, and lowered property values.

Mineral aggregate extraction can be a small-scale or large-scale industrial activity that often involves blasting, the use of heavy machinery, and open-pit mining techniques. This extraction process can have major impacts on the land, such as the lowering of the groundwater table from pumping (West & Cho, 2006), dust and noise pollution from blasting (Drew, Langer, & Sachs, 2002), increased truck traffic (Poulin & Sinding, 1996) and large-scale land-conversion (Langer & Arbogast, 2003). These perceived and real landscape impacts are the cause for the increasing controversy towards aggregate developments over the past several decades. Continued population growth in Southern Ontario has put further pressure on important aggregate resources areas that are located within areas valued for agricultural or environmental features (Binstock & Carter-Whitney, 2011), such as the Greenbelt, Niagara Escarpment, and Oak Ridges Moraine.

Natural aggregate resources are made up of sorted sand, gravel, and crushed stone materials which are extracted from the ground in mining features known as pits and quarries (Poulin, Pakalnis & Sinding, 1994). Aggregate materials are considered a type of mineral resource or mineral commodity and are often referred to as *mineral aggregates*. These high-bulk natural resources have a low commodity value, but are a critical material in the construction industry. Aggregate products play an important role in the everyday life of Ontario’s residents as these materials are used in almost all forms of built infrastructure, such as roads, sidewalks, foundations, sewers, and the buildings themselves (Ministry of Natural Resources [MNR], 2010a). In addition, aggregate materials are an important ingredient in many types of manufactured products, including glass, paint, steel, aluminum, and plastic (Miller, Myrans, & Gilmour, 2009). Due to their prolific and irreplaceable functions in the construction industry, aggregate materials are overall the most economically valuable nonfuel, mineral resources (per tonne) in North America (Poulin, Pakalnis, & Sinding, 1994) and account for the largest tonnage value of major mineral output in the world (see Figure 1).

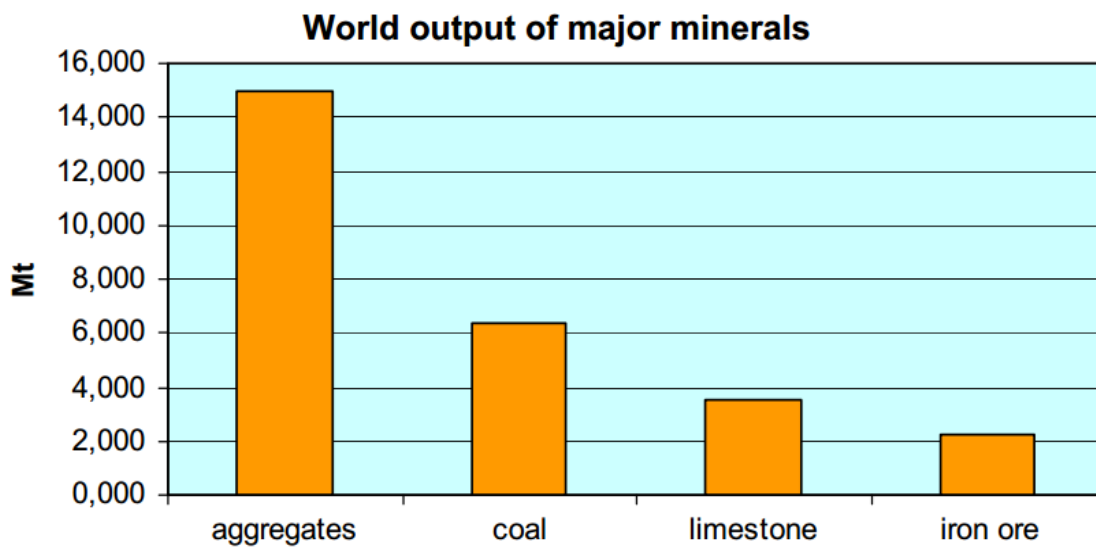


Figure 1: World output of major minerals (from Neri & Sanchez, 2010)

Aggregate demand can in part be met through the use of recycled concrete, the reuse of materials from demolition sites, or use of other unconventional products such as recycled glass and bricks (Association of Manitoba Municipalities, 2006). However, these materials are not always a viable replacement to virgin mineral aggregate products due to their inferior quality and reduced availability in large amounts (i.e. tonnages). There is currently no economically viable alternative to virgin aggregate resources in the construction industry as there is not enough recycled material to meet demand (MNR, 2012c; Association of Manitoba Municipalities, 2006). In 2007 about seven percent (about 13 million tonnes) of aggregate material used in Ontario came from recycled sources (MNR, 2012c). It is estimated that the Greater Toronto Area alone can provide 2.5 million tonnes of aggregate material that can be recycled, but the current annual provincial demand for good quality aggregate material exceeds 170 million tonnes (Aggregate recycling Ontario, 2011). The demand for and corresponding rate of aggregate recycling remains comparatively low as the use of these materials is not yet widely accepted by all industries and agencies who use and purchase aggregate materials. Recycled aggregate products are not always able to meet specific engineering specifications and concerns regarding environmental contamination prevent these products from being used as fill (MNR, 2012c).

Nearly 80 per cent of Ontario's aggregate development and production takes place in Southern Ontario (Miller, Myrans, & Gilmour, 2009) and because of continued population growth, this part of the province has the highest demand for aggregates and aggregate related products (MNR, 2012c; Miller, Myrans, & Gilmour, 2009). In 2011, the Province of Ontario was home to a total of 6,500 aggregate licences and permits (MNR, 2012a); 57% of aggregate resources are extracted from private land sources (3,700 licences). Given the growing population

of Ontario, the need for aggregate production to support the construction industry and to meet the increased demand for built infrastructure is irrefutable (Miller, Myrans, & Gilmour, 2009).

In 2007, the total tonnage of aggregate production in Ontario, including recycling and export, was 181 million tonnes of material; extraction of virgin material alone accounted for 164 million tonnes (Ministry of Natural Resources, 2010a). The extraction, production, and export (about 4 million tonnes per year to other provinces) of aggregate materials in Ontario has an economic value of \$1.3 billion/year and results in both upstream and downstream benefits to the economy of the province (MNR, 2010a). In 2007, the direct and indirect benefits of the aggregate industry in Ontario were measured to generate approximately: \$1.6 billion of GDP; \$827 million of labour income; 16,600 fulltime jobs; and \$2.9 billion of gross output (i.e. the total value of sales related to aggregate products) (MNR, 2010a). Overall, the aggregate industry is vital to the growth and economic prosperity of the Province of Ontario. However, reforms to increase the efficiency of the industry as well as create more social and environmental benefits, may be needed to foster a more robust and viable industry over the long-term.

The economic value of aggregate resources to the Province of Ontario is also reflected in a current land-use planning policy framework that favours the development of close-to-market aggregate deposits (Binstock & Carter-Whitney, 2011; ECO, 2011). Transporting aggregates from where they are extracted to where they are used is estimated to contribute approximately 60 per cent of the total development cost of aggregate products (MNR, 2012b). Due to the high cost of transporting aggregate products, greater value is placed on aggregate deposits that are located close-to-market sources (MNR, 2012b), such as those located in Southern Ontario in close proximity to the Greater Toronto Area. Nonetheless, the Provincial Government has recently reported that existing aggregate operations cannot meet the growing demand for these materials

within this area of the province (MNR, 2010a; Miller, Myrans, & Gilmour, 2009). This puts increasing strain on rural southern Ontario, which is also valued for prime agricultural land and significant natural heritage features, (e.g. the Oak Ridges Moraine and Niagara Escarpment). Planners and local decision-makers face the land-use challenge of protecting aggregate deposits for future use, meeting the current and future demand for the resource, and also mitigating the environmental impacts of the aggregate extraction process (Wernstedt, 2000). Therefore, policy-makers are charged with the difficult task of balancing divergent land-use needs, creating a sustainable mineral aggregates policy-framework, and meeting the commercial realities and economic pressures of the aggregate industry (Kellet, 1995).

The loss of good quality farmland in Southern Ontario is an important issue recognized by all levels of government in recent years (see Caldwell & Hilts, 2005; Ministry of Public Infrastructure Renewal, 2006). Although the conversion of agricultural land to residential or other forms of urban development is considered to be a permanent land-use change, aggregate resource extraction is considered to be a temporary or, interim use of the land. In Southern Ontario, the majority of aggregate extraction occurs on agricultural land (see MNR, 2010b) and after aggregate extraction has ceased, sand and gravel sites are often required to be restored to their previous condition depending on the surrounding land-use (MNR, 2010c). This land-use planning scenario is meant to facilitate only a temporary loss of productive farmland, due to aggregate extraction activities, in the rural parts of southern Ontario. However, this would imply that aggregate extraction sites are being adequately rehabilitated in order to restore previous landscape conditions (e.g. agriculture), or, remediated in such a way that would allow for another suitable land-use post extraction (e.g. natural area) (see Poulin, Pakanlis & Sinding, 1994). Recent reports (e.g. Binstock & Carter-Whitney, 2011; MNR, 2010c; ECO, 2005; Winfield & Taylor, 2005; Holt & James, 2003) examining aggregate site rehabilitation in Southern Ontario

have indicated that the rate of rehabilitation (e.g. amount of land that is restored from a disturbed state) actually occurring is inadequate. The inadequacy of aggregate site rehabilitation fuels land-use conflict by frustrating local residents and creating suspected cumulative ecological and hydrogeological impacts.

The rehabilitation of pits and quarries refers to the grading, replacement of soil, and re-vegetation of the land, in order to transform the depleted pit or quarry to a post-extractive land-use (MNR, 2010c). Progressive rehabilitation means rehabilitation done sequentially, whereas final rehabilitation refers to rehabilitation that is performed after aggregate resource excavation is complete (MNR, 2010c). The recent *State of the Aggregate Resources in Ontario Study (SAROS)* concluded that 42 per cent of active aggregate sites in Ontario are not initiating any type of progressive rehabilitation. The study also found that about 72% of surrendered aggregate licences had undergone some form of final rehabilitation effort. These results indicate that final rehabilitation is occurring at a somewhat reasonable rate, while the rate of progressive rehabilitation remains quite low. In addition, the study concluded that there is an absence of data related to the quantity and quality of rehabilitation being undertaken in Ontario (MNR, 2010c).

The policy framework that controls aggregate extraction activities in Ontario has evolved over the past 30 years, resulting in provincial authority over the management of aggregate resources (Sandberg, 2001) and a largely self-regulating industry (Miller, Myrans, & Gilmour, 2009). The majority of provincially significant natural resources, such as aggregates, are under the jurisdictional authority of the Province (Chambers & Sandberg, 2007). Today, aggregate developments continue to be regulated by both provincial and municipal policy frameworks (e.g. PPS 2005, *Aggregate Resources Act*, municipal official plan policies etc.), all of which require the progressive and final rehabilitation of licensed pits and quarries. Deficiencies in the past regulatory framework have been blamed for a legacy of un-remediated sites (Pichette, 1995).

Policy failures such as ineffective mechanisms for inspection and enforcement, in addition to, a lack of incentives for pit and quarry rehabilitation have been blamed for the poor rehabilitation rate (Binstock & Carter-Whitney, 2011; Winfield & Taylor, 2005). The inadequate final and progressive rehabilitation of extraction sites, continues to be a significant barrier in achieving sustainable aggregate resources management in Southern Ontario.

1.2 PREVIOUS STUDIES

Although the environmental, social, and economic implications of the mining industry have been comprehensively examined in scientific and other studies, the topic of mineral aggregate extraction has garnered little attention. A review of the literature undertaken in this study, indicates that aggregate extraction has been understudied within the realm of planning, especially in regards to cumulative environmental and landscape impacts and an evaluation of the current socio-political discourse. Wernstedt (2000) acknowledges that the issue of aggregate management must gain greater attention within academic literature. This is because of the ongoing conflict between members of the public, municipalities, and the aggregate industry as well as the limited availability and access to good quality resource deposits (Wernstedt, 2000).

There is limited recent academic research available that examines aggregate issues in the Province of Ontario (e.g. Markvart, 2009; Chambers & Sandberg, 2007; Patano & Sandberg, 2005; Baker, Slanz, & Summerville, 2001). Global peer-reviewed literature on aggregate site rehabilitation focuses on ecological processes and environmental impacts that are further detailed in section 2.3.2 (e.g. Frey & Spellerberg, 2011; Corry, Laforteza, & Brown, 2010; Santoul et al., 2009; Bzdon, 2008; Santoul et al., 2004). However, no academic, peer-reviewed research exists that focuses specifically on aggregate site rehabilitation within Ontario, Canada. The *SAROS* report on rehabilitation is a government report commissioned by the Ministry of Natural

Resources and completed by consultants. This report was published in 2010. The *SAROS* study used a small sample of aggregate sites across Ontario (n=50) to assess the rehabilitation rate and received no independent peer-review. There is no discussion in the *SAROS* report as to whether or not the observed rehabilitation rate is adequate.

With the growing debate and conflict over where to site aggregate extraction operations, it is interesting to note that discussions of aggregate issues have increased considerably within the mainstream media, but not within the academic realm. Thus, there is little scientific research from independent researchers examining aggregate planning and management issues. There is even less academic literature available within the geographic context of Southern Ontario, an area that produces 80 percent of Ontario's mineral aggregate resources (MNR, 2012b). To address this knowledge gap, this study will expand on the minimal amount of literature on aggregate planning and management issues in Southern Ontario.

1.3 RESEARCH PURPOSE

Aggregate rehabilitation has been chosen as the focus of this research project because of the important role that rehabilitation has in achieving sequential and strategic land-uses objectives (see examples of rehabilitated aggregate sites in Appendix C). Additionally, adequate rehabilitation also plays an essential role in lessening the long-term environmental impacts and social costs of aggregate extraction activities. Aggregate planning and management activities that affect the rate and quality of rehabilitation are controlled by provincial legislation. This policy-direction is based strongly on present political agendas that are influenced by the advocacy role played by key actor groups (i.e. industry, local government, environmental organizations, and citizen groups) in southern Ontario. The theoretical framework used as the foundation of this study (i.e. The Advocacy Coalition Framework, discussed in section 3.2) recognizes this

relationship and seeks to examine and evaluate the issue of aggregate site rehabilitation within the current socio-political discourse on aggregate planning and management in Ontario.

The purpose of this study is to assess the rate and quality of aggregate site rehabilitation occurring in Southern Ontario. Moreover, specific challenges and opportunities perceived and experienced by key actor groups will be identified. This comprehensive assessment of the rehabilitation process will be used to determine the effectiveness of the current policy framework to manage aggregate resources in southern Ontario. The author's underlying premise for this research study supports the notion that adequate aggregate site rehabilitation would be a crucial step in the evolution of the aggregate industry into a desirable and acceptable interim land-use. Further, an adequate rate and quality of rehabilitation will help to address environmental concerns and adverse social impacts, while meeting the need to extract and economically important natural resource.

1.4 STUDY SIGNIFICANCE

Since the 1970s, the development of aggregate resources in Southern Ontario has resulted in clashes between and among local municipalities, provincial governments, citizens, the aggregate industry, and concerned environmental groups (Baker and Shoemaker, 1995). In Southwestern Ontario, the aggregate industry faces serious challenges due to the negative public perceptions of extractive land-uses and corresponding activities such as blasting and hauling. Growing aggregates-related conflicts have focused on the environmental and social impacts and concerns, resulting from the high concentration of aggregate site developments in aggregate rich communities (Baker and Shoemaker, 1995). In addition, growing public concern has focused on the suspected cumulative effects of these types of developments on the surrounding landscape

and the inadequacy of existing regulatory frameworks to mitigate and control negative effects (Baker and Shoemaker, 1995).

Aggregate materials are economically important and a necessity for constructing and maintaining built infrastructure; however, public opposition can often prevent gravel extraction from occurring (West & Cho, 2006). The aggregate industry, with leadership from regulatory and land-use planning initiatives, must be sensitive to the perceptions and values of the public. This is especially important given the environmental concerns and potential negative effects that aggregate pits and quarries can have on the landscape. In order to quell ongoing land-use debate and conflict between actor groups, aggregate owners and operators should strive to obtain a *social licence* to operate (see Gunningham, Kagan, & Thornton, 2004) in Southern Ontario.

The working assumptions underpinning the context of this study are as follows: Adequate and effective aggregate site rehabilitation has the potential to form the cornerstone for achieving the concept of a corporate *social licence to operate* within the aggregate industry. Through adequate site rehabilitation, the aggregate industry can strive to achieve sustainable resource management by avoiding undesirable trade-offs (i.e. adverse social and environmental costs) and serving economic, social, and ecological objectives through integrated management and strategic planning approaches.

This research project also examines and explores practical applications for several contemporary concepts of planning and resource management theory. In this study, participatory and collaborative planning, adaptive resource management, and integrated resource management are key underlying themes in the evaluation of the current condition of aggregate resources management and planning in Ontario. Through the examination of the specific topic of aggregate site rehabilitation, the advantages of these evolving planning and resource management concepts

will be broadly considered in an effort to find effective strategies for reducing perpetuating land-use conflict. This pragmatic approach to the application of contemporary planning and resource management concepts will add to the growing body of literature and knowledge on these subjects.

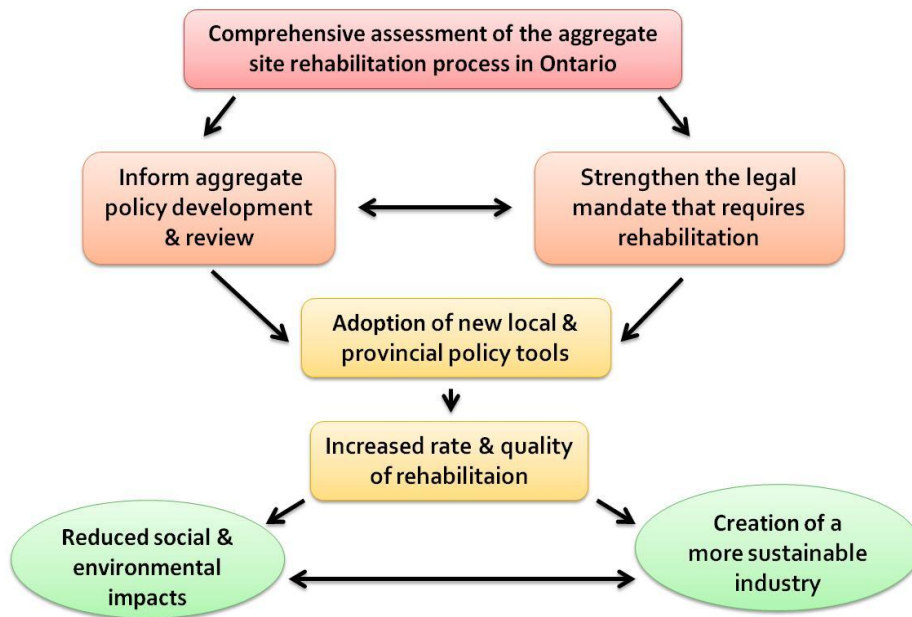


Figure 2: Study significance and expected outcomes.

The results of this study (Figure 2) can be used to identify gaps or deficiencies in the regulatory framework, thus informing aggregate policy review processes. The expected outcomes of this study will seek to strengthen the legal mandate that requires the completion of rehabilitation activities in the Province of Ontario, through the adoption of new local and provincial regulatory tools. This research can support the acceptance and implementation of new measures by the Province of Ontario and local municipalities to address problems with the current rehabilitation process. An improvement in the rate and quality of aggregate site rehabilitation quality would lessen the social and environmental costs of aggregate extraction on the landscape, resulting in a more sustainable industry.

1.5 RESEARCH QUESTIONS & OBJECTIVES

This study will answer three central research questions: What is the current rate of aggregate site rehabilitation occurring in Ontario? What is the quality of rehabilitation occurring in Ontario? And, is the current rate and quality of rehabilitation occurring in Ontario adequate? In this study, an adequate rate of rehabilitation is considered to be a rate of rehabilitation that would equal, or come close to, the rate of land disturbed from aggregate extraction. In practical terms, adequate quality is defined as rehabilitating the site to the previous land condition, or a superior condition that adds social, economic, or environmental value to the surrounding landscape. As demonstrated in Figure 3, through the investigation of the three central research questions, answers to the following two sub-questions will also be revealed: Is the existing policy framework for aggregate extraction activities effective in ensuring adequate rehabilitation? And, what are the opportunities and challenges encountered and observed by actor groups that stem from the current rehabilitation process?

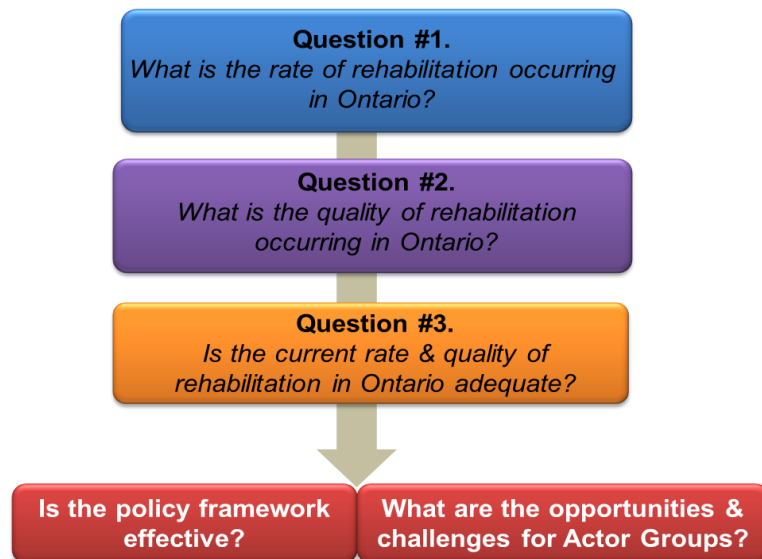


Figure 3: Central and sub-research questions for study.

The answers to the first three central research questions will inform the answers to the two sub-questions, which can then be translated into substantive recommendations and used to address identifiable insufficiencies in the current policy framework. The objective of this study is to evaluate comprehensively the current trend of aggregate site rehabilitation occurring within Southern Ontario and identify specific challenges and opportunities that may affect the outcome of the present rehabilitation process. This analysis and assessment can be used to inform current policy frameworks, which can then be modified in order to execute more successful rehabilitation procedures and achieve the planning objectives of an interim land-use. Ensuring that aggregate extraction in Southern Ontario effectively achieves the objective of an acceptable interim land-use, through full and successful rehabilitation, would help to demonstrate the ability of the aggregate industry to achieve principles of sustainable land management and a social licence to operate.

1.6 CONCEPTUAL FRAMEWORK

The conceptual framework for this research project offers explanatory insights into the current policy and decision-making process for aggregate site rehabilitation in Ontario.

Figure 4, seeks to explain the relationships between the three major elements of this study: the policy and management framework, the rate and quality of rehabilitation occurring, and the views of key actor groups who have an interest in aggregate management activities. The conceptual framework also demonstrates the connection between the core and sub-research questions posed in this study.

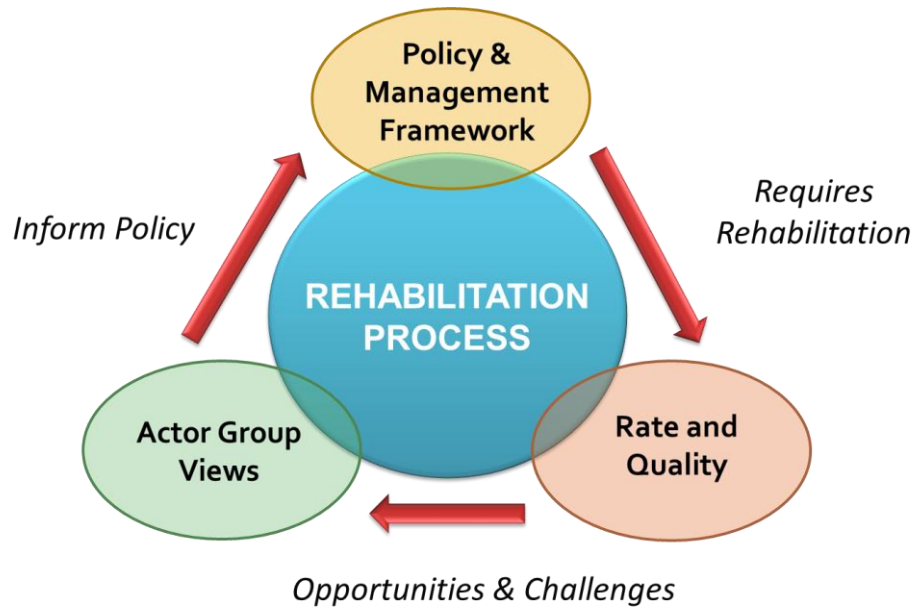


Figure 4: Conceptual framework guiding study

This conceptual framework describes the rehabilitation process as a feedback cycle influenced by the outcomes of the policy-making and policy implementation process. The policy and management framework is what requires rehabilitation to occur resulting in the rate and quality of completed rehabilitation. In turn, the rate and quality of aggregate site rehabilitation presents both opportunities and challenges that affect the actor groups who are involved with the rehabilitation process. This research project has collected actor group views and identified specific opportunities and challenges in order to inform the existing policy and management framework in an effort to improve the rate and quality of rehabilitation occurring in the Province of Ontario.

1.7 OUTLINE OF RESEARCH METHODOLOGY

This study employs a convergent mixed-methods research approach. Production statistics collected by the Ministry of Natural Resources and The Ontario Aggregate Resources Corporation were used to determine the aggregate site rehabilitation rate occurring in Ontario.

Aggregate site quality was assessed using a standardized assessment protocol to analyze a sample of 30 rehabilitation plans for aggregate sites within the Region of Waterloo. This assessment protocol was used to evaluate the quality of the rehabilitation plans under the assumption that higher quality rehabilitation plans will result in the implementation of higher quality rehabilitation in the field. Semi-structured interviews were conducted with representatives of key actor groups who are actively involved in aggregate resources planning and management in Southern Ontario. Interviews were conducted in order to identify any prevailing challenges in the rehabilitation process as well as subsequent opportunities that may improve rehabilitation activities. Interview data were also used to evaluate the effectiveness of the current policy framework from the perspective of each key actor group. In addition, a comprehensive literature and policy review, completed as part of this study, informed the results of the qualitative and quantitative data collected. Results of both the qualitative and quantitative data analysis are used to determine key findings and concrete policy recommendations. These findings and recommendations can be used to inform future revisions to aggregate planning and management policy-frameworks in Ontario.

1.8 THESIS OUTLINE

The following outline describes the content and structure of this thesis:

Chapter #2: Literature and Policy Review

This chapter will include a comprehensive analysis and evaluation of the current academic and grey literature on aggregate site rehabilitation from an economic, social, and ecological perspective. In addition, a policy review and critique will be completed with a strong focus on past and current aggregate policy and management frameworks in Ontario. Conclusions derived from both the literature and policy review will be presented.

Chapter #3: Research Methods

This section will identify and justify the research strategy used in this study and describe the data collection and analysis protocols used to derive results and conclusions. The theoretical framework is also presented and explained within the context of this study.

Chapter #4: Study Results

The results of the data analysis for the rehabilitation rate and quality occurring in Ontario are presented in this chapter. In addition, specific opportunities and challenges of the rehabilitation process, observed by the key actor groups, are presented in the form of three thematic networks.

Chapter #5: Discussion of Study Results

The three research questions posed in this study are answered in this chapter, including the observed rate and quality of aggregate site rehabilitation and the opportunities and challenges identified from the thematic networks presented in Chapter #4. The findings are examined and evaluated within the context of this study and the effectiveness of the current policy framework is evaluated.

Chapter #6: Key Findings & Recommendations

This chapter includes a summary of the key findings derived from this study as well as several concrete and pragmatic policy recommendations that can be used to improve the rate and quality of aggregate site rehabilitation occurring in Ontario.

- Chapter 2 - Literature & Policy Review

2.1 LITERATURE AND POLICY REVIEW METHODOLOGY

This literature and policy review, in conjunction with the results of this study, will aim to inform and answer the two sub-research questions described in section 1.5 of this report (see Figure 5). The three leading research questions cannot be answered by a review of existing literature; instead, answering these questions will occur through an analysis of the qualitative and quantitative data collected as part of this study. The results of the literature and policy review will be used to corroborate the findings of this study.

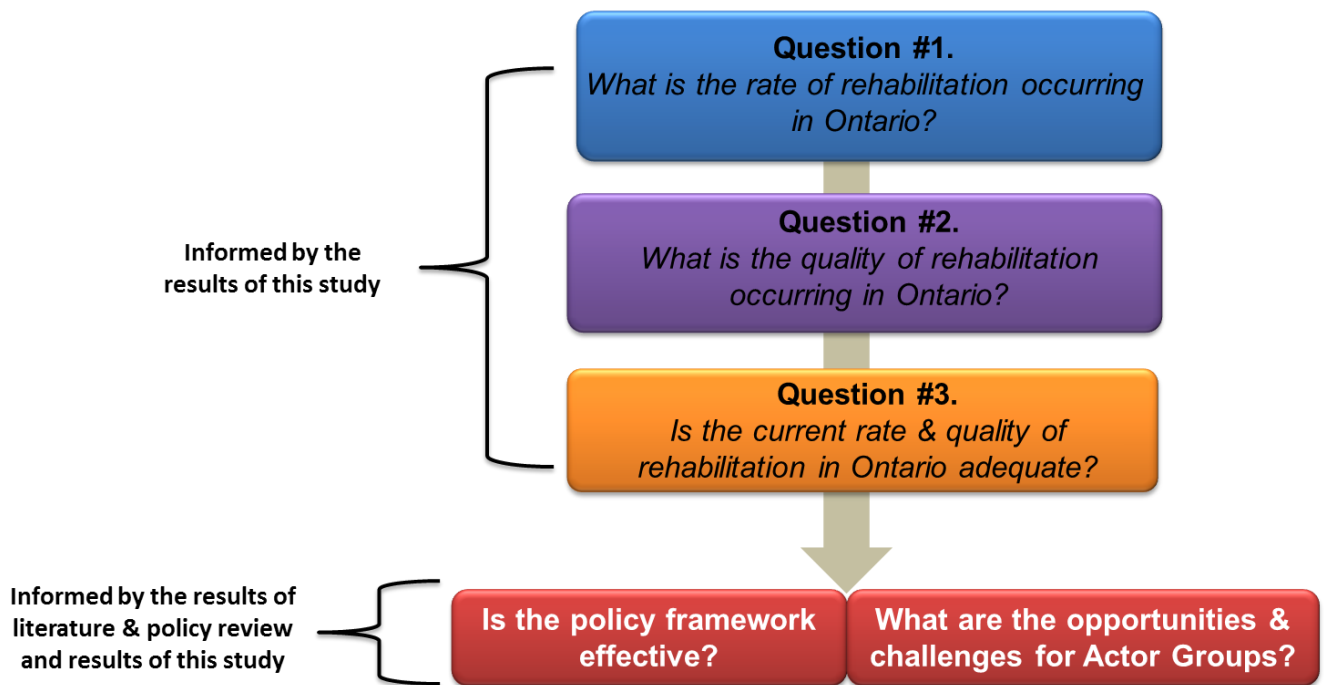


Figure 5: Role of literature & policy review in answering the research questions.

Academic literature (primarily journal articles) were identified using keyword searches in the SCOPUS and Web of Science research databases. The full list of keywords was “aggregate”, “pit”, “quarry”, “aggregate industry”, “restoration”, “reclamation”, “rehabilitation”, “aggregate policy”, “Ontario”. Searches were conducted in each research database using Boolean logic to combine keywords and phrases into searchable statements. Further, the citations of key academic articles were also reviewed so as to complete a comprehensive scan of all available literature on the topic of this research study. Because there is a limited amount of published academic literature available on aggregate site rehabilitation activities and processes, publication date limits were not used to narrow down the search period. Exclusive searches within the online journal records of the *Journal of Environmental Planning and Management* and *Landscape and Urban Planning* were also conducted because these specific journals contained a number of key studies that examined aggregate issues in Ontario. All academic references were stored and managed in RefWorks Web-Based Bibliographic Management Software.

Relevant grey literature, published by reputable organizations (e.g. Environmental Commissioner of Ontario Reports, Pembina Institute, Canadian Urban Institute, Canadian Institute for Environmental Law and Policy, Ministry of Natural Resources), was also included in this literature and policy review. Documents were retrieved using the World Wide Web using the aforementioned keyword searches. Although these sources are not peer-reviewed, they do provide credible and accessible information that is important to include within the discourse of this topic. Finally, the references in grey literature were also surveyed for any additional academic articles, books, or reports not captured by previous searches.

Relevant legislation, regulations and policy documents were accessed via the World Wide Web from either the Ministry of Natural Resources website or from the Province of Ontario’s “e-

laws” website. E-laws is an electronic database of all statutes and regulations for the Province of Ontario.

2.2 LITERATURE AND POLICY REVIEW INTRODUCTION

Aggregate is a non-renewable resource essential to almost all human activities (Drew et al., 2002) because this material is required in order to build and maintain the infrastructure of our communities (Langer & Arbogast, 2003; Wernstedt, 2000). Wernstedt (2000) points out that “at least one hundred metric tons of sand and gravel aggregates are used in a single, average housing unit” (pg. 77), illustrating just how much aggregate is required for construction purposes. This is equal to approximately eight dump truck loads of aggregate products. Conflict arises regarding this extractive industry when there are competing uses and values for the land (Dahl, Wolden, Erichsen, Ulvik, Neeb, and Riiber, 2012) as well as concerns about adverse hydrological, ecological and/or socio-economic effects. Wernstedt (2000) observes that conflicts are particularly trenchant for aggregate resources because these materials are often available only in localized deposits and specific geographic landforms, thereby constraining the availability and accessibility of these resources. The perceived and real social and environmental costs of aggregate extraction activities further escalate tensions and intensify the conflicts occurring between the aggregate industry, municipalities, provincial agencies, citizens, local communities, and concerned lobby groups (Binstock & Carter-Whitney, 2011; Baker & McLellan, 1992). An increasing demand for aggregate resources is compounding this already contentious land-use issue in Southern Ontario. Twenty years ago, Baker & McLellan (1992) already considered “aggregate wars” to be a regular occurrence within the land-use planning process of Southern Ontario (pg. 166). Today, this sentiment is still strongly felt within aggregate producing municipalities in Southern Ontario (e.g.

North Dumfries, Caledon, Puslinch, Flamborough, etc.) and further augmented by growing land-use constraints.

Existing, prospective, and depleted quarries and pits are seen by the public as large and unsightly consequences of the aggregate mining industry (Drew et al., 2002). Consequently, the mining of aggregate resources in southern Ontario offers a good example of a locally unwanted land use (LULU) (Baker & McLellan, 1992) and is often faced by vehement NIMBY (Not In My Back Yard) opposition (explained by Lake, 1987). Poulin et al. (1994) believe that the effective planning and implementation of a strategic land-use vision for aggregate extraction sites can assist in mitigating land-use conflicts. Aggregate extraction can be viewed as a sequential land-use; once the extraction of aggregate material is complete, the land can then be restored to a condition that meets the priorities and values of local citizens. The adequate rehabilitation of depleted aggregate pits and quarries is a critical element in sequential land-use visioning and planning. Drew et al. (2002) believe that the adverse environmental impacts and negative public perceptions of aggregate extraction can be greatly reduced through the effective rehabilitation of worked-out sites.

This literature review will identify the opportunities and challenges of the aggregate site rehabilitation activities faced by the relevant key actor groups who participate in aggregate resources planning and management. Additionally, the policy review will examine the existing legislative and regulatory framework for aggregate management in Ontario and evaluate whether or not the existing measures are effective in achieving adequate aggregate site rehabilitation activities (refer to definition of “adequacy” in section 1.5).

An evaluation of aggregate issues within a planning context is largely unavailable within current academic literature sources. Presently, only a relatively small number of published papers examine land-use conflict, mitigation of environmental impacts, and rehabilitation options and processes for the aggregate extraction industry. An even smaller number are recent publications. There is no academic literature available that evaluates the adequacy of the aggregate site rehabilitation rate and quality occurring within Ontario. Additionally, the planning and resource management literature has little to say about the role of key actor groups in aggregate policy issues.

The recent *SAROS Report* (MNR, 2010c), a non-academic, non-peer reviewed government publication, profiles the rate and quality of rehabilitation of worked-out aggregate sites across the Province, but examines only a small number of sites (n=50, which is less than 2% of the proportion of all licensed sites in Ontario). In addition, the MNR study does not investigate reasons why rehabilitation activities have not been initiated and provides limited insight into the challenges and opportunities presented by the rehabilitation process. Binstock & Carter-Whitney (2011) acknowledge a need to have a more comprehensive dataset in order to draw conclusions regarding the environmental performance and sustainability of the aggregate industry in Ontario. Wernstedt (2000) also highlights the need for more work to be done on assessing the regulatory oversight for the planning and management of aggregate resources, in order to curb on-going land-use conflict and reduce social and environmental impacts. However, Kellett (1995) has noted that integrating aspects of sustainability into policy frameworks further complicates planning and management processes for aggregate resources. Although integrating sustainability principles into aggregate planning and management can make achieving commercial realities for the industry more challenging, working to increase the sustainability of aggregate operations can

have long-term positive impacts (i.e. socially, environmentally, and economically) (Kellet, 1995). Thus, the aggregate industry should take initiatives to be long-term contributors to resource management sustainability.

2.3 LITERATURE REVIEW - AGGREGATE SITE REHABILITATION PROCESSES: OPPORTUNITIES & CHALLENGES

2.3.1 Defining the Concept of Rehabilitation

The Society for Ecological Restoration (SER) (2002) provides definitions that differentiate the terms restoration, rehabilitation, and reclamation. The practice referred to as *restoration* is defined as “the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed” (SER, 2002, section 2, para. 1). The somewhat different concept of *rehabilitation* “emphasizes the reparation of ecosystem processes, productivity and service, whereas the goals of restoration also include the re-establishment of the pre-existing biotic integrity in terms of species composition and community structure” (SER, 2002, section 9, para. 3). Lastly, *reclamation* is identified as the process of converting “lands perceived as being useless to a productive condition, commonly for agriculture and silviculture” (SER, 2002, section 9, para.4). Van Diggelen et al., (2001) conclude that the complete *restoration* of degraded landscapes is often not feasible due to high costs and conflicting land-uses; instead, *reclamation* or *rehabilitation* strategies are a more practical and realistic option for highly disturbed areas. Due to financial and practical limitations, Dulias (2010) notes that reclamation, through physical modification, is the most viable option for depleted aggregate sites. Rehabilitation is also a common practice for these mining features (see Corry et al., 2010). These three terms often have different meanings and definitions within the literature. In addition, these rigid definitions are not always effective in capturing the complexities (e.g. natural processes) associated with ecological rehabilitation and restoration. For example, Bradshaw (2000) points out that determining when

rehabilitation has been achieved is a matter of arbitrary definition and that ecosystems should not be viewed as fixed entities with a measurable end-point. Bradshaw (2002) claims that perfect restoration in the purists sense is an “unattainable end point and that what we should expect and settle for is rehabilitation” (pg.7).

In this study, the term *rehabilitation* will describe the process of treating the disturbed land in preparation for the proceeding land-use and encompasses the terms restoration and reclamation. The term *rehabilitation* has become the industry standard in Ontario for aggregate site management and is used almost exclusively. within the existing policy framework.

Most countries have implemented legislation that requires some form of rehabilitation for degraded landscapes after mining activities are complete (Bradshaw, 1997); this includes the aggregate sites located in Ontario (Corry et al., 2010). Kellett (1995) recognizes that high quality rehabilitation is a positive and necessary element in developing sustainable aggregate management policies.

2.3.2 Understanding the Role of Rehabilitation in Mitigating the Environmental Impacts of Aggregate Extraction Activities

Environmental concerns continue to be the main cause of intense land-use debate regarding aggregate extraction (Hilson, 2002). This is especially true when the geological distribution of aggregate resources near areas of aggregate demand, result in a concentration of active sites within a fairly small geographic area (Bloodworth, Scott & McEvoy, 2009). Cooke & Johnson (2002) describe the impacts of land disturbances, due to mining activities, as severe and often resulting in “extreme ecological restoration challenges” (pg. 43) and Kellett (1995) confirms that “the environmental disturbances to human populations and to ecosystems which is caused by working aggregates is well documented” (pg. 575). In general, aggregate mining has lesser

impacts on the natural environment than other types of mineral and metal mining, such as copper mining or coal mining (Langer & Arbogast, 2003). Nonetheless, the extraction of aggregate resources still results in a range of adverse environmental effects, including soil damage and destruction (Bradshaw, 1997), erosion and sedimentation (Hilson, 2002), change in local water conditions, alterations in vegetation cover, and microclimate changes (Dulias, 2010). The aggregate industry has used advances in technology in an attempt to mitigate the large-scale, negative environmental consequences associated with the extraction process (Bloodworth, Scott, & McEvoy, 2009; Drew et al., 2002). Nevertheless, the impacts of extraction activities can irreversibly alter environmental functions and structure, resulting in landscape level changes (Corry et al., 2010; Dulias, 2010; Winfield & Taylor, 2005; Hilson, 2002). This is one of the fundamental problems of the aggregate industry – the potential for permanent and irreversible environmental change can deny future generations of land-users the same environmental services that were available to the prior users (Kellett, 1995).

The operation of pits and quarries requires that all existing vegetation, topsoil and subsoil be removed in order to gain access to the resource (Winfield & Taylor, 2005). This significantly disrupts the natural habitat and can change the hydrogeology of the landscape as the slope of the land is altered, affecting regular water drainage patterns (Winfield & Taylor, 2005). Because many operations include extracting material at or below the water table, Peckenham, Thorton, & Whalen (2009) as well as Winfield & Taylor (2005) confirm that the effect of mining activities on local water resources, such as aquifers, is a common environmental concern. Specifically within the context of Ontario, the cumulative effects of multiple aggregate operations located within a particular geographic area, such as a watershed, has been raised as an issue of concern (e.g. Binstock & Carter-Whitney, 2011; Grand River Conservation Authority, 2010). However,

little research has been conducted on this issue and Peckenham, Thorton, & Whalen (2009) affirm that the effects of aggregate mining on aquifers systems, including water quality and quantity, are not well documented and are largely unknown.

Aggregate extraction causes the destruction of natural ecosystems through large-scale land disturbance. Cooke & Johnson (2002) draw the connection between the environmental impacts of mining developments and the importance of landscape rehabilitation once the extraction phase has ended. The authors conclude that “the restoration of mined land in practice can largely be considered as ecosystem reconstruction – the reestablishment of the capability of the land to capture and retain fundamental resources” (pg. 41). Rehabilitation is an essential tool in repairing the environmental damage caused by extraction activities and plays a fundamental role in viewing mining as a sequential or, interim land-use. In conclusion, the successful rehabilitation of aggregate sites is necessary to restore the land in order to re-establish some form of productive landscape (e.g. ecological, agricultural, and/or other economic productivity), thus eliminating or drastically reducing the adverse impact of the prior disturbance on the surrounding environment.

2.3.3 The Cost of Rehabilitation

Corry et al., (2010) indicate that the rehabilitation process for depleted aggregate sites in Ontario is varied and dependent on the succeeding land-use vision (development vs. the creation of a natural environment). However, Bradshaw (1997) notes that once mining operations cease at a site, the aggregate producer is often short of financial resources and attempts to remediate as cheaply and efficiently as possible. This may lead to inadequate restoration efforts resulting in the creation of a poor quality ecosystem post-extraction (e.g. characterized by the prevalence of invasive species, low biodiversity, lack of suitable habitat for wildlife) (Bradshaw, 1997). Corry et al. (2010) recognize that the restoration efforts for depleted or abandoned sites can have lasting

impacts, both positive and negative, on local habitat ecology, including landscape pattern and function. Regardless of all the challenges associated with rehabilitating mined lands, ecosystem restoration using predominately natural processes, can be achieved at a relatively low cost and can result in the creation of a self-sustaining ecosystem over the long-term (Bradshaw, 1997).

The cost of effective aggregate site rehabilitation is a clear challenge for pit and quarry owners and operators and can be a limiting factor in ensuring that good quality rehabilitation is completed. Because rehabilitation can play a critical role in reversing the negative environmental impacts of the aggregate extraction phase, this challenge must be recognized and overcome by the actor groups involved in the management and planning of aggregate resources. The perceived high cost of aggregate site rehabilitation by operators could be a factor influencing the rate and quality of aggregate site rehabilitation in Ontario. The Ontario Aggregate Resources Corporation (TOARC) estimates that the average cost to rehabilitate an aggregate site is approximately \$11,500 per hectare (TOARC, n.d [a]). In 2011, the average licensed area of an aggregate site in the Guelph MNR management district was 37.85ha. Assuming that the entire site is extracted, it would cost, on average, about \$435,275 to rehabilitate the disturbed land of one aggregate site. In contrast, the annual production value of aggregate materials in Ontario was estimated to be about 1.27 billion dollars in 2007 (MNR 201a). Given that there are 3,700 active aggregate licenses in the Province of Ontario, a rough average for the annual production value, per site, would equate to about \$343,243 per year ($\$1,270,000,000/3,700$). If a site operated for a minimum of ten years, the production value of the site would be approximately \$3.4 million dollars. Therefore, considering the profit potential of aggregate resources, the cost of rehabilitation is still significant, yet comparatively low.

2.3.4 Rehabilitation can Achieve Landscape Improvement

Different approaches for the reclamation or rehabilitation of depleted aggregate sites can include use of the pit for waste disposal (Frey & Spellerberg, 2011; Dulias, 2010), creation of golf courses, return to crop-land, restoration or creation of natural habitat, or residential development (Corry et al., 2010). Establishing recreational amenities such as lakes and ponds is also a popular option for depleted aggregate sites (Frey & Spellerberg, 2011). The research findings of Milgrom (2008) suggest that quarries and pits situated in areas that hold conservation value are best rehabilitated into some form of open-space and that depleted aggregate sites in urban or rural areas should be utilized as development, open-space, or agricultural land-uses. Dulias (2010) confirms that it can be impossible to return a site to its original state, given the vast area of land disturbed and long-term environmental changes to the landscape. Nonetheless, the aggregate industry does have the ability “to provide suitable habitat mosaics and reverse habitat fragmentation through restoration” (Bloodworth, Scott, & McEvoy, 2009, pg. S321). For example, aggregate site rehabilitation can include the creation of landscape features (e.g. lakes and wetlands), topography that can attract wildlife, provide suitable habitat for rare or endangered species, and can connect with natural features on adjacent lands (Ontario Stone, Sand, and Gravel Association [OSSGA], 2010).

Bzdon (2008) acknowledges that excavated mineral deposit sites provide opportunities to act as a local centre for floristic diversity. Bradshaw (1997) discusses how natural ecological processes can be used to restore mined lands in a cost-effective and relatively inexpensive manner. Corry et al. (2010) identify aggregate sites that are restored in a manner to promote local biodiversity as the best option for maintaining or improving local habitat connectivity and landscape diversity. Restored aggregate sites can also provide additional ecosystem services such

as flood management, carbon sequestration, and pollination (Bloodworth, Scott & McEvoy, 2009). Corry et al. (2010) conclude that although a single remediated site offers only a small amount of habitat, it can have a greater landscape level impact by connecting surrounding habitats and increasing habitat patch sizes. Bloodworth, Scott & McEvoy (2009), also argue that aggregate site restoration should be coordinated on a landscape scale in order to reduce the isolation of habitats and populations of species. Dulias (2010) assesses the advantages of aquatic reclamation over forest reclamation for depleted aggregate sites and concludes that aquatic reclamation results in greater biodiversity and can provide attractive recreational sites. Frey & Spellerberg (2011) provide a framework for the restoration of an abandoned gravel pit into a nature reserve and recreational amenity using a community engagement process. The authors conclude that this is an ideal restoration vision for an expired gravel pit when the site is located adjacent to a community, there is funding and local support for the project, and comprehensive planning networks can be established.

Santoul et al. (2009) and Santoul, Figuerola & Green (2004) discuss the potential for gravel pits to act as habitat to support water bird conservation. Research studies conducted in France indicate that depleted gravel pits, which are rehabilitated into artificial wetland environments, can play an important role in conserving bird biodiversity, especially in landscapes fragmented by human activities (Santoul et al., 2009; Santoul et al., 2004). However, as observed by Bloodworth, Scott & McEvoy (2009), poor quality restoration can result in large “pit lakes” that can result in the loss of groundwater through evapotranspiration processes (pg. S321).

Aggregate resources are a local product that is exported out of a host community with very little compensation or direct benefits returning to the community (Baker & McLellan, 1992). Host communities are often faced with the environmental and social uncertainties resulting from

an aggregate development and residents of these communities are provided with minimal compensation in light of being affected by numerous externalities (Baker & McLellan, 1992). Baker & McLellan (1992) highlight the potential effectiveness of compensation strategies, implemented through a substantive approach, as a tool for mitigating aggregate land-use conflicts. The authors propose that utilizing an inclusive method of dispute resolution can allow all stakeholders to have a role in negotiating the role of aggregate land-uses within the host community. For example, mineral aggregates could be removed from a site and then the area could be restored to recreational or conservation area that would be desired by the community. In this type of a rehabilitation framework, good quality site rehabilitation is used as a form of compensation to the host community. Further, Baker & McLellan (1992) believe that viewing aggregate mining as an opportunity for landscape improvement, rather than a landscape affliction, may assist in reducing conflict among the different stakeholders involved. The authors suggest that this type of an approach to the rehabilitation process can result in the creation of a new landscape that meets the goals and needs of all land users. Baker & McLellan (1992) note that “within this context, the opportunity exists to demonstrate that there can be community-enhancement, landscape improvement, increased diversity, and profit realized from an approach that recognizes that the landscape is a valuable resource beyond the extraction of mineral aggregates” (pg. 163).

Based on a survey of the literature that examines rehabilitation as a tool for potential landscape improvement, it is concluded that depleted aggregate sites can be restored in a manner that re-establishes ecosystem services and environmental function. Therefore, aggregate site rehabilitation can provide a unique opportunity for landscape change and possible landscape enhancement. Aggregate mining and subsequent rehabilitation activities can result in the creation

of new landscapes that can yield considerable social and ecological benefits that coalesce with strategic land-use planning visions. Through high-quality restoration efforts, aggregate site owners and operators can return a disturbed area to a land-use that provides a net social and ecological gain to the community and landscape, serving as a form of ecological and social compensation to the host community. Under this type of restoration scenario, not only will the environmental function of the previous land-use condition be restored, but it will also be improved (e.g. through creation of wildlife habitat, establishment of recreational amenities, planting of only native species etc.), relative to the pre-extraction condition of the site. Nonetheless, the prospect for ecological improvement is dependent on the condition of the land pre-extraction (i.e. degraded or ecologically rich) as well as the quality of the land post-rehabilitation (i.e. is the land adequately rehabilitated to a condition that achieves lasting socio-economic purpose such as agriculture or recreation). This approach to aggregate site restoration could help to increase public acceptance for extraction activities.

2.3.5 Rehabilitation as a Mechanism for Public Involvement

Generally, members of the public are not accepting of aggregate extraction activities. Quarries, as well as sand and gravel pits, are considered highly undesirable when compared to other land-uses (Bloodworth, Scott & McEvoy, 2009). When land-use conflict occurs over the siting of aggregate developments, in many cases the mining industry and the relevant regulatory agencies of government fail to provide effective and meaningful public involvement (Hilson 2002). Pits and quarries are experienced by the community in a physical, visual, and aesthetic manner (Drew et al., 2002). In particular, the fear of lowered property values as well as adverse visual impacts are two of the key reasons why adjacent property owners and local communities often object to aggregate extraction land-uses (Baker & McLellan, 1992). Additionally,

NIMBYism (Not In My Back Yard Syndrome) often stems from circumstances where major decisions are made without the knowledge or input of the public (see Lake, 1987).

Dahl et al. (2011) explored the use of transparent land-use planning processes in an effort to minimize locational conflict and Hilson (2002) discusses the importance of effective communication strategies in reducing land-use conflicts. Additionally, Bloodworth, Scott & McEvoy (2009) conclude that “gaining public acceptance of mineral extraction requires an alternative approach of planning and action through interactive communication, public participation and collective learning among all the stakeholders” (pg. S323).

A review of the literature examined in this section illustrates the potential for rehabilitation to be used as a tool for public involvement in the planning and management process. Social concerns that perpetuate NIMBYism and land-use conflict for the aggregate industry can be mitigated through satisfactory progressive and final rehabilitation efforts that provide an opportunity for initial and ongoing input from the local community. Including the host community in rehabilitation planning, throughout the lifespan of the project, would help to ensure ongoing and adequate public involvement in aggregate planning and management activities. Therefore, using inclusive rehabilitation planning as a strategy to involve the public in aggregate planning and management activities can improve the relationship between the aggregate industry and local host communities. This, in turn, could reduce problems associated with NIMBYism.

2.4 POLICY REVIEW – OVERVIEW OF THE EXISTING POLICY FRAMEWORK FOR AGGREGATE PLANNING AND MANAGEMENT IN ONTARIO

2.4.1 Introduction to Aggregate Resources Planning and Management

Since the 1970s, the creation of new legislation and a more concrete land-use planning policy framework, has resulted in reformed aggregate resources management in Ontario

(Pichette, 1995). Prior to the 1970s many of Ontario's pits and quarries were not rehabilitated and this practice has left a legacy of landscape scars that are aesthetically displeasing, environmentally degrading, and damaging to the public reputation of the aggregate industry (Sandberg, 2001). As a result, the approval and site licensing process for aggregate extraction sites in Ontario has become more stringent as well as increasingly restrictive (Baker & McLellan, 1992). Kellett (1995) highlights the central purpose of sustainable aggregate policies as protecting the environment while extraction occurs and restoring the quality of the land after restoration is complete.

Aggregate resources in Ontario are governed by a distinct policy hierarchy that includes two tiers of legislative and regulatory control: provincial and local (i.e. regional/municipal) policy tools (Figure 6). Within each of these two distinct tiers of provincial and local policy organization, sub-levels of procedure (i.e. provincial regulations and zoning by-laws) provide specific guidance on how aggregate operations are to be conducted. Both provincial and local policies maintain a similar objective of environmental protection, securing aggregate resources for future development, and balancing different stakeholder interests. In addition, both provincial and local policy requires final and progressive rehabilitation order to preserve environmental integrity and minimize the long-term adverse impacts of aggregate developments on the surrounding landscape.

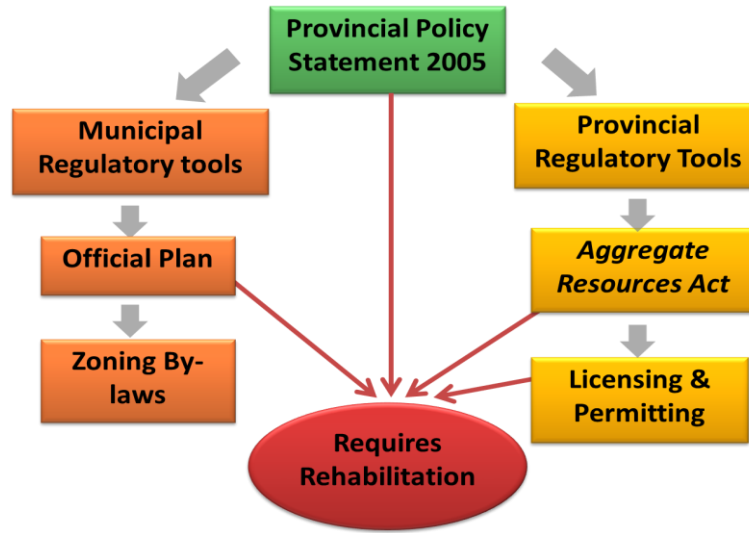


Figure 6: Aggregate management policy framework in the Province of Ontario

This policy review will examine the history of aggregate management within the Province, identify the key policy tools in the current regulatory framework, and seek to explain the policy hierarchy that guides aggregate planning and management in Ontario. This review and evaluation of policy tools will provide a basis for determining whether or not the current policy framework that directs that management of aggregate resources is effective in achieving adequate aggregate site rehabilitation in Ontario.

2.4.2 The History of Aggregate Management in Ontario

Aggregate planning and management in Ontario has undergone much reform in the past four decades (Figure 7). The policy system has evolved in response to public pressures to lessen the social and environmental costs of aggregate extraction activities. During the 1950s, economic growth and prosperity put increased pressures on the aggregate industry to produce more material (Yundt & Messerschmidt, 1979) and this resulted in greater impacts on the local environment and communities. The authors note that conflict between aggregate producers and municipalities began to arise by the late 1960s, in response to the large amount of extraction and production

taking place and growing landscape impacts. The provincial government was called upon to protect existing and future aggregate resource areas by establishing legislation that would regulate the siting and operation of aggregate developments (Yundt & Messerschmidt, 1979) and prioritizing aggregate development over competing land uses (Winfield & Taylor, 2005).

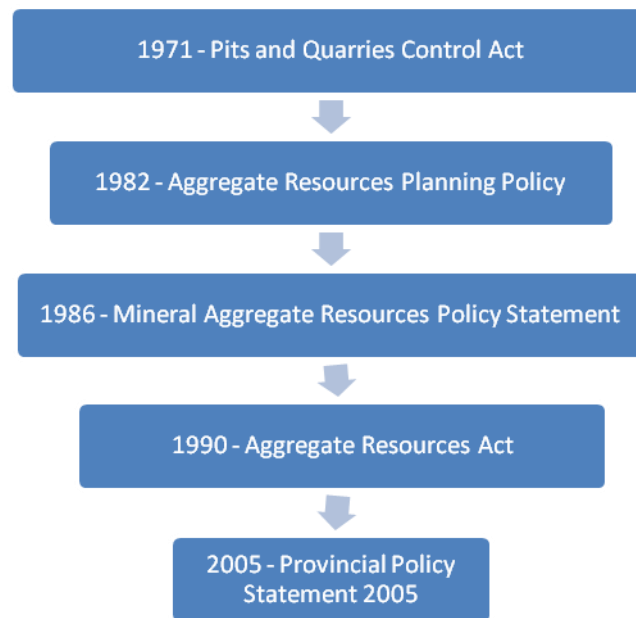


Figure 7: The history of aggregate management in Ontario

In 1971 the *Pits and Quarries Control Act (PQCA)* was enacted and was the first piece of provincial legislation that controlled aggregate development in Ontario. The PQCA was passed by the provincial government, at the request of the aggregate industry, in an attempt to reduce the unrest between the aggregate industry and the local residents of host municipalities (Yundt & Messerschmidt, 1979). This was also the first provincial policy directive that required that worked-out sites be rehabilitated and also designated the Ministry of Natural Resources as the provincial authority in charge of aggregate policy issues. Shortly after being brought into force, the *PQCA* was deemed ineffective (Baker & Shoemaker, 1995) and new policy tools (i.e. Mineral Aggregate Resources Guidelines, Aggregate Resources Planning Policy) were created in order to

improve enforcement and administration of aggregate planning and management at the provincial level (Yundt & Messerschmidt, 1979).

During the early 1980s, planning for aggregate resources became increasingly formalized through cabinet approval of the *Aggregate Resources Planning Policy* in 1982. Pichette (1995) considers the *Aggregate Resources Planning Policy* - also known as the 10-point policy - to be the formal beginning of provincial control over aggregate resource management in Ontario.

In 1986, the Ontario government introduced an aggregates-focused policy statement under the *Planning Act*. The Mineral Aggregate Resources Policy Statement (MARPS) acted as a precursor to the aggregates portion of an integrated Provincial Policy Statement and was an essential policy move ensuring the protection of close-to-market sources of aggregate in the province (Binstock & Carter-Whitney, 2011). This policy declared aggregate resources management as a matter of key provincial interest and was designed to secure the long-term availability of aggregate material (Pichette, 1995). The MARPS made it a legal requirement for municipalities to develop Official Plans and Zoning By-laws that *have regard for* the principles and policy direction outlined in the Policy Statement.

In 1990, the *Aggregate Resources Act* (ARA) replaced the former *Pits and Quarries Control Act* (1971) further ensuring provincial control over gravel pit and quarry developments as well as strengthening rehabilitation requirements. The ARA is a more stringent version of the *Pits and Quarries Control Act* and regulates pits and quarries on both private as well as public land. The main intent of the ARA is to decrease the adverse environmental impacts of aggregate development on the landscape (Binstock & Carter-Whitney, 2011).

In 1995, the MARPS was officially incorporated into the Province of Ontario's "*Comprehensive Set of Policy Statements*" as part of a streamlined planning process within Ontario. This policy move was made in an attempt to give municipalities more authority to make locally-minded decisions (so long as they were consistent with provincial policy) and establish long-term environmental protection measures (Binstock & Carter-Whitney, 2011). In 2005, the "*Comprehensive Set of Policy Statements*" was updated and replaced by the current version of the Provincial Policy Statement (i.e. PPS 2005). The general planning principles and guidelines first established in the MARPS, in regards to aggregate resources, have been maintained in the PPS 2005 (Binstock & Carter-Whitney, 2011).

2.4.3 Provincial Management Authorities

Presently in Ontario, aggregate resources management and corresponding land-use planning frameworks attempt to achieve the overall objective of ensuring the continual availability and development potential of aggregate resources, while minimizing adverse impacts on society and the environment (Pichette, 1995). The Provincial directive for aggregate management in Ontario focuses on three major topic areas: 1) resource conservation; 2) industry regulation; and 3) planning for aggregates (Pichette, 1995). The Ministry of Natural Resources has several key roles in aggregate resources management, that fall into these three main topic areas, including: developing policy, processing and reviewing applications for licences and permits, ensuring compliance with regulations and site plan conditions, and participating in local land-use planning processes (MNR, 2012a). Other provincial ministries can also be involved with legislative and regulatory requirements related to aggregate resources management. For example the Ministry of Transportation is involved with the identification and designaion of haul routes and the Ministry of the Environment reviews applications for 'Permits to Take Water'.

The Ontario Aggregate Resources Corporation (TOARC) in conjunction with the Aggregate Resources Trust, created in 1997, has the role of managing abandoned pits and quarries through the Quarries Rehabilitation Fund (TOARC, n.d.[b]). TOARC is charged with managing the Aggregate Resources Trust. This includes the responsibilities for collecting and dispersing aggregate fees, conducting research on aggregate management issues, rehabilitating any pits and quarries where the licence or permit has been revoked, and publishing annual financial and production summaries.

2.4.4 Provincial Policy & Legislation

The Provincial Policy Statement (PPS) was issued under Section 3 of the *Planning Act* and came into effect on March 1st of 2005. The purpose of the PPS is “to provide direction on matters of provincial interest related to land use planning and development, and promotes the provincial “policy-led” planning system” (Ontario Ministry of Municipal Affairs and Housing [OMMAH], 2011, Part I, para.1). The Ontario *Planning Act* requires that all land-use planning matters and corresponding decisions *shall be consistent with* the Provincial Policy Statement. This means that municipal policy tools (i.e. Official Plan policies or zoning by-laws) as well as decisions made at the Ontario Municipal Board must conform to the policy objectives outlined in the most current version of the PPS. The purpose of the PPS is to provide policy leadership and ensure that Ontario’s environmental, social, and economic interests are being adequately protected and accounted for when land-use decisions are made (OMMAH, 2011).

Section 2.5 of the PPS provides policy direction on the management and planning of mineral aggregate resources. The primary objective for aggregate policies contained within the PPS is for the protection of aggregate resources in order to ensure access to a long-term supply of aggregate material. Section 2.5.2.1 of the PPS states that “*mineral resources shall be protected*

for long-term use” and that “*as much of the mineral aggregate resources as is realistically possible shall be made available as close to markets as possible*” (OMMAH, 2011, Section 2.5, para 3). This section also eliminates the need for any form of supply and demand analysis that would demonstrate a need for aggregate resources during the licensing for aggregate extraction operations. To guarantee a long-term supply of virgin aggregate, the PPS calls for the protection of aggregate deposits from development or any other activity that may prevent the extraction of resource supplies. This is illustrated in PPS section 2.5.2.4, which mandates that “*mineral aggregate operations shall be protected from development and activities that would preclude or hinder their expansion or continued use or which would be incompatible for reasons of public health, public safety or environmental impact*” (OMMAH, 2011, section 2.5, para. 7). Furthermore, the PPS restricts proposed development activities adjacent to, or, located in known mineral aggregate deposits that would potentially hinder or preclude the establishment or access to a new aggregate operation.

The PPS describes aggregate extraction and development activities as an “interim land-use” (s. 2.5.3.1) and calls for the progressive and final rehabilitation of aggregate operations in order to accommodate subsequent land-uses and promote land-use compatibility. Therefore, the extraction of mineral aggregate resources is permitted to occur on land designated as “*prime agricultural areas*” or “*prime agricultural land*” as long as the rehabilitation of the site can be carried out so that “*substantially the same areas and same average soil quality for agriculture are restored*” (s. 2.5.4.1) (OMMAH, 2011, section 2.5, para. 11). However, in prime agricultural areas where mineral aggregate extraction will occur below the water table, the PPS allows for alternative forms of rehabilitation and the re-establishment of prime agricultural lands is not required (see OMMAH, 2011).

Licensing of individual sites is done under the *Aggregate Resources Act* R.S.O 1990(referred to as ARA). In response to the insufficiencies of the *Pits and Quarries Control Act*, the *Aggregate Resources Act*, first passed in 1990, serves as a consolidated policy framework for all the relevant statues that dealt with aggregate resource management prior to 1990. The ARA facilitates a site licensing system that is administered and managed by the Ministry of Natural Resources. In order for an operator to obtain a licence for a pit or quarry, a licence application must first be made to the MNR by filing a site plan. Site plans are also filed with the local municipal office, as zoning by-law amendments are often required for an aggregate licence to be granted. Under Ontario's *Environmental Bill of Rights*, aggregate site licence applications are posted on the Environmental Registry to allow for public comment and review. The MNR is required to consider all comments when making a final decision on whether or not to grant site licence approval. This is one consultation mechanism for involving public input in decisions regarding aggregate licensing applications. The municipality or the public can object to all or individual parts of the application and all objections are filed on record with the MNR. In some cases, serious objections to a licence application may be referred to the Ontario Municipal Board (OMB) for review.

The ARA requires rehabilitation occur for excavated aggregate sites in the form of both progressive and final rehabilitation activities (s. 47). When reviewing a site licence application, the ARA (s. 47) requires the MNR to consider the suitability of proposed extraction phases progressive rehabilitation plan. This regulatory directive is meant to ensure that rehabilitation occurs in a timely manner.

The authority of the *Planning Act* provides the provincial government with the policy leadership needed to guide all matters of provincial interest relating to aggregate planning and

management in Ontario. The *Planning Act* is the policy mechanism that offers some municipal control over aggregate resource extraction; namely, the authority to pass zoning by-laws and Official Plan policies that dictate where local aggregate developments can occur. However, these local land-use planning decisions must *have regard for* the provincial directive outlined in the PPS. The *Planning Act* requires that an aggregate licence, on private land, only be issued if a municipality's Official Plan policies and corresponding zoning by-laws permit the operation of a pit or quarry. An aggregate site licence cannot be issued under the *Aggregate Resources Act*, unless the conditions of the application comply with a municipality's zoning requirements. This is the only form of policy control that municipalities hold in terms of siting aggregate developments. A municipality can only deny a proposed pit if the development is deemed to be an unacceptable land-use, within the existing land-use planning framework (i.e. Official Plan policies). Municipal zoning-by law changes are the second consultation mechanism for the public to become informed and involved about proposed aggregate licence applications. All proposed zoning-by law changes are required to be discussed and decided upon at municipal public meetings and decisions made by the municipal council can be challenged at the OMB. All public meetings are advertised and open to public participation.

In addition, municipalities do have limited control over the operation of aggregate sites. The *Municipal Act* allows local municipal councils to regulate pit hours of operations, dust control measures, machinery type used, site setbacks, and grading requirements.

2.4.5 Determining the Effectiveness of the Current Policy Framework

Several organizations and authors concerned with aggregate resources management and planning in Ontario have offered criticisms towards the current version of the PPS. Because the PPS mandates the long-term protection of Ontario's natural heritage features (in section 2.1), but

also requires that as much aggregate resources as possible be made available to close-to-market sources (in section 2.5), there exists a contradiction in the provincial policy direction that regulates the use and protection of the land in Ontario. Given the large-scale land disturbance required by aggregate extraction operations, it would be difficult to simultaneously accomplish both of these objectives. In the majority of land-use planning scenarios, one policy objective must take precedence over the other (e.g. aggregate extraction over natural heritage protection). This inconsistency in the policy framework has further fueled land-use conflict regarding the siting of aggregate developments in areas deemed to have significant or sensitive natural heritage features. Policies outlined in the PPS rely on the variable interpretation of decision-making authorities (i.e. Ontario Municipal Board) to appropriately apply the policy. Various authors and agencies have highlighted this serious inconsistency for land-use protection detailed in the PPS, such as Binstock & Carter-Whitney(2011), Gravel Watch Ontario (n.d.), and Markvart (2009). For example, prime agricultural land and natural heritage features can be disturbed if adequate aggregate resources are present, but PPS 2005 also calls for the continued protection of these significant landscape features. Markvart (2009) points out that different interpretations of the PPS in regards to Official Plan amendments and zoning by-law amendments have resulted in tension between local communities, the aggregate industry, and provincial government authorities. Patano & Sandberg (2005) argue that the PPS and other provincial policies are designed to encourage the development as well as expansion of pits and quarries, especially those that are located close to major markets. Binstock & Carter-Whitney (2011) claim that in PPS 2005, aggregate extraction activities are given priority over other forms of land-use. Chambers & Sandberg (2007) indicate that there is a long history of the Province favouring industry interests.

Further criticisms have been made about the lack of emphasis that the current PPS puts on requiring the rehabilitation of aggregate sites. The current version of the PPS does call for the

final and progressive rehabilitation of aggregate sites within the province, but does not specify or lay-out timelines or procedures that would ensure the adequate and timely rehabilitation of extraction sites (e.g. there is no requirement to rehabilitate to the pre-existing natural condition of the land) (Binstock & Carter-Whitney, 2011). Gravel Watch Ontario (n.d.) also calls to attention the failure of the PPS to ensure enforcement of rehabilitation with clear expectations, resulting in insufficient land reclamation practices within the aggregate industry.

In 1995, Baker & Shoemaker reported that despite stricter requirements for rehabilitation that were included in the ARA, MNR statistics for the period of 1986-1990 indicated that, “overall, only about 2 percent of the land disturbed in any given year during 1986-1990 was rehabilitated” (pg. 5). Ten years later, Winfield & Taylor (2005) reported that less than half of the land disturbed for aggregate production between 1992 and 2001 was actually rehabilitated. The more recent State of the Aggregate Resources Report (MNR, 2010c) showed slight improvement in these figures, with 58 per cent of sites completing progressive rehabilitation and approximately 72 per cent of site are completing some form of final rehabilitation. Thus, it can be concluded that strengthening rehabilitation requirements in the regulatory frameworks (i.e. ARA) has resulted in a minor increase in the rate of rehabilitation occurring. However, there is still significant room for improvement as a large proportion of aggregate developments in Ontario fail to perform progressive rehabilitation as required by the ARA (as indicated by the SAROS report). Within the geographic context of Southern Ontario, Winfield & Taylor (2005) observe that over 75 per cent of the Greater Toronto Area’s aggregate supplies come from sensitive environmental areas such as the Niagara Escarpment and Oak Ridges Moraine. With Ontario’s pits and quarries being excavated faster than the rate of rehabilitation, there is a greater total impact on the environment from cumulative landscape impacts (Winfield & Taylor, 2005).

The reasons for the relatively low rate of progressive rehabilitation in Ontario are unclear. The State of the Aggregate Resources Report (2010b) suggests that the rehabilitation requirements of site plans for old aggregate licences are not stringent enough in comparison to the rehabilitation expectations of today. The Environmental Commissioner of Ontario (2005) as well as Winfield & Taylor (2005) suggest a continued lack of enforcement and ineffective mechanisms for inspection as fundamental reasons for the poor rehabilitation rate. In addition, Binstock & Carter-Whitney (2011) blame a lack of incentive for aggregate site owners and operators to completed good quality rehabilitation in a timely manner.

2.5 CONCLUSIONS AND RESULTS FROM THE LITERATURE AND POLICY REVIEW

Figure 8 and Figure 9 summarize the findings of the literature and policy review. Conclusions drawn from the literature on aggregate site rehabilitation identify several concrete challenges that faced by the rehabilitation process, such as the cost of implementing adequate rehabilitation activities and the successful abatement of adverse environmental and social impacts. In addition, mitigating the cumulative effects of several aggregates operations clustered within a landscape is more challenging than managing the individual contributions of a single extraction site

Results of Literature Review

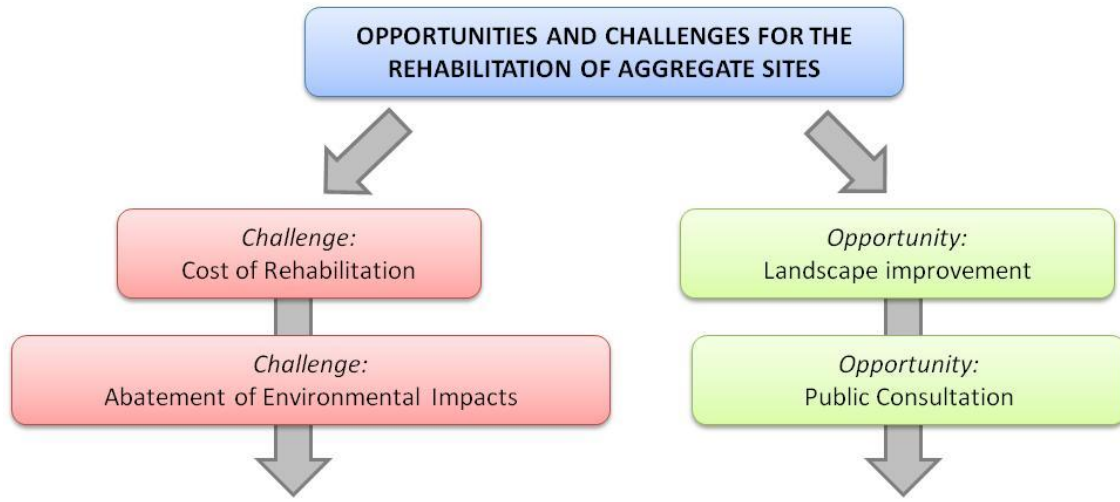


Figure 8: Results of the literature review outlining the opportunities and challenges for aggregate site rehabilitation

Results of Policy Review

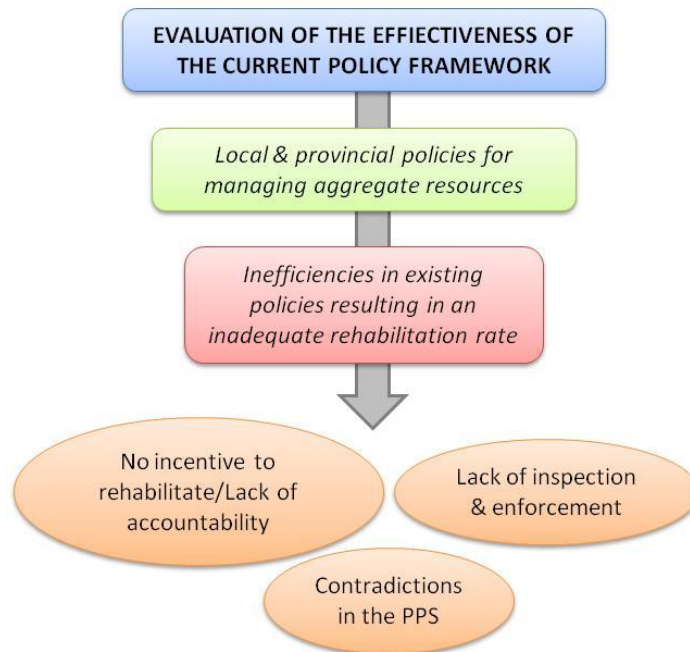


Figure 9: Results of the policy review identifying problems with current regulatory framework

Conclusions drawn from this policy review indicate several key inefficiencies and inadequacies in the current policy and management framework that are perpetuating a legacy of poor aggregate site rehabilitation practices in Ontario.

In addition, the results of both the literature and policy review emphasize that there are a numerous key actor groups, with corresponding roles and values, that are directly involved with aggregate planning and management activities in Ontario (refer to page 64 for a description of actor group values). Thus, aggregate management issues must be examined through an appropriate theoretical lens that recognizes the relationship between actor groups, the advocacy role that they can play, and subsequent policy development and implementation.

2.5.1 The Advocacy Coalition Framework – Recognizing the Role of Actor Groups in Aggregate Planning and Management and Subsequent Rehabilitation Processes

Within the geographic context of Southern Ontario, Patano & Sandberg (2005) see the growing land-use conflict over aggregate extraction as a transformation of the rural countryside from area of production (i.e. agriculture and aggregate extraction), to an area of consumption (i.e. housing and recreation). Patano & Sandberg (2005) note a strong shift in values in Southern Ontario; scenic landscape and ecological values are increasingly displacing traditional resource extraction values.

Patano & Sandberg (2005) identify the key actor groups involved in the aggregate planning and management process and summarize the aggregate land-use conflict occurring Southern Ontario:

The aggregate planning process in south-central Ontario can be conceptualised as a political struggle between the regional demand for aggregates and local residents' demands for an undisturbed countryside and state bureaucrats' and environmentalists' concern for the preservation of nature and natural processes (pg. 39).

Bloodworth, Scott & McEvoy, (2009) conclude that the economic value and strong provincial interest in maintaining the accessibility and availability of aggregate products drives the current policy and decision-making framework for these resources. Because municipal governments have electoral incentives to be more responsive and sympathetic to the concerns of citizen, local decision-makers can be critical about proposed new aggregate operations and about current provincial decision-making on aggregate resources. The present aggregate management and planning system in Ontario is limited in its ability to find compromises between the value systems of the different stakeholders who are involved in contentious land-use debates. This results in an ongoing struggle to between actor groups to have their resource values (i.e. resource extraction vs. landscape preservation) translated into provincial policy.

The research findings of Patano & Sandberg (2005) indicate that the political and economic strength of the aggregate industry prevails in favour of resources extraction. Environmental watchdog organizations such as Ontario Nature (see Ontario Nature, 2009) and Environmental Commissioner of Ontario (2011) have observed that the decisions made by the Ontario Municipal Board, regarding aggregate related controversies are often in favour of development applications. However, increasing social opposition from powerful community and environmental coalitions is starting to challenge this norm. Patano & Sandberg (2005) acknowledge that networks opposing new aggregates projects, often in the form of citizen activist groups, are gaining power and are starting to successfully resist the expansion of aggregate sites in many places in Southern Ontario. A number of recent examples of failed aggregate licence application highlight this finding:

- 1) In 2010, the Town of Caledon, in Southern Ontario, fostered a strong, community-wide anti-aggregate movement (see Chambers & Sandberg, 2007) that successfully blocked a large aggregate development application after 13 years of campaigning.
- 2) In the fall of 2012, an application to build a massive “mega-quarry” in Melancthon Township was withdrawn by the applicants. The proposed project was vehemently opposed by numerous local and regional interests groups, including Citizens Alliance, The Council of Canadians, North Dufferin Agricultural and Community Taskforce, The David Suzuki Foundation, and others. The strong voice of these powerful activist groups and citizen coalitions resulted in nation-wide antagonism towards the proposed project. In response to successful lobbying from concerned interest groups, the Provincial Government designated the project for a comprehensive Environmental Assessment. One year later, the applicants withdrew their application for the quarry, citing insufficient support from the community and government.
- 3) More recently (March 2013), a quarry application in Flamborough Township, also in Southern Ontario, was halted by the Provincial government. A Ministerial Order was issued by the Provincial Government that ultimately prevented the approval of the quarry. This political decision was made as a result of strong opposition and lobbying against the quarry by the local municipal government, an organized group of residents, numerous environmental organizations, and the local conservation authority.

These recent examples of blocked aggregate applications in Southern Ontario, as a result of coalition activism, illustrate the power that these groups have to influence provincial politics and consequent land-use decisions. In addition, these recent cases of successful anti-aggregate action

demonstrate that there are several key actor groups who are involved with aggregate resources planning and management, beyond the provincial government and aggregates industry.

A review of the relevant literature on aggregate site rehabilitation supports these conclusions and further reveals that a relationship exists between aggregate management policies, the rehabilitation process, and relevant actor groups. Further, a correlation can be also drawn between the differing values that actor groups advocate for (i.e. extractive values advocated by industry vs. environmental protection values advocated by environmental groups) and perpetuating aggregate related land-use conflict in Southern Ontario. Recognizing the ability of actor groups to influence the outcome of political decisions and manipulate policy frameworks, forms the theoretical foundation for this study – the Advocacy Coalition Framework, which is discussed in the following chapter.

- Chapter 3 - Research Methods

3.1 INTRODUCTION

This chapter will explain in detail the research strategies employed in this study.

Justification will be provided for the research methods chosen for this study and a theoretical framework will provide a foundation for guiding how the research techniques will be used to evaluate and analyze the results of the data collected. The research strategy used for this study, including data collection and analysis procedures, will be applied to answer the three central research questions. This procedure will result in concrete findings and recommendations.

3.2 THEORETICAL FRAMEWORK

Policy review and evaluation plays a critical role in the setting of policy agendas for government organizations and agencies. Many environmental policy studies have been conducted since the early 1970s; however, very few of these reviews and evaluations have resulted in substantive changes in environmental legislation and regulations (Susskind, Jain, & Martyniuk, 2001). Susskind, Jain, & Martyniuk, (2001) note that policy analysis and evaluation remain a minor element in the administrative capacity of many resource management institutions. The authors conclude that a lack of policy evaluation is a barrier to effective policy creation. Evaluation is necessary in identifying inefficiencies, inadequacies, and contradictions in resource management policies that may not become evident until serious problems with the implementation of planning and management strategies are observed.

Policymaking is a socio-political process and is described by Sabatier (1987) as a “struggle among groups with different values and interests operating within a given governmental

structure and changing socioeconomic environment” (pg. 650). Environmental policy issues are often complex and contentious, with many diverse stakeholders or actor groups vying for a variety of management objectives. This complex web of actor groups and corresponding array of interests can have a significant impact on the development of policy frameworks. Sabatier (2007) concludes that the traditional system of policy making has failed to recognize the role of external policy-making influences, such as the core beliefs and values of well-organized interest groups.

The Advocacy Coalition Framework (ACF) is a theoretical framework that emphasizes policy as an expression of values - economic, social, and environmental values (see Table 2 on pg. 64 for a description of actor groups and corresponding values that were used in this study). The ACF has been widely promoted as a useful theoretical approach for understanding policy change and can provide a more comprehensive and more appropriate look at the policy-making process (Sotirov & Memmler, 2012). The ACF was developed in the late 1980s by Sabatier & Jenkins-Smith (Sabatier & Jenkins-Smith, 1993) in an effort to explain advocacy coalition structure and behaviour, the role of science and technical information in policy creation, policy-oriented learning, and the process of policy change in controversial policy subsystems (Workshop on Policy Process Research [WOPPR], 2012). Sabatier & Jenkins-Smith (1993) argue that competing *advocacy coalitions* structure themselves around specific policy subsystems that can be defined by policy-topic, geographic scope, and influencing actors. These advocacy coalitions are composed of diverse actor groups, from the public sector, private sector, or civil society, which share fundamental core beliefs and a common point-of-view (e.g. environmental protection or resource extraction). In addition, these *advocacy coalitions* share secondary beliefs in regard to the way that their core beliefs should be reflected in agenda-setting and subsequent policy creation. The ACF model assumes that policy-changes occur over time as a result of

policy-based learning – a process which sees transformations in the belief systems of political decision makers, often influenced by various advocacy coalitions (Sabatier & Jenkins-Smith, 1993).

The ACF views policy development as the translation of belief systems. These belief systems are what guide the individuals who are involved in the political decision making process (Sabatier & Jenkins-Smith, 1993) and can be influenced by the broader political environment (e.g. lobbying from actor groups). The ACF also views the policy-making process as a political schema “that focuses on the belief systems of advocacy coalitions within policy subsystems” (Sabatier, 1987, pg. 649). Use of the ACF is based on an assumption that changes in policy are best viewed as changes “in the dominant belief systems within a given policy area/subsystem over time” (Sabatier, 1987, pg. 650) and recognizes the key role that different actor groups, and their interests, can have in the policy-making process. The development of a policy framework is essentially a representation of policymakers’ perceptions of the world and their corresponding belief systems (Sabatier, 1987). Advocacy from a well-organized coalition can inform this policy-making process by manipulating a policymaker’s perception of an issue. Strongly-formed advocacy coalitions can use their political power to influence the behaviour of the government in order to achieve their specific policy goals and objectives. The role of advocacy coalitions (i.e. actor groups) in the policy framework is depicted in a model of the advocacy coalition framework illustrated by Figure 10. This model and a more theoretical explanation of the ACF is detailed in Sabatier & Weible (2007) and Weible, Sabatier, and McQueen (2009). A more in-depth explanation of the ACF and how it can be applied to natural resource policy studies is available in Sotirov & Memmler (2012).

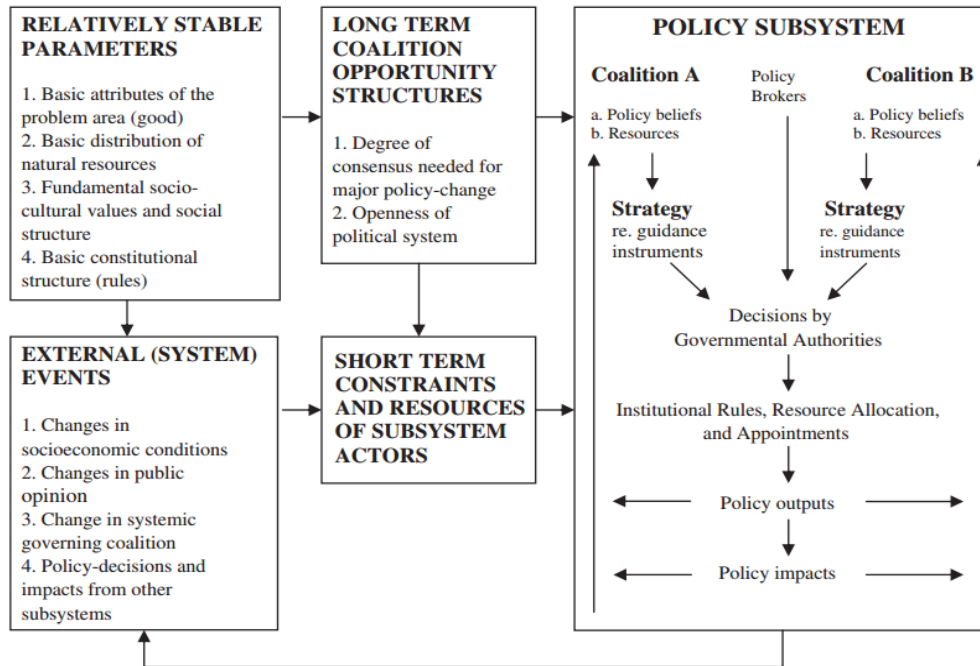


Figure 10: Model of the Advocacy Coalition Framework (from Sabatier & Weible, 2007, pg. 202)

The ACF Framework has been applied to numerous fields of policy study, including natural resource and environmental policy. Sotirov & Memmler (2012) reviewed the application of the ACF in natural resource policy studies and concluded that “the framework manages to explain meaningfully long-lasting policy debates about value conflicts and competing knowledge in the various natural resources policy areas across a multitude of geographical domains and political systems” (pg. 60). Weible, Sabatier, and McQueen (2009) completed an analysis of 80 applications of the ACF and determined that the ACF has a “strong association with environmental and natural resource policies...and can be applied across almost any policy domain” (pg. 126). The ACF has been applied by numerous authors to discuss and evaluate planning and resource management problems (e.g. Sotirov & Memmler, 2012; Nicholson-Crotty, 2005; Wolsink, 2003), land-use conflict (e.g. Weible, 2005; Berggren, 1998), and other environmental policy related issues (e.g. Weber & Christophersen, 2002; Andersson, 1999).

Therefore, the use of the ACF in these studies supports the suitability of its use as the theoretical framework for this study.

It is also important to recognize the limitations of the ACF in regard to its application in this study. In their review of the ACF, Weible et al. (2009) concluded that coalition concept can lead researchers to assume homogeneity among advocacy group members, either in beliefs or in coordination patterns. This means that it cannot be assumed that all members of a particular actor group hold the same beliefs and values towards a particular issue. However, given the small number of tightly formed actor groups involved in aggregate management in Ontario, the roles and values of each coalition are well defined and this critique is not considered a limitation of the use of the ACF in this study. Sotirov & Memmler (2012) also acknowledge that the ACF does not always clearly explain the causal relationship between the collective action of advocacy groups and the corresponding policy-change that can occur. This study includes only broad insights into the role that actor groups play in influencing the policy-making processes and is not limited by this specific criticism of the ACF.

The ACF framework explains a general model of policy-making that focuses on the belief systems of advocacy coalitions and the substantive role they can have in facilitating change in policy and governmental programs (Sabatier, 1987). Currently in Ontario, provincial government policies favour aggregate extraction activities over landscape preservation (Binstock and Carter-Whitney, 2011). This is largely due to the economic significance of the aggregate extraction in Ontario and illustrates the influence that advocacy coalitions (e.g. aggregate industry) can have on government policy development. Thus, the Advocacy Coalition Framework will form the theoretical foundation for this study, given the core values that can be attributed to the key actor groups involved in informing aggregate management policy in Ontario. Within the context of this study, the main assumptions that are founded in the ACF are used to develop a research

methodology that explores the major viewpoints of key actor groups in order to answer the research questions outlined in this study. In addition, the central concepts represented in the ACF will provide for greater insight into the socio-political discourse of aggregate resource management issues in Ontario. The ACF will remain a constant, underlying theme throughout this study and give a specific perspective to the methodology, findings, and recommendations suggested in this study.

3.3 MIXED-METHODS RESEARCH STRATEGY

A convergent mixed-methods research design was utilized for this study. Mixed-methods research techniques have been widely used by researchers to expand the scope and improve the analytical power of social sciences investigation (Sandelowski, 2000). A convergent mixed-methods research design utilizes both qualitative and quantitative data collection procedures in order to provide for a comprehensive analysis of the research questions (Creswell, 2009). In a convergent mixed-methods approach, both qualitative and quantitative data collection procedures are conducted at the same time and then the collected data are combined during the analysis and interpretation phase of the study (Creswell, 2009; Creswell & Plano Clark, 2007). Specifically a *convergent* mixed method research design was implemented for this study given the short time-frame available for data collection. This resulted in the need for both qualitative data being collected at the same time during the limited study period (Creswell & Plano Clark, 2007).

There are several notable advantages as well as disadvantages in using a mixed-methods research approach in social sciences studies as outlined in Table 1: Summary of the strengths and challenges of the convergent mixed method research approach (summarized from Creswell & Plano Clark, 2007). The convergent mixed-methods research design was selected for this study because this type of a research strategy is characterized as having a practical philosophy towards

investigating answers to research questions (Lund, 2012). Johnson & Onwuegbuzie (2004) identify mixed-methods research as a natural complement to traditional qualitative and quantitative research. Further, the authors highlight the pragmatic framework used for designing and conducting mixed methods research which, in turn, results in a more outcome-oriented method of inquiry. Mixed-method research strategies are used in both basic and applied research and are especially effective in delineating results in the applied field of evaluation research (Lund, 2012). Creswell (2009) further identifies mixed-method procedures as an adequate approach for addressing complex, social-science research questions. The author concludes that “there is more insight to be gained from the combination of both qualitative and quantitative research than either form by itself” (Creswell, 2009, pg. 203).

Table 1: Summary of the strengths and challenges of the convergent mixed method research approach (summarized from Creswell & Plano Clark, 2007)

Strengths of a convergent mixed-methods research design	Challenges of a convergent mixed-methods research design
i. Qualitative and quantitative data collection methods are prioritized equally. Data is kept independent and separate during analysis and then mixed during interpretation.	i. “Much effort and expertise is required” (pg. 80). Knowledge and expertise for both qualitative and quantitative data collection and analysis is required.
ii. Provides a more complete understanding of a topic as quantitative results are validated or explained.	ii. Researches must consider and adequately mitigate the consequences of different sample sizes for the qualitative and quantitative data collected.
iii. “It is an efficient design” (pg. 78). Both types of data are collected during one phase of research at the same time.	iii. It is a challenge to combine two different types of data and their corresponding results in a way that is meaningful and addresses the same research question.
iv. “The design make intuitive sense” (pg. 78) and is a popular approach to mixed-methods research.	iv. If the quantitative and qualitative results do not agree, this may be a difficult problem for the researcher to resolve and may require the collection of additional data.

Mixed-methods research strategies require the analysis and interpretation of both qualitative and quantitative data collected as part of a study. This involves the merging of the data in order to formulate concrete study results and findings. When broadly applied, this is a practice that is commonly referred to as *triangulation* – the use of two or more research methods to strengthen the validity of the results. In an effort to make mixed-methods studies more defensible, Green, Caracelli, and Graham (1989) put forth five techniques that can be used for integrating (i.e. triangulating) the data analysis procedures conducted as part of mixed-methods research designs. As described by Green et al. (1989), the specific evaluation technique used in this study for integrating and merging the qualitative and quantitative data analysis is described as a *complementarity* purpose (pg. 258). The *complementarity* mixed methods purpose and research design was chosen as the evaluative technique for this study as it can be used to measure “overlapping but also different facets of a phenomenon (pg. 258)” which allows for a more comprehensive understanding of the research problem. The application of the *complementarity* evaluation technique provides “clarification of the results of one method with the results from the other method” (pg. 259). As applied in this study, the results of the actor groups interviews (qualitative data) are used to enhance and elaborate on the results of the rehabilitation rate and quality analysis (quantitative data). The *complementarity* intent in this study is illustrative by the use of the interview data to help explain the meaning of the quantitative data, thereby using “two different measures to assess similar, as well as different, aspects of the research phenomenon” (pg. 258). The use of this mixed-methods evaluation technique will result in a number of well-supported, key findings for this study.

Johnson & Onwuegbuzie (2004) explain that, “the goal of mixed-methods research is not to replace either of these approaches but rather to draw from the strengths and minimize the

weakness of both in single research studies” (pg. 15). Quantitative methods involve the use of objective data that result from empirical observations and measures (Creswell, 2009). These data can be interpreted through statistical analysis and the outcomes can be repeated, resulting in reliable and meaningful interpretations. (Creswell, 2009). The use of qualitative research methods “employs a different philosophical assumptions” (pg. 173) and relies on the perceptions and interpretation of text and image data (Creswell, 2009). Qualitative research uses unique systems for analysis which are used to identify and explain diverse perspectives on a range of issues (Creswell, 2009). These two research methods are both used in this study in order to broaden the understanding of the aggregate site rehabilitation process in Ontario.

The topic of this study is complex and inter-disciplinary. In order to adequately and comprehensively answer the core and sub-research questions posed in this study, a blending of research methods is needed to develop a solid understanding of the subject of inquiry. A mixed research strategy will offer a “mix and match [of] design components” (Johnson & Onwuegbuzie, 2004, pg. 15) that will provide the most suitable approach for answering the research questions. Creswell & Plano Clark (2007) make a strong case for the validity and rigour of mixed-methods research and summarizes the value of mixed methods research design in the following four points (pg. 9):

- “Mixed methods research provides strengths that offset the weakness of both quantitative and qualitative research”.
- “Mixed methods research provides more comprehensive evidence for studying a research problem than either quantitative or qualitative research alone.”
- “Mixed methods research helps answer questions that cannot be answered by qualitative or quantitative approaches alone.”

- “Mixed methods encourages researchers to collaborate across the sometimes adversarial relationship between quantitative and qualitative researchers”

The qualitative research in this study is used to better understand, explain, and build on the results of the quantitative research. For example, in this study, quantitative methods are used to determine what the rate of rehabilitation occurring in Ontario is. Qualitative methods are used to determine whether or not the calculated rate of rehabilitation is adequate, based on the perceptions of key stakeholders who are involved in the rehabilitation process. In the context of this study, the use of both quantitative and qualitative methods is needed to formulate meaningful and understandable answers to the research questions. This practical research strategy will allow for triangulation of the study results (Johnson & Onwuegbuzie, 2004), corroborating the findings of the actor group interviews with the results of the analysis of the rehabilitation statistics. Figure 11 provides a schematic of the research framework for this project. For these reasons, and given the applied, pragmatic nature of the study topic, a mixed-methods approach is most appropriate for this study.

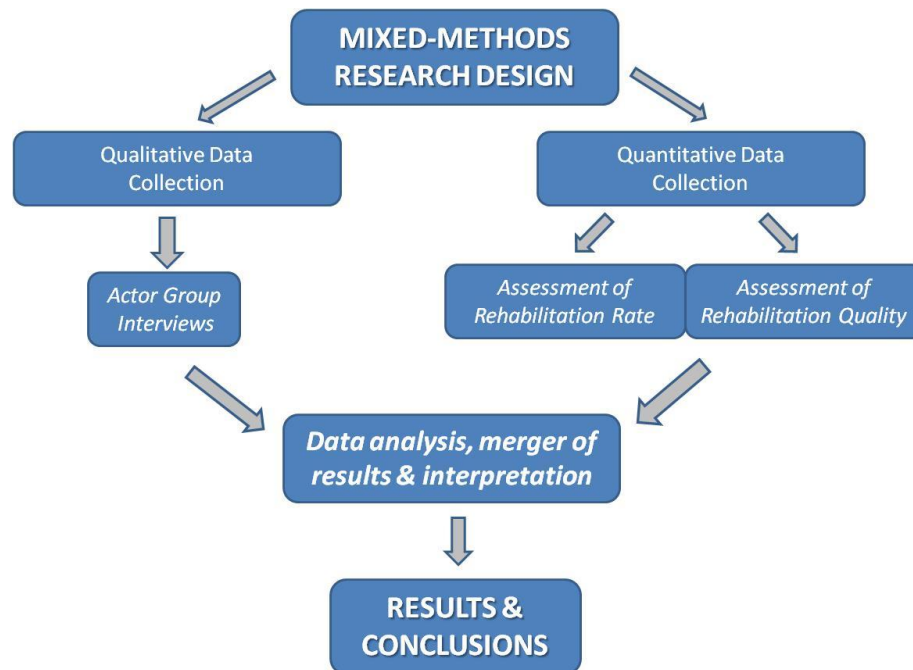


Figure 11: Schematic explaining the implementation of the mixed-methods approach used for this study

3.4 ETHICS APPROVAL

This project underwent and received ethics review and clearance from the University of Waterloo’s Office of Research Ethics. Ethics review and clearance was required by the University of Waterloo as this study involved research with human participants. Interviews with 10 representatives from actor groups were conducted as part of this research project. The Office of Research Ethics reviewed and cleared all materials and protocols used during the interview process. The anonymity of interview participants is ensured in this study as no unique identifiers for actor group participants are provided and all quotes are used anonymously. All written or electronic records of the interview materials will be stored securely in a locked filing cabinet or password secured electronic document and destroyed after one year.

3.5 QUANTITATIVE DATA COLLECTION & ANALYSIS

The quantitative data collection methodologies that were employed in this study will answer the following research questions: What is the rate of aggregate site rehabilitation that is occurring in the Province of Ontario? And, what is the quality of rehabilitation that is occurring? Annual production statistics collected by the Ministry of Natural Resources (data pre-1998) and The Ontario Aggregate Resources Corporation (data post-1998) were used to determine the rate of rehabilitation occurring and is the only source of production and rehabilitation statistics available within the province. An assessment of a random sample of 30 rehabilitation plans for aggregate sites located in the Region of Waterloo was also conducted in order to draw conclusions about the quality of rehabilitation occurring. An assessment of rehabilitation quality using field studies was not feasible for this study due to challenges encountered with gaining land owner permission to access active aggregate licences.

3.5.1 Analysis of Production & Rehabilitation Statistics

Prior to 1998, the Ministry of Natural Resources was responsible for collecting and publishing annual production statistics, in the form of consolidated statistical reports. In 1998, this responsibility was transferred to The Ontario Aggregate Resources Corporation (TOARC). These annual statistical updates available from the MNR (prior to 1998) and TOARC (after 1998) contain data that is reported by aggregate site owners and operators. TOARC reports for 1998 to 2011 are available electronically for download from the World Wide Web. Reports for the period of 1992-1998 are available upon request from the Ministry of Natural Resources.

These yearly reports contain rehabilitation statistics organized by MNR management district and each annual report contains statistics that summarize the “rehabilitation of licensed aggregate site”. In this study, these statistics were compiled for the period of 1992-2011, from the

annual statistical reports available from TOARC and the MNR, and used to calculate the rate of rehabilitation occurring in the Province of Ontario. The rehabilitation rate is calculated for the Province of Ontario as well as the Guelph MNR district – the largest aggregate-producing district in Ontario. The Guelph MNR district was isolated from the rest of the province for comparative reasons.

It is important to note that the data presented in these statistical reports are compiled from information supplied by aggregate producers and are not independently checked by the MNR or TOARC for accuracy. This limiting factor greatly reduces the credibility of the data presented in this report; however, it is the only continuous source of publicly data on aggregate site rehabilitation available in Ontario.

Basic statistical procedures (averages, ratio's, proportions etc.) will be used to determine the rate of aggregate site rehabilitation occurring in the Guelph MNR district and Province of Ontario. Data were compiled and analysed using Excel spreadsheet software (MS Office 2007).

3.5.2 Review of Rehabilitation Plans

An analytical review of a sample of rehabilitation plans for aggregate license in the Region of Waterloo was completed in order to draw broad conclusions regarding the quality of aggregate site rehabilitation occurring across the Province of Ontario. based Rehabilitation plans are required as part of the site-licensing process in Ontario and are approved by the Ministry of Natural Resources. Minimal rehabilitation requirements are set out in provincial Operational Standards (i.e. *Aggregate Resources of Ontario: Provincial Standards Version 1.0*, see MNR 2012b) for the management of aggregate resources; however, there are no specifications or guidelines on how to create effective and appropriate rehabilitation plans. The purpose of this

review was to determine whether or not the content of existing rehabilitation plans is likely to achieve high quality rehabilitation when implemented in the field, thereby meeting the provincial rehabilitation objectives of (from Ministry of Natural Resources, 2012b):

- Restoration of the land to its former use or condition.
- Establishing compatibility with surrounding uses, including landscape aesthetics.
- Encouraging biodiversity and/or soil capability/agricultural productivity.

The content of 30 rehabilitation plans will be compiled into tabular form, based on a pre-determined set of assessment parameters determined by the author of this study, including:

- Does the rehabilitation plan specify a final land-use?
- Does the rehabilitation plan specify that native species be planted? Are specific native species named?
- Will rehabilitation use topsoil from on-site or off-site? Will the topsoil be amended with fertilizers or other forms of added nutrients?
- Will the planted vegetation be maintained? If so, for how long?

The data were then summarized and interpreted as quantitative results. This analytical assessment of the quality of rehabilitation plans is based on the assumption that a better quality rehabilitation plan (here defined as plans that are more detailed and specific) will translate into superior rehabilitation efforts. The rehabilitation plans reviewed in this study were obtained digitally from the Ministry of Natural Resources, Guelph District office.

The Region of Waterloo has a total of 99 (N=99) active and surrendered aggregate sites, with an additional six sites currently in the application process. Only active and surrendered sites were sampled and surveyed as part of this study, resulting in the use of a stratified random

sampling technique. Out of the 99 active and surrendered aggregates sites, eight are considered to be surrendered and 91 are considered to be active. A sample size of 30 sites, represents 30% of the population of all active and surrendered sites in the Region of Waterloo.

Stratified random sampling was used in order to separate: active, surrendered, and sites currently in application. Thus, the population of aggregate site-licences was split into three groups: “active”, “surrendered” and “application”. Sites in the “application” phase were not sampled and not included in this study. Within the “surrendered” category three sites were randomly selected from the population and 28 sites were randomly selected from the “active” population of aggregates sites in the Region of Waterloo. Simple random sampling was used to identify sample sites within the strata identified using the Random Selection technique in Microsoft Excel 2007. The sampling technique of stratified random sampling was chosen for this research study as it provided an unbiased random selection of suitable sites across the Region and is feasible given that a complete sample frame exists, in addition to, a relatively small population of sites. Stratified random sampling was also used to ensure that both active and surrendered sites were included in the review process.

3.6 QUALITATIVE DATA COLLECTION & ANALYSIS

The qualitative data collection method used in this research study collected the views and perceptions of key actor groups who play a role in influencing policy for aggregate resources management in the Province of Ontario. In line with the mixed methods evaluation technique employed in this study, the interview data collect was used to help explain and substantiate results of quantitative data analysis.

Semi-structured interviews were conducted with representatives of key each actor group. Content analysis was then performed on the collected interview data in order to identify thematic

networks which could then be translated into specific opportunities and challenges. This procedure resulted in the development of the specific policy recommendations highlighted in Chapter #6 of this thesis.

3.6.1 Description of Actor Groups

Five key actor groups were identified as having an influential role in aggregate site management and corresponding rehabilitation in Ontario. All actor groups included in this study are involved in the planning and management of aggregate resources in Ontario. These actor groups play advocacy roles in decision-making processes and are most influential in the evolution of policy evaluation and development. The specific actor groups interviewed as part of this study are not individually identified by name in this thesis in order to protect their identity and ensure the anonymity of interview participants. Table 2 indicates the actor groups that were included and interviewed as part of this study.

Table 2: Description of actor groups included in study as well as the common values held by each group

Actor Group	Description	Value(s)
1. Provincial government	Provincial ministries and other provincially led organizations	Economic growth, low cost of province infrastructure, access to close-to-market aggregate sources.
2. Aggregate industry	Aggregate site operators and industry-led associations	Economic growth, resource extraction, unrestricted access to aggregate deposits.
3. Local government	Local municipalities and/or Regional municipalities	Local economic development, infrastructure maintenance, public involvement, tax revenue from aggregate production.
4. Environmental non-government organizations (ENGO)	Environmental groups advocating for the protection of the natural environment	Environmental protection and conservation, protection and preservation of the rural character of the country side, protection of prime agricultural land.
5. Community-based groups	Citizens groups representing public or community interests.	Preservation of the characteristics of the countryside, property values, public participation.

3.6.2 Actor Group Interviews

Interviews are used in qualitative studies to gather comprehensive “information pertaining to participants’ experiences and viewpoints of a particular topic” (Turner III, 2010, pg. 754), which provide the researcher with data that can be analyzed in order to test a hypothesis and answer a research question. Semi-structured interviews were used in this research study and all participants were asked identical questions; however, the questions were worded in a manner that would allow for open-ended and varying responses (see Kvale, 1996). In the semi-structured interview format used in this study, questions were organized thematically as they relate to the topic of the interview. This format was chosen given that the more structured an interview situation is, the easier it is to perform analyses on interview data (Kvale 1996). Turner III (2010) discusses the importance of constructing effective research questions and highlights the need for questions to be designed in a manner that will allow the research to reveal “the experiences and/or knowledge of the participants in order to gain maximum data from the interviews” (pg. 754). This idea was strongly considered when designing the interview questions used to collect data in this study.

The interviews lasted approximately 45 minutes and were comprised of a total of 14 open-ended questions. The interview questions were categorized into two separate themes: general questions related to aggregate planning and management and more specific questions related to aggregate site rehabilitation. Based on the results of McNamara (2009), interview questions were designed to include the following elements: open-ended wording, neutral questions, clearly worded questions, and “why” questions asked in a careful manner.

Interviews were recorded using an audio-recording device and then transcribed for content analysis. Two stakeholder representatives from each actor group were interviewed for a total of 10 interviews. The interview questions are presented in Appendix A.

3.6.3 Sampling Protocols for Interviewees

Sampling of interview participants used the method of *targeted sampling* to select stakeholder participants from each actor group. Targeted sampling is a form of non-random sampling that is most appropriate to use when specific questions need to be evaluated (Watters & Biernacki, 1989). Targeted sampling was used in this study as a random sample from a large population was not needed for obtaining the necessary information. In addition, targeted sampling was used for this study as this sampling method is purposeful, systematic and is designed to recruit specific individuals, who represent specific roles (Watters & Biernacki, 1989).

A sample of 10 interview participants was deemed appropriate and feasible given the limited timeline and resources available for this study. In addition, there are a very limited number of actor groups in Southern Ontario who are directly involved, and knowledgeable, in aggregate related management and planning issues. A total of 10 interviews was sufficient in capturing the views associated with these actor groups and it is unlikely that more interviews would have resulted in new information given that individual actor groups are categorized based on common, shared values. Specific individuals, representing each actor group, were identified based on the key role that they play within each of their representative organizations. An interview conducted with 10 key informants was determined to be sufficient in collecting enough data in order to perform a comprehensive analysis (i.e. “saturated” data). Yardley (2000) confirms that in qualitative research, the adequacy of a sample size should not be assessed in terms of size (as is done with quantitative research), but rather in terms of the data’s ability to

supply all the information needed to sufficiently address all the variations and complexities with regard to the study topic. Based on the time and resources available for this study, a total of 10 interviews was determined to result in satisfactory emersion in the relevant data needed to answer the research questions posed in this study.

Additional study resources (e.g. time and funding) would have allowed for more interviews with key informants to be conducted in order to reach the point of data saturation – the point in continuous data collection that signals that any additional data collected will serve only to confirm what has already been determined (see Sutter, 2012). The fact that the qualitative data saturation point was not evaluated during research activities, should be recognized as a limitation of this study. Exploring the point of data saturation for this study topic is an area that requires additional research.

3.6.4 Interview Data Analysis

Content analysis was performed on the results of the actor group interviews. One of the objectives of this study was to identify unique challenges and opportunities regarding aggregate site rehabilitation and make corresponding policy recommendations. Thus, the technique of *thematic analysis* was performed on the textual content of the actor interviews in order to identify specific themes or “clusters of similar issues” (Attride-Sterling, 2001) raised by each actor group. This method of analysis was selected for collecting interview results as it supports the theoretical framework guiding this study. The specific themes that evolve from the data analysis are furthered classified as specific opportunities and/or challenges which can influence the advocacy role that actor groups play in policy agenda-setting. Further, thematic analysis is a “robust and highly sensitive tool for the systematization and presentation of qualitative analyses” (Attride-

Sterling, 2001, pg. 35). It also fits the pragmatic nature of this study, and is a technique used to perform policy analyses (Agar, 1983; Stover 2010).

Thematic analysis provides for the clear identification of prominent themes in qualitative data; thus, it is an organized and structured way of dealing with textual data, such as transcribed interviews (Dixon-Woods et al., 2005). It is a flexible system of analysis and can be used to integrate qualitative and quantitative data (Dixon-Woods et al., 2005), which is why it was selected as the method of analysis for this mixed-methods study. Thematic analysis is used to analyze the content of collected qualitative data and involves the identification of a set of prominent and recurring themes (see Figure 12: Structure of a thematic network (from Attride-Stirling, 2001) and then organizes the findings of the analysis under a series of thematic headings (Dixon-Woods et. al, 2005).

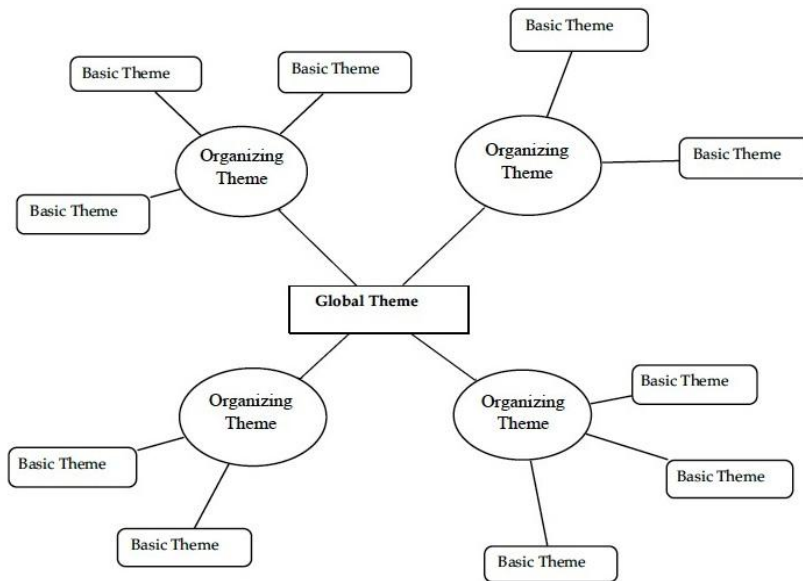


Figure 12: Structure of a thematic network (from Attride-Stirling, 2001)

Attride-Stirling (2001) presents a step-by-step guide for using the procedure of thematic analysis as a method for analyzing qualitative data that fits well with the theoretical framework

for this study. The author proposes that the results of thematic analysis can be presented as thematic networks, which are web-like illustrations that summarize the main themes embedded in the textual data. Further, the author points out that thematic networks work to disclose the understanding of an issue or the significance of an idea by “reconcil[ing] conflicting definitions of a problem” (pg. 387). Attride-Stirling’s (2001) technique for thematic analysis, “enables a methodical systematization of textual data, facilitates the disclosure of each step in the analytic process, aids the organization of an analysis and its presentation, and allows a sensitive, insightful and rich exploration of a text’s structures and underlying patterns” (pg. 386).

Table 3. Explanation of the hierarchical relationship in a thematic network (adapted from Attride-Stirling, 2001)

Thematic Group (hierarchical level)	Explanation
Global Theme	Highest level that seeks to combine and describe the entire dataset. Global themes represent macro-level themes, which summarize and provide meaning to the groupings of lower-order themes.
Organizing Theme	Mid-level theme that groups central ideas outlined in the basic themes together.
Basic Theme	Lowest order theme, e.g. a statement of belief founded in a central notion.

In Attride-Stirling’s (2001) method of thematic analysis, the creation of a series of thematic networks is used to systematically draw out a series of sub-themes in the data. Results from analysis of the interview data collected in this study are organized into hierarchical thematic relationships, which are described in Table 2. This analytical approach was used in this study in order to understand the relationship between the existing policy framework, aggregate site rehabilitation processes, and subsequent opportunities and challenges.

The technique of textual coding using the software QSR NVIVO 10 was used to interpret the qualitative interview data. Interviews were coded using a general inductive approach, allowing for the establishment of links between the research objectives of this study and the key

global, organizational, and basic themes derived from the raw interview data. This form of thematic analysis resulted in the development of a hierarchy of descriptive codes. The creation of this coding system coalesces with the theoretical context of this study and is used to identify opportunities and challenges presented by the rehabilitation process. A code list and description are presented in section 4.4.1 of this report.

3.7 VALIDATION OF QUALITATIVE RESULTS

One of the criticisms of qualitative research is that the research may fail to: i) adequately include a representative sample of participants, ii) create reliable measures, and iii) come up with results and outcomes that are replicable (Yardley, 2000). Thus, it is critical to ensure that the principles of good qualitative research are adequately achieved by the researcher in order to validate the quality of the corresponding study results. In this research project, the qualitative strand of research is given greater prominence than the quantitative strand, as a greater amount of qualitative data is collected. The validity of the qualitative investigative techniques and corresponding data is ensured in this study through the application of Yardley's (2000) *Characteristics of good quality qualitative research* (pg. 219). Table 4 (adapted from Yardley, 2000) defines each characteristic and explains how each criterion was met for the qualitative portion of this research study.

Table 4: Validation of the qualitative methods results using Yardley’s (200) characteristics for evaluating good quality qualitative research

CRITERIA	EXPLANATION	METHOD FOR ACHIVING CRITERON IN STUDY
1. Sensitivity to context	<p>The ability to develop a comprehensive understanding of the topic examined within the context of a qualitative study.</p> <p>Adequate grounded in the philosophy of the approach adopted and an awareness of the different perspectives and complex arguments surrounding the study subject manner.</p>	<ul style="list-style-type: none"> - Relevant literature was comprehensively reviewed and included in study narrative. - Use of “vertical generalisation” to link the specific opportunities or challenges identified with the corresponding root issues. - Use of the advocacy coalition theoretical framework to help explain and understand the role that actor group values and perceptions can have in politically charged resource management and planning issues.
2. Commitment and rigour	<p>The expectations for thoroughness in data collection, analysis, and reporting in any kind of research.</p> <p>Commitment encompasses prolonged engagement with the topic.</p> <p>Rigour refers to the resulting completeness of the data collection and analysis.</p>	<ul style="list-style-type: none"> - Interview participants chosen for their specific knowledge and direct involvement in aggregate planning and management in Ontario. - Audio-recording and transcription of interviews. - Clearly defined coding procedure and coding hierarchy. - Ample examples from interviews are presented in the support of analytical findings. - “Triangulation” of qualitative data with alternative sources of data.
3. Transparency and coherency	<p>The ability of the author to present the details of the study methodology and results in a manner that is descriptive and illustrates that results are reached through logical reasoning.</p> <p>The quality of the narrative to convince the reader of the meaning of the results.</p>	<ul style="list-style-type: none"> - The limitations of the study are clearly identified. - Areas that require further research highlighted throughout the study. - Explanation of the study results within the context of the research questions. - Study analysis and results are presented in a meaningful fashion that connects the observed result with the specific root cause.
4. Impact and importance	<p>The impact and utility of the research undertaken in the study in relation to the objectives of the analysis, the applications it was intended for, and the community for whom the findings were deemed relevant.</p>	<ul style="list-style-type: none"> - Analysis highlights key actor groups perceptions of aggregate management in Ontario. - Study findings have significant policy implications. - Study findings are aligned with practical and realistic policy recommendations.

3.8 CONCLUSION

This study has employed a mixed methods approach in order to collect the data needed to answer the core and sub-research questions posed in this study. The ACF will serve as a theoretical lens for this study as it recognizes the significant role that actor groups, and their specific perspectives on an issue, can play in policy formation in pluralistic political societies. This study uses a quantitative analysis of rehabilitation and production statistics from the past 19 years, an evaluation of rehabilitation quality using an assessment of 30 rehabilitation plans, and the creation of thematic networks for identifying opportunities and challenges as determined from ten actor group interviews. Results of the data analysis are presented in the following chapter.

- Chapter 4 - Study Results

4.1 INTRODUCTION

This chapter presents the results of a study based on data collected and analyzed using a mixed methods research approach. The quantitative analysis used rehabilitation and production statistics dating back to 1992, and reflects the results of the implementation of the *Aggregate Resources Act*, brought into force in the early 1990s. Prior to that time, there already existed a sizable legacy of un-rehabilitated land resulting from aggregate operations managed under the old *Pits and Quarries Control Act*, which is not considered or included in this analysis. The analysis of the past 19 years of rehabilitation statistics from Ontario indicates that there is a net growth in land left disturbed from aggregate operations. The rehabilitation plan assessment provides empirical evidence that rehabilitation plans lack sufficient detail to guide good quality aggregate site rehabilitation. Interview data are analyzed using thematic analysis and organized into three thematic networks that illustrate specific challenges and opportunities affecting the aggregate site rehabilitation process in Ontario.

4.2 ASSESSMENT OF RATE OF AGGREGATE SITE REHABILITATION OCCURING

4.2.1 *Results of Analysis for Rehabilitation Statistics*

The following results of this study illustrate the change in the amount of land being rehabilitated in the Guelph MNR Management District (Table 5) and Province of Ontario (Table 6), during the 1992-2011 time period. The categories below reflect statistics for licensed aggregate operations as reported in the annual production statistics reports. Results are presented as yearly averages for three different time periods (i.e. 1992-2001, 2002-2011, and 1992-2011).

The data were organized into three different time periods in order to compare the results in ten year increments. The 1992-2001 data reflect a time period after the establishment of the *Aggregate Resources Act* in 1990. The 2002 to 2011 time period reflects an additional ten years of data that were not assessed in the several reports published in the mid-2000s and critiqued the rehabilitation process (e.g. ECO, 2005; Winfield & Taylor, 2005; Holt & James 2003).

Definitions for the table headings are as follows:

Original disturbed area (ha): The amount of land area (in hectares) at the start of each year that remains excavated from the operation of a pit or quarry.

New disturbed area (ha): The amount of area (in hectares) that is newly excavated each year to operate a pit or quarry.

New rehabilitated area (ha): The amount of area (in hectares) that has been newly restored each year to a pre-extraction condition or use, or to a condition compatible with the adjacent land.

Proportion of the original disturbed area rehabilitated: The proportion of land relative to the original disturbed land that is newly rehabilitated each year.

Proportion of the original disturbed area added: The proportion of land relative to the original disturbed land that is newly excavated each year.

Net growth of the original disturbed area: The proportion of disturbed area growing each year. Calculated by subtracting the “proportion of the original disturbed area rehabilitated” from the “proportion of the original disturbed area added”

Proportion of newly disturbed land to newly rehabilitated land: The amount newly disturbed land per year divided by the amount of newly rehabilitated newly disturbed land per year.

The following numerical example illustrates how the above definitions should be interpreted when examining the rehabilitation data summarized in Table 5 and Table 6. If at the start of the year:

- 125 hectares of land are *originally disturbed*
- 2 hectares of land is *newly rehabilitated*; and
- 4 hectares of land are *newly disturbed*, then:
 - 1.6 per cent ($1.6\% = 2/125 * 100\%$) of the originally disturbed land is rehabilitated, representing the *proportion of the original disturbed area rehabilitated*;
 - 3.2 per cent ($3.2\% = 4/125 * 100\%$) of the originally disturbed land is added, representing the *proportion of the original disturbed area added*; and
 - 1.6 per cent ($3.2\% - 1.6\% = 1.6\%$) is the growth in disturbed area for that year, representing the *net growth of the original disturbed area*.

This process is further illustrated using a pictorial example in Figure 13.



Figure 13: Example of the pattern of disturbed area versus rehabilitated area for aggregate sites in Ontario.

This illustrates a net growth in the amount of disturbed land

Table 5: Summary of Rehabilitation Statistics for the Guelph MNR Management District (1992-2011)

Date Range	Average original disturbed area (in ha per year)	Average new disturbed area (in ha per year)	Average new rehabilitated area (in ha per year)	Average proportion of the original disturbed area rehabilitated	Average proportion of the original disturbed area added	Average net growth of the original disturbed area	Proportion of newly disturbed land to newly rehabilitated land
<i>1992-2001</i>	4,192	196	102	2.4%	4.7%	2.2%	192%
<i>2002-2011</i>	4,651	192	142	3.1%	4.1%	1.1%	135%
<i>1992-2011</i>	4,498	194	122	2.7%	4.3%	1.6%	159%

Table 6: Summary of Rehabilitation Statistics for the Province of Ontario (1992-2011)

Date Range	Average original disturbed area (in ha per year)	Average new disturbed area (in ha per year)	Average new rehabilitated area (in ha per year)	Average proportion of the original disturbed area rehabilitated	Average proportion of the original disturbed area added	Average net growth of the original disturbed area	Proportion of newly disturbed land to newly rehabilitated land
<i>1992-2001</i>	22,094	1,056	461	2.1%	4.8%	2.7%	229%
<i>2002-2011</i>	26,428	960	691	2.6%	3.6%	1.0%	139%
<i>1992-2011</i>	24,983	1,008	567	2.3%	4.0%	1.7%	178%

4.2.2 Guelph MNR Management District

Rehabilitation data for the Guelph MNR Management District were extracted and analyzed from the rest of Ontario to enable regional versus provincial comparisons and observations. The Guelph MNR Management District, located within Southern Ontario, is the largest aggregate producing management district in the Province. Results of the rehabilitation data analysis for the Guelph MNR Management District (Table 5) will be compared to the results determined for the whole of the Province of Ontario.

Overall, the average amount of rehabilitation that occurred during this 19 year time period was only 2.7% (i.e. the average proportion of original disturbed area rehabilitated). This is a small fraction of the amount of land that is left disturbed (97.3%) from aggregate extraction activities. A comparison of the averages over the two time periods, 1992-2001 and 2002-2011, shows a modest increase in the average amount of disturbed land being rehabilitated in the later timeframe (an average of 2.4% between 1992 -2001 and 3.1% between 2002-2011). However, additional statistical comparisons between the averages, using a t-test to determine whether or not they are significantly different, illustrates that the difference between the two means is not statistically significant ($p=0.67$). This more rigorous statistical analysis of the difference between the two time periods, indicates that that the rate of rehabilitation in the Guelph MNR District has not significantly improved over the past 19 years.

In terms of the annual amount of land newly disturbed from extraction activities, between 1992-2011 there was a 4.3% addition of extracted land each year (i.e. proportion of the original disturbed area added) in the Guelph MNR District. In the 2002-2011 timeframe there was 0.6% less land disturbed than in the 1992-2001 time period, again illustrating that less land was left disturbed in the later time period. However, because the amount of land being newly rehabilitated each year

is less than the amount of land being newly excavated, there is a net growth in the total amount of disturbed land. Examining only the time period of 1992-2001 the net growth in the total amount of land disturbed, in proportion to the original disturbed area, was 2.2%. In the following ten years of 2002-2011, this growth was reduced to 1.1%. This is a significant reduction that translates into the addition of 92 hectares (yearly average) of disturbed land added between 1992-2001 and 51 hectares (yearly average) added between 2002 and 2011. Although these numbers illustrate a trend where the proportion of rehabilitated land is increasing and the proportion of disturbed land is decreasing, newly disturbed land area continues to be greater than the land area that is newly rehabilitated each year. This results in a continued net growth in newly disturbed land area that is clearly represented by the proportion of newly disturbed land area between 1992 and 2011 (the proportion of newly disturbed land to newly rehabilitated land is 192% between 1992-2001 and 135% between 2002-2011). Despite an improvement after 2002, an average of 59% more land is disturbed than rehabilitated each year.

This data affirms that the rate of rehabilitation in the Guelph MNR District has not significantly improved over the past 19 years. It can be postulated that more stringent industry rehabilitation standards and practices, supported by stronger policy implemented in the early 1990s, has resulted in a greater rate of rehabilitation. Figure 14 illustrates significant improvements in the years: 2003, 2006, 2008, 2010, 2011. Nonetheless, Figure 14 also shows that there is still a noticeable difference in the average amount of land newly rehabilitated in comparison to the average amount of land newly disturbed, each year. This disparity creates an ongoing net growth in the total amount of land disturbed as indicated by Figure 15. In conclusion, the rehabilitation rate did increase, but the observed discrepancy between the amount of land newly extracted and newly

rehabilitated each year may have resulted in cumulative social and environmental impacts in the Guelph MNR District during 1992-2011.

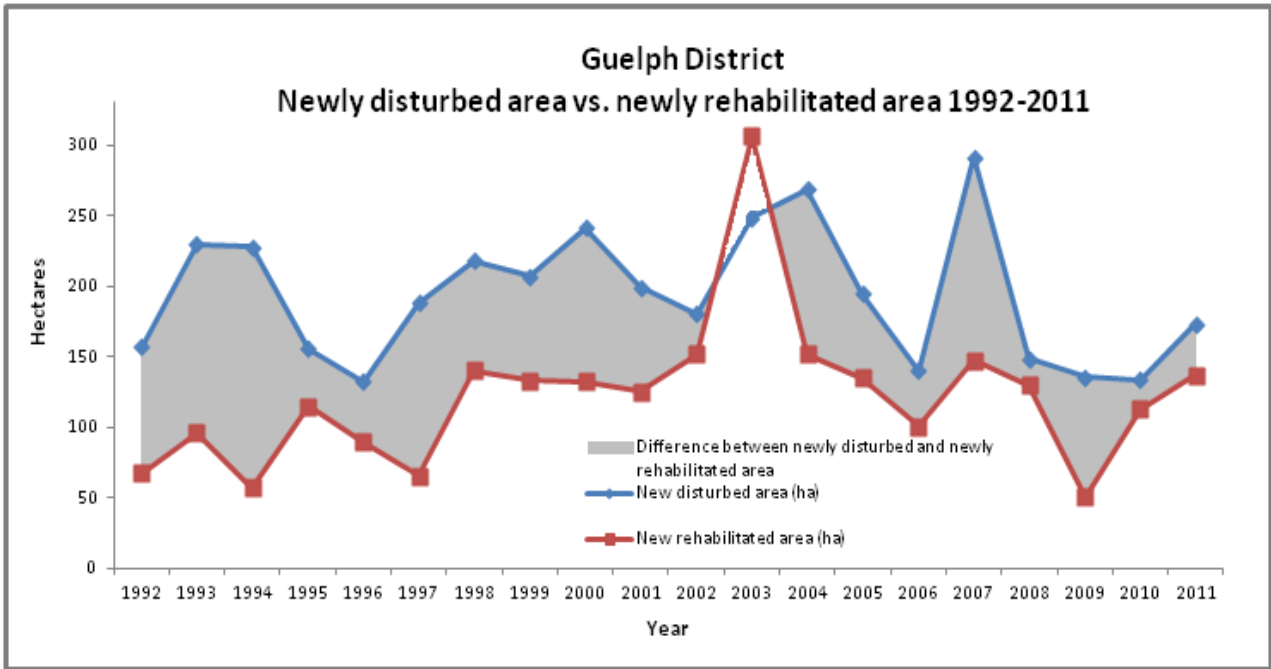


Figure 14: Difference between the area of land newly disturbed and the area of land newly rehabilitated, each year, in the Guelph MNR District (1992-2011). The shaded grey area illustrates the annual difference in the amount of land that is newly disturbed vs. newly rehabilitated. The year 2003 is an exception.

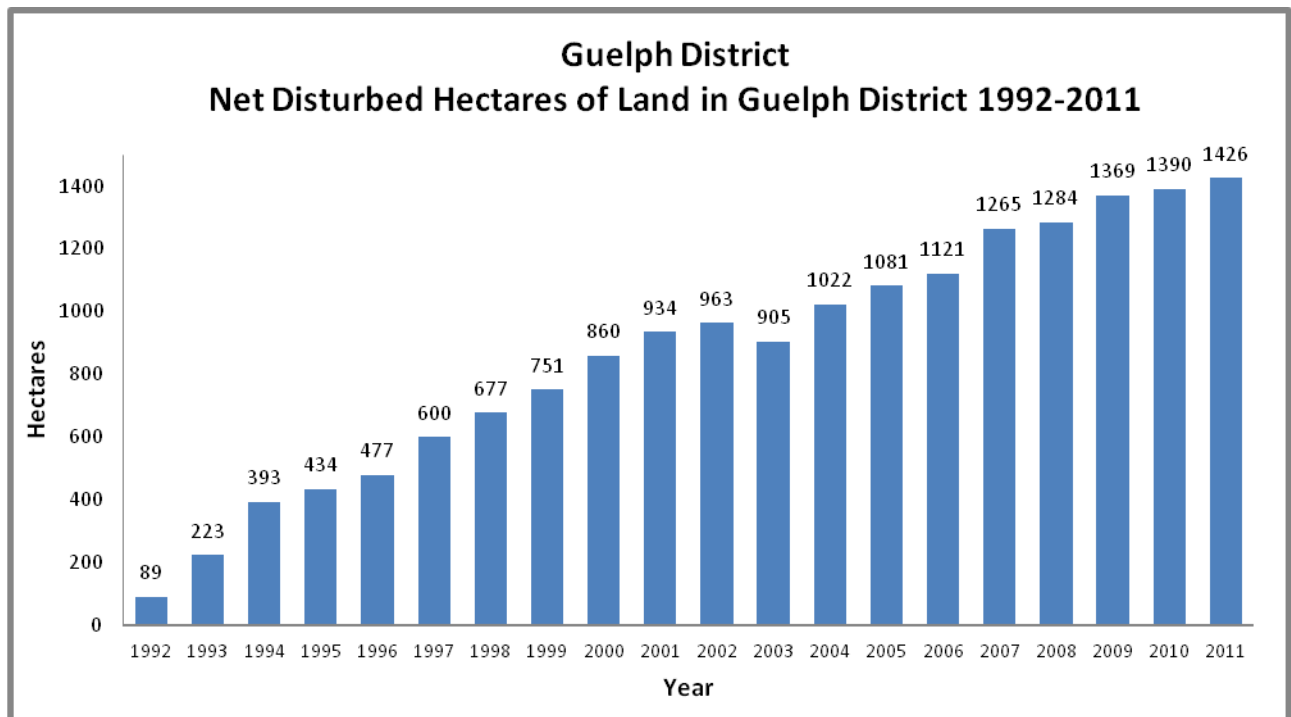


Figure 15: Cumulative growth in the area of land (ha) that is disturbed by aggregate extraction but not rehabilitated, each year, in the Guelph MNR District (1992-2011). Note that that the starting point at 1992 is not zero hectares of un-rehabilitated land. There is an existing legacy of un-rehabilitated land, prior to 1992 not captured in this statistical analysis (number of hectares unknown).

4.2.3 Province of Ontario

Analyzed rehabilitation data for the Province of Ontario demonstrate trends that are similar to the Guelph MNR management district. The average proportion of land rehabilitated, per year, increased by 0.5% after 2001, but newly rehabilitated land still represents only a small fraction of the total amount of land originally disturbed by aggregate extraction activities at the start of each year (2.2% on average for 1992-2011). Similarly to the Guelph MNR District, the Province of Ontario also experienced an average decrease (by 1.2%) in the amount of newly disturbed area added, per year, from 4.8% between 1992-2001 to 3.6% in 2002-2011.

As was also observed in the Guelph MNR district, in the Province of Ontario the amount of land being newly rehabilitating increased, on average, between 1992 and 2011, while the amount of land being newly disturbed decreased. Nevertheless, there remains a net growth in the original disturbed area observed across all three time periods. On average between 1992 and 2011 there was a 1.7% net growth, per year, in the amount of land disturbed in Ontario from aggregate extraction activities (Figure 17).

Although the average rate of rehabilitation is observed to have increased in Ontario (2.6% between 2002 and 2011, a 0.5% increase over the 2.1% between 1992 and 2001), indicating that efforts to improve the amount of rehabilitation may be having some success, Figure 16 indicates that this improvement is not represented consistently across the 2002-2011 time period. The rate of rehabilitation showed a significant improvement between 2002 to 2006, but then decreased again after 2007 to rates similar to those from the late 1990s. This type of observable trend could indicate that the rate of rehabilitation may be more closely linked to market influences (i.e. less demand for aggregate would equal less land extracted), rather than more stringent policy measures. In addition,

a statistical comparison (i.e. t-test) between the calculated averages for rate of rehabilitation between the two periods, illustrates that the difference between the two means is not statistically significant ($p=0.31$). Similarly to the Guelph MNR district, this statistical analysis indicates that that the rate of rehabilitation in the Province of Ontario did not significantly improve in the later time period, despite an average increase in the rate of rehabilitation.

Even though the rate of rehabilitation in Ontario is observed to have increased between 1992-2011, the original amount of land newly disturbed from aggregate extraction, on average per year, continued to grow by 425ha (1.7% of 24,983ha). As in the Guelph MNR management district, the proportion of newly disturbed land to newly rehabilitated land continued to be substantial (192% between 1992-2001 and 135% between 2002 and 2011) and over the past 19 years shows that on average 1.78% more land has been disturbed than rehabilitated.

From this data and the corresponding analysis, it can be concluded that the rate of rehabilitation has not significantly improved over the 19 year time period, despite minor observable improvements in the rate of rehabilitation. The rate of extraction continues to exceed the rate of land being rehabilitated and this has resulted in an ongoing net growth in disturbed land. Therefore, between 2002-2011, rehabilitation was not occurring at an adequate rate to compensate for the amount of land that is newly excavated each year as well as the total amount of land left disturbed. In comparison to the amount of original disturbed land left disturbed in Ontario (about 4,498 ha on average per year), the average yearly amount of land being rehabilitated over the past 19 years is negligible. Therefore, the concerns regarding the cumulative landscape impacts as well as social costs of aggregate are legitimate and should be recognized as a major challenge for the aggregate industry and provincial policy-makers. Potential reasons for this low rate of rehabilitation will be discussed in the following chapter (Chapter # 5).

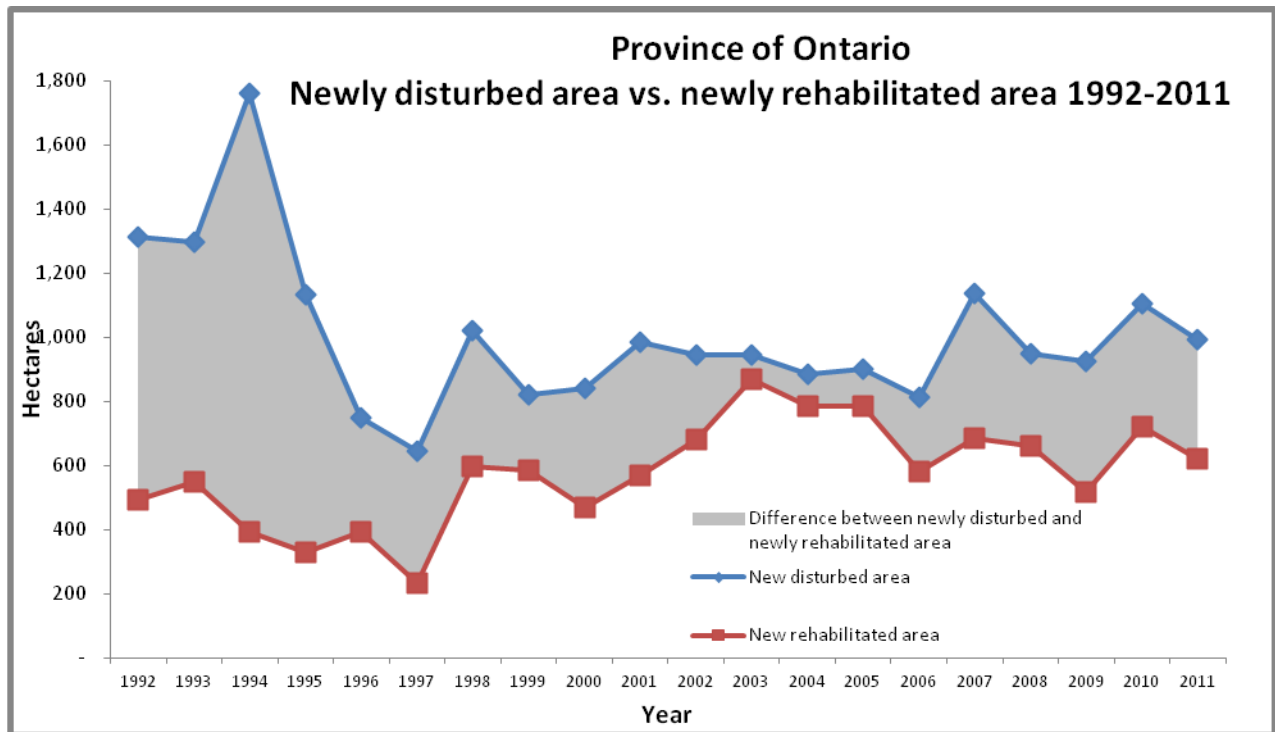


Figure 16: Difference between the area of land newly disturbed and the area of land newly rehabilitated, each year, in the Province of Ontario (1992-2011). The shaded grey area illustrates the annual difference in the amount of land that is newly disturbed vs. newly rehabilitated.

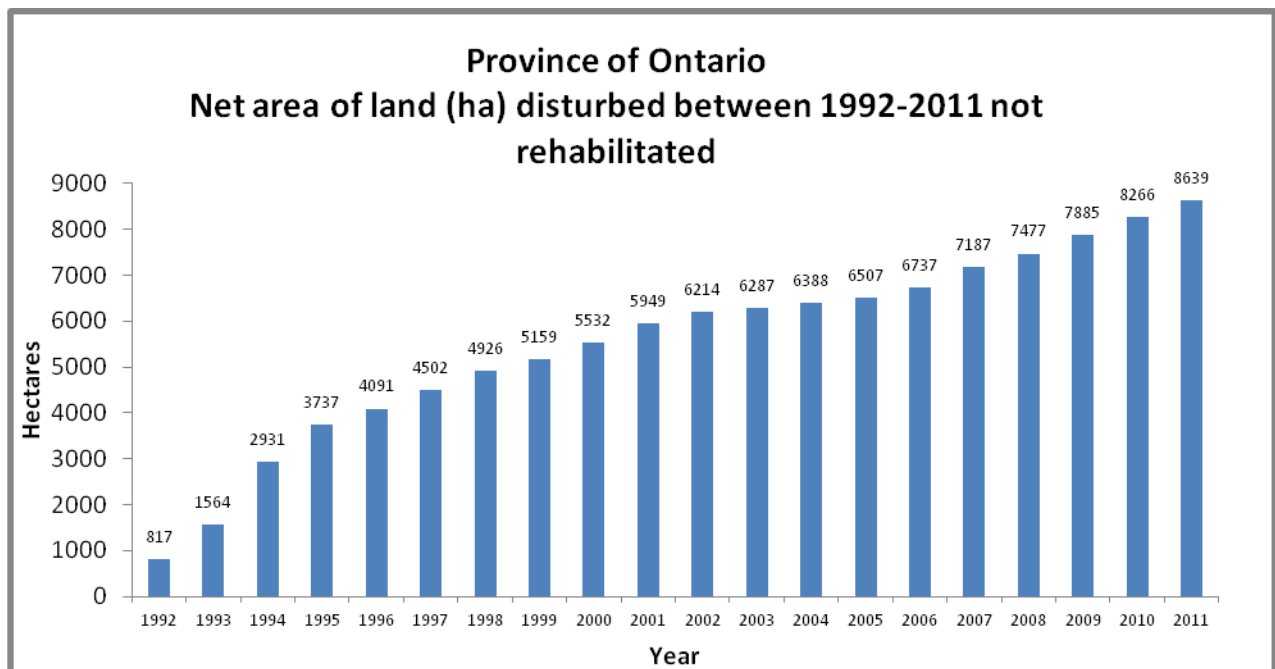


Figure 17: Cumulative growth in the area of land (ha) that is disturbed by aggregate extraction but not rehabilitated, each year, in the Province of Ontario (1992-2011). Note that that the starting point at 1992 is not zero hectares of un-rehabilitated land. There is an existing legacy of un-rehabilitated land, prior to 1992 not captured in this statistical analysis (number of hectares unknown).

4.3 ASSESSMENT OF THE QUALITY OF REHABILITATION OCCURRING

4.3.1 Results of Rehabilitation Plan Review

No formal guidelines exist for creating aggregate site rehabilitation plans, but most plans do follow a similar template and include a site-plan drawing, text explaining the rehabilitation procedures, and an illustration of the cross-section of the site. Each rehabilitation plan is different, but all plans are required to be drafted in a manner that will meet *Provincial Operation Standards for Rehabilitation Requirements*, which are designated under the *Aggregate Resources Act*. The primary objective of the minimum rehabilitation standards (detailed in MNR policy statements), which are set by the Province, is to restore the land to its former use or an alternative condition that is compatible with the surrounding land. Rehabilitation plans are one page in length and included as part of the aggregate licence applicant's site plan. Rehabilitation plans are created on a site-by-site basis and vary in the level of detail provided for specific rehabilitation activities. Categories for assessment were used to quantitatively organize the outcome of the assessment and are based on the most common rehabilitation requirements outlined in most plans. Results are determined based on the level of detail that each plan provides for each of the specific rehabilitation categories.

The intent of the rehabilitation plan review was to assess the quality of rehabilitation occurring, based on the quality of the corresponding rehabilitation plan. The assumption was made that higher quality plans are more likely to result in higher quality rehabilitation completed in the field. The results of the rehabilitation plan review were not corroborated with field surveys and therefore should be considered as broad empirical findings that require further investigation.

Further study should be undertaken to compare rehabilitation plans with rehabilitation activities implemented in the field. This would allow for a more complete evaluation of the creation and application of rehabilitation plans. Additionally, this type of a survey would be able to more

definitively measure whether or not aggregate site rehabilitation plans are effective in achieving good quality rehabilitation as guided by the *Provincial Standards*. Nonetheless, the results of the rehabilitation plan review (outlined in Table 7, Table 8, and Table 9), completed as part of this study, can be broadly interpreted and the outcomes of this analysis are further supported by corresponding academic literature on mining closure plans.

Out of the 30 rehabilitation plans reviewed as part of this study, half were created over 20 years ago, in the early 1990s. Of the remaining half, 12 were created between 10 and 20 years ago, while only three of the plans were created more recently in the last 10 years. These numbers illustrate that older rehabilitation plans are in place for many of the aggregate sites in the Region of Waterloo. The manner in which the age of a rehabilitation plan may affect the quality of rehabilitation conducted is further discussed on pg. 111. The size of aggregate extraction sites was not included as an assessment criterion in this study, as this factor is not considered to have a direct impact on the quality of rehabilitation occurring. Additionally, sites can undergo increases and decreases in licensed area without requiring adjustments to the rehabilitation plan. Thus, the size of an aggregate site is not considered to be a consistent assessment criterion.

The majority of rehabilitation plans do specify a final land-use; however, in some cases there are a variety of incongruent final-land uses proposed in the plan (e.g. agriculture and executive residential), in order to postpone the final land-use decision until after the licence permit is surrendered.

The most serious concern highlighted by the completed rehabilitation analysis is the number of rehabilitation plans that lack any course of action for specific rehabilitation procedures. For example, one-third of the rehabilitation plans examined did not indicate (i.e. “not specified”) the

source of the topsoil that would be used for rehabilitation activities. This is an important consideration as the source of the topsoil used in restoration projects, as well as the topsoil handling and storage practices, can have an impact on the effectiveness of rehabilitation procedures (see Cooke & Johnson, 2002; Rokich et al., 2000). Topsoil that is stripped and properly stored on-site can contain native or locally indigenous seeds and propagules that are ideal for re-vegetation; soil brought in from off-site may contain non-native seed sources or other forms of contamination that would negatively affect restoration efforts.

In addition, just over 10% of the rehabilitation plans identified carrying out on-site erosion control and only 30% of plans identified the specific species of vegetation that would be planted. Less than one quarter of rehabilitation plans indicated that re-vegetation will occur using native species. Consequently, this evaluation illustrates the ambiguity of current aggregate site rehabilitation plans for aggregate operations in the Region of Waterloo. The majority of plans outlined appropriate procedures for achieving rehabilitation objectives, as required by the *Provincial Standards*, these procedures (e.g. ripping, grading/sloping, replacement of topsoil, and re-vegetation) are vaguely explained and lack sufficient detail to guide the undertaking of specific rehabilitation activities. This lack of clarity can be expected to have a negative effect on the resulting quality of rehabilitation occurring in the field. Because rehabilitation plans lack direction and performance indicators, there is no criteria available to hold aggregate producers accountable for achieving successful rehabilitation. The lack of performance indicators in aggregate site rehabilitation plans is further discussed on pg. 111.

Table 7: Summary of Results of Rehabilitation Plan Review – General Information

	Age of Rehabilitation Plan			Final Land-use Specified		Rehabilitation Timeline		Rehabilitation plan modified	
	<i>20 + years</i>	<i>10-20 years</i>	<i>10 or less years</i>	<i>Yes</i>	<i>No</i>	<i>progressive</i>	<i>not specified</i>	<i>Yes</i>	<i>No</i>
# of rehab plans	15	12	3	26	4	29	1	16	14

Table 8: Summary of Results of Rehabilitation Plan Review – Topography

	Source of Topsoil				Ripping Required		Grading/Sloping		Erosion Control Required		Pond Management		
	<i>onsite</i>	<i>off-site</i>	<i>onsite & off-site</i>	<i>not specified</i>	<i>Yes</i>	<i>not specified</i>	<i>specified</i>	<i>not specified</i>	<i>specified</i>	<i>not specified</i>	<i>maintained & rehabilitated</i>	<i>Backfilled</i>	<i>not specified</i>
# of rehab plans	12	3	5	10	25	5	26	4	4	26	4	4	22

Table 9: Summary of Results of Rehabilitation Plan Review – Vegetation

	Vegetation Planting		Vegetative Species Specified					Vegetation Maintenance			
	<i>specified</i>	<i>not specified</i>	<i>Native tree/shrub (species specified)</i>	<i>Native tree/shrub (species not specified)</i>	<i>Grass/legume (species specified)</i>	<i>Grass/legume (species not specified)</i>	<i>not specified</i>	<i>Fertilizer</i>	<i>Re-seeding or Re-planting</i>	<i>Other</i>	<i>not specified</i>
# of rehab plans	26	4	5	2	4	8	11	3	20	1	6

4.4 RESULTS OF ACTOR GROUP INTERVIEWS

The qualitative data extracted and analyzed from the interviews was used to determine the perceptions and values of each of the actor groups in regard to the rehabilitation process for aggregate sites in Ontario. The evaluation of the interview data is used primarily to answer Question #3 of this research study – Is the current rate and quality of aggregate site rehabilitation in Ontario adequate? The analysis of these data also informs the answers to the two sub-research questions of this study: Is the policy framework effective? What are the opportunities and challenges faced by actor groups? Challenges reflect inadequacies and discrepancies in the existing policy and management framework that result in adverse environmental and social impacts. Opportunities represent prospective benefits to all actor groups presented by the rehabilitation process, but must be implemented through future adaptations to the policy framework and management ideologies.

4.4.1 Interview Data Coding Procedure

Each of the interview transcripts was read and re-read several times to identify specific and clear categories, patterns, and perspectives evident in the raw data. These observable patterns and perspectives formed descriptive themes in the interview transcripts, which then formed a coding frame and hierarchy which was used to organize and sort the collected data. Interpretation and identification of the descriptive themes during the conception of the coding frame was, in part, based on the researcher's prior knowledge of the subject matter. A hybrid approach was used in developing the coding frame and coding the textual interview data (see Saldana, 2012). A set of "pre-set" codes was first used to code the data using key themes that emerged during the policy and literature review and the researcher's expertise on the topic. The interviews were re-coded an additional two times using the initial "pre-set" codes in an effort to identify "emergent

codes” which helped to better explain and give greater meaning to the interview data (Saldana, 2012).

Once developed, the coding frame was used to formally code each of the interview transcripts and organize the textual data into a series of hierarchical themes. In the coding frame illustrated in Figure 18, global themes are represented by the numbers 1 to 3, organizational themes are represented by the letters a) to d) and global themes emerged as a result of the technique of in vivo coding and then placed into the appropriate thematic network (see 4.4.2). Table 10 provides a definition for the coding themes as well as an example from the interview text. The number of references coded under each theme is also presented in Table 10.

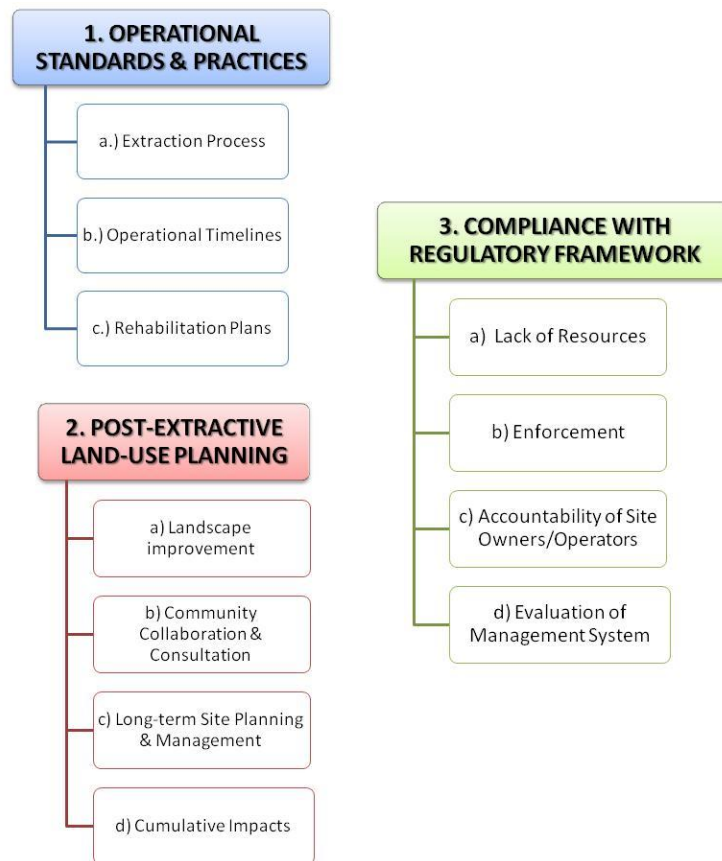


Figure 18: Coding frame and hierarchy used to code and organize interview data

The use of the coding frame and hierarchy allowed for the organization of the raw interview data in a consistent manner. Consequently, the organization of the data using this coding frame resulted in observable relationships between themes as well as the emergence of thematic patterns and networks. The use of thematic networks to organize and present the data is based on Attride-Stirling's (2001) method for thematic analysis. Three thematic networks resulted from the qualitative data analysis.

Table 10: Explanation of global and organizational themes used during coding procedure, including definitions of each theme and an example from the interview transcripts. Each theme is also identified as either a challenge or opportunity affecting the rehabilitation of aggregate sites in Ontario. The number of times each theme is coded for is also provided.

THEME	DEFINITION	EXAMPLE (quote from interview)	CHALLENGE OR OPPORTUNITY	# OF REFERENCES CODED
1. Operational Standards & Practices	Operational standards identify the day-to-day operation requirements for pits and quarries.	<i>“Rehabilitation is not occurring as quickly as it should be [because of] the old standards associated with the older site plans, as compared to the newer standards that we’re using today.”</i>	Challenge affecting aggregate site rehabilitation process	36
a. Extraction Process	How the extraction of aggregate will occur on the site (which parts of the licence area will be extracted first, how extraction will move across the site etc.)	<i>“We don’t want to rehabilitate before the aggregate extraction is completed, so depleting an area is one of the key things that needs to happen before you rehabilitate.”</i>	Challenge affecting aggregate site rehabilitation process	12
b. Operational Timelines	The timeframe in which material is extracted and progressive and final rehabilitation occurs; the life span of the pit or quarry.	<i>“There has to be a stronger emphasis to get the material out of the ground quicker instead of allowing it to happen over an indefinite period of time.”</i>	Challenge affecting aggregate site rehabilitation process	8
c. Rehabilitation Plans	A plan that states how the site will be rehabilitated. Site plans include maps and diagrams detailing how the site will be rehabilitated.	<i>As they [the rehabilitation plans] improve, then the rehabilitation rate improves as well, and they improve by becoming more specific and by doing a better job of implementing progressive rehabilitation.</i>	Challenge affecting aggregate site rehabilitation process	13
2. Post-extractive Land-use Planning	Planning for the management of the land and resources after extraction has finished. Setting long-term goals and objectives for the site and developing a strategy for how to reach those goals while keeping social, economic and environmental concerns in mind.	<i>“We’re not focused enough on the final outcomes. We’re not trying to force ourselves to look 20 years into the future; we’re thinking about what communities want right now...we need to rely strongly on good land use planning policies at the local and regional levels along with strong provincial policy to create those landscapes, and we’re not focusing enough yet on what we want those to become.”</i>	Challenge and opportunity for aggregate site rehabilitation process	69
a. Landscape Improvement	Adding social and/or ecological value to an aggregate site through rehabilitation efforts, resulting in an improvement to the condition of the site post-extraction; Rehabilitation that results in a net gain in social or environmental value to the community.	<i>“Final rehabilitation [should] provide the same or greater contributions to that community in the end than it did before the extraction was completed – and that means it has to be the best of the best.”</i>	Opportunity to improve aggregate site rehabilitation process	16
b. Community Collaboration & Consultation	Involving the community in the decision-making and planning process for aggregate site rehabilitation. A process that allows government, industry, and the community to work collectively to achieve mutual goals and objectives for a site.	<i>“We’re starting to see that more and more people are interested in what’s going on in their neighbourhood and what’s happening on the site next door, and so probably when the local community is more interested in the rehabilitation, it probably plays a role in what happens.”</i>	Opportunity to improve aggregate site rehabilitation process	22

c. Long-term Site Planning & Management	A strategic planning process that looks at the future and long-term vision for the site. Guides priority setting for the site and ensures that long-term management considerations are addressed.	<i>“So aggregate producers are not the long-term owners of the land; they’re creating the landscape for the next owner.”</i>	Challenge and opportunity for aggregate site rehabilitation process	21
d. Cumulative Impacts	Impacts on the environment and community, which result from the incremental impact of one aggregate site when added to other past, present, and foreseeable future aggregate sites in addition to other stresses on the relevant systems.	<i>“I think the biggest concern ... is the failure of the system, the entire system, to think and plan at the landscape level. So, you have no consideration of the cumulative impacts on the landscape...basically there is no inherent mechanism in planning that considers the cumulative landscape impacts.”</i>	Challenge affecting aggregate site rehabilitation process	7
3. Compliance with Regulatory Framework	The ability of the aggregate industry to conform to legislation and supporting regulations, including the Provincial Standards and Aggregate Resources Policy Manual that require progressive and final rehabilitation to occur.	<i>“And in terms of quality, I think it depends on the regulations that are in place, the level of enforcement by the MNR – and by enforcement, somebody going out on-site and saying, “What’s being done? Are you achieving any progressive rehabilitation? Are you doing it properly?”</i>	Challenge affecting aggregate site rehabilitation process	58
a. Lack of Resources	The resources (e.g. money, education, staffing etc.) required to ensure that rehabilitation occurs as set-out in the regulatory framework.	<i>“I think there are good operators and there are bad operators out there, and I think that unfortunately, MNR doesn’t have the resources ...to require better outcomes or to police what’s being done out in the field, and I think that’s a problem”</i>	Challenge affecting aggregate site rehabilitation process	16
b. Enforcement	Enforcement by government to ensure that rehabilitation is occurring as required by the regulatory framework.	<i>“ I think, too, part of it is lack of enforcement as well...the Ministry of Natural Resources needs to be doing a better job with ensuring progressive rehabilitation...I don’t think they have sufficient staff resources to do more enforcement than they currently do.”</i>	Challenge affecting aggregate site rehabilitation process	21
c. Accountability of Site Owners and Operators	The social and financial responsibility of site owners/operators to guarantee that rehabilitation occurs as mandated by existing regulatory frameworks.	<i>“The theory is out there, but in reality, if it’s going to cost the operator money to rehabilitate, they won’t do it because it eats into their profits. And that’s why – again, in theory, it would be nice to have financial assurances where money is put up, but small operators and mid-sized operators may not just have the cash or the means to put up a letter of credit or a bond.“</i>	Challenge affecting aggregate site rehabilitation process	19
d. Evaluation of Management System	A system that requires a review and evaluation of the existing policy and regulatory framework to identify deficiencies and gaps and to track progress and successes.	<i>“So that’s our biggest concern – it’s hard to comment on whether a rehabilitation policy is working if you don’t have the information to properly evaluate that policy.”</i>	Challenge affecting aggregate site rehabilitation process	9

4.4.2 Identification of Thematic Networks

Application of the coding system used to organize and interpret the interview data resulted in the emergence of three key global themes as well as multiple organizing and basic themes. The thematic networks depicted in Figure 19, Figure 20, and Figure 21 are used to illustrate and organize the relationship between the global, observable, and basic themes captured by the actor group interviews. Within the three thematic networks, the organizational themes can be interpreted as specific opportunities and challenges arising from the rehabilitation process as perceived by the actor groups interviewed in this study. Basic themes are specific, empiric elements of the current rehabilitation process that help to explain and give meaning to the occurrence of the organizing and global themes and are. The resulting three thematic discussed in detail in section 5.4.

These key thematic networks and relationships can be translated into specific opportunities and challenges that are faced by actor groups in the rehabilitation process (see Table 10). The opportunities and challenges illustrated in the three thematic networks are comprehensively discussed in Section 5.4 and Section 5.5. Understanding the organization of these three thematic networks and assessing the manifestation of the global, organization, and basic themes will help in evaluating the effectiveness of the current policy framework for the rehabilitation of aggregate sites in the Province of Ontario. These emerging patterns in the qualitative data can be used, in conjunction with the results of the quantitative data analysis and rehabilitation plan review, to form a triangulated answer to the research questions posed in this study.



Figure 19: Thematic Network for Global Theme of Operational Standards & Practices

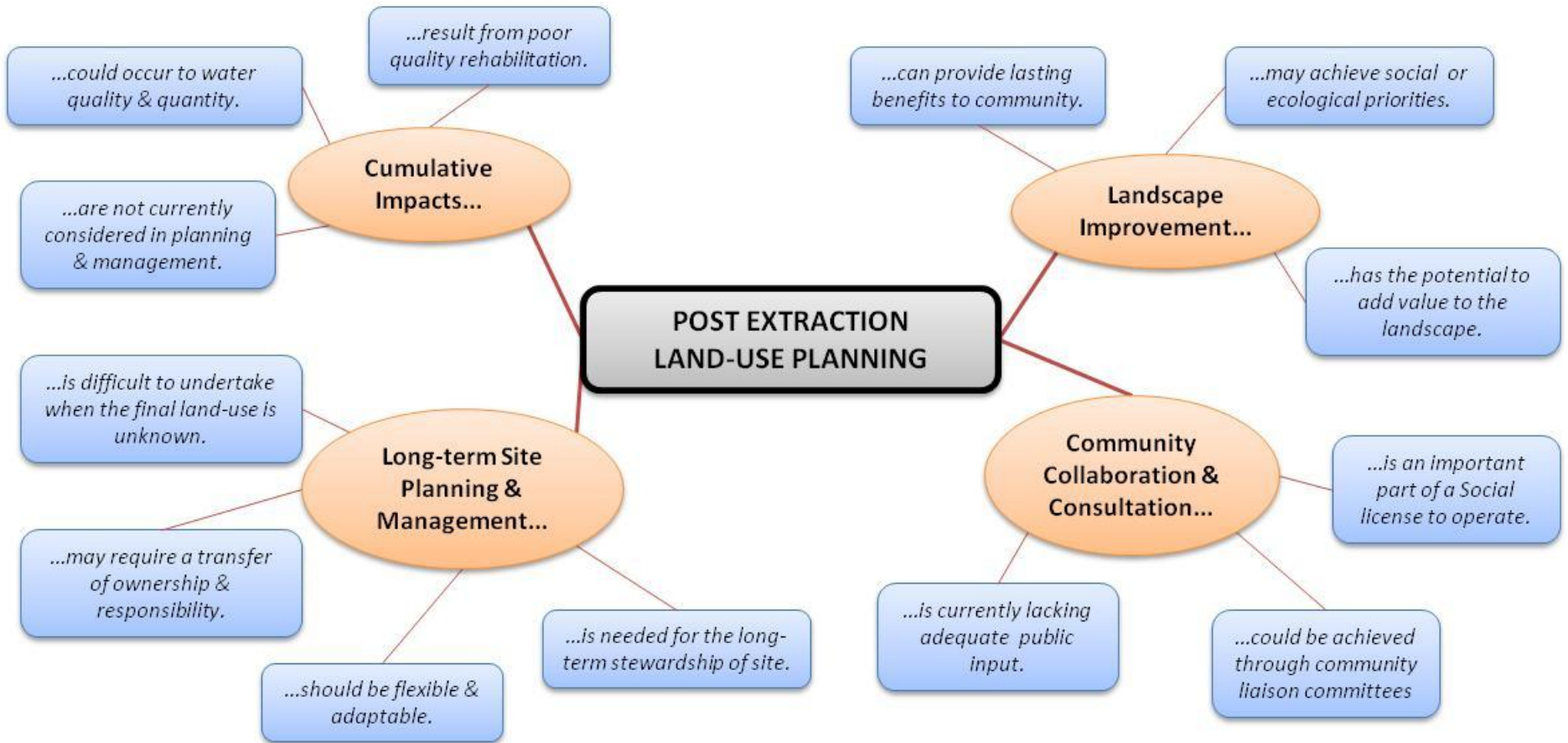


Figure 20: Thematic Network for Global Theme of Post Extraction Land-Use Planning

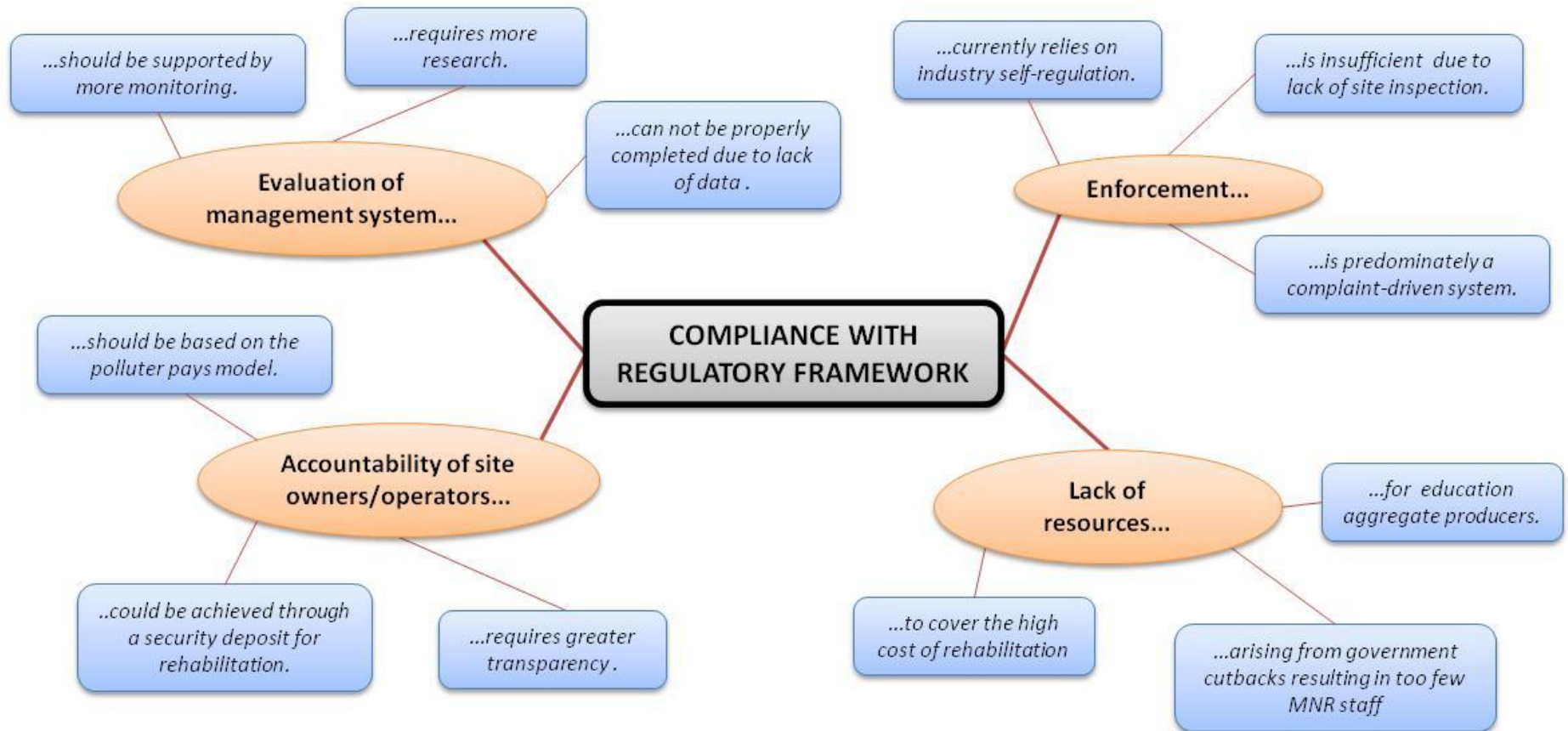


Figure 21: Thematic Network for Global Theme of Compliance with the Regulatory Framework

4.5 CONCLUSION

The results presented in this chapter highlight the slight improvement that has occurred to the amount of land being rehabilitated between 1992 and 2011, but do not consider the legacy of un-rehabilitated land prior to the early 1990's. In addition, it is clear from an analysis of the rehabilitation statistics for the past 20 years that there is a growth in land that is left disturbed from aggregate operations as not enough rehabilitation is occurring. The assessment of rehabilitation plans highlighted the need for more field-based research on this topic. However, broad conclusions can be drawn that the level of detail and specification in these plans is not sufficient to guide high-quality rehabilitation activities. Data analyzed and organized from the actor interviews revealed three key thematic networks: 1. Operational Standards & Practices, 2. Post-Extraction Land-Use Planning, and 3. Compliance with Regulatory Framework. These thematic networks characterize numerous opportunities and challenges presented by the current rehabilitation process and help to explain the current rate of aggregate site rehabilitation occurring in Ontario. These results will be further discussed in the following section and used to answer the core and sub research questions posed in this study.

- Chapter 5 - Discussion of Study Results

5.1 INTRODUCTION

In this chapter, the results of the analysis of the rehabilitation statistics, rehabilitation plan review, literature and policy review, and actor group interviews are merged and evaluated in order to answer the core and sub-research questions of this study. Table 11 (pg.100) summarizes the relationships between the research questions examined in this study, research strategies utilized, and the corresponding results derived from the data analysis. The following discussion is organized by research question.

Table 11: Summary of Study Results in relationship to the Study Framework

THEME	RESEARCH STRATEGY USED TO IDENTIFY THEME	CHALLENGE/ OPPORTUNITY	RESEARCH QUESTION ANSWERED
<i>Operational Timelines</i>	- Rehabilitation plan review - Actor group interviews	Challenge	What is the rate of rehabilitation occurring? Is it adequate?
<i>Extraction Process</i>	- Actor group interviews	Challenge	What is the rate of rehabilitation occurring? Is it adequate?
<i>Rehabilitation Plans</i>	- Rehabilitation plan review - Actor group interviews	Challenge	What is the quality of rehabilitation occurring? Is it adequate?
<i>Cumulative Impacts</i>	- Analysis of rehabilitation statistics - Literature & policy review	Challenge	What are opportunities & challenges for the rehabilitation process?
<i>Long-term Site Planning & Management</i>	- Actor group interviews	Challenge & Opportunity	What are opportunities & challenges for the rehabilitation process?
<i>Community Collaboration & Consultation</i>	- Actor group interviews - Literature & policy review	Opportunity	What are opportunities & challenges for the rehabilitation process?
<i>Landscape Improvement</i>	- Actor group interviews - Literature & policy review	Opportunity	What are opportunities & challenges for the rehabilitation process?
<i>Enforcement</i>	- Actor group interviews - Literature & policy review	Challenge	Is the current policy framework effective?
<i>Resources</i>	- Actor group interviews - Literature & policy review	Challenge	Is the current policy framework effective?
<i>Evaluation of Management System</i>	- Actor group interviews - Literature & policy review	Challenge & Opportunity	Is the current policy framework effective?
<i>Accountability of producers</i>	- Actor group interviews - Literature & policy review	Challenge & Opportunity	Is the current policy framework effective?

5.2 THE RATE OF AGGREGATE SITE REBILITATION OCCURING IN ONTARIO

5.2.1 *What is the Rate of Rehabilitation Occurring? Is the Rate of Rehabilitation in Ontario Adequate?*

The results of the analysis of the provincial rehabilitation statistics for the time period of 1992-2011 illustrate that the rate of aggregate site rehabilitation occurring in Ontario leaves an ever-increasing amount of land disturbed from aggregate operations. The observed trends in the fluctuating rate of rehabilitation and land disturbance in the Guelph MNR District and Province of Ontario cannot be explained by the data collected and analyzed in this study and require further exploration (e.g. the relatively high rehabilitation rate around 2003 for the Province of Ontario). It is possible that fluctuating economic conditions and corresponding market demand for aggregate products could play a role in the amount of land that is disturbed and rehabilitated each year.

An average of 78% more land is being newly disturbed than newly rehabilitated each year. Of the amount of land that is originally disturbed from aggregate operations, at the start of each new year of production, only about 2.3% of this disturbed land will be rehabilitated to its previous land condition or another suitable land-use. Because there is a difference between the amount of land newly rehabilitated and newly disturbed each year, there is a net addition to the original disturbed land of about 1.7% each year.

Because of the variation of aggregate deposits, market fluctuations, and current extraction practices occurring on active aggregate sites in Ontario, increasing the rate of rehabilitation to better match the rate of disturbance is a complex but necessary change that must occur in the aggregate industry. The past 19 year trend indicates that the rate of rehabilitation has not significantly improved and that the current rate of rehabilitation occurring is likely too slow to

compensate effectively for social and environmental impacts caused by the extraction process. Despite this conclusion, the data statistically analyzed in this study limits the reliability of the observed results. The past 19 years of rehabilitation statistics that were collected and analyzed in this study, were voluntarily provided by aggregate producers and have not been verified by a third-party for accuracy. In addition, observable variances in the data (i.e. the spike in rehabilitation that occurred in the Guelph MNR Management district in the year 2003) cannot be explained by this data set and again bring into question the legitimacy of the conclusions drawn in this study. More work is needed to verify the results interpreted in this study by completing a similar assessment of rehabilitation figures that are legally required on annual *Compliance Assessment Reports* that are submitted by aggregate producers to the MNR. Additional research is also required to more comprehensively understand fluctuations that occur in the amount of land that is disturbed and rehabilitated each year. For example, how does the life of a site licence effect the rate of rehabilitation, how is rehabilitated land calculated (e.g. would a water feature count as rehabilitated land?), are aggregate producers accurately reporting annual rehabilitation figures? These factors need to be more strongly considered and better understood in determining the adequacy of the current rate of aggregates site rehabilitation occurring in Ontario.

All participants in the actor group interviews recognized that improvements could and should be made to the current rehabilitation process in order to increase the amount of disturbed land being reclaimed. Results of the actor group interviews further coincide with the findings of the analysis of the rehabilitation statistics. Because there is a net growth in the amount of disturbed land each year, in addition to a recognized need for improvement by actor groups, the conclusion can be drawn that the current rate of aggregate site rehabilitation in Ontario is inadequate (based on the definition present in section 1.5). It is important to make a distinction

between the rate and amount of progressive versus final rehabilitation occurring to further understand the aforementioned conclusion.

The problem is not that rehabilitation is not occurring. It is taking place, just not at an adequate rate to compensate for the amount of land left disturbed. Current policy dictates that in order for an aggregate site licence to be officially surrendered, final rehabilitation must first be completed to a condition that is deemed satisfactory by the MNR (see MNR 2006). The findings of the *SAROS* report (MNR 2010c) support the notion that *final rehabilitation* is occurring at a somewhat reasonable rate, while *progressive rehabilitation* is seriously lagging behind. Therefore, it is likely that the low rate of rehabilitation occurring for Ontario's aggregate sites, as determined by this study, should then be attributed to a lack of *progressive rehabilitation* occurring on active site licences. A lack of *final rehabilitation* is likely having a smaller impact on the observed trend. The purpose of progressive rehabilitation is to ensure that aggregate licences achieve a minimum level of disturbance on a site-by-site basis. Nonetheless, as indicated by the rehabilitation statistics for 1992-2011, and further corroborated by findings of the actor interviews, progressive rehabilitation for active aggregate sites in Ontario is occurring at an extremely slow pace in Ontario. The result is a rehabilitation timeframe that causes a massive lag of rehabilitated land versus land left disturbed from ongoing aggregate operations. The outcome is an overall low rate of rehabilitation. There are several key causes for this slow and inadequate rate of progressive rehabilitation occurring in the Province of Ontario.

5.2.2 Discussion of the Challenges Affecting the Rate of Aggregate Site Rehabilitation Occurring

The average rate of rehabilitation in Ontario shows no statistically significant improvement between the two time periods compared (1992-2001 and 2002-2011). Despite stricter legislation

implemented in the 1990s, in addition to a growing social and environmental responsibility among aggregate producers, the amount of rehabilitation occurring has not significantly improved over the past 19 years. Although more work is needed to better understand and legitimize this finding, there are several noteworthy challenges affecting the rehabilitation process, and corresponding rate of rehabilitation, that can help to make sense of these results. Data extracted and organized from the actor group interviews help to explain the low rate of progressive rehabilitation occurring in Ontario. The concerns raised in the Global Theme of **Operational Standards & Practices** identified from the actor group interview data help to explain the low rate of rehabilitation observed in the Province of Ontario (Figure 22). Within the Operational Standards & Practices thematic network, the observed challenges of *Operational Timelines* and the *Extraction Process* were identified by actor groups as barriers to rehabilitation and help to explain why there is a low rate of progressive rehabilitation for aggregate developments. The **Regulatory Framework** guides the creation of Operational Standards & Practices and is therefore included extraneously in the conceptual model (Figure 22), but will be explicitly discussed within the context of evaluating the effectiveness of the current policy framework in Section 5.5.

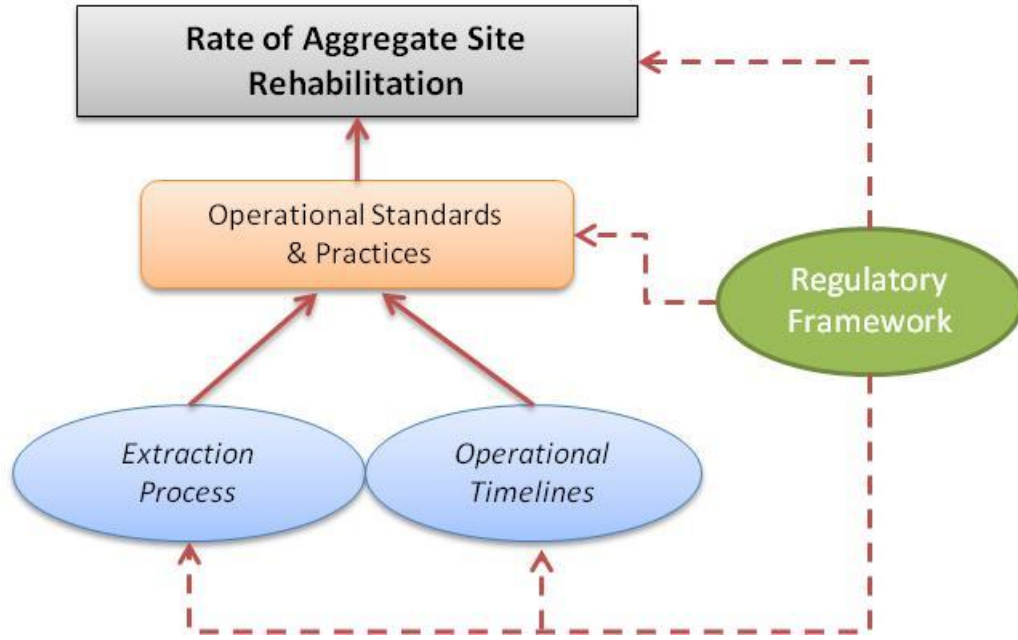


Figure 22: Challenges affecting the rate of rehabilitation occurring in Ontario

5.2.2.1 Operational Timelines

The organizational theme of *Operational Timelines* is defined as the timeframe in which aggregate material is extracted from an active aggregate site so that progressive and final rehabilitation can occur. The theme of *Operational Timelines* also includes the lifespan of a pit or quarry.

Operational Timelines affect the rate of progressive rehabilitation as there are no pre-established timelines in the operational plan that require progressive rehabilitation to occur. In addition, the speed and rate at which rehabilitation occurs progressively on a site is not mandated by existing regulatory frameworks. Operational plans and rehabilitation plans do require extraction and rehabilitation to occur in pre-planned, sequential extraction and rehabilitation phases, but these plans do not include concrete timelines. In addition, approved pits and quarries are not restricted by a predetermined lifespan or anticipated closure date (i.e. known colloquially in the industry as a “sunset clause”). The lack of fixed timelines for extraction phases and of a

target end-date for the lifespan of a pit prolongs the period during which rehabilitation can legally occur. Because timing for progressive rehabilitation is not regulated, it is the responsibility of the site operator to decide when the best time to complete rehabilitation is.

Fluctuating market demand for aggregate resources in Ontario also affects the rate at which aggregate sites extract material and complete progressive rehabilitation. The demand for the aggregate products required for infrastructure projects is closely tied to the current provincial economic condition. If the market demand for aggregate is high, many aggregate sites will be active and disturbing land in order to extract material. Once the aggregate material is fully extracted from one section of a site, progressive rehabilitation can occur.

Regulatory standards that mandate progressive rehabilitation require that extraction be done in a manner that exhausts part of a site before the next portion of the site can be extracted. This sequential extraction process ensures that extraction and subsequent progressive rehabilitation can be conducted in phases. But because the demand for aggregate material fluctuates, phases of a site will often remain open for extended periods of time even if very little, or no, material is removed due to a low demand for aggregate resources. During low demand periods, extraction may not be occurring, but the area is left disturbed. This is because operators are hesitant to rehabilitate (either progressive or final) only partially extracted phases in case demand picks-up again in the foreseeable future and extraction can once again occur at that location on the site. Land rehabilitation is a very costly endeavour and it is not economically sensible for the operator to complete if a portion of the site may have the potential for further extraction in the future. Because site-licences and individual extraction phases are not restricted by mandated closure and extraction timelines, a pit may remain active even though material is

not being removed. This prolongs the rehabilitation process resulting in land left disturbed. This challenge of operational timelines is illustrated by the following actor group quote:

“In terms of the rate of rehabilitation, I think it really depends on the lifespan of the pit which depends on how much resource a pit actually has, and it also depends on the market demand. So obviously if you have a large resource and a large quantity of material in a slow market demand, then that means very little of the material will be removed and the life of the pit goes on so there’s no rehabilitation.”

5.2.2.2 Extraction Process

The *Extraction Process* for aggregate sites can also be a challenge affecting the rate at which progressive rehabilitation occurs. The *Extraction Process* can be defined as the methods employed for extracting aggregate materials from operating aggregate site-licences.

One of the key factors influencing the extraction process is the variability in the deposits of material on the site – the location, depth, type, and quality of material is not homogenous. Simple sequential extraction on a site is not always feasible as variability in the deposits located on the site may dictate that the aggregate producer open and extract multiple site plan phases at once in order to meet market demand for certain types of aggregate products. Variability of the aggregate deposits and fluctuating market demands for specific kinds of aggregate material make it difficult to pre-plan the extraction process for the site so that timely progressive rehabilitation can occur. The quote below from the actor group interviews summarizes this obstacle for the extraction process of aggregate resources:

“The nature of the actual deposit will play a role, so some sites – if the deposit varies across the site, if it’s different in the middle than it is in the north or south end – sometimes the operator has more than one site area open at a time because they’re making different products.”

The *Extraction Process* may also require excavated areas of a site licence to remain disturbed in order to serve stockpiling and material processing functions. These areas can remain un-rehabilitated, and the site licence can remain active, even if new material is not being extracted. The use of the site-licence for the stockpiling and processing of material can continue for an unknown period of time and is a situation that further hinders progressive rehabilitation from occurring.

Grandfathering of older site licences occurred under the new *Aggregate Resources Act* and also plays a role in how extraction processes affect the rate of progressive rehabilitation occurring, on older aggregate developments. Some older site licences (i.e. pre ARA), are still in operation today, and follow a site plan that was not required to be pre-planned prior to extraction. “Grandfathering provisions” (see MNR 2006) allow aggregate producers with older site licences to operate and extract material in a manner that is not in-line with current industry practices (including progressive rehabilitation), given that they were approved before the assent of the *Aggregate Resources Act* (pre 1990). When these sites were first developed, in some cases more than 25 years ago, progressive rehabilitation was not yet an industry standard. Therefore, the traditional extraction process of older aggregate sites presents a barrier for the completion of progressive rehabilitation. These sites were never intended to, or designed, to be progressively rehabilitated.

5.3 THE QUALITY OF AGGREGATE SITE REHABILITATION OCCURRING IN ONTARIO

5.3.1 What is the Quality of Rehabilitation Occurring? Is the Quality of Rehabilitation in Ontario Adequate?

A decisive conclusion on the quality of rehabilitation occurring in Ontario cannot be made based on the assessment completed in this study. Additional research, including extensive field

assessments and surveys, is needed to complete a more comprehensive analysis of previously completed and ongoing aggregate site rehabilitation. More work is also needed to monitor and evaluate the long-term success of completed rehabilitation efforts.

5.3.2 Challenges Affecting the Quality of Aggregate Site Rehabilitation

Current and past **Operational Standards & Practices** for aggregate site management guide the implementation of rehabilitation activities for aggregate sites in Ontario. The current **Regulatory Framework** also plays a key role in the quality of aggregate site rehabilitation occurring in Ontario and is further evaluated in Section 5.5. The actor group interviews did reveal a number of significant perceptions regarding the quality of rehabilitation of aggregate site rehabilitation in Ontario. The consensus among the members of the actor groups interviewed is that there are excellent examples of good quality aggregate site rehabilitation, specifically within Southern Ontario, but there are also cases of sites that have rehabilitated poorly. The actor group interviews revealed that many different factors influence the outcome of completed rehabilitation, such as the cost of rehabilitation, the education level of the site owner/operator, and access to materials needed to perform rehabilitation activities. However, actor group representatives speculated that inadequate *Rehabilitation Plans* were the principal challenge affecting the quality of rehabilitation occurring in Ontario (Figure 23). The actor group interviews and the rehabilitation plan review completed as part of this study revealed several specific concerns with rehabilitation plans and the corresponding rehabilitation that may be taking place in the field.

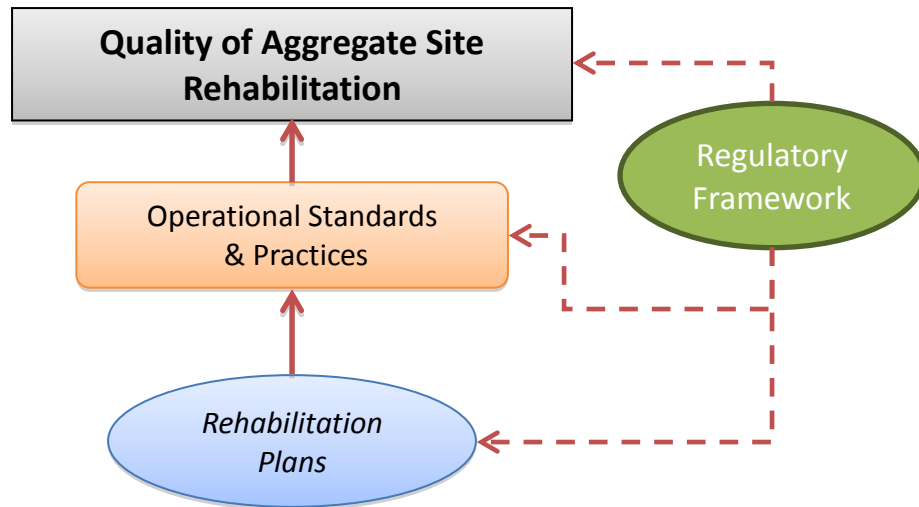


Figure 23: Challenges affecting the quality of rehabilitation occurring in Ontario

The quality of completed rehabilitation is likely contingent on a number of factors such as the historic use of the land (e.g. agricultural versus natural), the extraction process used to remove aggregate resources (e.g. below versus above water table extraction), and the expected final land-use for the site (e.g. industrial land-use versus a naturalized land-use). Therefore, assessing rehabilitation quality with narrow and rigid parameters may not result in an effective evaluation of the site condition. Instead, the assessment of rehabilitation quality should be broadly based on the ability of the site to achieve pre-defined rehabilitation goals (i.e. social, environmental, or economic) and integrate successfully with the land-use planning vision for the site and adjacent lands. Some general criteria for assessing aggregate site rehabilitation quality should include:

- Adequate conversion of the land to the pre-determined final land-use.
- Compatibility and integration of the rehabilitated site with the surrounding landscape.
- Ongoing site management where required.
- Implementation of site design and rehabilitation practices that reflect current industry standards and best management practices.

5.3.2.1 Rehabilitation Plans

Aggregate site rehabilitation planning is a unilateral activity, completed prior to the approval and operation of an aggregate site. A rehabilitation plan is not required to be reviewed or adjusted during the life-time of the aggregate operation unless there is a significant change to the operation of the pit, such as a major adjustment in licence boundaries (see MNR 2006 for specifications). As a result, rehabilitation plans that were created 15 to 20 years ago, reflect old industry standards and are not updated to incorporate current best-management practices for rehabilitation activities. Binstock & Carter-Whitney (2001) concur with this finding and acknowledge that site plans, including rehabilitation plans, should be reviewed throughout the lifetime of the aggregate operation. It is not uncommon for rehabilitation plans to be implemented 20 years after they were first created. A lack of review means that older rehabilitation plans may not meet or achieve the objectives of future land-use planning scenarios and the standards for rehabilitation practices of the day. This problem is identified in the quote below from one of the actor group interviews:

“What I would like to see is the ability to open up a site plan again – to sort of retroactively go back – and apply what has now become the best management practices in terms of rehabilitation; the approaches that we’re using in the new site plans.... Right now, the operators in some instances are able to hide behind the poor wording or the lack of detail with regards to progressive rehabilitation that is associated with their old plans. In some cases, the plans are years and years old, so they reflect in the bad old days rather than the much better rehabilitation practices that have developed over the years.”

One of the most common problems affecting rehabilitation quality, as noted by participants in the actor group interviews, was the broad procedures and ambiguous wording used in many rehabilitation plans. The assessment of rehabilitation quality conducted in this study also revealed that the *Provincial Standards* that guide the creation of rehabilitation do not require

detailed enough rehabilitation specifications. Eggert (1994) also observes that it is common for mining rehabilitation policy to impose only vague or qualitatively defined rehabilitation requirements. As a result, rehabilitation plans do not provide assurance that aggregate owners and operators will execute adequate quality progressive and final rehabilitation.

Rehabilitating a mine site is a complex process that, in some cases, attempts to re-establish and recreate a healthy, functioning ecosystem (Cooke & Johnson, 2002). Older rehabilitation plans, and even newer plans, do not contain enough detail and explicit specifications to facilitate the completion of high-quality rehabilitation. Accordingly, the presumption can be made that poor rehabilitation plans will result in poor quality rehabilitation and this will perpetuate cumulative landscape and social impacts. The following actor group interview quote supports this conclusion:

“As they [the rehabilitation plans] improve, then the rehabilitation quality improves as well, and they improve by becoming more specific and by doing a better job of implementing progressive rehabilitation.”

At a minimum, aggregate site rehabilitation plans should include a set of specific performance criteria, detailed methods for achieving these performance criteria, timelines for the completion of the performance criteria, and a system of monitoring or evaluating the success of rehabilitation efforts. Mchaina (2001) agrees that these four principles are essential in the environmental planning process for mine closure, decommissioning, and reclamation.

A key method for improving the quality of rehabilitation plans would be to tie specific rehabilitation activities with corresponding benchmarks and performance indicators. These types of technical specifications are not currently required in aggregate site rehabilitation plans.

Mchaina (2010) concludes that the key to effective rehabilitation planning is to work towards

achieving expected end-use conditions through the establishment of performance criteria, prior to commencement of mining operations. Mining operations can then be carried out in a manner that will support the outcome of the rehabilitation plan when it is implemented many years later. Eggert (1994) draws an important connection between the application of modern rehabilitation techniques and the significant reduction of long-term impacts. Thus, performance criteria should form the foundation of newly created mine closure and aggregate site rehabilitation plans.

5.4 DISCUSSION OF THE OPPORTUNITIES AND CHALLENGES FOR AGGREGATE SITE REHABILITATION IN ONTARIO

5.4.1 What Opportunities and Challenges for Actor Groups are presented by the Rehabilitation Process?

The organization and sub-themes related to the global theme of **Operational Standards and Practices** help to explain the rate and quality of aggregate site rehabilitation occurring in Ontario. The global theme of **Post-Extraction Land-use Planning** indicates some additional challenges and opportunities to the rehabilitation process (Figure 24) examined in this section, including: *Cumulative Impacts, Long-Term Site Planning & Management, Community Collaboration and Consultation, and Landscape Improvement*. Evaluating and understanding these challenges and opportunities can lead to improvements in the rate and quality of rehabilitation occurring through adjustments to the regulatory framework.

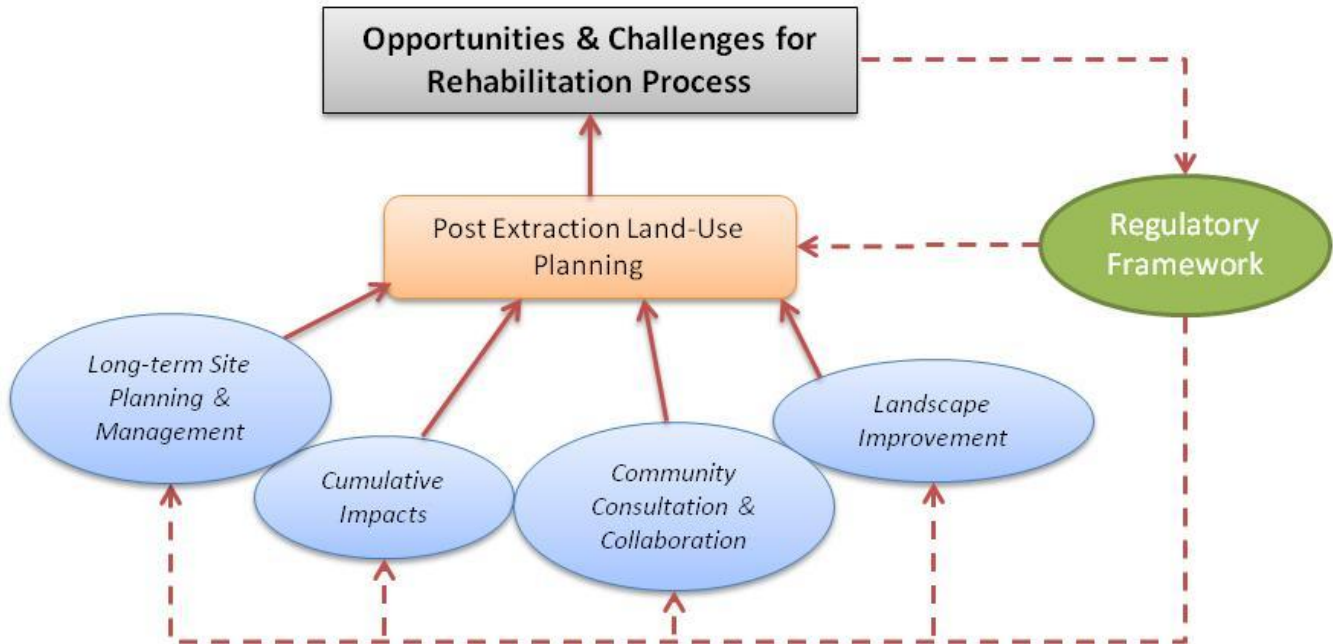


Figure 24: Opportunities & Challenges Relating to Post-Extractive Planning

5.4.1.1 **Cumulative Impacts**

The policy and literature review conducted as part of this study affirmed the important role that pit and quarry rehabilitation plays in abating the environmental impacts that result from the extraction process. The analysis of the rehabilitation statistics concluded that the current rate of rehabilitation occurring in Ontario could be resulting in adverse cumulative impacts as there is a net growth in disturbed land each year. This concern, which has also been raised by the Environmental Commissioner of Ontario (2011), emerged as a theme during the actor group interviews. If rehabilitation is not conducted at an adequate rate or quality, cumulative impacts augmented by poor quality rehabilitation will perpetuate poorly functioning ecosystems. For example, if agricultural productivity (e.g. soil quality, nutrients, infiltration etc.) is not sufficiently rehabilitated, there will be a loss in productive agricultural land. The impacts of aggregate extraction may seem minimal and temporary in comparison to other open-pit mining industries that create toxic tailings; however, these relatively modest impacts of individual

aggregate extraction sites accumulate when a number of operations are located in close proximity to one another, resulting in a greater net impact to the landscape. The clustering of aggregate sites further escalates the concern regarding cumulative impacts, as the highest quality aggregate deposits are also located in areas of significant social and ecological value (e.g. The Oak Ridges Moraine and The Niagara Escarpment) (ECO, 2011). Cumulative impacts from aggregate extraction in Southern Ontario can have negative effects on the environment as well as social and cultural heritage (e.g. the loss of agricultural land). Adequately timed and good quality rehabilitation can help to mitigate and decrease aggregate related cumulative impacts on the landscape.

The uncertain cumulative effects of aggregate extraction activities on water quality and quantity are of particular concern to many Southern Ontario communities that draw drinking water supplies from groundwater sources. This concern is understudied and the cumulative effects on ground water flows from the extraction of aggregate below the water table are unknown. In order to understand this concern better, there is need for more comprehensive and consistent data for assessing the cumulative impacts of aggregate extraction below the water table on the watershed and sub-watershed level. The responsibility for the collection of this necessary information (i.e. the development and undertaking of cumulative effects assessment) should be the joint-responsibility of the aggregate industry, provincial government, and local government (including conservation authorities). It is necessary to involve all stakeholders involved to ensure accountability, transparency, and the accurate interpretation and dissemination of results. Nonetheless, funding for such projects should be chiefly the responsibility of the industry that profits from the extraction of aggregate resources. This type of assessment is has occurred for the Grand River Watershed (see Grand River Conservation

Authority, 2010), but should also occur for all aggregate producing watersheds in Southern Ontario. Once cumulative watershed impacts are better understood, subsequent best management practices and regulatory tools can then be developed to manage and minimize the known impacts. Current aggregate regulation and licensing should employ the precautionary principle and assume that below water table extraction will result in negative cumulative impacts to groundwater sources. Operational strategies, including rehabilitation planning, should be developed and implemented to minimize the impacts of below water table extraction on the watershed.

The suspected cumulative impacts resulting from aggregate extraction in Southern Ontario are not a concern currently addressed by the aggregate planning and management regulatory framework. The approval process for a proposed aggregate operation does not consider the effects that a new pit or quarry may have in combination with existing aggregate developments or anticipated future extraction sites within a geographic area. There is no explicit mention of cumulative impacts in the *Aggregate Resource Act* or supporting provincial policies. Aggregate developments are assessed and approved on a site-by-site basis and very few considerations are made for activities occurring beyond the proposed licence boundary. Broad level and general considerations for the environmental and social impact of aggregate sites are included in municipal land-use planning processes (official plans and zoning by-laws), but these local tools cannot restrict an aggregate development on the premise of anticipated negative cumulative effects. Because the current regulatory framework for the approval of new aggregate operations does not consider cumulative impacts, rehabilitation (especially progressive rehabilitation) plays an even greater role in abating the environmental impacts of the aggregate extraction process (i.e. reducing erosion, restoring habitat, ripping compacted surfaces to allow for water infiltration).

In conclusion, more effective landscape level rehabilitation efforts could be completed if rehabilitation planning were completed at a broader scale by including multiple sites into one unified, comprehensive rehabilitation vision. Effective long-term site planning and management, in combination with a landscape level approach to rehabilitation, is the most ideal approach to limiting the lasting negative impacts of aggregate extraction.

5.4.1.2 Long-term Site Planning & Management

Aggregate extraction is an interim use of the land and rehabilitation prepares the land for its subsequent land-use. Rehabilitation efforts should result in a site condition that is equal to or possibly even superior to the original state of the land (i.e. increase in biodiversity or agricultural productivity). This end goal requires sufficient long-term planning as well as ongoing post-rehabilitation management to maintain the function and quality of a rehabilitated site (Mchaina, 2001). Achieving this objective also requires a predetermined process for determining whether or not a rehabilitated site sufficiently meets the standard of “equal to or superior to” the initial condition. Depending on the final rehabilitated land-use of the site, stewardship of the land is often required to ensure and achieve lasting environmental integrity (e.g. the replanting of vegetation that fails to establish, removal of invasive species, erosion control, soil amendment etc). Long-term monitoring should be conducted in order to assess the success of rehabilitation efforts and make management revisions if required. This includes observing changes in the site condition over time, after rehabilitation has occurred, and managing any unanticipated impacts such as the ones mentioned in the actor group quote below:

“But what a lot of people don’t really talk about is the after-use – you know, once the pit is gone, what happens then? If it is a farm with different pesticides or fertilizers, they’ll leach into the groundwater supply, or if it’s a golf course – again, what are the risks from the use of the land as a golf course to the land afterwards? Because you’re stripping a lot of the top soil and you’re minimizing that overburden, which

kind of filters out some of those potential contaminants. And those are some of the unknowns.”

Because the life-span of an aggregate site can be so long (20+ years), it is difficult to anticipate the most desirable final requirements for rehabilitation, due to surrounding land-use change, unanticipated environmental changes, and improvements in best-management practices. Currently, rehabilitation planning only occurs during the approval stage of a proposed site and usually includes flexibility for the final designated land-use. However, instead of only occurring at the beginning of aggregate operations, rehabilitation planning should continue, through regular reviews and adjustments throughout the lifespan of the pit in order to provide adaptability and flexibility and better respond to changes both within and outside of the licence boundary. Rehabilitation planning should be a dynamic and adaptive process and currently it is failing in this regard.

In situations where the land is restored for recreational or environmental conservation purposes, aggregate producers are keen to transfer the land to public ownership once the site has been rehabilitated. Although this may seem like an ideal situation, as the rehabilitated land can then be used to achieve social and ecological values in perpetuity, transferring the site to public ownership relinquishes any future obligation of the aggregate producer to manage and maintain the site properly. Under these circumstances, the public authority (e.g. local municipality or conservation authority) would then become responsible for the long-term management and maintenance of the site and any subsequent costs. Because of concerns with long-term management costs as well as liability issues with sites that contain open-water, public authorities are often hesitant and reluctant to take on the ownership responsibilities attached to rehabilitated aggregate sites.

The responsibility for the long-term stewardship is often an issue of debate and should be considered early in the rehabilitation planning processes. All stakeholders with a vested interest in the site should be included in the planning process in order to establish early commitments to the long-term management and maintenance of the site.

5.4.1.3 Community Collaboration & Consultation

Adequate and effective rehabilitation planning is not an easy task and is further complicated by competing land-use values and uncertainties regarding the final-land use of the site. The long lifespan of pits and quarries can make effective and suitable rehabilitation planning an onerous task for both municipal planners and aggregate producers. In addition, proposed aggregate operations are often met with vehement opposition from the local community. The planning challenge of siting aggregate developments could benefit from improved public participation throughout the lifespan of the pit, not just during the approval stage. Conclusions drawn from the literature review, conducted as part of this study, indicate that better public consultation and community engagement can result in greater public acceptance for contentious projects (Hilson, 2002; Lake, 1987). Better public consultation for aggregate sites can also facilitate rehabilitation efforts that provide a final-land use vision that is fully accepted and provides ecological and social value to the community. The importance of community collaboration and engagement is highlighted in the following interview quote:

“Community and public engagement – we’re starting to see that more and more people are interested in what’s going on in their neighbourhood and what’s happening on that site next door and so probably when the local community is more interested in the rehabilitation, it probably plays a r role in what happens”

One of the conclusions derived from the actor group interviews, was the sentiment that members of the public or other interested organizations are not afforded appropriate consultation

opportunities during the approval process for aggregate sites. Collaborative planning increases the effectiveness of public consultation in resource management and planning processes, by actively encouraging members of the public to participate in the decision-making process (Gunton, Peter, & Day, 2006). Collaborative planning promotes active involvement of the public in aggregate activities through the lifespan of the pit and ensures that rehabilitation efforts are supported by the community.

Collaborative planning is a contemporary approach to dealing with complex and contentious land-use decisions. Collaborative planning strategies engage all actor groups with a vested interest in the site and work to compromise differing values. This allows for the development of plans and management strategies through consensus-based negotiations (Gunton, Peter, & Day, 2006). Although still in its infancy, collaborative planning has been recognized as providing numerous benefits such as improved relationships among stakeholders and an increased understanding about the proposed project (Gunton, Peter, & Day, 2006). Collaboration between industry, municipalities, and members of the public helps to establish positive relationships and can increase the support for the extractive land-use. If the public is more actively involved in the decision-making process, there will be less resentment towards the project and members of the public feel that they have greater control over the management and operation of the site (Lake, 1987).

Public liaison committees are collaborative planning tools that can be implemented to facilitate the inclusion of the public in planning and decision-making, throughout the lifespan of the aggregate development. In addition, these types of committees are a useful forum for establishing and maintaining a list of contacts within the community (De Loë, Di Giantomasso, & Kreutzwiser, 2002). These committees meet several times a year and ensure open lines of

communication between aggregate producers and the local community. Because rehabilitation planning needs to be flexible and adjustable to better adapt to changes in the site condition and surrounding land-uses, public liaison committees can ensure that adjustments to rehabilitation plans meet the needs of the community. In addition to increased public consultation, using rehabilitation efforts to provide a net social or ecological benefit to the community through landscape improvement also works to improve the public perception and acceptance of the aggregate industry.

5.4.1.4 Landscape Improvement

The purpose of rehabilitation is to restore the site to its former use or condition, or to another use or condition that is compatible with the adjacent lands. While not required by current regulatory frameworks, restoring the site to a state that is superior in quality to the original quality of the land, can provide host communities with a net gain in environmental and/or social value. Improving the original condition of the site, to a use valued and supported by the community, serves as a form of compensation for tolerating the aggregate extraction operation. Thus, landscape improvement offers a strategic opportunity for aggregate site rehabilitation planning.

Pits and quarries are often viewed by the public as undesirable scars on the landscape. Moreover, part of the controversy surrounding the establishment of new aggregate site is often the unknown condition of the site after extraction is complete. A poor legacy of rehabilitation in Ontario has further compounded this public concern. Although rehabilitation continues to be a challenge facing the aggregate industry, the restoration of the site post-extraction also offers a unique opportunity to provide future benefits to the landscape that may not have been possible with the original site condition. Examples of landscape enhancement can include: increasing the

quality of agricultural land to support the production of food and speciality crops, turning pits into passive and active recreational amenities, and establishing terrestrial and aquatic landforms that provide habitat for native and/or endangered species.

Improving the original condition of the land through aggregate site rehabilitation efforts provides an opportunity to overcome the perception that aggregate extraction results in permanent landscape scars. Landscape improvement also demonstrates a commitment of aggregate producers to be responsible stewards of the land and achieve the vision of aggregate extraction as a temporary use of the land. Members of actor groups interviewed as part of this study also felt that it was imperative for rehabilitation efforts to achieve a post-extractive landscape condition that is equal to, or better than the original condition of the land:

“So I believe 100% that if the community sets its goal properly in consultation with the aggregate producer, that that can be achieved. There is an expectation that it [the rehabilitation] has to be the same or better.”

As rehabilitation standards continue to improve, so does the potential and opportunity for worked-out sites to achieve socio-economic and ecological priorities of the community through landscape enhancement. The development of new best management practises, greater involvement of the community, and collaboration between stakeholders can make landscape improvement a new industry standard. But ongoing research and monitoring is needed to better inform the development of best management practices to ensure that landscape improvement efforts result in long-term success.

The promise of landscape improvement 20 or so years after the approval of an aggregate project may not be enough of an incentive to encourage communities to accept aggregate extraction projects. However, planning for added value of the site post-extraction (either socially,

environmentally, or economically), along with timely progressive rehabilitation and more effective public consultation and collaboration measures, can play a significant role in reducing land-use conflict.

5.5 EVALUATION OF THE EXISTING POLICY FRAMEWORK

The results of this study highlight some major deficiencies in the current regulatory framework. In many cases, these deficiencies are a root cause for the observed poor rate of aggregate site rehabilitation occurring in the province and significantly influence rehabilitation quality. Shortcomings in the current regulatory framework result in problems with the rehabilitation rate and quality and also perpetuate land-use conflicts and adverse environmental and social impacts (Figure 25). Consequently, an increased rate and quality of rehabilitation would reduce land-use conflict as well as social and environmental impacts. **Operational Standards and Practices** are developed under the direction of the current legislation and policy, (i.e. notably the *Aggregate Resources Act*). Thus, the challenges resulting from current operational standards and practices are a result of shortcomings in current legislation and corresponding policy direction. The challenges and opportunities for the rehabilitation process that relate to **Post-Extractive Land-Use Planning** are more indirectly linked to current policy frameworks in the Province of Ontario, but are still a result of prevailing ideologies represented in the policy.

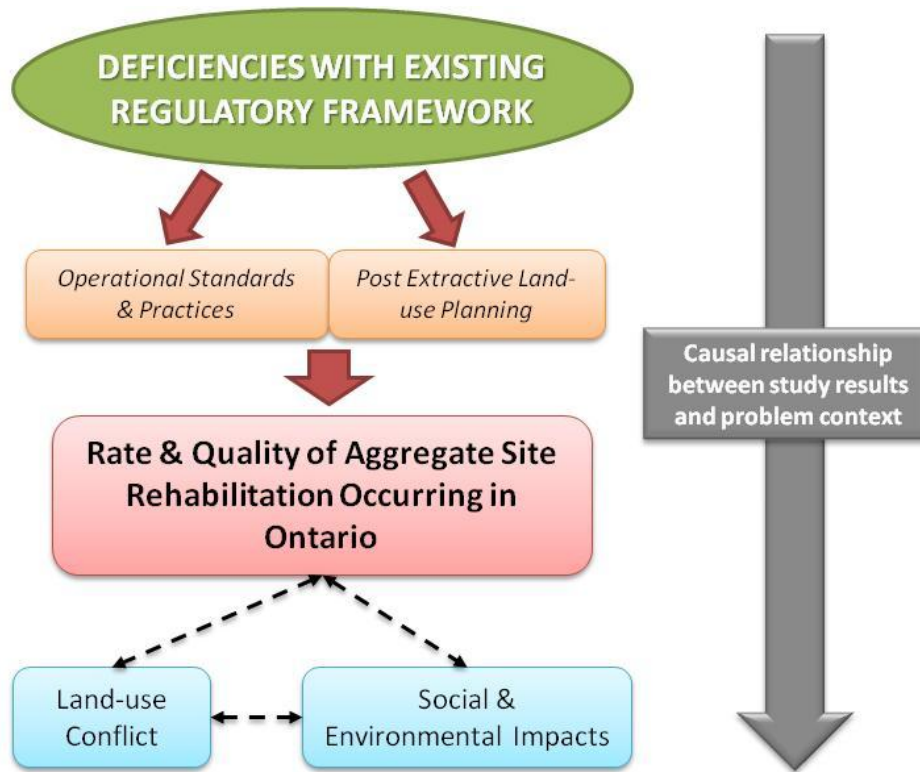


Figure 25: Diagram illustrating the causal relationship between deficiencies in the current regulatory framework and observed rate and quality of aggregate site rehabilitation occurring in Ontario

The challenges stemming from the current policy framework for the management and planning of aggregate resources are numerous and complex. Perceptions gathered from the actor group interviews shared a general consensus that the Provincial Government, via the Ministry of Natural Resources, is the most appropriate agency for overseeing the planning and management of aggregate resources in the Province, given that aggregate resources are a significant provincial interest. However, most members of the actor groups also felt that relationships with municipalities and other agencies involved with aggregate issues would benefit greatly from improved collaboration, thereby facilitating joint responsibility for planning and management activities. A similar finding by Baker, Slanz, & Summerville (2001) also called for greater local participation in aggregate related land management issues.

Several actor groups interviewed, as well as authors cited in the policy review, raised concerns regarding the process for regulatory reform and development for aggregate resources in Ontario. Representatives from the local government, environmental non-government organizations, and community-based actor groups felt that the core values that they advocate for are not equally reflected in the definition of current aggregate management requirements. The current process for developing and defining aggregate management policy in Ontario is influenced largely by the industry actor group who has the greatest ability (resources, staff, etc.) to lobby and leverage political support, thereby influencing corresponding policy outcomes in favour of aggregate extraction. This partiality is reflected in the current version of the Provincial Policy Statement (2005), which favours aggregate extraction over other land-use values. Corresponding legislative and policy initiatives follow this preferential treatment of aggregate resources. This inequity of political power results in a unilateral system of decision-making that further perpetuates land-use conflicts during the implementation of aggregate policies at the project level. Opponents of the current aggregate management and policy framework in Ontario feel disempowered by the current policy reform and development processes. This is likely the explanation for the prevalence of aggregate related cases heard by the Ontario Municipal Board each year. A growing effort is being made to “level the playing field” through industry initiatives that seek to foster collaborative relationships with other actor groups in an effort to create mutually beneficial partnerships (e.g. Professors Lake in Brampton, Snyder Flats in the Township of Woolwich, and Don Valley Brick Works Park in Toronto). The recent Aggregate Resources Act Review, which was completed by the Standing Committee on General Government in spring 2012, also attempted to facilitate a transparent and equitable process for policy revision and reform.

Results from the actor group interviews, as well as the policy review, indicate that the policy framework itself is legitimate and has undergone many improvements since first coming into force in the early 1970s (i.e. the *Pits and Quarries Control Act*). As with any policy framework, changes in the political landscape, economic values, and expectations of citizens require ongoing policy revision to rectify observable inadequacies once implemented. As determined in this study, the specific regulatory related challenges of *Resources, Enforcement, Aggregate Producer Accountability, and Management System Evaluation* were all identified as flaws resulting from a lack of clarity and ineffectual administrative capacity for the current policy framework. Results of this study indicate that evaluation and reform are needed for existing aggregate planning and management regulatory frameworks in Ontario.

5.5.1 Enforcement

A lack of sufficient enforcement was the principal regulatory challenge identified in this study as having a negative effect on the rate of aggregate site rehabilitation occurring in Ontario. This finding is also supported by Binstock & Carter-Whitney (2011), ECO (2011), ECO (2005), Winfield & Taylor (2005), and Baker & Shoemaker (1995). Correspondingly, it was determined that the legislative requirements for aggregate site extraction and rehabilitation in Ontario are not strong enough to facilitate and guide the adequate management of aggregate resources. This regulatory deficiency cultivates a low rate of rehabilitation and is significantly compounded by a lack of enforcement occurring in the field by the appropriate management authority.

Aggregate inspectors are staff members of the Ministry of Natural Resources that have the role of ensuring that aggregate producers comply with the *Aggregate Resources Act*, subsequent regulations, approved site plans, and other conditions of the granted licence to operate. Aggregate inspectors have the authority to inspect aggregate extraction sites and issue

compliance orders and notices as well as revoke licences in cases of severe violation. In some circumstances, charges can also be laid for serious non-compliance. If aggregate inspectors find that a pit or quarry operation is not completing progressive rehabilitation, in a manner that is compliant with the rehabilitation plan, a rehabilitation order can be issued. This legal order compels the aggregate operator to fulfil the requirements of the rehabilitation plan or face having the licence suspended or revoked. In this regard, the intention of the legislation and regulations is sufficient in authorizing enforcement activities to ensure that aggregate producers are following the law. The regulatory framework itself is sound, the problem with enforcement lies in the implementation of this directive.

In the mid-1990s aggressive cut-backs in the provincial government resulted in staffing shortages at many provincial ministries. Within the Guelph MNR Management two Aggregate Inspection Officers are responsible for ensuring the compliance with over 360 active and proposed aggregate licences, in addition to other duties such as reviewing site plan changes and applications for new sites. Due to the limited staff resources, the current enforcement system has converted into a predominately complaint-driven enforcement system. Inspections of an operating site, by an Aggregate Inspection Officer, generally occur if a member of the public makes a complaint raising concerns over non-compliance. If complaints are not made, then inspections of the site may only occur once a year or even less frequently. This low number of site visits occurs because, the *Aggregate Resources Act* does not require a preset number of inspections to occur at an active aggregate operation each year. Additionally, the ratio of Aggregate Inspectors in each MNR management district to the number of operating aggregate can be very high (i.e. two Aggregate Inspection Officers and 360+ operating aggregate sites in the Guelph MNR Management District).

The current method for enforcing the regulatory framework can also be viewed as a system of industry self-regulation (Miller et al., 2009). Aggregate Inspectors do complete random site inspections or inspections as a result of a public complaint; however, general compliance of the site licence operator is assessed through the submission of Annual Compliance Reports (as required by section 15.1 (1) of the *Aggregate Resources Act*). Annual Compliance Reports are completed by the operators of active sites and then sent to the local MNR office for review. Copies of the completed reports are also sent to the office of the host municipality in which the site is located. Annual compliance reports are publicly available documents that can be viewed by members of the public in local Ministry of Natural Resources offices. Ensuring that inspection and monitoring reports are transparent and publicly available will help to ensure accountability to both the industry and the regulator. Resulting compliance reports should be accessible and transparent. A lack of sufficient enforcement, resulting in a complaint driven system and corresponding industry self-regulation, is a flawed implementation of the objectives and purpose of the current regulatory framework for the management of aggregate resources in Ontario.

Industry self-regulation is a system that is described by King & Lenox (2000) as a regulatory structure that is likely to fall victim to “opportunistic behaviour”. The authors suggest that self-regulation, including self-reporting, in for-profit industries can result in ineffective regulation when sufficient sanctions or third-party intervention is not in place. Concerns regarding this system of compliance and enforcement in the aggregate industry in Ontario are summarized in the following actor group interview quote:

Self-regulation is okay to a degree, but you need enough staff resources to keep it honest, and I don't think that, right now, the MNR is sufficiently staffed to do that.

Enforcement, inspection, and compliance assessments should be conducted by a third-party agency that is independent from industry, such as the Ministry of Natural Resources. A non-government organization would be even more appropriate in this role as this type of agency would be less susceptible to industry lobbying and fluctuating political agenda-setting. The Cornerstone Standards Council (CSC) is a new aggregate certification initiative, originating in Ontario, which seeks to form this type of independent third-party review and oversight of the aggregate industry. Although still in its infancy, the CSC has been created for the purposes of improving the “conservation of the environment and community health and well-being in Canada by developing and implementing certification standards for aggregate extraction and use by the aggregate and construction industries within Canada” (CSC, 2012, para. 2). Similar to the Forest Stewardship Council model, this type of a collaborative arrangement between industry and other stakeholders could provide an “assurance system” that would result in greater accountability and properly managed aggregate resources.

Although a lack of enforcement was identified as a key challenge for aggregate management resources and may be a factor in the low rate of rehabilitation occurring, it should not be assumed that aggregate producers are not adhering to site plan guidelines and rehabilitation requirements. However, this was observed to be the perception of a number of actor groups interviewed. More research is needed to examine the issue of aggregate producer compliance with corresponding rehabilitation and site plan regulations.

5.5.2 Accountability of Aggregate Producers:

Enforcement, compliance, and accountability are closely associated in ensuring the expected outcome of policy frameworks. Aggregate producers have not only a legal obligation, but also a moral responsibility to be good stewards of the land and manage their operations in a

manner that is socially and environmentally responsible. Members of the actor groups included in this study felt that aggregate operators should be liable for their actions or inactions in regards to rehabilitation and other non-compliance issues. Results from the study interviews indicated that actor groups felt that the current regulatory framework does not have the capacity to ensure this accountability and this is a fundamental barrier to achieving adequate and timely rehabilitation.

The “polluter pays” principle can be applied to aggregate rehabilitation – those who disturb the land should be financially responsible for restoring (see Engel, Pagiola, Wunder, 2008). A per tonne royalty is paid to the Province, some of which is transferred to host municipalities as compensation for infrastructure maintenance costs. A very small amount of this royalty is used for the rehabilitation of abandoned pits and quarries, but is not used for rehabilitation activities conducted on active sites. The remainder of the revenue is paid to the province and host municipalities. Prior to 1997 a security deposit system, functioning as part of the regulatory framework, held aggregate producers financially accountable for ensuring that rehabilitation occurred (Baker, Slanz, & Summerville, 2001). Through the security deposit system a half cent royalty was levied, per tonne of aggregate produced, from operators and this money was held in a provincially managed rehabilitation fund (Baker and Shoemaker 1995). This financial model required aggregate producers to pay into a rehabilitation security deposit account, with the producers reimbursed if and when rehabilitation of the site was completed. If rehabilitation was not completed in a satisfactory manner, then the money held in the security deposit account would be used by the MNR to complete the necessary rehabilitation work. In the late 1990s this system was liquidated by the Province of Ontario due to insufficient resources and inefficiencies in the implementation and operation of the security deposit program (Region of Waterloo, 2008).

The current regulatory framework does not contain any financial securities or incentives to guarantee that the rehabilitation of worked-out sites occurs at all or within in a reasonable timeframe.

The MNR's *SAROS* report identified the need to collaborate with actor groups in order to evaluate the merits of a new industry incentive system for rehabilitation, explicitly the re-introduction of a security deposit type system (see MNR, 2010c). The need for an incentive system to ensure complete rehabilitation and operator accountability for the proper management of their sites is illustrated in the following interview quote:

“In other words, the operator would prepare a rehabilitation plan or remediation plan or whatever you want to call it and put up the money upfront so that there is a guarantee that, at the end of the day, there is money to undertake the rehabilitation.”

In addition to implementing a financial assurance system, actor group interviews also brought to attention the need to increase transparency between the industry, the regulating authority and the public to increase accountability. This could be achieved through better dissemination of information, such as Annual Compliance Reports, site plan information, non-compliance orders etc. This information is available to the public, but is not widely circulated and can be a challenge to acquire from the MNR as well as understand due to technical and legal jargon.

5.5.3 Management System

One of the important characteristics of successful policy development and implementation is the assessment of whether or not the current policy framework is effective in achieving its desired purpose and objectives. As outlined in the policy review conducted in this study, the aggregate management policy framework in Ontario has undergone numerous revisions in order

to strengthen the legislation and afford better protection to aggregate resources and the natural environment. Recently, another comprehensive evaluation and review process was initiated for the *Aggregate Resources Act*. In the spring of 2012, the provincial legislature's Standing Committee on General Government was convened to hear concerns from numerous actor groups regarding the current policy framework for the management of aggregate resources. This parliamentary review was conducted in response to the growing land-use conflict surrounding aggregate developments and corresponding concerns raised and publicized by several influential actor groups. The committee was adjourned and findings and recommendations are yet to be published by the Provincial Government. Until that time, modifications to the current regulatory framework for aggregate resources are unlikely.

The Parliamentary Standing Committee on General Government review of the current capacity of the *Aggregate Resources Act* is a fundamental process in the evaluation of the current policy framework. However, several key barriers currently exist that negate the feasibility and effectiveness of the current review process. These barriers, which limit the evaluation of the management system, were revealed during the actor group interviews conducted in this study. Primarily, more and higher quality research is required to determine the current state of aggregate planning and management in Ontario. This includes studies, like this one, that examine and evaluate the outcomes of the current policy framework. Transparent monitoring is also needed to assess rehabilitation efforts that have been completed in the past. This concern is acknowledged in the following actor group interview quote:

"I think our biggest concern is that very little is being monitored...and how difficult it is to get reliable information on what's being done."

It is important to determine what is happening “in the field” in order to consider the effectiveness of the current regulatory framework. More reliable research is needed to establish baseline figures for both the rate and quality of rehabilitation occurring. Monitoring of rehabilitation that has been completed in the past should be conducted to assess long-term success and incorporation with adjacent land-uses. In order to complete this research, better data storage and collection as well as monitoring should be a priority for both the MNR and industry. The present regulatory system requires only self-reported rehabilitation and disturbed area statistics from industry, which is a serious limitation that prevents the collection of objective information. Third party collaboration is needed to verify accuracy and proper information dissemination. More research on aggregate rehabilitation as well as more accurate and streamlined processes for collecting data can lead to more conclusive findings that can better inform policy review processes and result in stronger, more effective policy tools. It is essential for these data and research to be accessible and transparent to all actor groups in order to foster better relationships and more collaboration. In addition, this information can be used to better inform and educate aggregate producers in an effort to improve rehabilitation practices.

5.5.4 Resources

Financial resources, both from the perspective of the government and industry, are the number one challenge to the quantity and quality of rehabilitation occurring in Ontario. A lack of adequate financial resources within the Ministry of Natural Resources restricts the agency’s ability to enforce the aggregate site rehabilitation requirements. Between 1993 and 2006 the MNR’s annual operating budget was cut by 18% resulting in a loss of about 5,300 full-time jobs (ECO, 2007). Not enough staff are available to inspect aggregate activities thereby ensuring compliance with regulatory requirements. Conducting rehabilitation is an extremely costly

process for aggregate producers and the current system acts as an impediment as there is no incentive to complete rehabilitation activities (Miller et al., 2009). The result is a perpetuating cycle of slow rehabilitation.

As previously discussed, a lack of resources at the Ministry of Natural Resources results in insufficient aggregate site inspection and enforcement. This is a serious limitation of the current regulatory framework and has been recognized at the Ontario Municipal Board (OMB). In the 2010 Rockfort Quarry OMB hearing decision, the board did not approve the quarry application in part because it concluded that the MNR would not be able to sufficiently fulfill the requirements set-out in the Adaptive Management Plan prepared for the proposed quarry operation (Ontario Municipal Board, 2010). The Adaptive Management Plan for the proposed Rockfort Quarry was the primary mitigation tool suggested for the site and relied solely on the MNR for review, approval, and enforcement (Ontario Municipal Board, 2010). The OMB decision recognized the presence of significant natural and cultural resources located on the lands adjacent to the quarry application, and was not satisfied that the MNR could effectively enforce the mitigation measures that were outlined in the Adaptive Management Plan (AMP). The OMB determined that “there was nothing in the evidence...that gives the Board any certainty that even if it decided that it would be appropriate for the MNR to take on the responsibilities assigned to it in the AMP, that MNR has the resources to deal adequately with those responsibilities” (pg.71). This conclusion by the OMB clearly indicates doubt in the ability of the MNR to uphold its enforcement responsibility, due to lack of adequate staffing and other necessary resources. This is highlighted in the following quote from the OMB (2010) Rockfort Quarry board decision “The Board will not approve an aggregate proposal which leaves an issue

like the protection of the natural environment to be dealt with by a third party with demonstrably inadequate resources, like the MNR” (pg.71).

Several solutions to this problem have been proposed by actor groups – most notably, increasing the per tonnage royalty fees aggregate producers pay to the Province in order to support MNR staffing needs (Binstock & Carter-Whitney, 2011; Miller et al., 2009; Winfield & Taylor, 2005). This idea is summarized in the following actor group interview quote from this study:

“... the industry believes that [there is a need for better enforcement] too.... increase fees in order to put more money into the MNR aggregate program so they can hire more inspectors, process applications and site plan amendments, and do more inspection to make sure operators are doing the rehabilitation in a progressive fashion.”

Good quality rehabilitation is an expensive activity for aggregate operators to undertake (Miller et al., 2009) and often requires the purchasing of material, hiring of specialists, and use of heavy machinery to reconstruct the prior landscape (Cooke & Johnson, 2002). In addition, profit margins are often the lowest near the end of the lifespan of a mine, further straining the availability of financial resources (Cooke & Johnson, 2002). Aggregate extraction is a highly profitable industry, however the profit margins can vary greatly between large multi-national corporations and small-scale operations, which may only own and operate one or two sites. Large operators have more resources available (staff, equipment, expertise, funds etc.) to complete rehabilitation and often do so in light of greater public scrutiny. As revealed in the actor group interviews, a lack of resources by smaller aggregate operators, chiefly financial resources, impedes rehabilitation efforts and is mostly likely the leading cause for the extension of the life of an aggregate site long after extraction is complete. Within Ontario, small to medium

size operators hold the majority of site licences, while multi-national operators (e.g. Dufferin/Holcim, Lafarge, CBM/St. Mary's), hold only a few licences but extract large amounts of material from these sites.

Because aggregate site licences do not specify a site closure/surrender date for active aggregate sites, these developments can remain open, but inactive for many years as “zombie-pits”. It is speculated by the members of actor groups interviewed in this study that this strategy is used by aggregate producers to avoid completing rehabilitation activities when funds are low or not available. As soon as an active site licence is surrendered by the aggregate producer, final rehabilitation becomes a mandatory requirement for the site. Numerous factors affect the ability of aggregate producers to conduct rehabilitation; however, most of these factors can be linked to the high financial costs. This as demonstrated in the following quotes.

“... if no funds are available at the end of the life cycle of the pit, then the operator can only afford to do as much quality rehab as they can afford”

“The other difficulty is that sometimes, you may not have the material, and so you have to buy material; you have to buy the fill to bring it back in, and that's a cost of doing business, and some smaller or mid-sized operators just don't want to do that. So the rehabilitation may very well be stalled, and so, rehabilitation doesn't take place.”

Progressive rehabilitation encourages rehabilitation activities to occur sequentially in order to prevent the full financial burden for rehabilitation to occur at the end of the productivity of the site. In addition, the requirement of some type of security deposit provides assurance that rehabilitation will take place and also provides a source of funding to aggregate producers that can be used to complete restoration efforts. Similar financial security programs are implemented for other mining industry and should be strongly considered for the aggregate industry in Ontario.

5.6 CONCLUSION

This chapter provided the answers to the core and sub research questions posed in this study and evaluated the results of this study within the broader context of the theoretical framework. The conclusions of this study are as follows:

- Not enough progressive aggregate site rehabilitation is occurring, resulting in a net increase in disturbed land.
- More work is needed to evaluate the quality of rehabilitation occurring in Ontario, including monitoring to assess the long-term success of rehabilitation initiatives.
- Numerous opportunities and challenges can affect the rehabilitation process both in a negative and beneficial manner. Policy reform is needed to mitigate the challenges and leverage the benefits in order to improve aggregate site rehabilitation in Ontario.

These conclusions indicate that revision of the current aggregate policy and management frameworks is needed in order to improve aggregate site rehabilitation processes in Ontario.

These conclusions can be translated into several concrete, key findings and corresponding policy recommendations.

- Chapter 6 -

Key Findings & Recommendations

6.1 INTRODUCTION

Aggregate resources are economically significant and essential for the construction and maintenance of infrastructure in Ontario. The requirement for aggregate resources can be met, in part, through the increased use of recycled materials and aggregate alternatives; however, the need for virgin aggregate products will be sustained for several decades to come. There is no viable alternative for non-renewable, virgin aggregate resources in Ontario at this time. Close-to-market aggregate sources are the most economically viable, but with increasing urbanization in Southern Ontario these sources are becoming more and more constrained by other land-uses (e.g. residential development, agriculture etc.) and other land-use values (e.g. environmental conservation, recreation etc.).

Aggregate site licence applications in southern Ontario continue to be entrenched in land-use conflict. Lobbying and political pressure from all actor groups has engendered a broken system that increasingly relies on the Ontario Municipal Board for mediation and quasi-judicial decision-making. The results of this study indicate that the current policy framework for aggregate resources in Southern Ontario *is not* achieving an adequate rate of rehabilitation, resulting in a net increase in disturbed land and subsequent cumulative landscape impacts. There is no question that aggregate resources should continue to be developed within southern Ontario; however, the environmental impacts can be significantly lessened by improved rehabilitation processes. The quality of rehabilitation is also a concern highlighted in this study and requires

further research to draw definitive conclusions. Numerous challenges are affecting the rate and quality of aggregate site rehabilitation presently occurring in the Ontario. Many of the challenges stem from deficiencies in and the unsuccessful implementation of current legislation, regulations, and policy direction. The findings of this study indicate that the policy framework in Ontario that views aggregate developments as an interim land-use, needs to be reviewed and adjusted in order to fulfil the goals and objectives of the current management strategy.

As determined in this thesis, aggregate site rehabilitation offers a number of complex challenges and opportunities that can help to mitigate the social and environmental land-use concerns that have not been resolved under the current policy framework. The theoretical use of the Advocacy Coalition Framework in this study recognizes the central role that actor groups have in influencing the policy-making process and consequent management ideologies. More specifically, use of the Advocacy Coalition Framework helps us to understand the role that core values and belief systems, unique to each actor group, have in influencing policy development and change through corresponding advocacy action. The key findings and recommendations presented in this report articulate and summarize the results of this study through a theoretical lens that recognizes this theory.

Although the following key findings are broad, they unify several challenges into a single, explanatory conclusion. The recommendations detailed in this section suggest planning strategies and policy solutions that can be implemented in an effort to overcome some of the key challenges that negatively affect the rate and quality of aggregate site rehabilitation occurring in Ontario. These recommendations aim to achieve the shared goals of the actor groups involved with aggregate planning and management in the Province of Ontario.

6.2 KEY STUDY FINDINGS

Table 12 highlights the research strategies used in this study and the corresponding key findings resulting from the data collection, analysis, and discussion. Each key finding is supported by the results from application of at least two different research strategies. These key findings answer the core and sub-research questions of this study and are indicators that policy reform is needed.

Table 12: The research strategies used to derive the study's key findings

Key Study Finding	Research Strategy			
	<i>Literature & Policy Review</i>	<i>Rehabilitation Statistics</i>	<i>Rehabilitation Plan Review</i>	<i>Actor group Interviews</i>
1. The rate of aggregate rehabilitation needs to be improved.	✓	✓		✓
2. Cumulative impacts to the landscape need more attention.	✓	✓		✓
3. More research and monitoring is needed to assess rehabilitation quality.			✓	✓
4. Greater collaboration is required to reduce land-use conflict.	✓			✓
5. The existing policy & management framework is not functioning effectively.	✓	✓	✓	✓

6.2.1 Key Finding #1: The rate of aggregate site rehabilitation needs to be improved

Based on the quantitative data analyzed as part of this study, the rate of aggregate site rehabilitation occurring in the Province of Ontario is considered to be inadequate. Data collected by the MNR (2010c) indicate that *final* rehabilitation is occurring satisfactorily within Ontario

which means it is potentially *progressive* rehabilitation is to blame for the observed poor rate of rehabilitation. This inadequacy is judged on the evidence that the amount of land being rehabilitated each year is only a fraction of the total land left disturbed by aggregate extraction activities. This results in a net growth in disturbed land that, in turn, results in greater cumulative social and environmental impacts. The statistics show that the rate of rehabilitation has, on average, improved in the ten year period after 2001; however, the slight improvement observed in the proceeding 10 years is not statistically significant. Overall, the rate of rehabilitation is likely inadequate to mitigate cumulative social and environmental impacts that result from pit and quarry operations. Nonetheless, more research is needed to corroborate and better understand these findings.

It is also essential to consider the legacy of un-rehabilitated lands that are not captured by this assessment of data starting in 1992. It is estimated that in Ontario there is an inventory of over 2,400 abandoned aggregate sites that predate legislated rehabilitation requirements (TOARC, n.d [a]). Many of these sites have been inactive for 20 or more years, and the majority have already reverted to a secondary land-use, such as natural regeneration, urban expansion, or private recreation (TOARC, n.d [a]). TOARC (n.d [a]) has identified approximately 300 abandoned sites that require rehabilitation activities. This additional disturbed land is not included in this evaluation and compounds the findings reported in this study. Although much of this un-rehabilitated land is part of the legacy of poor aggregate management practices, stronger efforts should be made by both government and industry to “close the gap” between the amount of land rehabilitated and the amount of land left disturbed. Further policy improvement is needed in order to increase the rate of rehabilitation taking place, both for abandoned and active aggregate site licences.

Aggregate site extraction and rehabilitation is a complex process, heavily influenced by numerous factors (e.g. market demand, provincial policy, changes in land-use values) that are not easy to plan, predict or control. One of the reasons the public is so strongly opposed to new aggregate sites is because of the poor rehabilitation in the past and issues of non-compliance at a number of operating sites across the province (ECO, 2011). However, results of the actor group interviews disclosed some of the specific operational barriers that are inhibiting rehabilitation from occurring in a timely and sequential manner (e.g. variations in deposits, old site plans, lack of timelines etc.). It should not be assumed that the poor rate of rehabilitation occurring in the Province of Ontario is the result of negligent aggregate producers or poor site management, although more research is needed for an adequate assessment of industry compliance. Fluctuating market demand for aggregate products necessitates the application of operational and extraction processes that are most economically viable to the site operator and, in turn, may hinder progressive rehabilitation from occurring. Policy tools and solutions that recognize these obstacles would most likely be supported and implemented by aggregate producers, thereby achieving a better rehabilitation rate.

6.2.2 Key Finding #2: Cumulative impacts to the landscape are occurring

One of the most prevalent concerns regarding aggregate extraction activities in Ontario is the perceived and real adverse environmental and social impacts these developments have on host communities. Adequate and timely rehabilitation is essential in mitigating these impacts and preparing the land for its next land-use. Because aggregate developments are planned and managed on a site-by-site basis, the suspected cumulative impacts from multiple extraction sites are a serious concern that is not adequately addressed by the present policy framework.

Currently in Ontario, there is no mandatory requirement for the Ministry of Natural Resources to consider or request further study of cumulative social and environmental impacts during the approval process for pits and quarries. A number of the actor group representatives interviewed in this study felt strongly that the regional or landscape level impact of existing aggregate operations should be evaluated during the MNR's approval process for new aggregate developments. This could be accomplished by requiring proposed aggregate sites to complete a cumulative effects assessment or a similar type of comprehensive environmental assessment process. The development of such a process would also require the determination of the acceptability or unacceptability of specific cumulative effects. This should be done in a collaborative and transparent manner.

Cumulative impacts are of particular concern to aggregate rich municipalities. These areas of the province are high in good quality aggregate resources and therefore have a high concentration of active aggregate developments in a relatively small geographic area. Consequently, these areas of the Province will have a higher proportion of disturbed land and thus be at a greater potential risk from cumulative impacts. In Southern Ontario, this landscape problem has been labeled unfavourably as the "swiss cheese syndrome" (see ECO, 2009). This concern is largely understudied on a regional or broader scale (e.g. watershed) and the problem is further augmented by scientific "unknowns". Cumulative impacts to ground water sources and associated surface waters and ecosystems, resulting from multiple aggregate operations extracting below the water table, should be the priority for further research given that many municipalities in Southern Ontario draw their drinking water supplies from these water sources.

The slow rate of progressive rehabilitation occurring in the Province is further increasing the potential for adverse cumulative landscape impacts as there is currently a net increase in the

amount of land disturbed from aggregate operations each year. If this trend continues, cumulative impacts will become more adverse as well as more complex for the aggregate industry to manage and reduce via regulatory and planning measures. Because the quality and long-term success of past and current rehabilitation activities has not been determined, more work is needed to monitor and evaluate the quality of aggregate site rehabilitation occurring in Ontario. The easiest way to mitigate cumulative impacts is to return as much land as possible back to a natural state at a quality that is equal to, or better than, the original site condition.

6.2.3 Key Finding #3: More research and monitoring is needed to assess rehabilitation quality

Good quality rehabilitation plays an essential role in preparing the land for its final and sequential land-use. Currently in Ontario, very limited data are available for assessing the quality and effectiveness of current rehabilitation activities as well as rehabilitation that has been completed in the past. Achieving the best possible rehabilitation quality for a site has a significant impact on mitigating the short-term and long-term adverse environmental impacts of extraction and corresponding landscape disturbance.

More research is needed to evaluate the effectiveness of rehabilitation activities, for example by examining the soil productivity of sites restored to agricultural land-uses, and the biological diversity of areas converted for environmental conservation purposes. If rehabilitation efforts are not adequately restoring the previous land condition (or an alternative land condition deemed acceptable), cumulative impacts will be perpetuated. Long-term monitoring of rehabilitation sites is essential to track progress and evaluate the success as well as failures of specific rehabilitation techniques or best management practices. Improvements to rehabilitation

plans and the rehabilitation planning process can be made based on the outcome of long-term monitoring initiatives.

Research and data collection on aggregate related land-use topics in Ontario also presents an additional opportunity for collaboration among actor groups ensuring transparency and impartiality in the research strategies used to collect data. Currently, the aggregate industry (in the form of the Ontario Stone, Sand, and Gravel Association and The Ontario Aggregate Resources Corporation) has taken the leadership role in aggregate related research initiatives. Because of insufficient government resources, these two industry organizations are presently the best suited to administer these types of research programs, but should do so in collaboration with all actor groups to ensure transparency and objectivity of research findings. Study results should be disseminated to a wide-variety of audiences and be made available for peer-review. More research on aggregate site rehabilitation quality cultivates a more comprehensive understanding of the outcomes of specific rehabilitation activities and initiatives. In turn, this knowledge can be translated into stronger policy as well as used to educate aggregate producers about effective rehabilitation techniques and methods.

6.2.4 Key Finding #4: Greater collaboration is required to reduce land-use conflict

Greater public involvement and collaboration in aggregate site management and planning offers an opportunity to gain greater acceptance and support for the aggregate industry. Concerns regarding an inadequate rehabilitation rate and quality, potential cumulative impacts, and problems with compliance all continue to perpetuate ongoing land-use conflict. The current regulatory framework does require public consultation at the beginning of an aggregate licence application, but not throughout the lifespan of the project, which can last upwards of 20 years. Perceptions gathered as part of this study indicate that several of the actor groups do not feel

adequately involved in the approval process. The prevalence of aggregate related land-use issues being dealt with by the OMB also signifies that current regulatory structures for ensuring adequate consultation are not effective. Using the OMB as an outlet for discussion and mediation on aggregate related issues is an extremely costly endeavour for all actor groups involved. Disputes fought at the OMB can cost millions of dollars for all parties who participate, per proposed site.

Ongoing public consultation and better collaboration among actor groups was highlighted in this study as a key strategy for improving acceptance of extractive industries and gaining greater community support. Reforming the current regulatory system to imbed these types of planning strategies throughout the approval process as well as the operational plan of an aggregate site can help to establish open lines of communication. Specifically, rehabilitation planning can be used as a tool to facilitate this type of collaboration, as the involvement of all actor groups is needed to appropriately devise a final land-use vision. Because of the long life span of aggregate developments, adjustments may be required to the progressive rehabilitation plan and this should be accomplished with input from all stakeholders.

6.2.5 Key Finding #5: The existing policy & management framework is not functioning effectively

The overall conclusion of this study is that the current policy and regulatory framework that mandates aggregate site rehabilitation in Ontario requires review and reform. The land-use priority for the extraction of aggregates, currently imbedded in the regulatory framework, should shift to a focus that encourages and requires the more efficient use and recycling of aggregate products in an effort to conserve this non-renewable resource. The general management direction and intent of the current regulatory system is acceptable, but fails to function effectively in terms

of implementation. This deficiency in the policy system has resulted in the creation of a number of complex challenges that negatively affect the rate and quality of rehabilitation. Results of the actor group interviews also revealed perceptions that questioned the competency of the current management system. All actor groups included in this study raised some type of concern that stemmed from dissatisfaction with and/or uncertainty about the ability of the current system to ensure adequate aggregate site rehabilitation.

Nonetheless, all future policy discussions should be conducted in an open and transparent manner. This type of a policy review process will allow for the consideration of the values and perceptions of all actor groups involved. Policy measures that aim to negotiate and balance all actor group values will work more effectively towards achieving shared goals and objectives. Several concrete and practical policy recommendations and strategies are presented in the following section. These impartial and feasible policy solutions aim to improve the current policy system in a manner that would be accepted and adopted by all actor groups involved in the planning and management of aggregate resources in Ontario.

6.3 RECOMMENDATIONS

6.3.1 Policy Recommendation #1: Establish Maximum Disturbed Areas for Aggregate Operations

Establishing a maximum disturbed area for aggregate operations at each specific site is one policy and regulatory tool that would ensure timely progressive rehabilitation as well as reduce the potential for cumulative landscape impacts. A maximum disturbed area allowance would permit the disturbance of a specific, limited surface area at any one time, for a given aggregate operation. If a restriction were applied to the amount of land that producers could disturb, then this would require the site operator to rehabilitate progressively before moving on

to the next extraction phase. This type of extraction planning system would ensure that progressive rehabilitation occurs as well as decrease the amount of land left disturbed for long periods of time. When progressive rehabilitation occurs, environmental degradation and negative visual impacts are reduced as areas of overburden and waste can be re-vegetated despite extraction activities occurring in other areas of the aggregate site.

This type of policy tool has already been implemented by the MNR within the Protected Countryside Area of the Greenbelt Plan planning jurisdiction. Maximum disturbed area restrictions can help to achieve social and environmental land-use objectives while ensuring the access and development of close-to-market aggregate resources. The objective of the application of maximum disturbed area allowances in the Greenbelt Plan Area, is to maximize the amount of area rehabilitated and minimize the amount of disturbed area on an ongoing basis throughout the active lifetime of the pit or quarry. It is recommended that this policy tool that is currently being used only within the Greenbelt Plan Area be expanded for use in all active aggregate sites in Ontario. In environmentally significant areas, the MNR should approve smaller disturbed area maximums to ensure as low an impact as possible on the adjacent lands. In areas that are less environmentally sensitive, larger disturbed area maximums could be established. This type of policy tool would work to mitigate environmental and social impacts while still permitting the extraction of valuable aggregate resources. Timely progressive rehabilitation would be guaranteed as aggregate producers would have to rehabilitate in order to access material throughout the site licence.

This type of policy tool would be administered by the MNR under the authority of the *Aggregate Resources Act*. Mechanisms are already in place for implementing this management strategy in the Greenbelt Plan Area and can be shared with other MNR management districts. As

a result, there is no need to develop new procedures. Nonetheless, this new management tool will likely require greater administrative capacity and enforcement by the MNR, which in turn will require more government resources. Increasing the current levy, per tonne of aggregate paid to the province by aggregate producers, could help to cover this increased cost.

6.3.2 Policy Recommendation #2: Require Security Deposits for Aggregate Site Rehabilitation

In many cases, rehabilitation is viewed by aggregate producers as a costly task to be completed once extraction activities are complete. Final rehabilitation occurs at the end of the lifespan of a pit when profits are the lowest and the supply of aggregate has been exhausted. In some circumstances, operators will extend the lifespan of their pit or quarry to avoid having to complete final rehabilitation activities. This lengthens the amount of time that areas are left disturbed and results in “zombie pits” that have an active licence, but the operators are not extracting material. Currently, there is no effective incentive (regulatory or other form) for aggregate producers to complete final rehabilitation. Coupled with a lack of enforcement from the MNR, this problem is negatively affecting the rate and quality of rehabilitation occurring in Ontario and is creating a poor public image of the aggregate industry. Progressive rehabilitation is one method of spreading out the cost expenditure of rehabilitation and can be enforced through the implementation of maximum disturbed area allowances. Another method for encouraging rehabilitation is the reinstatement of some form of security deposit model to make certain that operators have a financial incentive to complete rehabilitation activities.

Reintroducing the security deposit model for rehabilitation was a recommendation highlighted in the *SAROS* Report (MNR, 2010c), and justification for implementing this type of a system is also presented in this study. The security deposit model that was in place for aggregate

sites prior to 1997, required licence holders to pay a per tonnage fee for the amount of material extracted. This money was held in an account that was managed by the MNR and was returned to the aggregate producers as reimbursement for completing rehabilitation work. Almost all actor groups included in this study believe that this was an effective mechanism for ensuring that rehabilitation took place; however, legitimate concerns were raised regarding the effectiveness and feasibility of the system due to a shortage in MNR staffing resources.

An alternative to the pre-1997 security deposit model would be to require aggregate site producers to secure the money required to complete rehabilitation activities upfront during the site licensing approval process. Again, this type of a system would ensure the availability of the funds required to complete rehabilitation at the end of the lifespan of the operation. Comparable schemes are used in other mining sectors and could be adjusted to be more applicable to the aggregate industry. In some proposed cases of large-sale mining projects, anticipated rehabilitation costs were so high that the economic viability of the mining project was questioned (Robertson, Devenny, & Shaw, 2009; Eggert, 1994). A similar system should be considered for implementation in the aggregate site rehabilitation process.

Although this type of a model may not be welcomed by the aggregate industry because of a perceived increase in cost, it may be necessary to ensure the adequate and responsible management of aggregate resources in Ontario. A security deposit model would serve as financial incentive for rehabilitation to be performed, and an increase in aggregate levies paid to the province could be used to cover the additional cost of administering the program by the MNR. The rehabilitation funds paid upfront by the aggregate producers, and managed by the MNR, could accumulate interest, which would help to offset the cost of increased levies. Alternatively, a variation of this model could be applied to only higher-risk sites, such as large-

scale developments, those which operate below the water table, or licences located in environmentally sensitive areas (e.g. the Niagara Escarpment or Oak Ridges Moraine) This would afford a degree of fiscal equality to smaller aggregate producers, who cannot source sufficient funds upfront and often operate smaller-scale sites that are only a few hectares in size.

6.3.3 Policy Recommendation #3: Establish Citizen Advisory Committees

With the recent and growing amount of controversy surrounding aggregate site developments in Southern Ontario, improved collaboration and public consultation in the planning and management process is a necessary step in alleviating land-use conflict. Improving relationships between aggregate producers and the local community could play a significant role in increasing acceptance for the proposed aggregate developments. Current regulatory frameworks only require public consultation during the approval stage of pit or quarry. Once approvals have been granted, the public is no longer involved in the operation or management of the site.

Public liaison or citizen advisory committees are a public consultation tool that can be used to establish open lines of communication between the aggregate operators and members of the public. Citizen advisory or liaison committees are commonly used planning tools that aim to foster more positive relationships between the community and facility operator and facilitate the involvement of the community in the management of the site. Through regularly scheduled meetings, representatives on the community provide advice and feedback to the aggregate operator and also discuss areas of concern. Public open houses and events (tree planting, site tours etc.) hosted by the aggregate operator can also help to foster positive relationships with the public. Public liaison committees provide a more cost-effective as well as open and transparent process for conflict resolution.

Citizen advisory committees have been successfully established for other contentious facilities and land-use projects, such as correctional institutions, waste management sites, and airports. This type of collaborative approach to management establishes regular and effective discussion and empowers the community to become more actively involved with the operation, management, and long-term land-use planning for the site (i.e. final rehabilitation planning). These types of arrangements between the host community and aggregate producers have begun to become increasingly popular in Southern Ontario. Examples include the Township of Uxbridge Bioregional Planning for Aggregates initiative, the development of the Brampton Esker Park System, and the establishment of the Wainfleet Wetlands Conservation Area. Citizen liaison or advisory committees also emphasize a commitment by the aggregate producer to operate their site in a manner that is transparent and accountable to the community. Although these types of committees are not provided with explicit decision-making powers, they can be structured in a manner that operates in an advisory capacity with the responsibility to study critical issues, accept public testimonies, undertake independent research, and review reports and documents (Municipal Research and Services Center, 2008). These types of actions prepare and provide the committee with the ability to “analyze, formulate, and forward well-developed, thoughtful recommendations” to the decision-making body (Municipal Research and Services Center, 2008, pg. 1), such as the aggregate producer or the MNR. Establishing a good relationship with the host community is a key step towards achieving a social licence to operate. The current regulatory framework should be reformed to include greater public consultation and engagement measures through the establishment of public liaison or advisory committees.

In order to establish an effective and successful citizen advisory committee for aggregate site management, the following issues would first have to be gauged: i) committee establishment

and membership, ii) reporting accountability, iii) information access, iv) decision-making authority, and v) committee objectives and mandate. Memorandums of agreements should be drafted between the aggregate producer, municipality, and citizen advisory committee in order to explicitly define these roles and responsibilities. Citizen advisory committee pilot projects could be implemented in one or two municipalities in order to facilitate the creation of a well defined model for broader implementation.

6.3.4 Policy Recommendation #4: Timelines for Licences

Establishing rehabilitation plans that are tied to timelines is another regulatory measure for strengthening the requirement for aggregate sites to undergo progressive and final rehabilitation. Both operational plans and rehabilitation plans can be made more stringent by including anticipated dates for extraction and rehabilitation phases. Currently, rehabilitation plans and operational plans do not contain timelines and this has resulted in the prevalence of “zombie-pits” and extraction processes that result in more land being disturbed than rehabilitated. Timelines can be made to be flexible in order to adapt to fluctuating market demand and can be established in a collaborative manner with MNR staff, municipal planners, and citizen liaison committees.

In addition, the regulatory framework should be modified to include a “sunset clause” for aggregate licences (i.e. a firm end date for an aggregate operation). Therefore, when an application for a new licence is approved it is known upfront how long the site will be active. A sunset clause would serve as a legal termination point at which time the aggregate licence would be considered no longer active (i.e. surrendered) and final rehabilitation would then be required and completed by a predetermined deadline. This management strategy would give communities a “light at the end of the tunnel”. In combination with a rehabilitation security deposit, this

regulatory tool would make certain that all pits and quarries complete final rehabilitation in a timely manner and do not extend the life of the operation in order to avoid the cost of completing rehabilitation. Unnecessarily extending the life of an extraction site (i.e. there is no more material left to extract, but the site is left disturbed) negatively affects the rate of rehabilitation and augments cumulative landscape and social impacts. As an alternative, legally binding sunset clauses for each extraction phase of an aggregate operation, instead of the entire licence itself, could also be considered and may be more acceptable to the aggregate industry. More work is needed to assess the feasibility and of these two options. Either way, firm timelines tied to the closure of extraction phases or the entire licence itself should be implemented to ensure that rehabilitation is completed.

Pits and quarries located in environmentally sensitive areas should aim to have a shorter lifespan, thus reducing the ongoing impact of the development on the surrounding landscape. Sunset clauses are currently being considered by the MNR for application in the Greenbelt and Niagara Escarpment area, but should be considered for use throughout Ontario. Sunset clauses should be considered for all new applications and gradually phased-in for existing operations. Both a sunset clause for aggregate sites as well as a stronger rehabilitation plan that is tied to a specific timeline would help to meet the need for aggregate without compromising other important land-uses in southern Ontario, such as agriculture and environmental conservation.

In addition to timelines for licenses that mandate when rehabilitation should occur as well as a when the pit or quarry should close, aggregate site plans (which include progressive and rehabilitation plans) should also be tied to a mandatory *review and revision timeline*. This mandatory *review and revision timeline* would require aggregate producers and the regulatory authority (i.e. the Ministry of Natural Resources and local municipal government) to review and

possibly modify a site plan every five years from the date that the site plan is approved. This type of a regular revision timeline would ensure that the site plan remains consistent and up-to-date with current industry standards and best management practices for extraction and rehabilitation activities. This mandatory five year review timeline would also serve as an opportunity to modify the site and rehabilitation plan in order to adjust to changes in the surrounding landscape (e.g. conversion from rural to urban) or better address community and local priorities (similar to the process that occurs for municipal Official Plans). When a five year review of a site plan occurs, open-house information sessions could be held in order to encourage input and involvement from the local community. This type of policy tool would help to eliminate the problem of grandfathered site licences that allow antiquated extraction and industry practices to perpetuate. Moreover, this policy tool would also promote the flexible and adaptive management of aggregate sites which can operate for a long-period of time in uncertain landscape conditions. Rigid, unchanging site-plans are not able to evolve in accordance with long-term changes in the landscape, whereas flexible site planning can better achieve management outcomes in the long-run.

6.4 CONCLUDING REMARKS

Key findings in the study highlight the need to continue to improve the aggregate site rehabilitation process in Ontario. Efforts to improve rehabilitation practices in the past 20 years, since the inception of the Aggregate Resources Act, have not resulted in a significant improvement to the amount of rehabilitation occurring. It is likely that final rehabilitation of surrendered aggregate sites is occurring somewhat satisfactorily; however, progressive rehabilitation significantly lags behind resulting in an ongoing annual increase in non-rehabilitated lands from gravel pit and quarry operations. Between 1992 and 2011, the aggregate industry

added just over 8600ha of disturbed land to Ontario's landscapes, much of this in Southern Ontario. This amount of land is equal to 86 square kilometers, or about the size of 10,487 football fields. Based on statistical trends, this number will increase in the following years if no efforts are made to reduce the growing accumulation of un-rehabilitated land that is created by active aggregate site licences. Further compounding this problem is the legacy of disturbed lands caused by aggregate operations prior to 1992, as well as the inventory of approximately 300 abandoned sites that are located across the province. A list of these sites should be compiled and their current land-use condition evaluated.

It is clear from this analysis of the rehabilitation statistics from the past 19 years, that it is likely that insufficient aggregate site rehabilitation is occurring in Ontario. In addition the quality of final and progressive rehabilitation that is occurring at aggregate sites is largely unknown, which limits the ability to accurately assess whether or not aggregate site rehabilitation practices are effectively achieving social, ecological, and economic priorities. Both the continued growth in disturbed land and the unknown quality of rehabilitation occurring calls into question the ability of aggregate sites to meet the policy objective of a suitable interim use of the land. Extraction processes and regulatory requirements need to be reformed in order to ensure better land management, especially in southern Ontario where increasing land-use constraints will continue to stress close-to-market aggregate sources.

The actor group interviews revealed a number of significant opportunities and challenges affecting the rehabilitation process and subsequent rehabilitation rate and quality occurring in Ontario. Correspondingly, the data analyzed from the actor group interviews, when evaluated in conjunction with the results of the statistical analysis for the past 20 years, reveal the inadequacy of the existing policy and management framework. This policy problem is predicated on the

inequitable expression of differing actor group core values and advocacy powers that are transcribed into aggregate site management and planning requirements. Over the past two decades, the aggregate industry has successfully lobbied for a provincial policy agenda that favours and encourages close-to-market aggregate extraction in Southern Ontario. This provincial directive has left the remaining actor groups feeling disempowered in the decision-making and agenda-setting “policy arena”, resulting in ongoing land-use conflict.

In Ontario, the potential does exist for aggregate extraction to shift paradigms and evolve into a more sustainable industry that assumes both a social licence to operate and an environmental stewardship role. Some progress by the aggregate industry has been made since the early 1990s; however, policy revision and reform is needed to encourage this ongoing transition. Although the aggregate industry is likely going to continue to drive aggregate policy-making in Ontario, substantiated by provincial economic ideologies, it is possible for the remaining actor groups to advocate for changes to antiquated management regimes. Non-industry actor groups are beginning to play a bigger role and have a greater influence in the outcome of aggregate related land-use debates (e.g., OMB and provincial decisions regarding the proposed Rockfort Quarry, Melancton Quarry, Flamborough Quarry – none of these licence applications was approved). These recent decisions highlight the role that actor groups can have in influencing political judgements and working towards changing the core aspects of a policy subsystem. The policy recommendations presented in this study attempt to pragmatically negotiate the differing values of actor groups, in an effort to cultivate an extractive resource industry that is environmentally, socially, and economically sustainable.

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- Appendix A - Interview Questions

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Project: Aggregate Site Rehabilitation in the Province of Ontario: Opportunities and Challenges

Actor Interview Questions:

General:

- 1) What is your opinion about the abundance of aggregate resources in the Province of Ontario; economically, politically, and environmentally?
- 2) Who do you think should be responsible for the management of aggregate resources in Ontario (i.e. local government, provincial government, aggregate producers etc.)? Why?
- 3) Do you think that the community is fairly considered and has a public voice in aggregate planning and management activities (i.e. siting of new aggregate extraction sites, development of site-specific operational guidelines, or creation of final rehabilitation plan etc.)?
- 4) What is your biggest concern regarding aggregate extraction activities in the Province of Ontario?

Rehabilitation:

- 5) What factors do you think affect the rehabilitation rate and quality for aggregate sites in the Province of Ontario?
- 6) What are your expectations for the final rehabilitation of worked-out aggregate sites?
- 7) What are your expectations for the progressive rehabilitation of active aggregate sites?
- 8) In terms of amount, do you think there is enough land being rehabilitated from aggregate developments in the Province of Ontario? Could it be increased? If so, how?

- 9) In terms of timing, is rehabilitation occurring as quickly as it should be in the Province of Ontario? If not, why?
- 10) Is rehabilitation occurring satisfactorily in terms of quality in the Province of Ontario? If not, what would improve it?
- 11) What role do you see for the public in rehabilitation activities?
- 12) Do you think that current rehabilitation efforts are adequately responding to socio-economic and ecological priorities in the Province of Ontario (i.e. healthy community and healthy ecosystem goals)?
- 13) What is your biggest concern regarding aggregate site rehabilitation activities in the Province of Ontario?
- 14) Is there anything else you would like to add?

- Appendix B - Raw Rehabilitation Data

PROVINCE OF ONTARIO UNPROCESSED REHABILITATION DATA						
Year	Total # of licences	Total licensed area (ha)	Original disturbed area (ha)	New disturbed area (ha)	New rehabilitated area (ha)	Total disturbed area (ha)
1992	2,499	74,034.30		1,312.30	494.90	18,922.70
1993	2,484	78,286.70		1,295.60	548.90	20,031.50
1994	2,683	82,057.74		1,760.63	393.80	20,846.64
1995	2,887	79,610.25		1,133.41	327.11	19,878.91
1996	2,696	90,022.57		748.31	394.62	23,329.32
1997	2,727	87,443.61	22,086.85	643.86	232.81	22,497.91
1998	2,798	89,431.91	19,697.81	1,020.89	597.18	20,121.52
1999	2,807	92,694.97	22,718.11	819.38	585.81	22,951.68
2000	2,799	93,246.12	22,829.18	841.29	468.66	23,201.81
2001	2,787	93,011.15	23,135.69	985.76	568.91	23,552.55
2002	2,776	92,848.94	23,613.12	946.37	681.37	23,878.12
2003	2,782	93,974.76	23,790.89	943.37	869.92	23,864.34
2004	2,752	93,514.79	23,907.22	886.33	785.08	24,008.48
2005	2,741	93,238.58	23,819.88	903.00	784.41	23,938.47
2006	2,795	96,539.45	24,354.87	811.18	581.20	24,584.84
2007	3,764	132,638.79	27,777.78	1,137.29	686.89	28,228.18
2008	3,762	132,734.30	28,493.19	949.02	659.88	28,782.33
2009	3,762	134,665.78	28,820.46	925.03	516.56	29,228.94
2010	3,747	134,377.32	29,462.27	1,103.36	722.50	29,843.13
2011	3,729	134,283.66	30,244.97	992.81	619.75	30,618.02

GUELPH MNR DISTRICT UNPROCESSED REHABILITATION DATA						
Year	Total # of licences	Total licensed area (ha)	Original disturbed area (ha)	New disturbed area (ha)	New rehabilitated area (ha)	Total disturbed area (ha)
1992	443	14654.8		157	67.6	3627.9
1993	453	15612.1		229.8	96.5	3940.2
1994	483	15610.37		227.82	57.04	3943.72
1995	470	15895.83		156	115.16	4000.19
1996	517	18965.75		132.57	89.44	4830.84
1997	474	16340.13	3984.83	188.11	65.88	4107.06
1998	476	16521.22	4133.74	217.97	140.38	4211.33
1999	469	16434.32	4201.56	207.201	133.43	4275.32
2000	475	16701.82	4274.51	241.25	132.24	4383.53
2001	463	16413.54	4364.89	199.61	125.22	4439.28
2002	463	16547.33	4489.75	180.29	151.92	4518.12
2003	458	16382.94	4489.13	248.5	306.08	4431.55
2004	455	16272.68	4494.54	268.56	151.7	4611.4
2005	451	16193.25	4600.53	194.74	135.4	4659.88
2006	457	16410.8	4690.97	140.46	100.57	4730.87
2007	449	16143.42	4758.34	291.33	147.4	4902.26
2008	445	15981.5	4624.13	148.75	129.67	4643.2
2009	452	16292.26	4671.57	135.46	50.54	4756.48
2010	454	16181.77	4803.76	133.94	112.94	4824.77
2011	454	16213.95	4887.22	173.11	137.33	4923

- Appendix C - Examples of Rehabilitated Aggregate Sites



Elora Quarry Conservation Area in Wellington County. Previously an operating quarry, this site has been restored to a recreational land-use.



A residential subdivision in the City of Kitchener. The licence for this gravel pit was surrendered in 2008 and the site was developed into a residential land-use.



Kolb Park in the City of Kitchener. Gravel was extracted at from this site between 1983 and 1989. In collaboration with the City of Kitchener, this site was rehabilitated to a natural riparian ecosystem along the Grand River.



Heritage Green Community Sport Park in the City of Hamilton. Aggregate sources from this quarry were exhausted in the late 1980's and the site was rehabilitated to sports field facilities. Passive recreational facilities (i.e. trails) are also