An Examination of Stakeholder Perceptions in Conventional and Participatory Monitoring and Evaluation of Environmental Management

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Abstract

Effective environmental management is integrally linked to well-designed monitoring and evaluation (M&E) systems. Within the need for M&E to manage our environments in the most effective ways, there is an emerging trend to include social dimensions in environmental management and M&E efforts. Accordingly, this research responds to the need to better understand stakeholder perceptions of key performance indicators (KPIs) related to M&E, as well as the influences of engaging in a participatory monitoring and evaluation (PM&E) process. Two objectives were associated with this aim. Objective One (Study One) addressed the tension that practitioners and scholars face regarding the intricate balance of employing a conventional M&E approach in environmental management, with the perceptions of various stakeholders. This study statistically compares two different stakeholder groups' perceptions about KPIs for M&E at 12 different viewpoint locations in Niagara Parks. Visitor perceptions were also considered against the environmental managers' perceptions of the viewpoint sites. Results demonstrate that visitor groups do not differ in their overall perceptions of KPIs for viewpoints; however, they do differ in their perceptions for specific KPI sub-criteria. Additionally, environmental managers and visitor groups significantly differ in their perceptions of KPIs for viewpoints. Objective Two (Study Two) was concerned with exploring the influences of engaging in a PM&E process on stakeholder perceptions of KPIs for trails. This study compared stakeholder perceptions of KPIs for trails between a group of individuals before and after they completed a PM&E workshop. Results demonstrated that the PM&E process can be used to reach consensus among stakeholders regarding the overall goals and associated KPIs for environmental management planning. Additionally, stakeholders experience a real change in their perceptions of KPIs for trails after participating in the first three phases of a PM&E process.

Overall findings have many implications for theory and practice including, but not limited to, improved environmental management, appropriate integration of stakeholder perceptions in management, addressing intergroup conflicts, gaining stakeholder support for environmental management actions, as well as informing areas for influencing stakeholder behaviour and perceptions. This thesis highlights the value and practicality of using stakeholder perceptions in environmental management.

Keywords: perceptions; monitoring; evaluation; environmental management; key performance indicators

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Table of Contents

List of Tables

Chapter Two: Study One: Inter-group Perceptions of Monitoring and Evaluation and KPIs for Viewpoints

Chapter Three: Influences of Engaging in a PM&E Process on Stakeholder Perceptions of KPIs for Trails

Appendices

List of Figures

List of Abbreviations

M&E	Monitoring and Evaluation
PM&E	Participatory Monitoring and Evaluation
KPIs	Key Performance Indicators
MOU	Memorandum of Understanding
NPC	Niagara Parks Commission
EESI	Excellence in Environmental Stewardship Initiative
NPS	National Parks Service
T1	Time One
T2	Time Two

Chapter One: Introduction to the Research

1.0 Introduction

There is increasing recognition among both practitioners and scholars that effective environmental management is integrally linked to well-designed monitoring and evaluation (M&E) systems (Bennett, 2016; Gordon et al., 2005; Hockings et al., 2000; Margoluis & Salafsky, 1998; Stem et al., 2005; Theobald, 2013; Trimble & Plummer, 2018; Woodhill, 2000). Monitoring and evaluation in environmental management is regarded as a process, undertaken to assess and improve the performance of a system in order to achieve a desirable outcome(s) (Estrella & Gaventa, 1998; Jackson & Kassam, 1998). Within this definition, there are two distinct M&E approaches which relate to this research: conventional M&E and participatory M&E. Conventional M&E typically emphasizes achieving ultimate system effectiveness, and as such, they are externally oriented towards enhancing cost efficiency or accountability, particularly using top-down approaches (Estrella & Gaventa, 1998; Guba & Lincoln, 1989; Jackson & Kassam, 1998). Participatory M&E (PM&E) is defined as a process whereby multiple different stakeholders (scholars, citizens, NGO's, government, etc.) collectively engage in the monitoring and evaluation of a particular program or intervention over time (Jackson & Kassam, 1998).

Due to the wide application of M&E in various contexts, there is no exact recipe for conducting M&E (Estrella et al., 2000; Hockings et al., 2000; Margoluis & Salafsky, 1998; Stem et al., 2005). Conventionally, M&E has been approached using a project cycle framework involving seven different phases through which the project evolves, from a basic needs assessment or appraisal, towards evaluation and documentation of results (Shah et al., 2006). In this context, the implementing agency drives the entire process, and "experts" that are external to the project are usually contracted to conduct the evaluation as a way to ensure objectivity (Estrella & Gaventa, 1998; Jackson & Kassam, 1998; Shah et al., 2006). Compared to a more conventional approach, the project cycle for a PM&E approach is somewhat different. A participatory approach to M&E builds on the involvement of all relevant stakeholders at every stage of the process, encouraging dialogue at the grassroots level (Estrella et al., 2000; Estrella &

Gaventa, 1998; Shah et al., 2006; Margoluis & Salafsky, 1998). As such, additional steps or phases are important within PM&E, as stakeholders must collectively plan and design the M&E process. Additionally, emphasis is placed on the learning processes that can take place throughout a PM&E process, and the unique opportunity afforded to participants to learn from experience and adapt management strategies as new information becomes available (Estrella & Gaventa, 1998; Shah et al., 2006; Margoluis & Salafsky, 1998; Onyango, 2018). Therefore, feedback and participatory decision making based on evaluation results are an important step in a PM&E project cycle (Shah et al., 2006). Regardless of approach, in the formative stages of the (P)M&E process, identified stakeholder(s) must discuss and develop an environmental management plan, and develop a suite of Key Performance Indicators (KPIs).

KPIs are of interest in environmental management because they are helpful to compare the actual and estimated performance of an intervention or management approach (Abbot & Guijt, 1997; Cox et al., 2003; Jackson & Kassam, 1998; Shah et al., 2006). However, selecting KPIs is a multiple criteria decision-making problem, especially since performance measurement criteria vary from project to project (Toor & Ongunlana, 2010). In line with this, different stakeholders have different perceptions regarding the success of a particular project and what those indicators need to look like (Abbot & Guijt, 1998; Cox et al., 2003; Davis, 2014; Margoluis & Salafsky, 1998; Toor & Ongunlana, 2009). Thus, selecting the most meaningful indicators represents a major challenge that organizations must overcome in order to implement effective M&E, and in turn, effective environmental management practices (Abbot & Guijt, 1998).

Efforts have been made to develop practical and consistent M&E systems within and between disciplines, often with mixed results (Bamberger et al., 2016; Naidoo, 2012; Reed, 2008; Stem et al., 2005). Tensions arise regarding how to conduct M&E because real-world conservation projects operate in complex and dynamic contexts, and thus different M&E needs require different approaches (Reed, 2008; Stem et al., 2005). The approach chosen depends on the overall goal of practitioners. Common examples of goals include gaining a general sense of the existing condition of the environment at one point in time (status assessment), or determining if a conservation intervention is having an intended effect (effectiveness measurement; Estrella

& Gaventa, 1998; Shah et al., 2006; Stem et al., 2005). Essentially, there is no one M&E approach that fits all environmental efforts (Hockings et al., 2000; Margoluis & Salafsky, 1998; Reed, 2008). In order to determine which approach is most appropriate, managers and practitioners must have a clear understanding of their M&E needs (Stem et al., 2005). However, as environmental managers are now challenged to demonstrate positive results, it is especially important to learn and document what approaches and interventions work in specific settings, and what does not work, in order to improve management decisions.

Generally, M&E has favoured traditional methods of gathering ecological information about a system, in order to obtain "objective" data for evaluation purposes (Estrella & Gaventa, 1998; Bennett, 2016; Forster et al., 2017; Guba & Lincoln, 1989). However, environmental management is entering into a new era, where practitioners and scholars are now facing unfamiliar environmental challenges and wicked problems, requiring innovative methods to demonstrate progress towards reaching environmental goals. As such, M&E has also developed over time, and offers new benefits (Estrella & Gaventa, 1998; Stem et al., 2005). Currently, there is increasing recognition of the importance of engaging stakeholders in environmental management, including the M&E phases (Abbot & Guijt, 1998; Estrella & Gaventa, 1998; Hockings et al., 2000; Margoluis & Salafsky, 1998; Reed, 2008; Stem et al., 2005).

M&E is considered one component or phase within a larger environmental management plan. The focus of the M&E phase is to collect scientific data for the purpose of understanding the extent to which an intervention method is successful, and to identify areas in which it can improve (Margoluis & Salafsky, 1998; Selin et al., 2000). This cyclical process involving problem identification, taking action, monitoring, and reflecting and redefining the problem, inherently affords the opportunity to strengthen and deepen the contributions of primary stakeholders, through shared learning, joint-decision making, co-ownership, etc. (Jackson & Kassam, 1998; Onyango, 2018).

Additionally, in order to achieve sustainability under conditions of socio-ecological change, continuous learning in environmental management initiatives is crucial (Armitage, et al., 2008). In line with this, greater public participation and learning about the interactions between

science and society has become increasingly important (Kates, 2011). Berkes et al. (2003) argue that environmental management processes can be improved by making them adaptable and flexible, so as to be able to deal with the uncertainty that complex systems inherently produce. Adaptive management is often defined as a systematic, iterative process of learning for addressing complex issues in natural resource management (Dreiss et al., 2017; Margoluis & Salafsky, 1998). It is argued that adaptive management approaches broaden stakeholder participation and environmental stewardship, as more diverse actors are included for improved outcomes (Bennett, 2016; Dreiss et al., 2017; Light et al., 2013).

The emphasis toward adaptive environmental management directly relates to practical or action-oriented learning, as a process or tool to build adaptive capacity (Abbot & Guijt, 1998; Margoluis & Salafsky, 1998). For example, Campos and Coupal (1996) describes participatory M&E as a process of individual and collective learning, whereby participants engage in an educational experience and reflect upon the overall collaborative process (in Estrella & Gaventa, 1998). PM&E specifically can be considered a learning process that creates the conditions conducive to action and change (Estrella & Gaventa, 1998). In this sense, participatory M&E encourages local communities to build adaptive capacity. Participants involved are able to gain skills which strengthen local capacities for tasks such as resource management or planning, problem solving, and collaborative decision-making (Jackson & Kassam, 1998; Onyango, 2018). Participants also develop a greater understanding of the factors (internal or external), which affect the dynamics of a project, such as successes, failures, potential solutions, or alternative actions (Campos & Coupal, 1996 in Estrella & Gaventa, 1998).

The concept of participatory M&E as an experiential learning cycle towards building adaptive capacity serves to emphasize the notion that participants learn together from experience as well as through each other, resulting in action-oriented planning (Abbot & Guijt, 1998; Estrella & Gaventa, 1998, p. 23). Stakeholders continuously reflect on the impact of their intervention or management plan, learning from their own success and mistakes (Selin et al., 2000; Onyango, 2018). Essentially, this process emphasizes learning by doing, and takes the view that resource management or environmental management processes can be treated like experiments, from which those involved can learn (Stem et al., 2005). This process is a major

emphasis in sustainability science. Fang et al. (2018, p. 2) notes that "sustainability science is a different kind of science that is primarily use inspired... with significant fundamental and applied knowledge components, and commitment to moving such knowledge into societal action". PM&E provides this opportunity to move experience-based knowledge into societal action.

Finally, multiparty, collaborative environmental initiatives have been proposed as an effective tool to address these complex issues set out above (Baird et al., 2016; Bennett et al., 2018; Light et al., 2013; Selin et al., 2000). Participatory M&E is usually a collaborative process, as stakeholders who see different aspects of a problem come together and constructively explore their differences, to search for unique solutions to wicked problems (Gray, 1989). Essential to this process are characteristics of inclusion of diverse stakeholders, engagement in shared decision-making, sharing knowledge, reflecting, and taking action as a result of what was learned (Onyango, 2018). An underlying objective of participatory M&E is to achieve a more holistic perspective of an environmental initiative, by involving a diverse set of stakeholders (Stem et al., 2005). Jackson and Kassam (1998) even argue that this process yields more accurate sustainable development strategies. Furthermore, by involving all relevant project stakeholders, the outcomes and findings of (P)M&E can be applicable to a variety of information-users, or the diverse stakeholder group (Estrella & Gaventa, 1998). Additionally, through this collaborative process, decision-making strategies have a higher likelihood of being implemented, as stakeholders learn to negotiate and agree upon solutions (Emerson et al., 2012; Ulibari, 2015).

Armitage et al. (2009) explicitly notes collaboration as a necessary component in effective environmental management. Collaborative efforts which specifically include PM&E ensures a continued focus on opportunities for reflection and learning. As stated by Jackson and Kassam (1998, p. 2), "it is precisely by sharing the different types of knowledge they bring to the evaluation process- and the new knowledge they create together- that citizens and professionals can generate analysis that will render interventions more capable of yielding significant and lasting results".

It is evident that planning and collaboration, combined with continuous M&E, can enhance the effectiveness of environmental management programs or projects. Within this, an

emerging trend is to include social dimensions in environmental management and M&E efforts (Bennett, 2016; Clayton et al., 2013; Gelcich & O'Keefe, 2016). Specifically, there is increasing recognition of the importance of engaging stakeholders in environmental management, including the M&E phases. This can be accomplished in a multitude of ways ranging from inviting stakeholders to assist in one or more evaluation task, to working collaboratively with stakeholders on all phases of an M&E project. As such, M&E has evolved and shifted away from externally controlled, quantitative data seeking programs, towards the recognition of locally-relevant processes for gathering, analyzing and using new types of information (Abbot & Guijt, 1998; Estrella et al., 2000; Selin et al., 2000). Within the need for M&E to deal with wicked problems and effective environmental management, there are multiple salient tensions and questions being asked in relation to the appropriate incorporation of stakeholder perceptions in environmental management and M&E in different contexts. Therefore, within this larger focus of M&E for environmental management, this research focuses specifically on stakeholder perceptions of KPIs in two environmental contexts (parks and recreational trails), and will examine stakeholder perceptions within a more conventional M&E approach, as well as a PM&E approach.

The term 'perceptions' is interpreted differently in varying contexts, including in different environmental fields, and as a result, have many different meanings. For example, it can refer to an evaluation of something (Bennett, 2016); is used synonymously with "views", "evaluation", and "opinions" (Boshoff et al., 2007; Eagles et al., 2013); or may refer to values or beliefs linked to behaviour and levels of support (Clayton et al., 2013; Patel et al., 1999; Petursdottir et al., 2013; Stern, 2000). Bennett (2016, p. 585) defines perceptions as "the way an individual observes, understands, interprets, and evaluates a referent object, action, experience, individual, policy, or outcome". This definition, while incorporating some aspects of the cognitive process of perceiving, is quite broad and can encompass a range of topics in environmental management. The study of perception is traditionally a field of psychology, whereby 'perception' refers to, "the subjective process of acquiring, interpreting, and organizing sensory information" (Lavrakas, 2008, p. 579). However, Beyerl et al. (2016, p. 3) provide a critique of this definition, noting that that the cognitive process of perceiving the environment is complex (Troscianko & Smith, 2010) and therefore should not be oversimplified or reduced as

simply the act of sensing physical stimuli and creating mental representations of environmental information. The authors further posit that 'perception' must be considered a process which involves the interpretation of phenomena within a given context. Accordingly, 'perception' in this thesis is understood as "the subjective way people experience, think about and understand someone or something. This involves conscious and unconscious processes of meaning making in a complex social and natural world, as well as affective states and reactions" (Beyerl et al., 2016, p. 3).

The focus of the thesis on stakeholder perceptions stems from recent arguments that environmental management requires a social lens, and that incorporating such considerations affords important insights and benefits (Bennett et al., 2017; Clayton et al., 2016; Clayton et al., 2013). This is especially important in settings where humans interact directly with natural areas. For example, knowledge of stakeholder perceptions of an environment is identified as an important factor for developing public support for management actions (Bennett, 2016; Burger et al., 2017; Patel et al., 1999; Petursdottir et al., 2013; Yasué et al., 2010). Similarly, visitors' enjoyment and experience in nature depends on their perception of the environment (Butler & Hvenegaard, 2002). Additionally, while monitoring of perceptions is especially important for the social benefits of environmental management (Curado et al., 2014), it is also important for ecological benefits, due to the fact that how people interact with the environment is either directly or indirectly related to how people perceive the environment (Albert et al., 2013; Alessa et al., 2003; Bertolas, 1998; Gelcich & O 'Keeffe, 2016; Petrosillo et al., 2007). Given that human actions can have significant impacts on an environment (Steg & Vlek, 2008), it is necessary to understand how individuals perceive KPIs related to environmental management. Perceptions are specific to stakeholders and understanding their differences regarding the success of a particular project informs associated performance indicators. (Davis, 2014). Thus, selecting the most meaningful indicators represents a major challenge confronted by environmental managers. However, by deepening the understanding of how stakeholders measure success and how that varies between stakeholder groups, and incorporating these perceptions in environmental management planning, practitioners can holistically improve environmental management strategies while also gaining support from key stakeholders. Gaining a complete understanding of socio-ecological systems is of paramount importance because management

decisions can yield different results and have significantly different impacts on an environment (Alwaer & Clements-Croome, 2010; Himes, 2007; Yates et al., 2019).

1.1 Purpose and Objectives

This research responds to the need to better understand stakeholder perceptions in environmental management generally and M&E specifically (Toor & Ogunlana, 2010; Ogunsanmi, 2013; Onyango, 2018). Therefore, the overarching purpose of this thesis is to examine stakeholder perceptions of KPIs for environmental management, as well as the influences that affect stakeholder perceptions of KPIs. Reflective of the challenges identified above in terms of environmental management, as well as the unique management challenges that occur in a parks setting, this research is set within Niagara Parks and is facilitated by a memorandum of understanding (MOU) between the Niagara Parks Commission (NPC) and Brock University- the Excellence in Environmental Stewardship Initiative (EESI). It will involve the collection of quantitative field data to establish a baseline of the perceptions and attitudes that stakeholders and collaborators hold in regard to the M&E process.

The NPC was founded in 1885 and is an operational enterprise of the Government of Ontario (The Niagara Parks Commission, 2020). The NPC is similar to a private corporation, with specific objectives, powers, and duties prescribed under the Niagara Parks Act (Government of Ontario, 2020). The NPC is obligated to maintain economic self-sufficiency through sound business practices, and as an agency of the Ministry of Tourism, Culture & Sport, must fulfill a broad range of stewardship responsibilities. Specifically, NPC is responsible for preserving and enhancing the natural beauty of Niagara Falls and the Niagara River corridor as a public green space and environmental heritage location (The Niagara Parks Commission, 2019). Their mission is to protect the natural and cultural heritage along the Niagara River for the enjoyment of visitors, while maintaining financial self-sufficiency (The Niagara Parks Commission, 2019). The specific aims and objects of the NPC as set out in their 2018-2028 Strategic Plan that directly relate to this thesis include, but is not limited to, maintaining, preserving, and enhancing the beauty and surroundings of Niagara Falls and the Niagara River while also maintaining financial self-sufficiency, developing, operating, and maintaining a system of parks and recreation areas, historic sites, and educational facilities which will add to the visitor's

enjoyment, and providing viewing opportunities as well we educational opportunities to visitors, and more (The Niagara Parks Commission, 2018).

Located in Southern Ontario, Canada, the NPC encapsulates 16.19 square kilometers of parkland along the Niagara river, in addition to the Niagara Parkway which spans 56 kilometers (see Figure 1.1). This area includes numerous trails, historic sites, picnic areas, viewpoints, and attractions. The property is located within the Niagara Escarpment Biosphere Reserve, a UNESCO world biosphere. Due to its unique location and scenic landscapes, the park experiences exceptionally high visitor rates with more than 11 million visitors yearly (The Niagara Parks Commission, 2016), and consequent visitor pressures in some particularly sensitive areas, lending consideration to appropriate environmental management planning. With a mandate of environmental protection, the NPC must navigate tension between different stakeholder groups and expectations in multiple scenarios, with their commitment to ecological integrity.

Figure 1.1: A map of the Niagara Parks Commission property (The Niagara Parks Commission, 2020)

In addition to the unique context of this location, the NPC was chosen as a parks agency for the focus of this research as part of a Memorandum of Understanding between Brock University and the Niagara Parks Commission- the Excellence in Environmental Stewardship Initiative (ESSI). This partnership is designed to enhance the stewardship and conservation practices of both organizations, through, for example, evidence- based research opportunities. The promotion of environmental stewardship outreach and application for environmental management in this setting highlights the relevance of this research. Therefore, within this setting and the overarching purpose, two objectives are associated with this thesis:

Objective 1: To examine inter-group differences in the perceptions of KPIs for viewpoints.

Objective One addresses the tension that practitioners and scholars face regarding the intricate balance of employing a conventional M&E approach in environmental management, with the perceptions of varying of stakeholder interests.

Typically, perceptions are one type of information that is dismissed as unreliable or anecdotal with respect to evidence-based environmental management decisions (Bennett, 2016; Cook et al., 2010; Mackinson, 2001; Oba & Kaitira, 2006). Some argue that these anecdotal contributions or decisions based on subjective perceptions run the potential risk of hiding behind assumed successful outcomes (Kellert et al., 2000; Pullin & Salafsky, 2010; Sutherland et al., 2004). Historically, traditional scientific M&E focusing predominantly on ecological indicators has been used as a way to eliminate bias and ensure objective decision making in environmental management. However, perceptions are a unique addition to ecological data, and can work to improve adaptive and collaborative environmental management. Perceptions of relevant stakeholders can provide important insights into observations, understanding, and interpretations of social and ecological impacts and outcomes of environmental management actions (Bennett, 2016; Forster et al., 2017; Guba & Lincoln, 1998). Additionally, perceptions of these factors can contribute to positive or negative local evaluations of conservation or other environmental initiatives (Bennett, 2016). Specifically, positive perceptions ultimately ensure the support of local stakeholders or constituents, thus enabling the long-term success of management planning. Finally, better incorporation of evidence from a multiplicity of sources, and across social and

natural sciences in M&E can provide a more comprehensive picture on which to base environmental management decisions (Forster et al., 2017; Huntington, 2000).

Evidently, there is an existing tension in scholarship and practice on how best to utilize a conventional M&E approaches in varying contexts, and appropriately incorporating stakeholder perceptions in environmental management. Few studies have attempted to reconcile stakeholder perceptions with the different approaches of M&E. Exploring stakeholder perceptions between these environmental management approaches responds to the need for more integrated environmental management approaches, in order to improve management response time for addressing time sensitive environmental challenges (Danielson et al., 2000). By deepening the understanding of how different stakeholders measure success and how that varies between stakeholder groups, and incorporating these perceptions in environmental management planning, practitioners can comprehensively improve environmental management strategies while also gaining support from key stakeholders. As such, this study will statistically compare stakeholder perceptions about KPIs for M&E at 12 different viewpoint locations in Niagara Parks. This objective will be achieved through two sub-objectives. The first sub-objective of this research is concerned with inter-group differences in the perception of KPIs for viewpoints held by two different stakeholder groups, as well as the influences affecting stakeholder perceptions of KPIs. The first group consists of residents of the Niagara region, and the second consists of tourists. The second sub-objective is concerned with how visitor perceptions compared to that of the environmental managers of the viewpoint sites, and therefore the data collected from the visitor groups will be considered against the perceptions of the environmental managers of these viewpoints. This study will be achieved through a non-experimental survey regarding inter group differences in perceptions about M&E.

Objective 2: To explore the influences of engaging in a PM&E process on stakeholder perceptions of KPIs for trails.

Objective Two aims to understand the effects of a PM&E workshop on stakeholder perceptions of KPIs for trails. PM&E processes have recently been emphasized as a beneficial and effective method for addressing complex environmental problems, particularly because stakeholders who see different aspects of a problem come together and constructively explore

their differences, to search for unique solutions to wicked problems (Gray, 1989). However, within literature and practice, it remains unclear exactly how the participatory process affects stakeholder perceptions generally, and specifically in reference to perceptions regarding KPIs (Hermans et al., 2011; Kananura et al., 2017; Mebrahtu, 2002; Njuki et al., 2006).

Stakeholders' perception of environmental management, and related M&E processes is central to their attitudes and beliefs about different management strategies, as well as their personal experiences in the environment (Buijs et al., 2008; Daugstad et al., 2006; Engen et al., 2019; Hanke et al., 2002). Therefore, different stakeholders inherently hold different perceptions about the approaches taken to manage the environment in particular contexts (Abbot & Guijt, 1998; Davis, 2014; Forster et al., 2017; Guba & Lincoln, 1989). It is the assumption that, by collectively engaging in a PM&E process, stakeholders arrive at some form of consensus regarding the best management approach and plan forward (Abbot & Guijt, 1998; Estrella & Gaventa, 1998; Guijt et al., 1998). While this is one of the main goals of PM&E, it is ignorant to assume that stakeholders experience a real change in their perceptions throughout or by the end of the process. Environmental issues are dynamic and complex, and stakeholder perceptions often adapt and change in similar ways. As stakeholder support for environmental initiatives and management strategies are essential for reaching environmental goals, understanding how the PM&E process affects stakeholder perceptions, and in what ways, is of paramount importance (Alwaer & Clements-Croome, 2010; Himes, 2007; Kananura et al., 2017; Mebrahtu, 2002; Yates et al., 2019).

In order to address this void, this study will compare stakeholder perceptions of KPIs for trails between a group of individuals before and after they participate in a PM&E workshop. Trails are the focus for this study as these assets have experienced increased visitorship in recent decades, and are now experiencing management issues related to increasing environmental pressure. Study Two utilizes a pre and post experimental design. Using the Niagara Glen Nature Centre site, this study seeks to first examine individual stakeholders' perceptions about KPIs in the context of this particular site, through the use of a survey and sorting exercise. Next, an intervention will take place in which the stakeholders will participate in a collaborative workshop to engage in the formative stages of a PM&E process. After the intervention, the participating stakeholders will re-take the initial survey and sorting exercise regarding KPIs.

1.2 Organization of Thesis

This introduction chapter introduces the concept of monitoring and evaluation, and summarizes the importance of monitoring and evaluation of the environment. It also clarifies important terminology associated with the concept, including the two distinct approaches of M&E that are relevant to this thesis: conventional M&E and participatory M&E. Additionally, this chapter introduced new ideas regarding M&E and its evolution towards incorporating more social dimensions of data collection for holistic environmental management strategies. The first chapter also explained the need for this research, including important tensions and voids in existing scholarship, as well as the overall purpose and objectives that drove this study.

The remaining sections of the thesis will be organized into chapters based on the objectives described in section 1.1. This research consisted of two studies, corresponding to the respective objectives. Objective one (referred to as Study One) will be described in Chapter Two. Study one examined inter-group differences in perceptions of M&E, with specific focus on stakeholder perceptions of KPIs of a particular site. More specifically, Study One consisted of a survey that was administered to tourists and residents visiting different viewpoints across the Niagara Parkway, as well as the environmental managers with authority of the sites. The survey data was used to identify differences in perception between stakeholder groups, as well as the factors that may be affecting differences in perceptions. Objective two (or Study Two) constitutes Chapter Three. To fulfill the second objective, the influence of engaging in a PM&E process on stakeholder perceptions of KPIs were examined through a quasi-experimental research design, where participants completed a pre-and-post activity and questionnaire, and a M&E workshop served as the intervention.

The final chapter of this thesis, Chapter Four, synthesizes the studies and discusses the overall findings in relation to scholarship and practice. Chapter Four connects the studies to the broader context of the literature described in Chapter One, and draws conclusions on aspects of the use of different monitoring approaches in varying contexts of environmental management. This chapter also includes important discussions about how these findings and conclusions can be connected to practice, and will identify important areas for future research.

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Chapter Two: Study One: Inter-group Perceptions of Monitoring and Evaluation and KPIs for Viewpoints

*Target Journal- Landscape and Urban Planning

2.0 Introduction

Visual or scenic experiences are a considerable aspect of encounters with the natural environment, especially in nature tourism and recreation (Zube et al., 1982; Brown & Daniel, 1984). Landscape viewpoints are of interest to a broad range of people, from recreational users seeking scenic backdrops for outdoor activities, to environmental managers who utilize viewpoints to attract tourists or use it as a backdrop against which environmental management actions are debated and implemented. As such, many iconic landscapes have been studied in order to gain a better understanding of the key attractions, values, or benefits these landscapes hold from the visitors' perspective, and how this information can be incorporated in land-use planning and management processes (e.g., Hutson & Montgomery, 2010; Kaltenborn et al., 2019, Jacobsen & Tommervik, 2016).

While the ways in which people experience and value these scenic landscapes have been widely studied, there is little understanding of how different stakeholder groups perceive environmental management strategies for these landscapes, and specifically the key performance indicators (KPIs) that make-up an environmental management approach (Buijs et al., 2008; Daugstad et al., 2006; Engen et al., 2019; Hanke et al., 2002; Pitz et al., 2016). KPIs are measurable, manageable variables that reflect the essence of management objectives (Toor & Ongunlala, 2010; Wang & Lawson, 2002). KPIs serve as metrics for tracking variables of interest in the monitoring and evaluation of environmental management approaches.

Typically, traditional scientific monitoring and evaluation (M&E) focusing predominantly on ecological indicators has been used as a way to eliminate bias and ensure objective decision making in environmental management more broadly (Bennett, 2019; Koontz & Thomas, 2006; Sutherland et al., 2004). However, perceptions are a unique addition to ecological data, and can work to improve adaptive and collaborative environmental management. Perceptions of relevant stakeholders can provide important insights into observations,

understanding, and interpretations of social and ecological impacts and outcomes of environmental management actions (Bennett, 2016). Consideration towards stakeholder perceptions of KPIs for the management of viewpoints is crucial, as the combination of social information with the ecological data being collected in a conventional M&E approach, can allow practitioners to holistically improve environmental management strategies while also gaining support from key stakeholders (Bennett, 2016; Berkes et al., 2003; Forster et al., 2017; Jackson & Kassam, 1998; Stem et al., 2005). If explored, such diverse perspectives can also offer unique insight into the landscape preferences of different groups or visitors to viewpoints, and in turn, translate into more successful management practices of these areas (Albert et al., 2013; Bennett, 2016; Burger, 2002; Hill & Daniel, 2008; Light et al., 2013; Villamor et al., 2014).

Iconic scenic landscapes provide the overall context for this study. Iconic landscapes are widely admired, essential to identity, spiritually important, or unique to the scenery of the area (Chylinska, 2018; Cooper et al., 2016; Daniels, 1993; Terlouw, 2014). Their 'iconic' role might result from a number of aspects, such as "their natural beauty, sublimity, extensiveness, complexity, or mystery" (Chylinska, 2018, p. 536). Studies of iconic landscapes from the visitors' perspective are important to gain a better understanding of the key attractions of these landscapes (e.g., Hutson & Montgomery, 2010; Kaltenborn et al., 2019; Jacobsen & Tommervik, 2016). As well, the perceptions of visitors likely influence the environmental management approaches taken by site managers, who often have an objective to conserve and improve scenic resources (Alessa et al., 2003; Shultis & Way, 2006). Different landscape vistas would benefit from knowledge of how visitors perceive environmental management approaches and related KPIs, allowing managers to create better and more sustainable views, and prioritize maintenance activities.

There is increasing recognition of the importance of incorporating stakeholders' perceptions in environmental management planning, so that practitioners can holistically improve environmental management strategies while also gaining support from key stakeholders. However, there is an existing tension in scholarship and practice on how to appropriately incorporate stakeholder perceptions in environmental management decisions. Additionally, different stakeholders may have different perceptions regarding the success of an environmental

management strategy (Davis, 2014). Therefore, understanding how different stakeholders perceive the KPIs that make-up an environmental management approach is of paramount importance, as management decisions can yield different results and have significantly different impacts on an environment (Alwaer & Clements-Croome, 2010; Himes, 2007; Yates et al., 2019). As such, the overarching objective of this study explores the inter-group differences in perceptions of KPIs for M&E at 12 different viewpoint locations across the iconic Niagara Parks landscape. Two sub-objectives are associated with this aim. The first sub-objective of this research is concerned with inter-group differences in the perception of KPIs for viewpoints held by two different stakeholder groups, as well as the influences affecting stakeholder perceptions of KPIs. The first group consists of residents of the Niagara region, and the second consists of tourists. The second sub-objective is concerned with how visitor perceptions compared to that of the environmental managers of the viewpoint sites, and therefore the data collected from the visitor groups will be considered against the perceptions of the environmental managers of these viewpoints. This study will be achieved through a non-experimental survey regarding inter-group differences in perceptions about M&E.

2.1 Background Literature

Since the late 1960s, there has been growing recognition among environmental scholars and practitioners that "effective project management goes beyond simple implementation and is integrally linked to well-designed monitoring and evaluation systems" (e.g., Hockings et al., 2000; Margoluis & Salafsky, 1998; Woodhill, 2000 in Stem et al., 2005, p. 1). In particular, M&E has taken on increased importance in the environmental domain, as scholars and practitioners struggle to demonstrate progress made towards addressing wicked problems. M&E is regarded as a process, undertaken to assess and improve the performance of a system in order to achieve a desirable outcome(s) (Estrella & Gaventa, 1998; Jackson & Kassam, 1998). It has been argued that traditional scientific M&E, also known as conventional M&E, is necessary to eliminate bias and ensure objective decision making in environmental management, especially when multiple interests or stakeholders are involved (Bennett, 2016; Koontz & Thomas, 2006; Sutherland et al., 2004). Scientific measures tend to be favoured for their reliability and accuracy

in ecological measurement, thus preventing mislead intuitions while increasing accountability (Cook et al., 2010; Forster et al., 2017; Pullin & Knight, 2003; Sutherland et al., 2004).

Historically, conventional M&E approaches emphasize achieving ultimate system effectiveness, and as such, they are externally oriented towards enhancing cost efficiency or accountability, particularly using top-down approaches (Estrella & Gaventa, 1998; Guba & Lincoln, 1989; Jackson & Kassam, 1998). Experts external to the project are usually contracted to conduct the evaluation as a way to ensure objectivity, therefore stakeholders or participants of the project have no input in the M&E process; this includes the types of information obtained for analysis, as well as reflecting on and using evaluation findings in the ongoing planning and implementation of project initiatives (Guba & Lincoln, 1989; Guijt et al., 1998; Rossi et al., 1999). However, more recently there has been increasing recognition of the importance of engaging stakeholders in environmental management strategies (Margoluis & Salafsky, 1998). Consideration towards stakeholders' perceptions of their environment can combine objective, ecological data with qualitative information about a system as well. Specifically, for social monitoring it is useful to incorporate qualitative methods and measures that capture distinct insights, such as the perceptions, values and experiences of stakeholders (Trimble & Plummer, 2018). In this context, environmental managers can be provided with a more complete understanding of the success of environmental management approaches for different landscape viewpoints.

Research on landscape perception over time has explored a significant number of influential theories and discourses (Scott, 2006). For example, evolutionary theories of landscape perception shaped significant research on whether humans generally possess innate preferences for particular environments (Appleton, 1975; Kaplan, 1992). Bio-basic human theories proposed that humans can be biologically conditioned to favour certain landscape characteristics, from which quantitative models for predicting preferences and perceptions of land management were developed, with varying success (Daniel & Boster, 1976; Ulrich, 1997). The root of landscape preference and perception research was founded on the expert-led, or objective, philosophy (Lothian, 1999; Scott, 2003; Scott, 2006; Shafer et al., 1969). This paradigm is based on the assertation that only trained professionals, or professionals with adequate experience have the

ability to express judgements of scenic quality through interpreting the aesthetic values of society in a consistent, scientific and coherent format (Jacques, 1980; Kaplan & Kaplan, 1982; Nicholls & Sclater, 1993; Sanoff, 1991; Scott, 2006). Shafer et al. (1969, p. 1) justifies that it is important "to identify what quantitative variables in a natural landscape are significantly related to public preference for that landscape. By knowing what features in a landscape affect its aesthetic appeal, natural resource planners can make decisions on a factual basis about purchasing, developing, or preserving these features". However, there has been increasing dissatisfaction with expert-led approaches, primarily relating to the formation of "synthetic" landscapes from pre-selected components and from the biases inherent in expert-driven values and preferences in what are often subjective assessments in the field (Duffield & Coppock, 1975; Gold, 1980; Scott, 2006).

As a response to the dissatisfaction of older philosophies driving environmental management decisions, the use of public perceptions and preferences in evaluating landscapes and related environmental management approaches is gaining attention (Kent, 1993; Penning-Rowsell, 1982; Seddon 1986). Consequently, researchers and practitioners are recognizing that it is the public who ultimately experience changing landscapes, and their views and preferences must be included in decision making (Villamor et al., 2014). There is an increasing level of endorsement for 'bottom-up' approaches to evaluating scenic landscapes (Scott, 2003; Villamor et al., 2014). The basic definition provided by the European Landscape Convention (CoE, 2008, p. 9) recognizes scenic landscapes as "an area, as perceived by people...". Following this definition, it is noted that to assess the landscapes experts must take into account the particular values assigned to them by the interested parties and the population concerned" (CoE, 2008, p. 13). Using this approach, the study of stakeholder perceptions can be used to assess landscape viewpoints on the basis of the actual population concerned.

Landscape viewpoints can affect people in different ways, and even a small group of people may hold complex perceptions regarding viewpoints that may be influenced by personal experience, socio-economic status, educational background and expertise, culture, etc. (Brabyn; 1996; Jorgensen, 2011; Scott, 2003). It is this variability of perceptions between different people or groups than can generate conflict and disagreements in viewpoint management approaches.

For example, viewpoint managers might have an underlying preference for the presence of certain vegetative species within a viewpoint, such as species at risk. On the other hand, tourists who have traveled great distances to experience a particular scenic viewpoint may prefer that same view to be more open, with reduced amount of vegetation. Viewpoint managers are thereby tasked with providing positive and memorable visual experiences for a wide range of user groups, while simultaneously protecting the natural environment and ensuring management goals are met (Kohlhardt et al., 2017; Manning, 2007; Newsome et al., 2012).

The use and analysis of viewpoint KPIs provide the possibility for a more objective basis for identifying landscape character, by taking into account the totality of stakeholders' visual perception of the landscape and dividing it into quantifiable characteristics (Sang & Tveit, 2008). To date, the work on indicators for monitoring and analyzing landscape viewpoints has been mainly focused on ecological indicators, with numerous models and frameworks available from which experts can aggregate appropriate indicators for different contexts (e.g., more naturalized viewpoints vs manmade viewpoints) (Fry et al., 2009; Hansen & Loveland, 2012; Hedblom et al., 2020). However, landscapes are acknowledged as having different social functions as well, such as being a source of psychological wellbeing, educational values, etc. (Hedblom et al., 2020). In literature, (for example OECD, 1997; NIJOS, 2003; Wascher, 2004; Palang, 2008) the most frequently used categories of landscape values are: amenities, aesthetic value, identity value, historical-cultural value, and educational value. In the context of Niagara Parks, the U.S. National Parks Service's (NPS) visual inventory system was considered the most applicable for the NPC's scenic resources, particularly for the integration of cultural and heritage elements and values in the scenic inventory process (Niagara Parks Viewpoints, 2019). This inventory takes into account physical characteristics of the viewpoint, such as accessibility, amenities, vegetation, maintenance, and view/scenic quality. Within these broad "inventory" variables, the NPS inventory system provides specific characteristics or sub-variables that can be recorded for the purpose of monitoring and assessment of viewpoints. In attempting to gain a more holistic understanding of stakeholder perceptions of viewpoints, it is important to consider both ecological indicators and social indicators, as both aspects will impact visitor experiences.

There is a considerable research gap regarding how different people perceive these particular landscapes (viewpoints) and related indicators, and what influences people's perception of certain landscapes (Hunziker et al., 2007). According to Kienast et al. (2015), the main reason for the lack of detailed monitoring programs over time is the high cost of gathering such data. Constraints of time and resources, together with a reluctance to involve the public in 'professional' landscape matters, have limited the scope and influence of much participation to conventional 'top-down' strategies (Lasker & Weiss, 2003; Margoluis et al., 2009; Scott, 2006). Additionally, in certain contexts it is difficult to meaningfully include all stakeholder or stakeholder groups in management decisions regarding viewpoints. As mentioned above, it is argued that there is some level of expertise that must be included in final management decisions, especially in regards to ecologically sensitive regions or regions with specific legislative requirements for protecting natural resources (Jacques, 1980; Kaplan & Kaplan, 1982; Nicholls & Sclater, 1993; Sanoff, 1991; Scott, 2006). Furthermore, areas with extremely high numbers of visitors and ever-changing tourist populations, for example, make it challenging to engage with each visitor. Nature enthusiasts may not want to be engaged with and may prefer to feel as though they are in a remote area, away from human activity. Essentially, balancing the level of stakeholder involvement in management approaches for viewpoints varies by context and depends on the overall management goals for the environment.

Although tensions still exist regarding the approaches taken in landscape and viewpoint management, it is evident that some level of consideration towards how stakeholders experience and perceive their environment is critical because management decisions based, at least partially, on user experience can yield different results and have significantly different impacts on an environment (Alwaer & Clements-Croome, 2010; Himes, 2007; Yates et al., 2019). By incorporating these perceptions in environmental management planning, practitioners have a greater opportunity to holistically improve environmental management strategies while also gaining support from key stakeholders (Stem et al., 2005). However, due to these existing tensions in practice and scholarship, and because each viewpoint offers the viewer a different experience, it still remains unclear how different stakeholders interpret or perceive these iconic viewpoints, and more specifically, how they perceive the KPIs that make up the environmental management strategies for these environments.

2.2 Methods

2.2.1 Study Site

Niagara Parks, Ontario, Canada, specifically the Niagara Parkway, was selected as the site of this study. The Niagara Parkway is a scenic route running parallel to the Niagara River. This area is widely considered an iconic landscape, holding important aesthetic, spiritual, cultural, and economic value, which attracts a large number of tourists and sightseers from around the world (Colton & Buckley, 2014; Chaffer, 2015; Sternberg, 1997). The Niagara Parkway runs 55 kilometers from Fort Erie in the South, to Niagara on the Lake in the North. The NPC have over 70 designated viewpoints in its land along the Niagara river, primarily in the North and South sectors. The sites are all managed and maintained by the Niagara Parks Commission (NPC). However, many of these are legacy sites, established under different landscape management objectives.

In order to capture the diverse nature of scenic landscapes associated with the NPC, 12 different vistas along this expanse of land were chosen as the focus of this study (Figure 2.1). These sites have been identified by the NPC as priority sites to develop standards for conserving and improving scenic resources, to create better and more sustainable views, and prioritize maintenance activities (Niagara Parks Viewpoints, 2019). Multiple viewpoints were chosen as opposed to a single viewpoint to account for a variety of site types and management styles, which may influence stakeholder perceptions of viewpoints. Three overarching site types were identified through conversations with NPC collaborators. First, park site types included open green areas designated to public use for rest and recreation. Second, scenic lookout site types included locations where people primarily view scenery at a designated observation point. Third, historical/interpretation site types included areas associated with historical or cultural relevancy. Additionally, different viewpoints prescribe different management practices, and the intended goal is to include viewpoints that have well-established management practices as well as viewpoints that do not prescribe to specific management practices at the time of this study. Adapted from the guidelines of the Canadian Landscape Standard, the ‘prescribed management’ classification in this study refers to sites in which the viewpoint is groomed or maintained in any manner (frequently, monthly, or seasonally): including mowed grass, trimmed vegetation or

foliage, planted flower beds, etc. The low-unmanaged classification refers to sites in which the viewpoint has not been groomed, and has remained untouched for at least one year, appearing more “natural”. While there are noticeable physical differences between the North and South viewpoints, the North viewpoints experience much higher visitation rates than the South viewpoints. Therefore, due to a short data collection season, a majority of the 12 viewpoints chosen for this study are located in the North. Table 2.1 summarizes the criteria/characteristics of the sites that will be considered in the analysis of stakeholder perceptions.

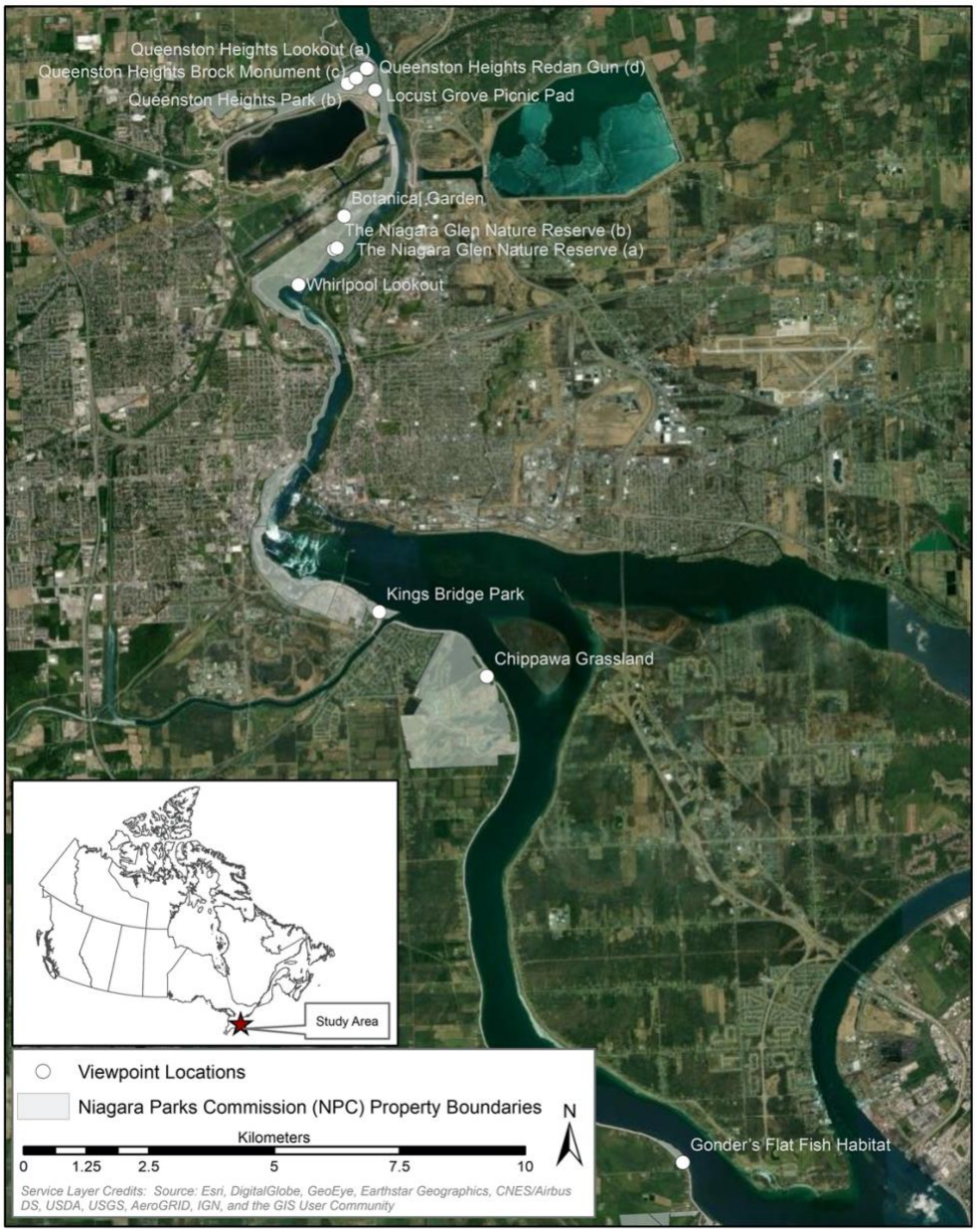

Figure 2.1: A map of Niagara Parkway indicating location of 12 scenic vistas

Table 2.1: Viewpoint locations along the Niagara Parkway, including type of site, and management style

Viewpoint Location	Type	Management Style
1. Whirlpool Lookout	Scenic Lookout	Low-Unmanaged
2. The Niagara Glen Nature Reserve (a)	Scenic Lookout	Low-Unmanaged
3. Queenston Heights Lookout (a)	Scenic Lookout	Low-Unmanaged
4. Gonder's Flat Fish Habitat	Scenic Lookout	Prescribed Management
5. The Niagara Glen Nature Reserve (b)	Park	Prescribed Management
6. Queenston Heights Park (b)	Park	Prescribed Management
7. Locust Grove Picnic Pad	Park	Low-Unmanaged
8. Kings Bridge Park	Park	Prescribed Management
9. Queenston Heights Brock Monument (c)	Historical/interpretation	Prescribed Management
10. Botanical Garden	Historical/interpretation	Prescribed Management
11. Queenston Heights Redan Gun (d)	Historical/interpretation	Low-Unmanaged
12. Chippewa Grassland	Historical/interpretation	Low-Unmanaged

2.2.2 Procedure

In order to gain information about users' perceptions regarding KPIs for environmental management of the sites, a total of 701 visitors were surveyed across the 12 sites (roughly 60 participants at each site). Each visitor only viewed a single site, and therefore completed one survey. A pseudorandom sampling approach was taken to sample two distinct groups: tourists and residents of the surrounding community. Tourists are considered any persons traveling to and staying in places outside their usual environment (more than 80 kilometers one way from home) for not more than one consecutive year for leisure, business, and other purposes (Statistics Canada, 2015). Residents are considered permanent residents within the Niagara region, living in close proximity to Niagara Parks. Differentiation between these stakeholder groups was determined by a screening question when approaching site users, as well as through a demographic question within the survey. A total of eight respondents were initially screened out either based on their age or because the researcher collected enough questionnaires from one stakeholder group at a site. All respondents were over 18 years of age, English speaking, and had given informed consent. Additionally, two environmental managers who have authority over all 12 of the viewpoint locations were surveyed.

In terms of sampling procedure, multiple days within the summer season that people can be surveyed were randomly selected to collect data. All data was collected between August 28th-October 15th, 2019. This time period allowed the researcher to account for variation in weather, maintenance of sites, etc. On the randomly selected days, tourist and resident stakeholder groups were approached on site and asked if they would be willing to participate in the study by completing the questionnaire. All participants provided informed consent prior to participating, and the study was approved by the Research Ethics Board at Brock University.

2.2.3 KPI Questionnaire

This study used the methodology pioneered by the World Governance Assessment (ODI, 2008). The methodology relies on identifying key stakeholder groups and asking them to complete a quantitative questionnaire on the topic in question. If used correctly, this methodology can identify differences in perception between stakeholder groups, as well as factors that might be affecting differences in perceptions (ODI, 2008). As such, this can be a useful methodology for understanding stakeholder perceptions.

The questionnaire consisted of three different parts (Appendix 2-1). The first section was comprised of demographic-type questions. The second and third sections focused on stakeholder perceptions of KPIs for viewpoints. Development of the KPIs used in the questionnaire were guided by the NPS' visual resource inventory (in Niagara Parks Viewpoints, 2019), as well as through conversations with key NPC collaborators who trialed the NPC inventory system one month prior to this research. The second section consisted of a general list of KPI items used for site management, for which the participants were asked to rank in order of most important to least important for their viewing experience at a site in Niagara Parks. Finally, in the third section the KPI items were further expanded and the participants were asked to rate the adequacy of each KPI item, and indicate their preference for each KPI item and related sub-variables using a 5-point Likert-type scale (where 1= not important at all, 2= not necessarily important, 3= important sometimes, 4= important, and 5= extremely important). Following direct exposure to the site, participants were asked to complete the questionnaire via the tablet (or hard copy if accessibility was an issue). The average length of the questionnaire was 15 minutes.

2.2.4 Data Analysis

Several statistical analyses were performed using IBM SPSS to answer the respective objectives of this study (see section 2.1). First, a series of one-way analysis of variance (ANOVA) were used to test the influence of each demographic variable (gender, age, education, and income) on the perceptions of overall scores for the KPIs (accessibility, amenities, vegetation, maintenance, view quality) for each site (overall scores were averaged from the participants' total responses). These demographics are important to consider at the forefront, as these extraneous factors may influence participant perceptions of KPIs.

The first objective of this research is concerned with inter-group differences in the perception of KPIs, particularly those between tourists and residents. Using the means scores for each KPI of each group, a series of one-way analysis of variance (ANOVA) was performed to ascertain if respondent groups had differing perceptions of the overall KPI scored for each of the viewpoint sites. The results of the ANOVA can determine if there is a significant difference in the perceptions between the two groups on the rating of KPIs. Additionally, a series of between-subjects factorial ANOVAs were performed to examine the effect of perceptions of management style and stakeholder group, as well as site type and stakeholder group, on the overall KPI scores of NPC viewpoints. Next, in order to further explore stakeholder perceptions of KPIs of NPC viewpoints, a principal component factor analysis with a varimax rotation with Kaiser normalization was performed on each of the sub-variables for the KPI items. Using the composite scores created for each KPI variable based on the loading factors, a between-subjects one-way ANOVA was performed to examine the effect of stakeholder group on the perceptions of KPIs for NPC viewpoints. As per the second objective, this research was also interested in how visitor perceptions compared to that of the environmental managers of the viewpoint sites. As such, a Wilcoxon signed rank test was used to compare each stakeholder group (residents and tourists) with the environmental managers' data.

2.3 Results

Results from the study are presented in three parts. First, the demographic information and overall rankings of the KPI variables will be presented. This subsection includes the

demographic information for the two visitor groups surveyed, the purpose for their visit to the site, and the frequency in which they visit the site. The second sub-section addresses the first objective of the study (see section 2.1). This subsection presents the overall rankings of the KPI variables for viewpoints between both visitor groups, the relationship between demographic information, site type, and management style on stakeholder perceptions of KPIs for viewpoints, as well as the effect of stakeholder group on the perceptions of the KPI items for NPC viewpoints. The third sub-section addresses the second objective of the study (see section 2.1). This sub-section compares the visitor groups' perceptions of overall scores for each KPI variable and the environmental managers' perceptions of overall KPI scores.

2.3.1 Demographic Information

A total of 701 respondents completed the survey; 333 of tourists, and 368 of residents. Table 2.2 shows demographic information across the stakeholder groups. Out of these responses, over half of the total participants (58%) indicated that the purpose of their visit to the site was "enjoying nature" or "sightseeing". Relatedly, 28% of participants indicated that it was their first time visiting the site, and 48% indicated that they had only been to the site 1-2 times before.

Table 2.2: Demographic information for groups surveyed

	Residents	**Tourists**
N	368	333
Gender		
Male	47.6%	52.6%
Female	52.4%	47.4%
Age		
18-24	7.1%	4.8%
25-29	16.6%	10.2%
30-34	12.5%	14.7%
35-39	13.3%	13.5%
40-44	15.8%	16.8%
45-49	16.8%	18.9%
50+	17.9%	21.0%
Education		
Highschool or equivalent	22.0%	18.3%
Some college/university	21.2%	14.1%
College diploma or equivalent	30.4%	32.7%
Bachelor's degree	20.4%	28.8%
Master's degree or higher	6.0%	6.0%
Employment		
Employed full or part time	69.0%	75.0%
Other	30.8%	25.0%

2.3.2 Stakeholder Perceptions of KPIs for Viewpoints and Influences Affecting Perceptions

2.3.3 Overall Ranking of KPIs

In terms of ranking the overall importance of KPIs for viewpoints broadly, 37.6% of respondents ranked "view quality" as the most important KPI for NPC sites. This was followed by "vegetation", "amenities", "accessibility", with "maintenance" as the least important input. All KPI items were ranked in the same order of importance by both resident and tourist stakeholder groups. (Table 2.3).

Table 2.3: Ranking the importance of KPI items

KPI Items	Residents	Tourists	Total
View Quality	35.9%	41.7%	37.6%
Vegetation	30.3%	31.9%	31.1%
Amenities	15%	12.8%	14%
Accessibility	13.3%	9.5%	11.2%
Maintenance	5.2%	3.9%	4.7%

2.3.4 Relationship between Demographic Information and KPI perceptions

A series of between-subjects one-way ANOVAs were performed to examine the effect of demographics on the overall scores for each KPI variable (accessibility, amenities, vegetation, maintenance, and view quality). Accessibility scores, $F(6, 694) = 2.222$, $p = .039$, $\eta^2 = 0.018$, and amenity scores, $F(6, 693) = 2.282$, $p = .034$, $\eta^2 = 0.019$, significantly differed as a function of age, such that older individuals provided significantly lower accessibility and amenity ratings as compared to younger individuals. However, a Scheffe post-hoc analyses on age showed no significant differences between the age groups. There was also a significant main effect of gender, $F(1, 698) = 6.034$, $p = .014$, $\eta^2 = 0.008$, such that females rated the amenities higher than males. There was also a significant main effect of gender, $F(1, 698) = 5.283$, $p = .022$, $\eta^2 = 0.007$, such that females rated overall maintenance higher than males. There was a marginally significant effect of education level, $F(4, 695) = 2.371$, $p = .051$, $\eta^2 = 0.013$, such that the more education a person had, the higher the person scored the amenities. However, a Scheffe post-hoc analysis showed no significant differences in the perceptions of the overall amenities of NPC viewpoints between education levels. There was no significant effect of age, gender, education, or employment status on any other KPI variable, all $F(1, 697) = < 3$, all $p = > 0.05$, all $\eta^2 = < .01$ (Appendix 2-2).

2.3.5 Relationship between management style and overall perceptions of KPIs

A series of between-subjects factorial ANOVA was performed to examine the effect of perceptions of management style and stakeholder group on overall KPI scores of NPC viewpoints. For each KPI item, there was a significant main effect of perceptions management

style, all $F(1,696) = < 78.873$, all $p = > .001$, all $\eta^2 p = < .102$, such that people perceived the viewpoints that had a prescribed management approach as having better KPIs than low/unmanaged viewpoints. There was, however, no main effect of stakeholder group, all $F(1,696) = < 3.790$, all $p > .05$, all $\eta^2 p = < .005$, such that overall KPI scores did not differ whether participants were residents or tourists. Finally, there was no significant interaction between stakeholder group and management style, all $F(1,76) = < .482$, all $p = > .488$, all $\eta^2 p = < .001$ (Appendix 2-3).

2.3.6 Relationship between site type and overall perceptions of KPIs

Site Type and Accessibility Score

A 2x3 between-subjects factorial ANOVA was performed to examine the effect of perceptions of site type and stakeholder group on the overall accessibility scores of NPC viewpoints. There was a significant main effect of perceptions site type, $F(2,694) = 5.205$, $p = .006$, $\eta^2 p = .015$, such that people perceived "park" site types as having better accessibility than "historical/interpretation" or "scenic lookout" site types. However, a Scheffe post-hoc test analysis on site type showed no significant differences in the perception of accessibility between the different site types, all $p > .05$. There was no main effect of stakeholder group, $F(1,694) = 0.022$, $p > .05$, $\eta^2 p = .000$, such that the overall accessibility scores did not differ whether participants were residents or tourists. Finally, there was no interaction between stakeholder group and site type, $F(2,694) = 0.065$, $p = .937$, $\eta^2 p = .000$.

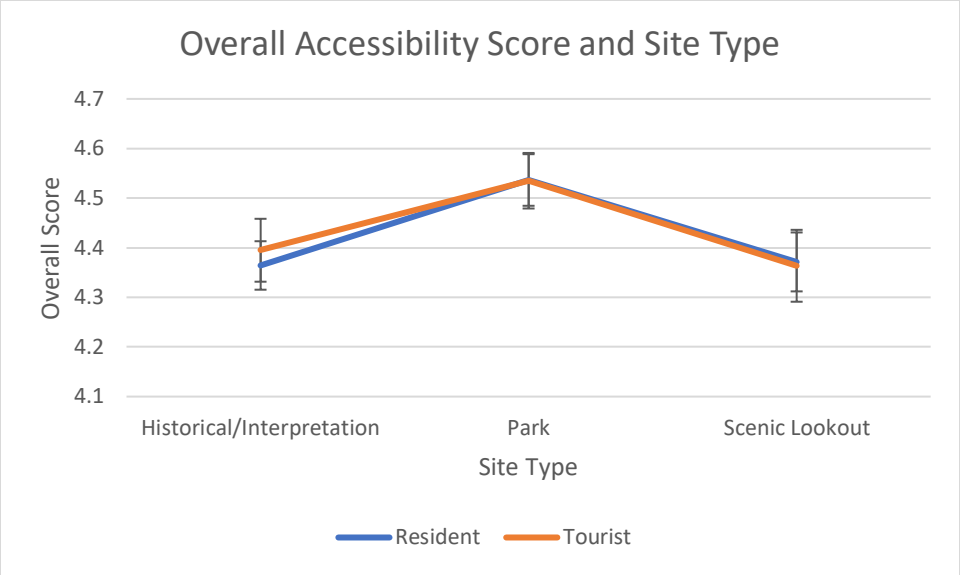

Figure 2.2: Resident and Tourists' overall score for accessibility between three site types with standard error bars

Site Type and Amenities Score

A 2x3 between-subjects factorial ANOVA was performed to examine the effect of perceptions of site type and stakeholder group on the overall amenities scores of NPC viewpoints. There was a significant main effect of perceptions site type, $F(2,693) = 6.440$, $p = .002$, $\eta^2p = .018$, such that people perceived "park" site types as having better amenities than "historical/interpretation" or "scenic lookout" site types. However, a Scheffe post-hoc test analysis on site type showed no significant differences in the perception of amenities between the different site types, all $p > .05$. There was also a significant main effect of stakeholder group, $F(1,693) = 0.042$, $p= 0.042$, $\eta^2p = .006$, such that the tourists had higher ratings of amenities than the residents. Finally, there was no interaction between stakeholder group and site type, $F(2,693) =0.262$, $p = .770$, $\eta^2p = .001$.

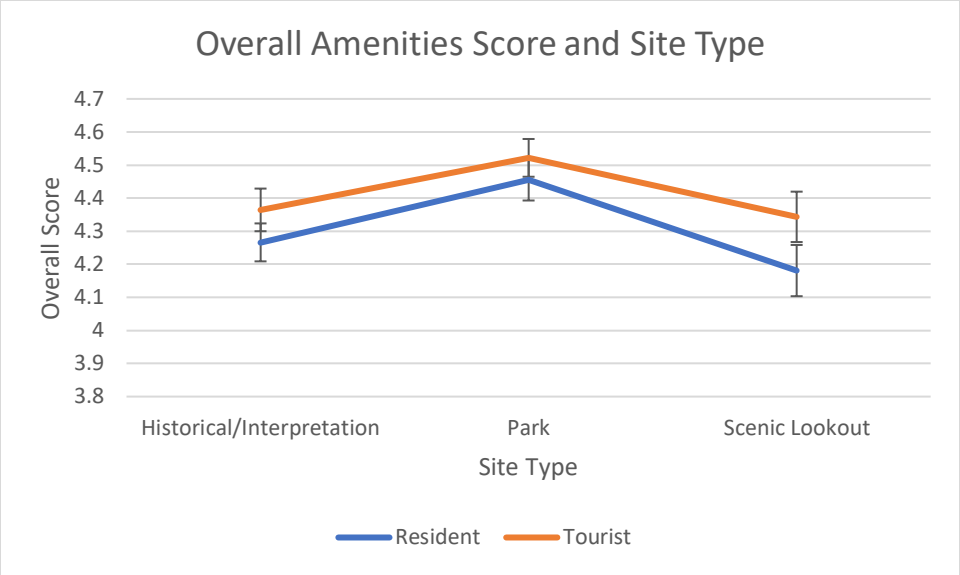

Figure 2.3: Resident and Tourists' overall score for amenities between three site types with standard error bars

Site Type and Vegetation Score

A 2x3 between-subjects factorial ANOVA was performed to examine the effect of perceptions of site type and stakeholder group on the overall vegetation scores of NPC viewpoints. There was a significant main effect of perceptions site type, $F(2,694) = 7.931$, $p = .001$, $\eta^2 p = .022$, such that people perceived "scenic lookout" site types as having their more preferred vegetation than "historical/interpretation" or "park" site types. However, a Scheffe post-hoc test analysis on site type showed no significant differences in the perception of vegetation between the different site types, all $p > .05$. There was no main effect of stakeholder group, $F(1,694) = 3.251$, $p = .072$, $\eta^2 p = .005$, such that the overall vegetation scores did not differ whether participants were residents or tourists. Finally, there was no interaction between stakeholder group and site type, $F(2,694) = 0.281$, $p = .755$, $\eta^2 p = .001$.

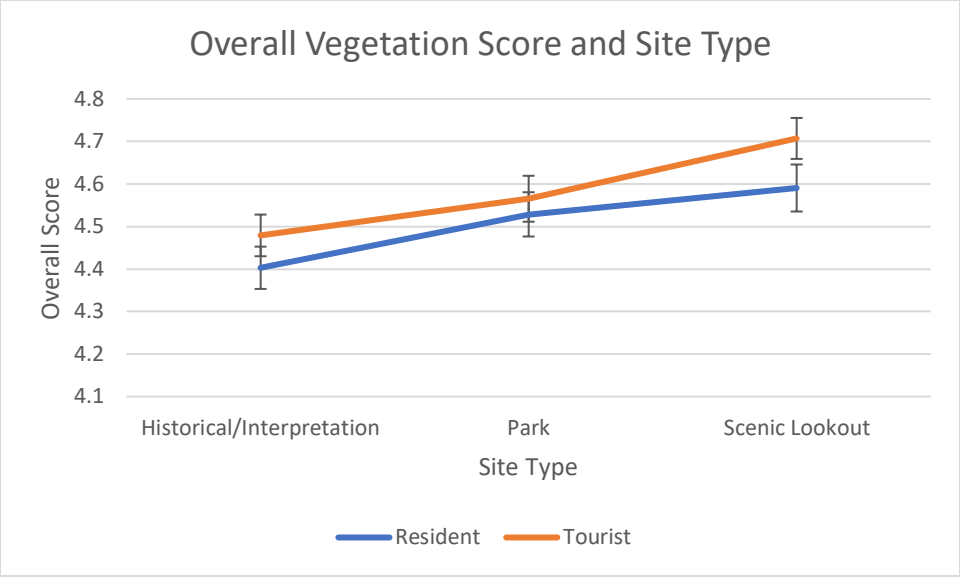

Figure 2.4: Resident and Tourists' overall score for vegetation between three site types with standard error bars

Site Type and Maintenance Score

A 2x3 between-subjects factorial ANOVA was performed to examine the effect of perceptions of site type and stakeholder group on the overall maintenance scores of NPC viewpoints. There was no main effect of perceptions site type, $F(2,693) = 1.414$, $p = .244$, $\eta^2 p = .004$, such that the overall maintenance score did not differ whether the site was a park, scenic lookout, or historical/interpretation site. There was also no main effect of stakeholder group, $F(1,693) = .001$, $p = .998$, $\eta^2 p = .001$, such that the overall maintenance scores did not differ whether participants were residents or tourists. Finally, there was no interaction between stakeholder group and site type, $F(2,693) = 1.339$, $p = .263$, $\eta^2 p = .004$.

Site Type and View Quality Score

A 2x3 between-subjects factorial ANOVA was performed to examine the effect of perceptions of site type and stakeholder group on the overall view quality scores of NPC viewpoints. There was a significant main effect of perceptions site type, $F(2,695) = 17.608$, $p = .001$, $\eta^2 p = .048$. A Scheffe post-hoc test analysis on site type showed that park site types were rated as having lower view quality than scenic lookout sites or historical interpretation sites.

There was no main effect of stakeholder group, $F(1,695) = 0.037$, $p = .847$, $\eta^2 p = .001$, such that the overall view quality scores did not differ whether participants were residents or tourists. Finally, there was a significant interaction between stakeholder group and site type, F(2,695) =3.650, p = .026, $\eta^2 p = .010$. A simple effects analysis was performed to further explore this interaction. We found that residents and tourists significantly differ in their perceptions scenic lookouts, but not for historical interpretation or park site types. There was a significant difference in residents perceptions (M= 4.50, SD= .539) versus tourists perceptions (M= 4.69, SD= .466) of view quality of scenic lookout sites, t(202)= - 2.574, p= .011, such that residents rated the view quality of these sites lower than tourists.

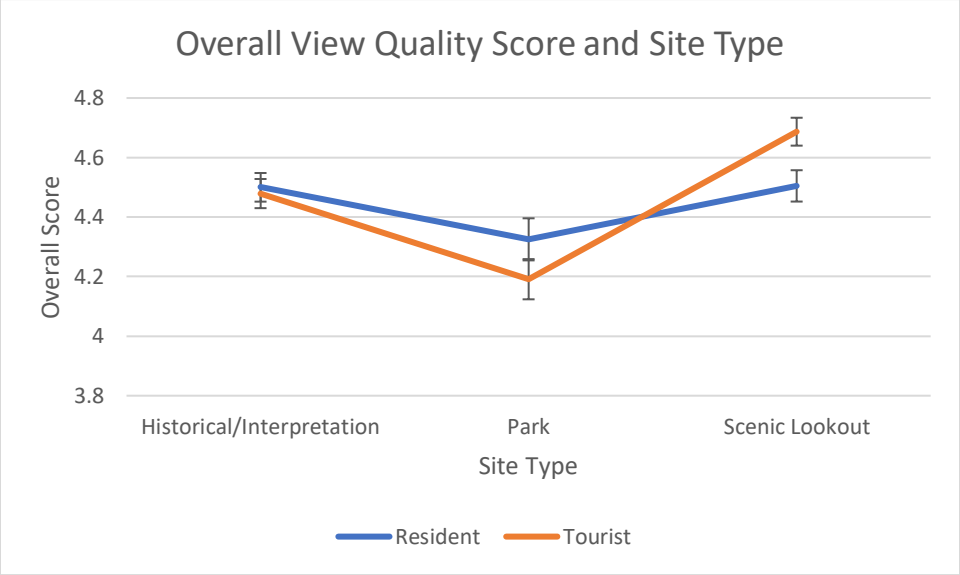

Figure 2.5: Resident and Tourists' overall score for view quality between three site types with standard error bars

2.3.7 Comparing stakeholder perceptions of five KPI sub-variables

In order to further explore stakeholder perceptions of KPIs across NPC viewpoints, a principal component factor analysis with a varimax rotation with Kaiser normalization was performed on each of the sub-variables of accessibility (six items), amenities (eight items), vegetation (four items), maintenance (three items), and view quality (three items). This analysis identified patterns in the correlations between variables, and grouped them into factors which are inter-related. This was done to collapse the numerous variables into more manageable groups. A

two-factor solution was obtained for accessibility such that vehicle, cyclist and wheelchair access loaded on one factor, and pedestrian public transportation, and all-season access loaded on another. A two-factor solution was obtained for amenities such that seating, parking, cycling, washrooms, food/beverage, amenities for children, and safety features loaded on one factor, and signage loaded on another. A one-factor solution was obtained for vegetation such that natural vegetation, non-native vegetation, diverse species, and canopy cover all loaded on one factor. A two-factor solution was obtained for maintenance such that natural vegetation in view, and framed vegetation in view loaded on one factor, and wide-open view loaded on another. Finally, a one-factor solution was obtained for view quality such that association with cultural/heritage site, consistent landscape elements, and distinctive and exceptional views all loaded on one factor.

Next, using the composite scores created for each KPI variable based on the loadings on the one factor in Table 2.4, a series of between-subjects one-way ANOVA was performed to examine the effect of stakeholder group on the perceptions of the KPI items for NPC viewpoints. There was a significant main effect of stakeholder group on the perception of "other" accessibility, $F(1, 680) = 4.198$, $p = .041$, $\eta^2 = 0.001$, such that residents rated the "other" accessibility KPI variables higher than tourists. There were no other significant differences with stakeholder group for any other accessibility sub-variable, all $F(1, 698) = < 3.340$, all $p = > .05$, all $\eta^2 = < .004$. There was also no significant effect of stakeholder group on the perception of any other KPI item (amenities, vegetation, maintenance, view quality), all $F(1,698) = < 2$, $p = > .0.10$, $\eta^2 = < .002$

Table 2.4: Factor analysis table for perceptions of five KPI sub-variables

KPI items	**Factor 1**	**Factor 2**	**Communality**
Accessibility	Personal Transprt.	Other	
Vehicle	.**908**	.119	.839
Pedestrian	.085	**.893**	.805
Cyclist	**.636**	.567	.726
Public Transport	.558	**.656**	.724
All Season	.226	**.836**	.750
Wheelchair	**.879**	.207	.816
Eigenvalue	2.37	2.31	

KPI items	**Factor 1**	**Factor 2**	**Communality**
% of Total Variance	39.52	38.45	
Total Variance	38.45	77.97	
Amenities	Other	Signage	
Seating	**.818**	.063	.673
Signage	.440	**.509**	.453
Parking	**.692**	.511	.739
Cycling	**.852**	.144	.746
Washroom	**.866**	-.333	.860
Food/Beverage	**.823**	-.372	.815
Amenities for Children	**.825**	-.444	.878
Safety Features	**.703**	.299	.583
Eigenvalue	2.37	2.31	
% of Total Variance	39.52	38.45	
Total Variance	38.45	77.97	
Vegetation	Vegetation		
Natural Vegetation	**.827**		.685
Non-native Vegetation	**.709**		.503
Diverse Species	**.800**		.641
Canopy Cover	**.508**		.258
Eigenvalue	2.087		
% of Total Variance	52.171		
Total Variance	52.171		
Maintenance	Natural	Manicured	
Wide-open View	.134	**.977**	.973
Natural Vegetation in View	**.774**	-.219	.647
Framed Vegetation in View	**.793**	.048	.630
Eigenvalue	1.12	1.01	
% of Total Variance	41.38	33.64	
Total Variance	33.65	75.02	
View Quality	View Quality		
Association with Heritage Site	**.458**		.210
Consistent Landscape Elements	**.752**		.565
Distinctive and Exceptional Views	**.802**		.643
Eigenvalue	1.418		
% of Total Variance	47.28		
Total Variance	47.28		

2.3.8 Comparing Environmental Managers' Perceptions with Stakeholder Perceptions for Overall KPI Scores

In order to explore the perceptions of each stakeholder group in comparison to the viewpoint environmental managers, a Wilcoxon signed-rank test was used. First, we compared the residents' perceptions of overall scores for each KPI variable and the environmental managers' perceptions of overall KPI scores. Residents differed in their perceptions of overall vegetation and view quality scores, but not in their perceptions of accessibility, amenities, or maintenance. Next, we compared the tourists' perceptions of overall scores for each KPI variable and the environmental managers' perceptions of overall scores for each KPI variable. Tourists differed in their perceptions of accessibility, amenities, vegetation, and view quality, but not maintenance (Table 2.5).

Table 2.5: Comparison of environmental managers' overall scores with residents and tourists' overall scores for five KPI items

	Median of Residents (N=368)	Median of Env. Managers (N=2)	Standardized Test Statistic	Effect size (r)
Overall Scores				
Accessibility	4	4	11.194	.58
Amenities	4	4	7.422	.39
Vegetation	5	4	12.475	.65
Maintenance	4	4	8.336	.43
View Quality	5	4	10.857	.57
	Median of Tourists (N=332)	**Median of Env. Managers (N= 2)**	**Standardized Test Statistic**	**Effect size (r)**
Accessibility	5	4	10.039	.55
Amenities	5	4	9.342	.51
Vegetation	5	4	13.313	.73
Maintenance	4	4	7.414	.41
View Quality	5	4	10.581	.58

**All P values less than .001*

2.4 Discussion

2.4.1 Investigating stakeholder perceptions of KPIs for viewpoints

The results provide some initial evidence of how stakeholder groups perceive KPIs for viewpoints, how stakeholder group perceptions compare, as well as the influences that affect stakeholder perceptions of viewpoints. Overall, in the context of Niagara Parks' iconic scenic landscapes, tourists' perceptions and residents' perceptions did not significantly differ in most aspects. In examining stakeholder preferences for landscapes across Niagara Parks, this research was able to identify key factors which contribute to their perceived quality and relative importance. Most importantly, view quality was rated as the most important KPI across both stakeholder groups. Lothian (1999) highlights the crucial role played by scenic landscapes in attracting tourists in many regions. Especially in an iconic landscape such as Niagara Falls, view quality is especially important in visitors' perception of different viewpoints. These findings also highlight the practical use of including stakeholder perceptions in environmental management, as view quality may be considered a priority for future management decisions, more so than items related to vegetation, amenities, accessibility, or maintenance.

In terms of overall ratings of the KPI items across all sites, residents and tourists did not differ in their perceptions for accessibility, amenities, vegetation, maintenance, or view quality. Additionally, both groups collectively rated the KPIs across all NPC sites extremely high, indicating that both groups felt like the current condition of the viewpoints were adequate. These findings agree with early landscape literature, which suggests that certain landscapes contain visual values and elements which are generally accepted as aesthetic by the public (Angileri & Toccolini, 1993; Svobodova et al., 2011). For example, the presence of water features have been shown to have a positive influence in overall landscape perceptions (Arriaza et al., 2004; Bergen et al., 1995; Bulut and Yilmaz, 2007). As such, people coming from very different environments can hold similar overall perceptions of scenic landscapes (Webster and Kruglanski, 1994; Svobodova et al., 2011). This may be especially true for iconic scenic environments, which are well known for their beauty or aesthetic qualities (Chylinska, 2018).

However, though the overall ratings from the visitor groups were not significantly different, specific attention can be drawn towards the sub-variables that make up each KPI variable. Specifically, when considering the sub-variables that are associated with accessibility, residents' perceptions differed on a few specific items. Residents valued pedestrian access, public transportation, and all season access more than tourists. These types of accessibility features are more likely to affect permanent residents of the region more so than tourists, who usually visit during one season ("peak-season"), and have limited methods of transportation (car, tour bus, etc.). It is also important to note that in this specific context, many viewpoint sites have recently adopted a paid parking method as a way to monitor and control the number of visitors to popular sites. As a result, residents who have traditionally frequented these sites have shown resistance to this implementation and therefore may be seeking other methods of accessing these sites other than personal vehicles. There were no other differences in perception between residents and tourists for any of the other KPI sub-variables. Again, these findings are congruent with landscape literature which suggests that landscape perceptions can be affected by previous cultural and personal experience of the observer (Svobodova et al., 2011).

2.4.2 Influences of stakeholder perceptions

Demographics

Certain demographic factors were found to impact stakeholder perceptions of particular KPIs. In terms of accessibility, older people tended to rate the accessibility of NPC sites lower than younger people. These findings are consistent with other work related to age's relevance to perceptions and uses of green space (see Kienast et al., 2012; Payne et al., 2002; Mowen et al., 2005; van der Vlugt et al., 2019; Wennberg et al., 2009). According to van der Vlugt et al. (2019), accessibility is closely related to mobility, as accessibility has a direct impact on individual mobility behaviour. In a study on the perceived accessibility in Nottingham, UK, van der Vlugt et al. (2019) found that perceptions of accessibility decreased with age. Older people consider accessibility as very important in outdoor environments, and therefore may be more likely to notice accessibility limitations or challenges in accessibility than other age groups (Lattman et al., 2019; van der Vlugt et al., 2019; Wennberg et al., 2009). In terms of amenities,

younger people rated the amenities of NPC sites higher than older people. Amenities included educational or directional signage, parking, washrooms, play equipment, and so on, which may hold greater importance for younger people, such as families with children, thus resulting in more favourable perceptions from younger people. Perceptions of the maintenance of viewpoints were also impacted by demographics. Specifically, females rated the overall maintenance of sites higher than males, suggesting that males tended to be slightly more critical than women in their evaluation of the landscape. These findings are consistent with the results of studies by Caula et al. (2009), Lyons (1983), Strumse (1996), and Lindemann-Matthies et al. (2010). Arguments for the more favourable visual perceptions of women are generally founded on gender differences in evolutionary terms, such as the positive and calmer attitude of women toward nature (Strumse, 1996). Finally, participants with a higher level of education were less critical in their evaluation of the KPIs for viewpoints, though the difference in the average evaluations between different education levels was marginal.

These findings agree with previous studies, which have shown that the personal characteristics of the observer or of a whole social group (e.g., age, education, gender, etc.) significantly influence visual perceptions and preferences of landscapes in general (Lyons, 1983, Misgav, 2000; Sklenicka and Molnarova, 2010; Svobodova et al., 2011; Virden, 1990). These results confirm the significance of sociodemographic characteristics of respondents, particularly in terms of age and gender. However, these factors did not have a significant impact of the variability of the overall scores of each KPI item across the sites. Therefore, while it is important to consider different demographic groups and their needs when considering an environmental management strategy, demographic differences only had a marginal effect on the perceptions of KPIs for viewpoints, as all groups had an overall positive perception of all KPIs across the sites.

Management Style

In terms of differing management styles (low-unmanaged or prescribed management), both stakeholder groups perceived the sites that had a prescribed management practice as having higher ratings for all KPIs. Similar findings were found in a study by Madureira et al. (2018) on preferences for urban green space characteristics in three Portuguese Cities. This study found that “cleanliness and maintenance” was chosen as the most important characteristics of green

spaces, in comparison to twelve other attributes. It may be argued that sites that have a prescribed management practice appeared cleaner and more manicured, thus positively influencing stakeholders' overall KPI ratings at these sites. Additionally, sites that had a prescribed management practice typically consisted of lush or unique vegetation which was strategically groomed so that the scenic views were easily visible. In essence, the sites with a prescribed management strategy may appear cleaner and specifically maintained for the visitor, which may be associated with their popularity and higher overall ratings. Interestingly, in a study by Caula et al. (2009), public preferences towards urban green spaces, most people (over 70% of study participants) preferred more "natural" green spaces in comparison to "ornamental" or manicured types of green spaces within their neighbourhoods. Rohde and Kendle (1994) further claim that urban wildlife and vegetation provides "wilderness qualities" that people are inherently attracted to. These conflicting ideologies highlight the importance of considering different contexts, and the ultimate goals for user experiences within an iconic landscape setting. In such circumstances, where people travel to a specific area with the intention of experiencing and viewing an iconic landscape, visitors may tend to prefer a view that is appropriately managed to allow for an exceptional viewing experience.

Site Type

In terms of differing site types (historical/interpretation, park, or scenic lookout), tourists and residents' perceptions differed for view quality of certain site types. It was found that tourists had higher ratings of view quality at scenic lookout sites when compared to residents, but resident and tourist perceptions of view quality did not differ for historical/ interpretation sites or park sites. Pedersen (1978) state that people gain familiarity through direct experience of environments, which impacts their overall perceptions of such environments. Furthermore, different visitors may have different sources of attachment to a place or landscape. Therefore, a possible explanation of these results is that visitors who are not frequently exposed to these exceptional views may hold a greater affinity for the unique aesthetic and overall experience at these scenic viewpoints, whereas residents attach greater meaning to their sense of home (Stedman et al., 2004). Similar findings were reported by Jutla (2000), where residents and tourists differed in their perceptions of a cityscape in Simla, India, in that tourists emphasized the

importance of natural and cultural landscape elements in their images of the foreign city, whereas residents focused on elements related to their familiarity with the city.

Additionally, tourists also differed from residents in their perceptions of amenities, as tourists rated amenities higher than residents across all NPC site types. Appropriate amenities are especially important in high tourist destinations, not only to accommodate a variety needs but also to encourage visitors to spend more time at the destination. In an opportunity assessment from Destination Development International (DDI) (2011) of New Tecumseth, Ontario, visitors viewed marketing towards amenities such as public washrooms, visitor information, and parking as an important consideration for choosing a destination. Furthermore, the presence of amenities was seen to impact visitors' first impressions of the area. Specifically, directional signage and a functional wayfinding system were recommended by visitors, since visitors are likely to give up and move in if they cannot find what they are looking for (DDI, 2011). Therefore, it is possible that tourists are more attentive to and/or appreciative of these types of amenities. In many cases, tourists spend long hours visiting multiple viewpoints across vast landscapes. As such, tourists may be more likely to need and use these types of amenities. In comparison, local people can access many of these amenities from their residences, or may be familiar enough with the area that certain amenities are not needed, and therefore may not value these types of amenities as much as tourists.

Finally, both stakeholder groups perceived accessibility and amenities greater at park site types than historical/interpretation or scenic lookout sites. Parks are often used as a gathering place for families for an extended period of time and as such, greater attention to accessibility and amenities at these site types is expected. For this reason, the park site types that were included in this study provide multiple amenities for outdoor cooking, seating, and shelter. Both stakeholder groups also perceived scenic lookout site types as having better vegetation than historical/interpretation site or park site types. In some scenic lookout sites, or historical/interpretation sites, environmental managers may be restricted in the level of accessibility they can provide simply due to location, terrain, safety purposes, etc. For example, one of the historical/interpretation sites (Queenston Heights Redan Gun), was located at the bottom of a set of wooden stairs, making access difficult for people who use mobility devices. In

another example, one of the scenic lookout sites (Queenston Heights Lookout) had a 3 ft. concrete barrier between the viewed landscape and viewers. During data collection, some participants even vocalized how the view could not be easily enjoyed for someone in a wheelchair. Contrastingly, parks are typically designed for the enjoyment and accommodation of a wide range of people, and therefore managers may consider accessibility of these site types a priority.

2.4.3 Investigating environmental managers' perceptions against visitor perceptions

The environmental managers' perceptions were used to compare residents' perceptions, as well as tourists' overall perceptions of each KPI item. It was found that residents significantly differed in their perceptions of overall vegetation and view quality scores, but not in their perceptions of accessibility, amenities, or maintenance when compared to the managers. Specifically, the resident group rated both vegetation and view quality higher than the environmental managers. Tourists differed in their perceptions of accessibility, amenities, vegetation, and view quality, but not maintenance. Again, tourists rated accessibility, amenities, vegetation, and view quality higher than the managers. In all cases where stakeholder perceptions differed, managers rated the KPI items lower than both stakeholder groups. This is congruent with literature, which finds that respondents whose profession is related to landscape management, tend to be more critical of the overall landscape due to the projection of their professional knowledge into their visual preferences (Svobodova et al., 2011). Overall, the visitor groups differed significantly in their perceptions of KPIs for viewpoints. These findings are similar to those found by Le Lay et al. (2013), in that expert and non-experts differed in their perceptions regarding aesthetic preference and knowledge.

2.5 Conclusion

Iconic scenic landscape views are a significant natural and social-cultural resource. These landscapes host numerous visitors, and must be managed in a way that appeals to a wide variety of people. Consequently, there is increasing recognition of the importance of effective management approaches, which require flexible and transparent decision-making that embraces a diversity of knowledge and values, including those of visitors to these sites (Reed, 2008). As

such, this research examined how different stakeholder groups perceive KPIs for viewpoints across Niagara Parks' iconic landscape. Two distinct groups- residents and tourists- were surveyed on their perceptions of KPIs for viewpoints. Findings suggest that both stakeholder groups generally perceived the KPIs for viewpoints similarly, with the only main differences apparent within the sub-variables of accessibility, as well as in different site types. Specifically, residents valued pedestrian access, public transportation, and all season access more than tourists. Additionally, tourists had higher ratings of view quality at scenic lookout sites, as well as higher ratings of amenities across all NPC site types in comparison to residents. Results agreed with other studies (see Angileri & Toccolini, 1993; Svobodova et al., 2011), in that generally people from different environments may hold similar perceptions about the overall aesthetic quality of landscapes, however personal experiences and characteristics can also significantly influence visual perceptions of landscapes. In line with this, tourists tended to rate certain KPI items higher when compared to residents, suggesting that visitors who are not frequently exposed to these specific landscape views generally had greater perceptions of the quality of KPIs at these sites. Additionally, environmental managers significantly differed in their perceptions of KPIs for viewpoints. In comparison to residents, the environmental managers rated vegetation and view quality slightly lower, but had the same ratings for all other KPIs. In comparison to tourists, the environmental managers rated every KPI item slightly lower, except for maintenance. Overall, residents and tourists did not differ in their overall perceptions of KPIs for viewpoints, however, environmental managers significantly differed in their perceptions, having rated most of the KPI items lower than the two visitor groups.

The results of this study provide several practical implications for environmental managers and the use of M&E for viewpoints. First, residents and tourists do not significantly differ in their overall perceptions of KPIs for viewpoints at these NPC sites. This suggests that environmental managers of these sites may assume that most visitors perceive these scenic viewpoints in similar ways. In turn, management practices that consider the overall perceptions of visitors to the viewpoint sites are likely to appease both stakeholder groups and overall visitors to these sites. This is important, as perceptions of these factors can contribute to positive or negative local evaluations of conservation or other environmental initiatives (Bennett, 2016). Specifically, positive perceptions ultimately ensure the support of local stakeholders or

constituents, thus enabling the long-term success of management planning (Bennett, 2016). In terms of NPC viewpoints, both stakeholder groups seem to hold positive perceptions of the current viewpoint management across the sites. However, some perceptions did differ in terms of more specific aspects or sub-variable KPIs related to viewpoints, in that residents place a higher emphasis on different types of accessibility for the viewpoints. Identifying and understanding this perspective can help environmental managers improve their management strategies by incorporating solutions that address the specific priorities or concerns of different groups (Reed, 2008).

Second, the environmental managers of these sites had overall lower ratings for the majority of KPIs across NPC sites, compared to the two visitor groups. While this may be a function of their familiarity and knowledge of the sites, this finding offers important implications in terms of effective viewpoint management and the importance of M&E. Specifically, these findings further reinforce the need to shift away from expert-driven environmental management approaches, towards understanding and incorporating public perceptions of viewpoint management. By collecting and using both ecological and social information, environmental managers are able to make more holistic decisions about viewpoint management. Despite scholars generally recognizing the importance of understanding group differences in values, beliefs, and preferences (Burger, 2002; Reed, 2008), the results of this study highlight the value in gathering information on how different groups perceive different KPIs for viewpoints. This knowledge of inter-group differences offers an initial understanding of the social context, to subsequently address additional issues. For example, differences in how people perceive KPIs for viewpoints may have implications in terms of how different groups respond to management initiatives and opinions of management priorities, which often result in disagreements between groups (Albert et al., 2013; Eagles et al., 2013; Hill & Daniel, 2008). Therefore, knowledge of differences in perceptions is particularly important for developing a common understanding between the groups, which can reduce challenges developing from conflicting values and competing priorities (Forster et al., 2017). Additionally, incorporating the social dimensions to accompany ecological data in a conventional M&E approach can allow environmental managers to enhance or improve environmental management strategies while also gaining support from

key stakeholders (Beierle, 2002; Fischer, 2000; Margoluis & Salafsky, 1998; Reed, 2008; Reed et al., 2008; Richards et al., 2004).

Salient questions in scholarship about monitoring and evaluation strategies that include stakeholders, and environmental management practices for viewpoints motivated this empirical study. Scholarly tensions exist for how best to approach and balance a conventional M&E approach in environmental management, with the perceptions of different stakeholder interests (see section 2.1). This study contributes to this tension by providing empirical evidence for how different stakeholder groups perceive KPIs for viewpoints, which is related to a new form of conventional M&E, whereby stakeholder perceptions should be used in combination with ecological data, to provide a more comprehensive picture of environmental management goals in different contexts (Adams & Sandbrook, 2013; Cook et al., 2010; Forster et al., 2017; Yasué et al., 2010). Most noteworthy, these findings further support the need to incorporate more social dimensions in environmental management, particularly the use of public perceptions (Kent, 1993; Penning-Rowsell, 1982; Seddon, 1986). Utilizing conventional approaches to landscape management, such as the objectivist paradigm or "expert-led" approaches to landscape management can inherently lead to biases in expert-driven values and preferences (Duffield & Coppock, 1975; Gold, 1980; Scott, 2006), where emphasis may be placed on the KPI items that hold the most value to this one group. There is an apparent need to move away from expert-led approaches to environmental management, towards more participative approaches, which includes evaluations of the visual qualities of landscapes by means of collecting and using data about the visual perceptions of the public (Bulut and Yilmaz, 2007; Conrad et al., 2011, Svbodova et al. 2011). Better incorporation of evidence from a multiplicity of sources, and across social and natural sciences in M&E can provide a more comprehensive picture on which to base environmental management decisions (Forster et al., 2017; Huntington, 2000). Generally, and especially in terms of environmental management, participant attitudes and perceptions should be supplemented with objective measurement of tangible impacts and outcomes of the collaborative initiative, such as economic indicators, physical-biological indicators, quality of life indicators, etc. (Bennett, 2016). However, perceptions offer a unique addition to ecological data, and can work to improve adaptive and collaborative environmental management. Perceptions of relevant stakeholders provide important insights into observations, understanding,

and interpretations of social and ecological impacts and outcomes of environmental management actions, as well as the overall perceived quality of KPIs related to management (Bennett, 2016). Additionally, perceptions of these factors can contribute to positive or negative local evaluations of conservation or other environmental initiatives (Bennett, 2016). Specifically, positive perceptions ultimately ensure the support of local stakeholders or constituents, thus enabling the long-term success of management planning (Bennett, 2016).

Additional research is required to enhance the body of empirical evidence, as well as explore some of the questions that were illuminated from the findings of this study. First, while this research provides initial evidence regarding how different groups perceive KPIs in the context of iconic viewpoints, future research should further investigate the consequences of these perceptions of KPIs on these environments. For example, in addition to social benefits, there may also be ecological benefits associated with visitor or public perceptions of the environment. Therefore, knowledge of perceptions opens opportunities for management to mitigate visitor behaviours. Additionally, knowledge of perceptions has been reported to provide potential insights into individuals' experiences (Ballantyne & Packer, 2007; Higham, Kearsley, & Kliskey, 2000; Patel, Rapport, Vanderlinden, & Eyles, 1999; Petursdottir et al., 2013), as well as values, behaviours, and support for environmental management decisions (Bennett et al., 2017; Burger, 2003; Forster et al., 2017; Gelcich & O 'Keeffe, 2016; Jefferson et al., 2013; Le Lay et al., 2013; Lester et al., 2017; Petrosillo et al., 2007). Knowledge of perceptions can, by extension, inform management on public support for management (Bennett et al., 2017; Gelcich & O 'Keeffe, 2016; Yasué et al., 2010). Lastly, future research could also explore how stakeholder perceptions can be influenced in order to gain support for new environmental management strategies, as well as to result in the behaviour changes mentioned above. The ability to shape perceptions may be determined by whether the content or what is being communicated to visitors conforms to their values or norms (Clayton et al., 2016). The ability to shape perceptions may also be determined by stakeholders' perceived level of involvement or influence in environmental management decisions, i.e., whether their perceptions are being meaningfully incorporated into management. This suggests that the ability to influence perceptions may be more nuanced and complex, and therefore, more in-depth research is needed.

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Chapter Three: Study Two: Influences of Engaging in a PM&E Process on Stakeholder Perceptions of KPIs for Trails

*Target Journal- Journal of Environmental Management

3.0 Introduction

The rapid growth in popularity of outdoor recreation and nature-based tourism has led to increased challenges for managing environmental impacts in natural areas (Andereck et al., 2005, Denstadli et al., 2010; Merriam & Smith, 1974; Van Winkle et al., 2008). More recently, national parks have experienced increased visitorship and intensification of diverse activities, leading to higher pressure on the natural environment. To illustrate, Yosemite National Park and Zion National Park are two poignant examples among many sensitive natural areas that have experienced increased visitorship and associated adverse environmental impacts in recent years (Dixon et al., 2019; Mace & Bates, 2013; Manning et al., 2017; Marion et al., 2016; Wang & Lawson, 2002). In 2019, these national parks each hosted 4.5 million recreational visitors (NPS, 2020). Within such park settings as well as outside of parks, there are particular features that are coming under concern due to visitor related impacts. Specifically, trails are typically used to navigate park grounds and therefore, experience some of the highest foot traffic. For example, the West Coast Trail, located in the Pacific Rim National Park, has also experienced increased visitors within the last 10 years, reaching more than 700,000 in 2018 (Parks Canada, 2018). Such heightened levels of visitation have caused immense concern regarding adverse impacts to natural resources and visitor experiences, such as increased air and noise pollution, wildlife disturbance, vegetation damage, parking damage, visitor stress, and traffic congestion (Ament et al., 2008; Belnap, 1998; Burson et al., 2000; Clarke, 2001; Daigle and Zimmerman, 2004; Dilsaver and Wyckoff, 1999, Mace et al., 2004; Manning et al., 2000; Reeves, 2006; Runte, 1997; Tyser & Worley, 1992).

Similarly, Niagara Parks is a protected park which attracts a large number of tourists and sightseers from around the world (Colton & Buckley, 2014; Chaffer, 2015; Sternberg, 1997). Within this vast landscape, the trails of the Niagara Glen are positioned within a highly sensitive and ecologically significant area, and receive well over 100,000 visitors a season (C. Burant,

personal communication, March 2020). This area falls under a large umbrella of trails and protected areas that have experienced increased pressure on the environment, thus requiring more effective methods for managing such resources. Visitation rates and related impacts have been exacerbated by Covid-19 and the unprecedented restrictions in the use of public spaces (Honey-Roses et al., 2020). Moreover, in the context of Niagara, many parks and outdoor recreation areas were considered safe places for recreation activities, and therefore parks and other outdoor recreation areas ultimately closed due to crowding and lack of physical distancing (O'Connell et al., 2020). The impacts of this type of visitor use is especially important to consider now, as more people are engaging in outdoor recreation activities than ever before, creating an urgent need for management approaches that address visitor use in these types of environments.

Managers of parks and recreational trails are now challenged to address a conflicting mandate: to provide recreational opportunity for visitors, while simultaneously protecting ecosystems and ensuring a satisfactory visitor experience (Kohlhardt et al., 2017, Manning, 2007, Newsome et al., 2012). High visitation rates and intensive recreational activities are contributing to negative environmental and social impacts (Ament et al., 2008; Belnap, 1998; Burson et al., 2000; Mace et al., 2004; Manning et al., 2000; Reeves, 2006; Runte, 1997; Tyser & Worley, 1992). However, these natural areas have become increasingly important in modern societies, as they preserve natural and cultural resources and enhance quality of life by providing opportunities for recreation (Sayan & Atik, 2011). In line with this, greater public participation and learning about the interactions between science and society has become increasingly important to address the complex issues set out above. (Kates, 2011). Thus, there is an immense need for new management strategies that can navigate these tensions, and work towards reaching environmental management goals (Bennett, 2016; Philips, 2002; Manning, 2007).

More recently, it has been recognized that effective environmental management is integrally linked to well-designed monitoring and evaluation (M&E) systems (Gordon et al., 2005; Hockings et al., 2000; Margoluis & Salafsky, 1998; Stem et al., 2005; Theobald, 2013; Trimble & Plummer, 2018; Woodhill, 2000). Generally, M&E has favoured conventional methods of gathering ecological information about a system, whereby experts that are external to the project are contracted to conduct the evaluation as a way to ensure objectivity (Bennett,

2016; Forster et al., 2017; Rossi et al., 1999). However, there is increasing recognition that these traditional approaches to environmental management are insufficient and work to alienate local stakeholders from environmental management decisions and local knowledge (Shah et al., 2006). This is especially problematic because stakeholders are unable to gain the shared experience of learning and building adaptive capacity through conventional M&E strategies (Blackstone et al., 2007). Expanding out of the limitations of conventional M&E processes, emphasis is being shifted "away from externally controlled data-seeking programs, towards the recognition of locally-relevant processes for gathering, analyzing, and using information" (Abbot & Guijt, 1997, p. 9). Essentially, there is now increasing recognition of the importance of engaging stakeholders in environmental management, including the M&E phases.

Collaborative M&E processes have been proposed as an effective tool to holistically address these complex issues set out above (Baird et al., 2016; Bennett et al., 2018), as stakeholders who see different aspects of a problem come together and constructively explore their differences, to search for a unique solution to specific problems (Gray, 1989). Specifically, participatory monitoring and evaluation (PM&E) expanded out of the limitations of conventional M&E processes, and emphasizes the "need to strengthen and deepen the contribution of primary stakeholders as active participants in all phases of a collaborative initiative" (Onyango, 2018, p. 1). This cyclical process involving problem identification, taking action, monitoring, and reflecting and redefining the problem, inherently affords the opportunity to strengthen and deepen the contributions of primary stakeholders, through shared learning, joint-decision making, co-ownership, etc. (Estrella & Gaventa 1998; Onyango, 2018; Reed, 2008). PM&E involves the actual stakeholders in the process of monitoring and evaluating project activities. This is seen as beneficial for many reasons, and particularly because it allows for shared learning experiences, while also helping local communities build their adaptive capacity to be able to respond to environmental problems, and manage their environments in the most effective ways (Abbot & Guijt, 1998; Estrella & Gaventa, 1998; Guijt & Gaventa, 1998; Jackson & Kassam, 1998; Onyango, 2018). An underlying objective of PM&E is to achieve a more holistic perspective of an environmental initiative, by involving a diverse set of stakeholders (Stem et al., 2005). Additionally, through this collaborative process, environmental strategies have a higher

likelihood of being implemented, as stakeholders learn to negotiate and agree upon solutions (Emerson et al., 2012; Ulibari, 2015).

However, within literature and practice, it remains unclear exactly how the participatory process affects stakeholder perceptions generally, and specifically in reference to perceptions regarding Key Performance Indicators (KPIs) for environmental management (Hermans et al., 2011; Kananura et al., 2017; Mebrahtu, 2002; Njuki et al., 2006). KPIs are measurable, manageable variables that reflect the essence of management objectives (Toor & Ongunlala, 2010; Wang & Lawson, 2002). Selecting the most meaningful KPIs is an essential component of the PM&E process, as they serve as metrics for tracking variables of interest in the evaluation. Selecting KPIs can be interpreted as a multiple criteria decision-making problem as performance measurement criteria vary from project to project (Toor & Ongunlana, 2010), and different stakeholders have different perceptions regarding the success of a particular project (Cox et al., 2003; Davis, 2014). The increasing need for environmental managers to address the impacts of outdoor recreation to sensitive environments, have further raised the need to understand which KPIs should be used to accomplish these goals. Additionally, as stakeholder support for environmental initiatives and management strategies are essential for reaching environmental goals, understanding how the PM&E process affects stakeholder perceptions of KPIs, and in what ways, is of paramount importance (Alwaer & Clements-Croome, 2010; Himes, 2007; Kananura et al., 2017; Mebrahtu, 2002; Yates et al., 2019; Zabala et al., 2017).

Employing a PM&E process for environmental management provides a unique opportunity to collaboratively address the complex management issues relating to recreational trails in parks, while gaining key insight into the influences of engaging in a PM&E process on stakeholder perceptions. As such, this study aims to compare stakeholder perceptions of KPIs for trails before and after they participate in a PM&E workshop. The study employs an experimental design and occurs at the Niagara Glen Trails site.

3.1 Background Literature

The impact of outdoor recreation and nature tourism in natural areas, such as recreational trails, has become an important focus of environmental management research and practice (Andereck et al., 2005, Denstadli et al., 2010; Merriam & Smith, 1974; Van Winkle et al., 2008). Increased visitorship, as well as diverse and intensified activities have led to higher pressure on the natural environment. This, in combination with a mandate of environmental protection, creates a situation where managers must navigate the tension between visitor use and protecting the ecosystem; an illustrative example of the challenges faced by many protected parks and trails. Similarly, users of trails and recreational areas face a related challenge. While outdoor enthusiasts are often motivated to find remote places distant from human activity, the same individuals tend to welcome basic services provided by park managers, such as trail maintenance, toilets, directional signs, interpretive material, etc. (Kohlhardt et al., 2017; Lawson & Manning, 2002; Newman et al., 2005). In order to adequately address these conflicting mandates and user needs, it is important to give appropriate attention to the unique perspectives of the different user groups, or stakeholders, involved (see section 3.0).

Stakeholders are often defined as "any group or individual who can affect or is affected by the achievement of the firm's objectives" (Freeman, 1984, p. 46). Stakeholder groups in the context of recreational trail use may include tourists, local residents, tourism businesses, employees or staff, and environmental managers. Alongside the different ways in which each stakeholder uses the site, perceptions of various trail aspects and preferences for management actions may vary across these groups or between individuals as well (Bennett, 2016; Denstadli et al., 2010). As such, it is important to understand the prevalence and nature of diversity among stakeholders' perceptions of trails. For example, many peripheral businesses benefit economically from tourism associated with the trails, and therefore see increased trail tourism as a positive aspect. On the other hand, residents may experience overcrowding on trails due to the increased tourism, resulting in an unsatisfactory trail user experience. It can be difficult to untangle stakeholder perceptions and balance differences in perception regarding negative or positive impacts on trails. Thus, understanding how stakeholders, whose support is required to achieve environmental management goals, measure success and how that varies between stakeholder groups is of paramount importance for aligning environmental management goals

with user needs (Alwaer & Clements-Croome, 2010; Himes, 2007; Yates et al., 2019; Zabala et al., 2017).

Natural areas such as protected parks and recreational trails have long had some form of relationship with neighbouring communities and industry (e.g., tourism; Machlis & Field, 2000). These relationships are often complex and can be seen as conflicting due to a lack of integration of local populations in decision-making processes (Denstadli et al., 2010). Historically, outside stakeholders did not have significant involvement in the planning and management processes of protected recreational areas, as this was seen as the responsibilities of the park managers or environmental managers (Denstadli et al., 2010; Estrella & Gaventa, 1998; Guijt & Gaventa 1998; Jackson & Kassam, 1998; Onyango, 2018). However, more recently many scholars are suggesting that environmental managers and local communities can better achieve environmental and recreational goals by cooperating together rather than acting alone (Onyango 2018). Environmental management strategies and programs that reflect grassroots-based or bottom-up approaches through participatory methodologies are gaining increasing attention as a way to effectively address complex environmental and social problems (Abbot & Guijt, 1997; Estrella & Gaventa, 1998; Reed, 2008). Collaboration has become an increasingly popular tool for managing environmental and social aspects of natural resource-based recreation and tourism (Armitage et al., 2009; Stem et al., 2005).

Specifically, participatory approaches to M&E are being emphasized as one method to tackle the unique relationship between park managers and other stakeholder groups who have a vested interest in their local natural environment (Estrella & Gaventa, 1998; Reed, 2008; Stringer et al., 2006). PM&E is considered a process whereby multiple different stakeholders collectively engage in the monitoring and evaluation of a management strategy or intervention over time (Jackson & Kassam, 1998). Involved in this process includes "stakeholders' self-assessment, collective knowledge generation, and cooperative action" (Jackson & Kassam, 1998, p. 3). The concept of PM&E arose from the recognition of the limitations of conventional M&E, which did not include stakeholders as active participants in the monitoring and evaluating phase, even though they are the ones being directly affected by environmental management decisions (Guijt & Gaventa, 1998; Onyango, 2018). Concerns were raised regarding the alienation of local stakeholders from environmental management decisions and local knowledge (Shah et al., 2006).

Conventional approaches to M&E only allow the stakeholders to provide information, and rely heavily on outside scholarly experts to "objectively" assess the effectiveness and efficiency of development interventions in reference to project plans, frameworks, etc. (Shah et al., 2006; Guba & Lincoln, 1989; Jackson & Kassam, 1998). Contrastingly, PM&E involves the actual stakeholders in the process of monitoring and evaluating project activities. This is seen as beneficial for many reasons, and particularly because it allows for shared learning experiences, while also helping local communities build their adaptive capacity to be able to respond to environmental problems, and manage their environments in the most effective ways (Abbot & Guijt, 1998; Estrella & Gaventa, 1998; Guijt & Gaventa, 1998; Onyango, 2018). In this sense, PM&E encourages local communities to build adaptive capacity. Participants involved are able to gain skills which strengthen local capacities for tasks such as resource management or planning, problem solving, and collaborative decision-making (Abbot & Guijt, 1997; Estrella & Gaventa, 1998; Onyango, 2018). Participants also develop a greater understanding of the factors (internal or external), which affect the dynamics of a project, such as successes, failures, potential solutions, or alternative actions (Campos & Coupal 1996 in Estrella & Gaventa 1998), which is critical to effective environmental management.

According to Shah et al. (2006), there are nine key phases within a participatory project cycle. As the participatory project builds on the involvement of stakeholders at every stage of the process, it is recommended to follow the phases in sequence (Shah et al., 2006). In the formative phases of the PM&E process, relevant stakeholder(s) must 1) assess and appraise the current needs of the site, 2) discuss and develop an M&E plan, and 3) develop a suite of baseline Key Performance Indicators (KPIs). KPIs are of interest in environmental management because they are helpful to compare the actual and estimated performance of an intervention or management approach (Cox et al., 2003). However, selecting KPIs is a multiple criteria decision-making problem, especially since performance measurement criteria vary from project to project (Toor & Ongunlana, 2010). In line with this, different stakeholders have different perceptions regarding the success of a particular project and what those indicators need to look like (Davis, 2014). Thus, selecting the most meaningful indicators represents a major challenge that organizations must overcome in order to implement effective M&E, and in turn, effective environmental

management practices. As such, this research only focuses on the first three phases of the PM&E process, as these directly relate to the formation and development of KPIs for trail management.

Managing ecological and social impacts through the selection of indicators is a key component to achieving trail management goals. Indicators reflect the meaning of broader management objectives and are specific measurable variables that reflect the condition of a resource, in this case, trails (Lime et al., 2004). Indicators are crucial to being able to systematically monitor resources and visitor experiences, in order to see whether the recreational area is being managed for the goals specified in management plans (Estrella & Gaventa, 1998; Lime et al., 2004; Stem et al., 2005). Effectively managing visitor use and ecological resources requires current information about the trails. Monitoring represents a system to measure various aspects of human activity that impacts both biophysical resources and visitor experience conditions in a given area (Lime et al., 2004). This component is critical because it fulfils the essential responsibility of environmental managers, who must objectively assess the performance of ongoing activities against the overall management objectives and goals (Cox et al., 2003). Such information allows stakeholders to quantifiably evaluate whether existing conditions are acceptable, if conditions are deteriorating, or have reached an unacceptable situation. Continuous monitoring will aid in directing decision-makers to take corrective action. In addition to allowing stakeholders to document the status of resource and experiential conditions, monitoring provides important feedback on the effectiveness of management actions to address unacceptable conditions. Monitoring also provides managers with defensible, evidence-based information regarding actions taken to improve negative impacts. Without such measurements, and especially without longitudinal data, environmental managers have limited data to defend any actions taken or proposed to improve recreational trails.

Sustainability of recreational trails can be operationalized by selecting appropriate indicators and defining standards, and subsequently managing for compliance with such standards (Iddi & Nuhu, 2018; UNPD, 1997). Through the PM&E process, and particularly in the formative stages, stakeholder groups come together to decide on appropriate standards and indicators together (Abbot & Guijt, 1997; Jackson & Kassam, 1998). Hammitt and Cole (1998) observe that in a recreational context “impacts become good or bad, important or significant, only when humans make value judgements about them (p. 10). Ndubisi (2002, p. 197) suggests

that studies related to environmental perception "seek to understand human values and aesthetic experiences in order to take them into account in creating and maintaining landscapes that are socially responsible and ecologically sound". In the context of recreational trails, stakeholders are challenged to identify a set of indicators and associated standards for effectively managing the trail and trail resources (Manning, 2007). Additional consideration is needed in the context nature tourism. In this case, managers and other stakeholders must also consider and identify the level of impact that is acceptable (Denstadli et al., 2010; Manning, 2007). It is typically unlikely that impact levels will cause complete loss of relevant systems, so measures of acceptability become proxies for measures of long-term sustainability. However, effective implementation requires some level of consensus amongst stakeholders (Toor & Ogunlana, 2009). PM&E processes provide a favourable environment for such consensus building, and involves the actual stakeholders throughout the entire lifespan of project activities.

In recognition of these challenges, there is a growing need for more appropriate and adaptive environmental management practices (Allan & Stankey, 2009; Armitage et al., 2008; Dreiss et al., 2017; Light et al., 2013; Bennet, 2018). Collaboration has become an increasingly popular tool for managing environmental and social aspects of natural resource-based recreation and tourism (Armitage et al., 2009; Stem et al., 2005). While PM&E processes are recognized for its benefits to the community, environment, and stakeholders involved, there still remains several unresolved and integral questions regarding the processes which comprise this type of undertaking. One of the main goals when working through a PM&E process is for the stakeholders to arrive at a consensus regarding an environmental management strategy and related KPIs (Estrella et al., 2000). As stated by Abbot & Guijt (1998), the methods and indicators that may be appropriate for one stakeholder, may not be suitable or a priority for another. Warner (1997, p. 417) argues that building consensus, which he defines as "a condition in which all participants can live with the result", is necessary to achieve sustainability or management objectives, which ultimately benefits the stakeholders involved and the wider society in which they live. Consensus-building is distinct to PM&E, used to arrive at management decisions that incorporate the perspectives of a variety of stakeholder interests or concerns, and in turn increasing their capacity to meet local needs and priorities (Martin and Sherington, 1997; Reed, 2007; Reed, 2008). For this to occur, stakeholders are required to

iteratively reflect on the knowledge and perspectives brought forth during the collaborative process, learning together from experience as well as through each other. In this way, PM&E can be considered a learning process that creates the conditions conducive to action and change. However, it remains unclear exactly how the participatory process effects stakeholder perceptions generally, and specifically with reference to the KPIs that make up an environmental management strategy (Estrella & Gaventa, 1998). More specifically, although PM&E processes work towards stakeholder consensus about management goals and KPIs, it cannot be assumed that stakeholders experience a real change in their perceptions throughout or by the end of the PM&E process (Hermans et al., 2011; Kananura et al., 2017; Mebrahtu, 2002; Njuki et al., 2006). In practice, it also remains unclear which KPIs are considered most important for developing environmental standards and in turn, effective management strategies for trails experiencing adverse impacts from increasing visitation rates (Denstadli et al., 2010; Kohlhardt et al., 2017; Manning, 2007). Selecting the most important indicators and defining standards has become an increasingly important task related to effective environmental management and ongoing monitoring and evaluation of these areas (Kohlhardt et al., 2017, Manning, 2007, Newsome et al., 2012). As such, this research responds to the need to better understand the effects of engaging in a PM&E workshop on stakeholder perceptions of KPIs, within the context of trail management.

3.2 Methods and Materials

3.2.1 Study Site

Recreational trails provide the overall context for the study. The Niagara Glen Nature trails, also referred to as the Niagara Glen, was selected as the site for this study, as the area contains a network of connected recreational trails (Figure 3.1). The Niagara Glen covers an area of approximately 0.219km^2 or 2.19ha of the Niagara Escarpment, approximately 7km from Niagara Falls, Ontario. The site is managed and maintained by the Niagara Parks Commission (NPC). The Niagara Glen is an important Carolinian forest, and is one of the most ecologically and geologically significant areas on the Niagara Peninsula, due to the unique escarpment cliffs and important flora and fauna (Varga & Kor, 1993). The proximity of the Niagara Glen to Niagara Falls results in the site receiving well over 100,000 visitors a season (C. Burant, personal

communication, August 2019). Various groups interact with the Niagara Glen including rock climbing groups, nature groups, and visitors from across the world. This, in combination with their mandate of environmental protection, creates a situation where managers must navigate the tension between visitor use and protecting the environmental and social resources contained within the site.

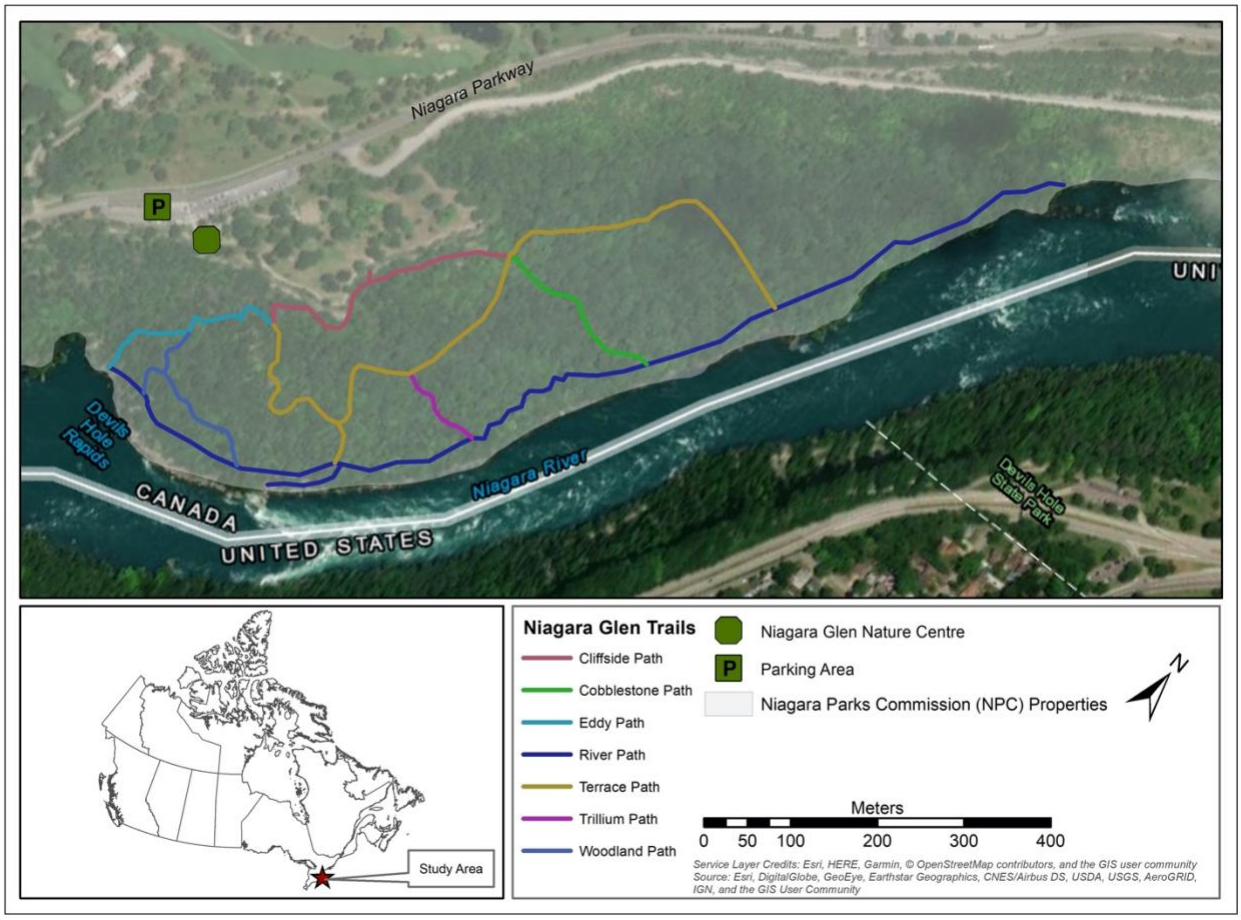

Figure 3.1: A map of the Niagara Glen Nature Reserve trail network and nature centre

3.2.2 Research Design

This research employed an experimental approach involving a pre and post test design. This pre-post administration was designed to capture the stakeholders' initial thinking about KPIs for trail management and how, if at all, it changed over the course of the workshop. A concurrent mixed method approach to data collection was used to achieve the objectives of this study, in which there were three data collection points. T1 (time one) constituted the first data

collection point, and involved an in-person Q-method sorting activity (herein referred to as Q-sort) and questionnaire. Next, an intervention was the second data collection point. As stakeholders participated in a PM&E workshop, the researcher recorded participant observations to capture the benefits and other characteristics about the PM&E process. Finally, T2 (time two) constituted the third and final data collection point, which involved a second Q-sort and questionnaire via online format. Figure 3.2 provides a visual representation of the three data collection points in the study. All participants provided written consent prior to participating, and the study was approved by the Research Ethics Board at Brock University. Importantly, this study falls under the Excellence in Environmental Stewardship Initiative- a formal partnership between the Niagara Parks Commission (NPC) and Brock University. Within this partnership, two environmental managers from NPC helped design the Q-sort (KPI criteria), the workshop, as well as helped with recruitment. Although these individuals hold some level of authority regarding decision making at the Niagara Glen site, they were ultimately unable to participate in this study due to potential bias.

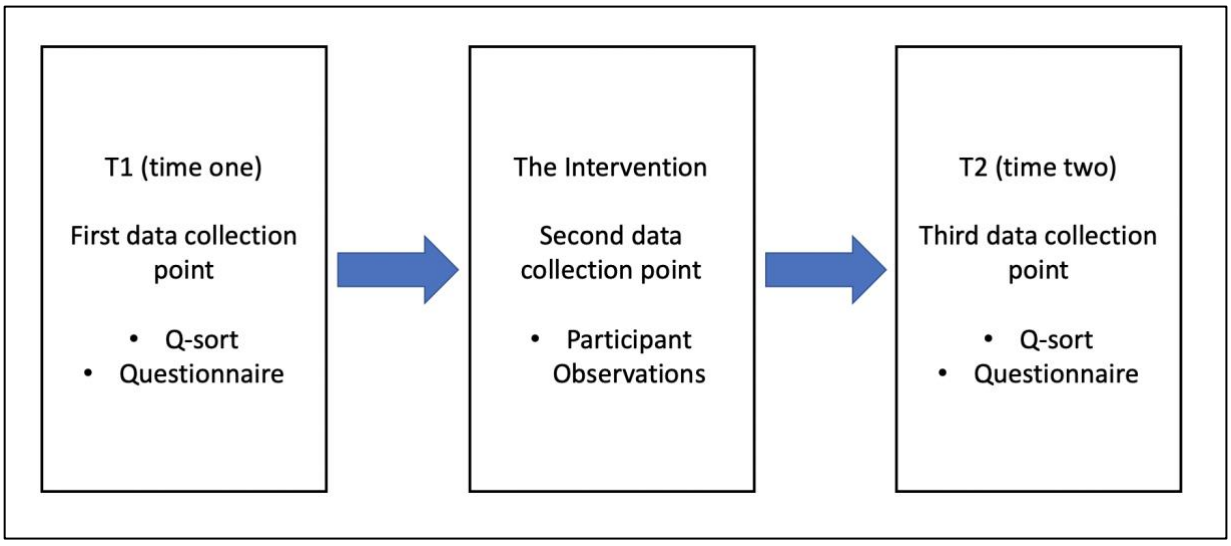

Figure 3.2: Visual representation of data collection process

3.2.3 Methods

Q Methodology

Q methodology was first introduced in 1935 as a research tool that can be used in a qualitative study to generate quantitative results (Dick et al., 2010; Purslow & Owl, 2012, Shinebourne & Adams, 2007; Watts & Stenner, 2005). Traditional methods, such as Likert measures, place respondents on a linear scale, whereas Q methodology allows respondents to create individual definitions based on their personal experience and opinions (McKeown & Thomas, 1988). Q methodology is the systematic and rigorous quantitative study of subjectivity (McKeown & Thomas, 1988). Subjectivity is defined here as a person's communication of his or her point of view on any matter of personal or social importance. In this case, participants engaging in the formative stages of a PM&E process for trail management rank ordered "statements" pertaining to KPIs for trail management.

This method has advantages over more traditional Likert scale surveys for understanding attitudes, as participants must use "forced choice" which brings their personal values and experiences into the ranking process (Brown, 1980; Watts & Stenner, 2012). In a traditional Likert scale survey, participants would be able to agree or disagree with as many statements as they chose to see themselves in a positive light. However, in Q-method, participants need to rank the statements against each other, which potentially works to eliminate some of the bias of self-reporting in these surveys (Robbins & Krueger, 2000).

Participants in this study ranked the statements two separate times: once immediately before the PM&E workshop took place, and then they were prompted to rank them again approximately 7 days after the workshop took place. This time frame allowed the participants to reflect and fully develop their perceptions about the PM&E workshop and KPIs for trail management at the Glen. The experiences and values of each participant guided them in how they chose to rank the statements, and the participants in this study were able to draw on their own past experience with the Niagara Glen trails to sort the items in the first round of sorting, while bringing in their experiences with the PM&E workshop for the final sort.

Questionnaire

Two different questionnaires were given to the participants at different data collection points throughout the study as a way to deepen the understanding of participant perceptions of the KPIs. The first questionnaire was given to participants immediately after they completed the Q-sort activity. The questionnaire consisted of two different parts. The first section was comprised of demographic-type questions. A demographics section was included to capture the range and diversity of stakeholders participating in the PM&E process. The second section consisted of five open ended questions, which asked participants to provide reflections regarding the placement of their KPIs in the Q-sort activity. Specifically, participants were asked to describe why they placed certain KPIs in the top two "most important" categories, as well as the top two "least important" categories. Participants were also asked which KPIs they had trouble placing and why. Finally, participants were asked to describe any other thoughts they had while completing the Q-sort activity.

The second questionnaire was given to participants one week after they participated in the PM&E workshop. This questionnaire consisted of one section, because it was not necessary to collect demographic information more than once. The second questionnaire consisted of seven potential questions (six open-ended, and one close-ended) related to their perceptions of KPIs and the PM&E process that took place during the workshop. Similar to the first questionnaire, participants were first asked to describe why they placed certain KPIs in the top two "most important" categories, the top two "least important" categories, as well as which KPIs they had trouble placing and why. Next, participants were asked to identify whether or not they had experienced any changes in their perceptions of KPIs during the PM&E workshop. If participants answered "yes", they were given two additional questions that specifically inquired about the changes that occurred and the aspects of the workshop that lead to a change in their perception.

Participant Observations

Participant observations were conducted using Bailey's (2007) procedure. Bailey (2007) states that boundaries must be set for where the observations will be conducted, therefore the collaborative group in this research will be observed during the one-day PM&E workshop, in

order to gain a clearer understanding of how the interactions occur in the formative stages of a PM&E process. Observations included a combination of both structured and unstructured formats. A table of the four PM&E principles (participation, negotiation, flexibility, and learning) was created in a field notebook. When participants demonstrated or discussed any of the principles listed above, it was recorded in the table under the appropriate heading. Direct quotations were also recorded when possible. Any other important or intriguing observations related to the PM&E process were also recorded in the notebook.

3.2.4 Procedures

Step One: Designing the Q-sort

The data collection tool in Q methodology is called the Q-sort, and it is comprised of statements that participants rank on a normal distribution curve. The statements used in Q methodology are called the concourse (Brown, 1986), and the initial step in developing the tool was to create a concourse that represented a range of KPIs for the management of trails. The concourse consists of the breadth of possible options regarding the subjective topic in question, and becomes the overall population of statements from which the final Q-set is taken (Brown, 1993).

The Q-set, or concourse, was developed using quasi-naturalistic methods, meaning it was developed from secondary sources external to the study (McKeown & Thomas, 2013), including literature related to trail KPIs (see Table 3.1), a previous master's thesis study which collected ecological data at the Niagara Glen site (Mallette, 2019), as well as key conversations with environmental managers of the site (who were not involved in the workshop). Twenty-eight statements covering a both social and ecological dimensions of trail management were chosen, giving participants a variety of options to rank while still being short enough for them to complete in a reasonable time (Table 3.1; see Appendix 3-1 for full definition list of KPIs).

Table 3.1: List of KPI criteria used to develop Q-set

KPI #	KPI Criteria	Citations
1	Vegetation cover	Marion, 2008; Leung & Meyer, 2004; Lime et al., 2004; Leung & Marion, 2000; Manning, 2007; Mallette, 2019
2	Non-native species cover	Lime et al., 2004; Leung & Marion, 2000; Mallette, 2019
3	Canopy cover	Mallette, 2019
4	Tree health	Marion, 2008; Leung & Meyer, 2004; Mallette, 2019
5	Vegetation trampling	Leung & Meyer, 2004; Lime et al., 2004; LEES, 2013; Belnap, 1998; Mallette, 2019
6	Tree root exposure	Leung & Meyer, 2004; Belnap, 1998
7	Bare soil	Marion, 2008; Leung & Meyer, 2004; Leung & Meyer, 2004; Lime et al., 2004; Leung & Marion, 2000; Mallette, 2019
8	Soil pH	Belnap, 1998; Mallette, 2019
9	Soil compaction	Leung & Meyer, 2004; Lime et al., 2004; Leung & Marion, 2000; Belnap, 1998; Mallette, 2019
10	Soil stability	Marion & Leung, 2011; Leung & Meyer, 2004; LEES, 2013; Belnap, 1998
11	Trail/soil erosion	Marion, 2008; Marion & Leung, 2011; Leung & Meyer, 2004; Lime et al., 2004; Cole, 1991; Hammitt & Cole, 1998
12	Trail muddiness	Marion, 2008; Marion & Leung, 2011; Leung & Meyer, 2004; Lime et al., 2004
13	Excessive trail widening	Marion, 2008; Marion & Leung, 2011; Lime et al., 2004; Cole, 1991
14	Cultural resource deterioration	Leung & Meyer, 2004; Lime et al., 2004; Manning, 2007
15	Litter	Marion, 2008; Marion & Leung, 2011; Leung & Meyer, 2004; Lime et al., 2004; LEES, 2013
16	Carrying capacity	Leung & Meyer, 2004; Manning, 2007
17	Visitor conflict due to incompatible use	Leung & Meyer, 2004; Lime et al., 2004; Hammitt & Cole, 1998
18	Visitor conflict due to crowding	Leung & Meyer, 2004; Lime et al., 2004; Hammitt & Cole, 1998; Manning, 2007
19	Visitor displacement	Lime et al., 2004
20	Threats to visitor safety	Lime et al., 2004
21	Unsanctioned trails/social trails	Leung & Meyer, 2004; Leung et al., 2011; Belnap, 1998
22	Vandalism	Marion & Leung, 2011; Leung & Meyer, 2004; Lime et al., 2004; LEES, 2013
23	Signage	LEES, 2013
24	Accessibility	Sayan & Atik, 2011; Wilson, 2000
25	Limited access due to physical barriers on trail	LEES, 2013
26	Scienic Views	National Park Service, 1997; Cocklin et al., 1990
27	Noise pollution	Mace et al., 2004, Mace et al., 2003
28	Presence of structures	Puustinen et al., 2009

Step Two: Identifying Participants and Recruitment

As per a PM&E process, participants were recruited in a way that would capture multiple different stakeholder groups that have a vested interest in the project (Margoluis & Salafsky, 1998). All participants were required to have some familiarity with the site, having used the site for recreational purposes within the last year, so as to be able to reflect upon their personal experiences and use of the site. All individuals were identified through non-probability purposive sampling, in which individuals are selected based on the purpose of the study (Riddick & Russell, 2015), through conversations with key NPC collaborators. The key NPC collaborators were not able to participate in the workshop due to any potential bias that could have impacted the results. The identified stakeholders were contacted by the researcher via email and asked if they would be willing to participate in a one-day, in-person workshop, as well as a Q-method sorting activity and questionnaire via Qualtrics online one week after the workshop took place. Five different stakeholder groups accounting for roughly 20 potential participants were contacted to participate in the study

A total of seven individuals from the Niagara Region participated in the study (n= 7). The sample contained six males and one female who ranged in age from 27 to 73 years. Among the seven participants, two reported that they had a high school education level, three held a college diploma or equivalent, and two held a bachelor's degree or higher. Finally, these participants comprised three different stakeholder groups, including Niagara Parks staff (three participants), nature club members who utilize the site (two participants), and local residents who use the site (two participants). Other potential participants that were contacted were ultimately unable to participate due to scheduling conflicts or lack of interest. Additionally, two participants who originally agreed to attend the workshop did not show up on the day it was taking place. This might have been due to the timing of early March, in which people were preparing to go on holiday, or they may have had conflicting work schedules. Additionally, Covid-19 had recently begun spreading throughout the province of Ontario, which may have impacted people's willingness to participate in the workshop. However, because Q methodology does not require a large number of participants to obtain significant data for the purpose of identifying and interpreting perspectives (Brown, 1980), the goals of the study were achieved.

Step Three: T1

The initial Q-sort and questionnaire was administered once at the outset of the PM&E workshop. Immediately after a 20 minute guided trail walk in the Niagara Glen, the first Q-sort took place. During the administration of the Q-sort, each participating stakeholder was given a set of twenty-eight index cards. Each card had one of the concourse statements written on it. They were first asked to do an initial sort where they placed the cards into three piles of "more important" (11 cards), "least important" (11 cards), and "neutral" (6 cards).

Next, they were given a worksheet on which to rank the different statements on a 28-item forced distribution ranging from + 4 (most important) to −4 (least important). Participants began by taking the pile of statements they designated as more important and choosing the two statements they believed were most important to place on the worksheet in the + 4 column on the far right. They were then asked to place the next three statements they found more important into the + 3 column and so on until all the statements from their "more important" pile had been placed on the worksheet. This process was repeated with the "least important" statements, starting with the two statements in the −4 column, and finally with the "neutral statements". Neutral statements generally ranged from −1 to + 1. Participants began by the most neutral statements in the '0' column, and statements that were slightly more important would veer toward the positive, whereas statements slightly less important to them would veer toward the negative side of the ranking sheet.

As part of this activity, participants were asked to complete a corresponding questionnaire. First, participants provided basic demographic data about themselves. The second section asks participants to reflect on certain aspects of the Q-sort and provide detail the choices made in their sorting activity.

Step four: The Intervention

Following the pre-test, the participants engaged in a one-day workshop in which they were led through the formative stages of a PM&E process. Workshop-based techniques are often used in PM&E, as they seek to create a learning atmosphere and safe environment for participants (Jackson & Kassam, 1998). The workshop was developed using the guiding

framework by Shah et al. (2006) which outlines the phases involved in PM&E process (see section 3.1). There are typically nine key phases which constitute the M&E process, however the workshop focused on the formative stages of the PM&E process in which KPI development is integral to coincide with the purpose of the research. The workshop consisted of the first three phases of a PM&E project cycle: 1) participatory appraisal, 2) participatory planning and project design, and 3) participatory development of baseline indicators. As such, the workshop intervention consisted of three group activities, which aimed to achieve the goals of each phase described above, and progressively create group consensus surrounding KPIs for the Niagara Glen trail system located on site (see Appendix 3-2 for agenda of workshop). While participants were engaging in this process, participant observations were conducted to capture the four principles associated with PM&E (participation, negotiation, flexibility, and learning), as well as any other benefits, challenges, or characteristics of engaging in a PM&E process. Observations were recorded in a field notebook and transcribed immediately after the workshop took place.

Step five: T2

One week after the trails workshop took place, the participants were contacted via email to complete the same sorting activity and questionnaire again via Qualtrics (online format). Participants were contacted to complete these activities one week after the workshop took place, to allow the participants time to reflect on the workshop experience and fully consider their perceptions of the KPIs. The online format of the post-workshop Q-sort and questionnaire was chosen to avoid additional travel costs and scheduling conflicts for the group of participants. One week after the email invite asking participants to complete the post-workshop Q-sort and questionnaire, a follow-up email was sent to any remaining participants that had not yet completed the activities (3 participants). A follow-up email was essential to limiting the amount of time passed between the PM&E workshop and the final data collection point, so that participants would be able to provide accurate reflections about the workshop and their perceptions.

3.2.5 Data Analysis

Q-sort data

Q-methodology involves a quantitative data analysis of the Q-sort. Using a software package specifically developed for Q methodology is recommended, such as the free download of KADE, version 1.1.0 for Windows or Mac developed by Banasick (2019). Banasick's (2019) statistical program allows Q-sort data to be input as piles of statement numbers for each participant. It conducts the analysis by allowing a choice of centroid or principal component method for factor analysis and then allows the resulting factors to be rotated either analytically through a varimax rotation, or judgementally with the aid of two-dimensional plots. After relevant factors are selected, the final analysis steps produces an extensive report with tables indicating factor loadings, statement factor scores, distinguishing statements for each factor, and consensus statements across factors (Banasick, 2019).

The first stage of data analysis for the Q-sort data related to identifying the perspectives of the seven participants before and after the workshop took place, for the purpose of determining how participants converged or diverged in their perceptions of KPIs. Each data set from the pre-workshop Q-sort and post-workshop Q-sort were input into the KADE software separately, so that each participants' pre-workshop Q-sort served as seven entries within the P set. Each participant was given a number identifier (P1, P2, P3, etc.) in order to protect the identities of the participants as well as to organize the pre and post data by individual for later analyses. As data entered into the dedicated Q-method analysis program, participant identifiers became column headings with the statements forming the rows. The data was then organized into a correlation matrix, which Brown (1993) describes as a way through which the data must pass on the way to revealing their factor structure. Each participant's numerical data was intercorrelated to identify which participants sorted the statements into similar ones (McKeown & Thomas, 1998). The resulting correlation matrix represents the level of agreement or disagreement between the individual Q-sorts (van Exel & de Graaf, 2005), by showing the extent to which each Q-sort is correlated or uncorrelated in terms of significant or insignificant loadings. In order to determine which participants had similar rankings of the KPI items, all seven data Q-sorts were then factor analyzed using the principal components method based on

the desire to achieve a more statistically precise solution regarding the alignment of perspectives between the group of participants in the pre-workshop Q-sort and the post-workshop Q-sort. Factors were extracted based on the eigenvalue criteria EV > 1.0 . Varimax rotation was used to reduce the number of confounded sorts. The pre-workshop and post-workshop factors were then compared to determine if there was an overall change in the convergence of perceptions after the workshop took place, based on the number of factors that were extracted in the pre and post Q-sort analysis.

The second stage of data analysis addressed individual perspective changes and included a factor analysis of pre-workshop and post-workshop factors, for the purpose of determining any statistical changes of individuals' perceptions between pre-workshop and post-workshop. Because the factors that were created from the group KADE analysis from T1 to T2, namely the pre-workshop Q-sorts and the post-workshop Q-sorts, were not exactly the same, the movement of individuals between the sorts cannot fully explain whether or not their individual Q-sorts from T1 to T2 indicate a statistically significant change in perspective. Therefore, data from the pre-workshop and post-workshop Q-sorts were entered into the software for each individual separately, and analyzed using the principal components method. This produced orthogonal factors for each individual representing each participant's pre-workshop and post-workshop sort. Statistically significant differences were determined using the test and re-test criteria established in Frank (1956), and Brown (1980). Next, correlation coefficients among factors and factor loadings were examined to assess the convergence or divergence in perspectives before and after the workshop. Reliability coefficients of a person with themselves normally range from .80 upward (Brown, 1980; Frank, 1956). Therefore, if the correlation score between a person's Q-sort at time 1 and time 2 is less than .80, a statistically significant change can be said to have occurred.

Questionnaires

Data from the pre-workshop and post-workshop questionnaires were used to inform the analysis of the data gathered in the Q-sort activities. Analysis followed the protocol by Saldaña (2013) for coding open-ended questions, as well as Gibbs (2007) and Given (2008) for thematic analysis. First, all raw data was transcribed and given a thorough read through. Each question in

the pre and post-questionnaire underwent a first cycle coding process, in which short excerpts from participant responses were assigned a unique code. A code is considered an identifier that is given a name that most exactly describes what the text is saying (Saldaña, 2013). Next, each question was subject to a second cycle coding process in order to reduce and extract themes from participant responses (Given, 2008). Themes were thematically analyzed following Gibbs (2007) protocol, whereby the researcher identified patterns among the codes to extract themes that describe the most important concepts within the data set. Codes were considered relevant themes if they were present in more than one participant's answer for the same question. Additionally, as participants were asked to identify which KPI items they placed in respective importance categories, the number of times a KPI item was mentioned was also recorded. Information on whether or not the participants perceived a change in their perspectives regarding KPIs, per the post-workshop questionnaire, was also used in the interpretation of data concerning whether changes in perspective did occur.

Participant observations

Participant observations followed the protocol set out by Bailey (2007), and used a combination of both structured and unstructured formats. A table of the underlying PM&E principles (participation, learning, negotiation, flexibility) was used to record observations and interactions occurring during the workshop. Any other important or intriguing observations was also recorded in a notebook, alongside notes taken based upon assessing the PM&E process. Using this method, participant observations are pre-organized into "codes" which represent the underlying principles of PM&E. These codes were then thematically analyzed following the protocol by Gibbs (2007), whereby the researcher identified patterns among the codes to extract themes that describe the most important concepts within the data set.

3.3 Results

Results from the study are presented in three parts. First, the T1 or pre-workshop results will be presented. This subsection includes the Q-sort results, as well as the qualitative results from the questionnaire data. The second subsection includes a detailed account of the workshop activities and associated participant observations. The third subsection presents the results from

T2 or the post-workshop results, including the second Q-sort results, as well as the qualitative results from the second questionnaire.

3.3.1 T1: Pre-workshop

Three factors emerged from the Q-sort, indicating that among the seven participants, there were three different groups that had diverging perceptions of KPIs for trails. Three participants (1, 2, and 3) loaded onto the first factor. This perspective had six distinguishing statements that were significant to the 99% confidence level ($p < .01$). Distinguishing statements implies that the mean ranking for each of the statements in Factor 1 are significantly different than the rankings given for Factor 2 and Factor 3. Two participants (4 and 5) loaded into the second factor. This perspective had six statement that were significant to the 99% confidence level ($p < .01$). This implies that the mean ranking for each of the statements in Factor 2 are significantly different than the mean rankings for Factor 1 and Factor 3. Finally, two participants (6 and 7) loaded onto the third factor. This perspective had four statements were significant to the 99% confidence level ($p < .01$) (Table 3.3). Again, this implies that the mean ranking for each of the statements in Factor 3 are significantly different than the mean rankings given for Factor 1 and Factor 2.

Table 3.2: Factor analysis of pre-workshop Q-sorts of participants

Participant	Factor 1	Factor 2	Factor 3
P1 NPC staff	**0.8421**	-0.3146	-0.0821
P2 NPC staff	**0.6367**	0.3574	0.1858
P3 Nature club member	**0.55**	0.2049	0.1507
P4 Resident	0.161	**0.8687**	0.1657
P5 Nature club member	0.0073	**0.7203**	0.0021
P6 Resident	0.0201	-0.0086	**0.8408**
P7 NPC Staff	0.1839	0.1776	**0.833**
Eigenvalue	2.1823	1.2681	1.0927
% Explained Variance	31	18	16
Cumulative % Explained Variance	31	49	65

Table 3.3: Significant distinguishing statements for each factor

Distinguishing Statement	Mean Ranking Factor 1	Mean Ranking Factor 2	Mean Ranking Factor 3
Factor 1			
Accessibility	4	-3	-4
Threats to visitor safety	3	-1	1
Vegetation trampling	0	4	2
Soil compaction	-2	0	0
Trail/soil erosion	-3	1	3
Excessive trail widening	-3	1	0
Factor 2			
Vegetation trampling	0	4	2
Cultural resource deterioration	-2	3	-3
Non-native species cover	-1	2	0
Threats to visitor safety	3	-1	1
Signage	1	-1	2
Limited access due to physical barriers	3	-1	4
Factor 3			
Scenic views	0	-2	-3
Trail muddiness	-2	-3	2
Vegetation trampling	0	4	2
Threats to visitor safety	3	-1	1

In the questionnaire, the first question asked participants to identify which KPI items they placed in their "most important" categories (specifically +4 and +3) and explain why. When examining participant responses regarding the KPI items placed in their "most important" categories, there was a wide variety of responses with little overlap between participant answers (see Appendix 3-3). The participants were also asked participants to explain why they placed certain KPI items in the "most important" category. Overall, four different themes emerged including visitor safety, protecting nature, visitor access, and relate to other KPIs were apparent across participants reasoning for choosing particular KPIs. For example, P4 expressed that vegetation trampling was one of the most important KPI criteria items because it is important to "maintain the natural ecological state that the site is in". Similarly, P5 noted that visitor conflict due to overcrowding was the most important KPI because "crowding causes more damage to the

Glen environment…". While both participants indicated different KPI criteria, both provided similar explanations involving the importance of or concern for protecting nature at the Glen.

The second question asked participants to explain to identify which KPI items they placed in their "least important" categories (-4 and -3), and explain why. When examining participant responses regarding the KPI items placed in their least important categories (-4 and -3 placement), noise pollution, accessibility, and presence of structures were among the highest responses from participants, accounting for 8 out of fourteen total responses (see Appendix 3-3). When asked to explain the placement of their "least important" KPI items, two distinct themes emerged from the participant answers: visitor/user type and user expectations. Six out of seven participant answers coded for the theme user expectations. Participants stated that these particular KPI items were not as important as others because users should expect certain things to be present along the trails. For example, P1 responded that "there are so many noise pollution contributors in the area that cannot be changed, that it is something to ultimately accept as part of the experience". Notably, P7 indicated that trail muddiness was one of the least important KPI criteria items, however when explaining their placement of this KPI criteria item, they also mentioned user expectations: "mud is something hikers should expect to encounter". Therefore, while the participants did mention different KPI items throughout this question, distinct themes emerged once again among the answers as to why certain KPI items were seen as unimportant.

The third question asked participants which KPI criteria statements they had difficulty and why. Overall, twelve different KPI items were listed across the participants. The participants identified numerous different KPI items as difficult to place, with little overlap of answers between the participants (see Appendix 3-3). However, when answering why they had difficulty placing such items, two distinct codes emerged. Participants' answers expressed that the status of the KPI items were dependent on two circumstances: the visitor/user type, and the amount of education that a user has regarding the site. For example, P2 stated that "vandalism and litter will appear on all trails due to the non-respectful trail user, which we can only try to curb through continued education and time…". Similarly, P7, who belonged to an entirely different perspective group than P2 stated "visitor impact on the site will diminish if direct efforts in the

site's management are made clear and known. If people see/understand that this is a sensitive habitat that requires intensive care, they may be less inclined to abuse their privileges here".

Finally, the fourth question asked participants to describe any other thoughts or ideas about the KPI criteria that emerged while sorting the statements. Two themes emerged from participant answers: human vs. nature balance, and interconnected KPIs. Four participants referenced the importance of protecting nature at this site. P5 specifically stated "protection is the highest importance, all other come after". Similarly, P6 noted that "the health of the area is probably more important [than what is important to them]". In line with this, limiting access to the Glen and making sure users were aware of visitor impacts was viewed as a way to balance human use of the site with protecting its natural assets. For example, P1 stated that "through limiting access we could see a overall improvement to the trail and more positive KPIs". Interconnected KPIs was also a common theme throughout participant responses. Participants expressed their realization that many of the KPI criteria items were mutually exclusive, in that when one or more major KPI items are addressed, others will naturally improve as well. For example, P1 explicitly stated "most of the KPIs have some correlation to one another, and by improving one you should see an improvement to another". Similarly, P2 wrote "some KPIs seem to flow into another as in a cause and effect sort of thing, if we take of the +3 then the +2 will also show results".

3.3.2 The Intervention

The workshop (intervention) began as soon as T1 was completed. First, the participants engaged in a "go-round" where each participant was asked to consider the condition of the trails and reflect/share their observations, such as issues observed or positive aspects of the trails. This information comprised the needs assessment and appraisal of the Niagara Glen, which was then used in a group discussion to form three overarching management goals for which the workshop would focus on. Participants noted that updated signage, presence of on-site staff members, NPC partnerships focused on stewardship, and the unique vegetation of the site were positive aspects of the trail and current trail management plan. Participants also identified a variety of needs such as increasing users' knowledge about the site and level of difficulty of trails, as well as understanding the trail's carrying capacity/user capacity. As multiple needs were identified, the

participants needed to negotiate among themselves to identify the highest priority needs. Ultimately, participants considered the Niagara Parks Commission mandate to protect and preserve the natural environment, while offering rich visitor experiences as the overarching goal for managing the Glen. Based off of this discussion, three PM&E sub-goals were developed by the participants: 1) define, establish and implement a carrying capacity, 2) increase education about trail safety and behaviour, 3) focus on trail maintenance to limit and/or divert users to appropriate trails. These sub-goals were considered a priority for achieving a balance between protecting and maintaining the natural area and beauty at the Niagara Glen, while offering visitors access to the site, and ultimately became the focal point for planning and designing the PM&E project.

Next, the participants broke up into three groups. The groups each compiled a priority list of KPI items that related to the overall management goals that were developed in the previous activity. Once the three groups compiled their priority list, the groups rejoined to discuss their choices and further streamline their list of KPIs. The goal of this activity was to help participants progressively narrow the broad list of KPI items from the Q-sort to reach a consensus about which KPIs to prioritize. By breaking up into small groups, each participant was able to communicate their own perceptions or views and reach a consensus in a more manageable way. At the same time, this required negotiation and flexibility among participants, as each stakeholder brought different ideas and perspectives into the activity. For example, P1 referred to their Q-sort throughout the discussion, noting that the trail conditions, and specifically trail erosion, should be a focal priority for trail management. However, by the end of the second group activity, P1 seemed to shift their perspective noting that "trail conditions are largely impacted by the number of visitors to the site… like with more people there will be more litter or more vegetation being trampled". As a result of these tough discussions, participants selected and established the following KPI criteria: goal 1) carrying capacity, goal 2) vandalism, litter, signage, educational resources, unsanctioned trails/social trails, safety, and 3) infrastructure (physical boundaries), measure of diversion.

The last activity was a brainstorm activity involving a group discussion. Each of the KPI items were highlighted on a chart, and the participants were asked to brainstorm ideas on how to measure each of the KPI criteria items. This activity was designed to address the third stage of

the PM&E process, which required the participants to develop appropriate and measurable KPIs for each goal on their priority list. The participants experienced difficulty staying on task and were ultimately unable to develop measurable KPIs for the KPI criteria identified in the previous activity. The participants expressed multiple reasons as to why they felt unable to proceed including a lack of expertise, authority, and sufficient information to move forward or make decisions. For example, while all of the participants agreed that the site needed to establish a carrying capacity, the participants did not know how to define or use scientific data to establish a standard for the Niagara Glen. Measurable KPIs were vaguely explored and discussed, such as having a trail counter to record the number of people on the trail yearly, and combining this with "ecological data" to determine how the environment changes as the amount of visitors increases or decreases. Overall, there was an obvious disconnect between what the participants felt like they could plan based on their own expertise, as well as how far ahead they could design a PM&E program without higher level management present to answer important factors influencing a PM&E design. As such, the conversation largely related back to general ideas on how to improve the site and trail management plan, rather than specific and measurable KPIs. Due to this lack of progression, qualities of negotiation and flexibility were difficult to observe among the participants, as participants were not able to reach a concrete agreement about how or when data would be collected and analyzed, how results would be communicated, or what action would be taken in response to the results.

While the participants who engaged in the workshop demonstrated a high level of participation throughout, there were other observations related to the challenges associated with stakeholder participation in PM&E. Due to the nature and time-frame of the study, participants only engaged in the first three phases of a PM&E process, which made it difficult to observe learning qualities among participants. However, participants spoke about learning facts, new knowledge, as well as processes and procedures related to the management of the Niagara Glen. Through the sharing of personal experiences and perceptions, each participant was afforded the opportunity to learn from each other and consider factors about the Glen trails that did not apply to themselves. In fact, multiple participants expressed this as a reason for experiencing a change in their perceptions after the workshop. For example, P6 stated "it's just an eye opener to try and determine what is important to me, others, and the environmental side of the trail".

3.3.3 T2: Post-workshop

Two factors emerged from the data. Four participants (1, 2, 4, and 7) loaded onto the first factor. This perspective had thirteen distinguishing statements that were significant to the 99% confidence level ($p < .01$). The distinguishing statements imply that the mean rankings for each of the statements in Factor 1 are significantly different than the mean rankings of the same statements in Factor 2. Three participants (3, 5, and 6) loaded into the second factor. This perspective also had thirteen distinguishing statements that were significant to the 99% confidence level ($p < .01$). 95% ($p< 0.5$). This implies that the mean ranking for each of the statements in Factor 2 are significantly different than the mean rankings for Factor 1.

Table 3.4: Factor analysis of post-workshop Q-sorts of participants

Participant	Factor 1	Factor 2
P1 NPC staff	**0.7965**	-0.0512
P2 NPC staff	**0.8812**	0.268
P3 Nature club member	0.0063	**0.8488**
P4 Resident	**0.7481**	0.1894
P5 Nature club member	0.2414	**0.7466**
P6 Resident	0.2233	**0.8197**
P7 NPC staff	**0.4564**	0.3126
Eigenvalue	3.0731	1.3717
% Explained Variance	44	20
Cumulative % Explained Variance	44	64

Table 3.5: Distinguishing statements for each factor

Distinguishing Statement	Mean Rating Factor 1	Mean Rating Factor 2
Factor 1		
Soil compaction	2	-4
Tree health	1	-1
Vandalism	1	3
Bare soil	0	-2
Trail muddiness	0	-2
Canopy cover	0	-3
Visitor conflict due to crowding	-1	-3
Accessibility	-1	2
Cultural resource deterioration	-1	1
Soil stability	-2	0
Visitor conflict due to incompatible use	-3	1
Presence of structures	-3	-1
Noise pollution	-4	0
Factor 2		
Vandalism	1	3
Accessibility	-1	2
Visitor conflict due to incompatible use	-3	1
Cultural resource deterioration	-1	1
Soil stability	-2	0
Noise pollution	-4	0
Presence of structures	-3	-1
Tree health	1	-1
Bare soil	0	-2
Trail muddiness	0	-2
Canopy cover	0	-3
Visitor conflict due to crowding	-1	-3
Soil compaction	2	-4

The individual participants' pre and post Q-sort data was input into the KADE software separately in order to determine if participants experienced a statistical change within a factor identity. Comparisons of individual participants' pre-workshop and post-workshop Q-sorts were obtained by conducting a Q-sort analysis for each participant, with each participant's pre-workshop sort and post-workshop sort serving as the two entries into the P set. Table 3.6 shows the correlation between the sorts for each participant, as well as the distinguishing statements,

which indicate which statements are statistically significant at $p < .01$. Six out of seven of the participants showed statistically significant $r < .80$ correlations, indicating a statistically significant change in their perspectives from time 1, the pre-workshop Q-sort, and time 2, the post workshop Q-sort (Table 3.6).

Table 3.6: Comparison of individual participants' pre and post Q-sorts and self-reported change from questionnaire

	Correlation Between Sorts	Distinguishing Statements	Statistical Change $r < 0.80$	Self-reported Change (see below)
P1 Pre	0.68	1, 8, 16, 25	Yes	No
P1 Post				
% expl. Variance				
P2 Pre	0.76	None	Yes	Did not provide answer
P2 Post				
% expl. Variance				
P3 Pre	0.39	3, 11, 13, 18	Yes	Yes
P3 Post				
% expl. Variance				
P4 Pre	0.48	6, 18, 21, 23	Yes	Yes
P4 Post				
% expl. Variance				
P5 Pre	0.42	1, 18	Yes	No
P5 Post				
% expl. Variance				
P6 Pre	0.72	None	Yes	No
P6 Post				
% expl. Variance				
P7 Pre	0.90	None	No	Yes
P7 Post				
% expl. Variance				

The first question in the post-workshop questionnaire asked participants to identify which KPI items they placed in their "most important" categories (+4 and +3) and explain why. Six out of seven participants provided responses to this question. When examining participant responses regarding the KPI items placed in their "most important" categories, the majority of participants named carrying capacity as one of the most important KPI criteria items for trail management (six out of seven participants), followed by threats to visitor safety (three out of seven participants) (see Appendix 3-4). When asked to explain why they placed certain KPI items in

the “most important” category three distinct themes emerged across participant answers: protect nature, visitor safety, and interconnected KPIs. Carrying capacity was consistently noted as a way to protect nature, or protect the natural area of the Glen, by limiting opportunities for overcrowding or human-caused environmental degradation. P5 expressed this viewpoint by stating “Overcrowding is the most damaging threat to the environment in and around the Glen therefore need to control amount of visitors.” This participant also described the carrying capacity KPI item in relation to the second major theme, visitor safety, stating that visitor safety is being affected by the increase in visitation…”. Overcrowding was also seen as the source of many other issues associated with the glen. For example, P4 noted that “Overcrowding can lead to a list of different issues, including soil compaction, vegetation trampling and array of different issues that come from too many people packed on the hiking track”. Others generally agreed, that by combating overcrowding by implementing a carrying capacity, other KPI items would benefit. P6 explained “I still feel overcrowding and carrying capacity is the stem to almost all items list of the KPIs”.

The second question in the post-workshop questionnaire asked participants to identify which KPI items they placed in their “least important” categories (-4 and -3), and explain why. Five out of seven participants provided a response to this question. When examining participant responses regarding the KPI items placed in their least important categories (-4 and -3 placement), there was noticeably less overlap in the answers participants listed. Noise pollution and trail muddiness were the only overlapping answers, with only two participants choosing the KPIs (see Appendix 3-4). However, when asked to explain the placement of their “least important” KPI items, one distinct theme emerged from the participant answers: user expectations. While the participants largely chose different KPI items in the least important category, they were typically chosen for the same reason. Participants expressed that certain KPI items, such as noise pollution or the presence of structures, should be expected by the visitors or users of the site. For example, P4 stressed that “no matter the level of control in a place it is inevitable a trail will get muddy”.

The third question asked participants which KPI criteria statements they had difficulty and why. Once again, the KPI items listed varied across all participants, with no consensus about

which KPI items were difficult to place (see Appendix 3-4). However, one distinct theme emerged from the answers: balancing nature vs. humans. Participants struggled with the idea of limiting or diverting human access away from the Niagara Glen trails as a way to protect nature. As such, KPI criteria such as accessibility and signage, which was seen as methods to increase visitation, were difficult to place. P7 explained that "visitor displacement is challenging because one of the ultimate goals of sustaining the Glen habitat is to divert visitors, as the current visitor volume greatly exceeds the carrying capacity of the Glen. Ultimately, KPI criteria that had the potential to increase the amount of visitors to the site, and therefore affect the carrying capacity KPI were seen as difficult to place.

Next, participants were asked in a close ended question whether or not they experienced any changes in their perceptions towards any of the KPI criteria for the Niagara Glen Nature Trails during the workshop. Out of the six people who provided a response to this question, three participants chose "yes" indicating that they had experienced a change in perception, three participants chose "no", indicating that they had not experienced a change in perception. If the participants answered "yes", they were asked two additional open-ended questions about their change in perception. Therefore, three of the seven participants had access to the additional questions. First, these participants were asked to describe in detail any changes between the initial Q-sort and the second Q-sort. In this case, no common themes emerged among the individuals reporting changes, as all three participants gave different reasons for changes (e.g. time, greater appreciation for nature, deepened understanding, etc.). The final question for the three participants asked participants to describe whether any specific activity in the workshop lead to a change in their perception of the KPI criteria. Two distinct themes emerged from the data: discussion/communication and learning. Two out of three participants specifically indicated that the discussions that took place throughout the workshop contributed to their perception changes between the first and second Q-sort. Furthermore, these discussions led to increased awareness and knowledge about trail management and KPIs more generally. P4 noted his perception change came from a greater "understanding of how many people go there [Niagara Glen trails] … on what is needed to be changed or is being affected by the amount of traffic".

3.4 Discussion

Overall, there was a shift in perspectives from the pre-workshop to post-workshop results. Before the workshop took place, three distinct perspectives emerged among the seven participants, but only two distinct perspectives emerged from the Q-sort after the workshop took place, meaning the stakeholders had greater congruence of perceptions related to KPIs by the end of the workshop. These findings suggest that participating in a PM&E workshop can influence stakeholder perceptions of KPIs, and result in greater congruence of perceptions among participants. Aspects of the workshop that participants named as significant for changing their perceptions included the general discussion and communication among participants, which lead to greater knowledge and understanding of different perspectives and information. This finding is especially important in environmental management and PM&E contexts, as it highlights the practical use and benefit of PM&E for reaching consensus on management goals and associated indicators among a diverse group of stakeholders. Furthermore, not only does this type of M&E work towards a greater understanding of our environmental systems, it also heavily emphasizes the promotion of social learning and stakeholder empowerment (Bohunovsky et al., 2010; Greenwood et al., 1993; Hilhorst and Guijt, 2006; Leys and Vanclay; 2011; Okali et al., 1994; Weaver and Rotmans, 2006; Woodhill, 2006). Fritsch and Newig (2012) argue that this type of social learning may be one of the most important mechanisms that can deliver more pragmatic benefits from participation. Through this process, participants became more aware and conscious of their wider social realities, as well as their visions and perceptions of trail management, which can translate into shared increase in responsibility, and therefore accountability in the authenticity and accuracy of PM&E findings and resulting actions (Abbot & Guijt, 1998; Estrella & Gaventa, 1998; Shah et at., 2006; Jackson & Kassam, 1998).

Importantly, three out of six participants indicated that they had a change in perception of KPIs specifically due to their participation in the PM&E workshop for trail management, however six out of seven participants experienced a statistical change in their perceptions. Moreover, P7 self-reported that they experienced a change in their perception, however, this is not supported by their Q-sort results. This participant was also the only person that did not include the carrying capacity KPI criteria in their “most important” (+4 and +3) category. First, these findings indicate that not only does the PM&E process work to reach a consensus among

stakeholders, but the stakeholder can experience a real change in their perceptions by participating in an PM&E process. As a result of these real changes in perception, and as the stakeholders were directly involved in the decision-making and design process, there may be a higher likelihood to gain support from participating stakeholders in terms of overall management objectives and future management actions. Specifically, positive perceptions from being meaningfully involved in management decisions ultimately ensure the support of local stakeholders or constituents, thus enabling the long-term success of management planning (Bennett, 2016).

Interestingly, these findings also suggest that stakeholders may be less conscious or able to identify when they experience a change in their perceptions, or to what extent the PM&E process influenced their perceptions of KPIs. While this phenomenon has not been entirely explored in PM&E literature, this idea is supported by psychology scholars who propose that a person may be unconscious or lack awareness of the influences or effects of triggering stimulus, in this case, the stimulus being the PM&E workshop, or incremental changes in their beliefs (Bargh & Ferguson, 2000; Nisbett & Wilson, 1970). Therefore, participants may be less able to identify changes in their perceptions of KPIs within the first three phases of a PM&E process, as it is difficult to recognize any incremental changes in personal perceptions that occur within that that time frame. Additionally, the formative phases of PM&E largely focus on group discussion about management goals and related indicators. Participants may require more tangible changes regarding the impacts on the trails, reflected in the later PM&E phase like data collection and evaluation, to be able to fully accept or recognize their own changes in their perception of KPIs and the PM&E process. Participating in an entire cycle of the PM&E process may provide more time to absorb and come to terms with any new information or ideas informing their perceptions of KPIs or trail management. This is an important consideration for both scholars and practitioners who are trying to capture the influences and benefits of participating in a PM&E process. Although the impacts of engaging in this process may not fully be recognized by stakeholders within the formative phases, there may still be unconscious and incremental changes in perception happening among the stakeholders which ultimately impact the PM&E process by allowing stakeholders to reach greater consensus regarding management goals, indicators, and so on.

Further exploration of the Q-sort analysis and questionnaire revealed other noteworthy findings about the overall perceptions of KPIs held by the stakeholders. After the workshop took place, participants appeared to have a high level of congruence in their perceptions of the "most important" KPI criteria items for trail management, and generally indicated carrying capacity as the most important KPI criteria item for trail management (6 out of 7 participants). At the same time, the Q-sort data revealed a diverse range of KPI criteria in the "least important" category post-workshop, or less congruence among participants. This may be viewed as typical in environmental management and M&E projects, as not all potential indicators can be or need to be assessed during an evaluation due to the limited evaluation capacity of most protected area management agencies (Wells and Mangubhai, 2005; Hockings et al., 2006; Day, 2008; Boyd and Charles, 2006; Heck et al., 2012). Priority indicators need to be selected based on management goals and objectives (Hockings et al., 2000; Hockings et al., 2006). In fact, Jackson & Kassam (1998) note that when conducting PM&E, priority indicators should make sense to participants and their understanding of the project, and indicators should be avoided when they do not meet or relate to specific project objectives. As such, participants sifted through each indicator together and ultimately prioritized the carrying capacity KPI criteria item, as it directly related to one of the main trail management goals identified by participants: define and implement a carrying capacity for the Niagara Glen to control the number of visitors to the area. Under this context, priority KPI items become the focal point of the PM&E workshop, and participants did not directly address or discuss non-priority KPIs. As a result, participants had greater consensus about the most important KPI criteria, and less consensus about less important KPI criteria because the specific placement of these criteria did not matter as much as other KPI items.

However, another possible explanation of this result relates back to the concept of mutual exclusivity regarding KPI items. Participants recognized that many of the KPI items were interconnected, and improving one KPI would lead to an improvement in other KPI. Therefore, participants came to an agreement about the most important KPIs for trail management at the Glen, with the idea that all other KPIs that follow will significantly improve without direct attention. Toor and Ogunlana (2009) have noted that KPIs are often logically interconnected, and should not be looked at in isolation from each other. Similar phenomenon can be seen in studies from Manning (1999), which states that defining appropriate management for recreation settings

revolves around a three-element concept which includes social conditions (e.g., visitor encounters), resource conditions (e.g., trail erosion), and management conditions (e.g., type and extent of site management). Cahill et al. (2007) and Lawson and Manning (2001) further states that these conditions are interrelated, and an alteration in one variable can influence the others. This concept has also been previously observed and discussed in literature surrounding the carrying capacity KPI specifically. In placing focus on the relationship between visitor use and environmental conditions, it is observed that "increasing numbers of visitors cause greater environmental impacts, as measured by soil compaction, destruction of vegetation, and other related variables" (Wang & Lawson, 2002). Additionally, carrying capacity also affects the social aspects or quality of visitor experience, such as crowding. Therefore, the emphasis on defining a carrying capacity is related to the degree of resource protection and the type of visitor experience to be provided and maintained, monitoring conditions over time, and adopting management practices which ensure the acceptable conditions have been maintained.

In the context of nature tourism and outdoor recreation specifically, managers and other stakeholders must consider and identify the level of impact that is acceptable (Denstadli et al., 2010; Manning, 2007). It is typically unlikely that impact levels will cause complete loss of relevant systems, so measures of acceptability become proxies for measures of long-term sustainability. Sayan and Atik (2011) suggest that a sound management approach should define the optimum level of recreation use that will provide the desired biophysical and social conditions. The concept of carrying capacity has been introduced as an important concept in park and protected area management for the estimation of optimum recreation use. Since the 1960s, many studies have been carried out concerning different aspects of the carrying capacity for national parks and protected areas (Sayan & Atik, 2011; Papageorgiou & Brotherton, 1999; Lawson et al., 2003; Wang & Lawson, 2002). Additionally, Wang and Lawson (2002) carried out a study which attempted to estimate and define a carrying capacity for Yosemite National Park (Wang & Lawson, 2002). But despite this growing scientific literature, efforts to determine and apply carrying capacity to areas such as national parks have sometimes failed, as it remains unclear at exactly what point carrying capacity has been reached in different contexts. Recent experience suggests that carrying capacity can be determined through the formulation of management objectives, and development of associated indicators and standards of quality for

which to monitor over time, and adopting management practices to ensure that acceptable conditions have been maintained. PM&E processes are positioned at this important intersection. PM&E has been highlighted as an effective tool to address these complex issues set out above (Baird et al., 2016; Bennett et al., 2018), as environmental managers and other stakeholders collectively identify the level of impact that is acceptable, as well as the set of indicators and associated standards (Manning, 2007). Therefore, PM&E can be considered an important tool to navigate tensions between the dual mandates in environmental management (Beaumont, 2001; Kim et al., 2011; Manning, 2003; Munro et al., 2008; Orams, 1996a; Papageorgiou, 2001; Ren & Folta, 2016; Roberts et al., 2014; Tubb, 2003).

3.5 Conclusion

Environmental managers are tasked with navigating the tension between visitor use and maintaining/improving ecological integrity (Kohlhardt et al., 2017, Manning, 2007, Newsome et al., 2012). Furthermore, there is increasing recognition among conservation practitioners and scholars that effective environmental management is integrally linked to well-designed M&E systems (Gordon et al., 2005; Hockings et al., 2000; Margoluis & Salafsky, 1998; Stem et al., 2005; Theobald, 2013; Trimble & Plummer, 2018; Woodhill, 2000), which emphasize participatory stakeholder approaches. As such, this study aimed to investigate the influences of engaging in a PM&E process on stakeholder perceptions of KPIs, and stakeholder perceptions of KPIs for trail management more broadly. Findings suggest that stakeholder perceptions of KPIs for trail management can be influenced by participating in the PM&E process. Upon entering the PM&E workshop, participants demonstrated highly differentiated perceptions about the relative importance of KPIs for trail management. However, after engaging in the PM&E process, participants showed greater congruence of perceptions towards certain KPI items. Additionally, although only three participants self-reported a change in their perceptions, the majority of participants experienced a significant change in their individual perceptions regarding KPIs for trail management after the workshop took place. Through collaborative discussions and consensus-building activities, participants demonstrated qualities of the PM&E principles negotiation, flexibility, and learning, which ultimately led to increased knowledge and understanding of other participants' views and KPIs more generally. Carrying capacity was

ultimately chosen as one of the most important criteria for monitoring the Glen trails due to the drastic need to balance human use of the environment with protecting the natural assets and ecological integrity of the area.

The results of this study provide several practical implications for environmental managers and the use of PM&E. First, engaging in a PM&E process was found to be an effective tool for influencing stakeholder perceptions of KPIs, resulting in greater consensus of trail management objectives and associated indicators. Stakeholders who initially had differing perceptions about specific KPIs for trail management, collaboratively participated in a PM&E workshop to further explore different perceptions or ideas existing among participants. The participants recognized the importance of balancing human use with protecting the natural environment, which came about throughout the workshop activities, and guided participants to reach consensus towards overall management objectives. Group consensus within an environmental management plan is especially important for reaching targets or goals (Estrella and Gaventa, 1998). Additionally, by reaching group consensus on environmental management objectives and plans, managers of these environments gain the support of key stakeholders in regard to the actions taken towards environmental management. The PM&E process can be used as an effective tool to reach consensus among stakeholders. An important component of effective environmental management in this context is the prevention or resolution of conflicts, towards consensus of decisions for the planning and protection of shared natural resources (Estrella et al., 2000; Warner, 1997). It is argued that consensus-building is the driving force behind PM&E processes, that work to ultimately achieve enhanced and fair environmental management decisions, accounting for a diversity of values and needs (Estrella et al., 2000; Reed, 2008; Richards et al., 2004; Warner, 1997). Second, the results from this study revealed key insights about the unconscious perceptions held by stakeholders. Specifically, stakeholders may not be able to recognize incremental changes in their perceptions as a function of participating in PM&E. Moving forward, an important consideration for scholars and practitioners who are employing a PM&E process is that although the impacts of engaging in this process may not fully be recognized within the formative phases, these perception changes may still be occurring and may take longer for stakeholders to fully realize.

Finally, this study provides a detailed insight into the selection and preferences of environmental management actions and associated KPIs for trail management at the Niagara Glen. Integrated knowledge about stakeholder perceptions of environmental management actions have become increasingly important, especially for developing consensus to improve support for environmental management actions and address some of the tensions existing mandates and management approaches (Bennett, 2016; Burger et al., 2017; Patel et al., 1999; Petursdottir et al., 2013; Yasué et al., 2010). By involving a diverse set of stakeholders, managers of these environments can achieve a more holistic perspective of an environmental initiative (Stem et al., 2005), and gain support of key stakeholders for environmental management actions (Bennett, 2016). Understanding how stakeholders, whose support is required to achieve environmental management goals, measure success and how that varies between stakeholder groups is of paramount importance because management decisions can yield different results and have significantly different impacts on an environment (Alwaer & Clements-Croome, 2010; Himes, 2007; Yates et al., 2019).

Additional research is required to enhance the body of empirical evidence as well as explore some of the questions illuminated from the findings of this study. More evidence is needed to better understand the influence of the PM&E process on perceptions of KPIs, trail management, and environmental management more broadly. Future research should examine the influences of engaging in a longer PM&E process, including all nine phases, on stakeholder perceptions of KPIs. As mentioned, PM&E is an iterative process involving multiple cycles of data collection and analysis, learning, and taking action. Through this experiential learning process, stakeholder perceptions may change or adapt as the PM&E process progresses and new knowledge becomes available. Additionally, examining PM&E throughout a longer process may provide more opportunities to observe the principles of PM&E in action, such as negotiation and flexibility, as these qualities are crucial for PM&E given the changing circumstances, people, and skills available for the process (Rossman, 2015; Guijt & Gaventa, 1998). Research is also needed that examines PM&E and stakeholder perceptions of KPIs in different contexts. PM&E is very contextual, and environmental management indicators are highly specific and localized, which limits the wide application of common management indicators for M&E programs than span social and geographic space. Future research should focus on employing PM&E practices

within different contexts, such as for other trails or national parks, as well as other environments such as coastal or marine environments, and other ecological conditions. Finally, future research should specifically examine the use of PM&E processes for environmental management within a complex park governance structure. Within this context, there exists a hierarchy of decision-makers and authoritative persons. This illustrates a unique tension for employing a PM&E approach in park settings, as all key stakeholders (as defined by those undertaking the project) need to be present throughout all phases of the PM&E process in order to build a feasible and inspiring process that can evolve towards fulfilling trail or environmental management objectives (Estrella & Gaventa, 1998; Jackson & Kassam, 1998; Shah et al., 2006). Research in this area is essential for both research and practice, as navigating this tension is becoming more critical to reach environmental management goals.

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Chapter Four: General Discussions and Conclusions

4.0 Thesis Summary

Well-designed monitoring and evaluation (M&E) systems are integral to effective environmental management (Gordon et al., 2005; Hockings et al., 2000; Margoluis & Salafsky, 1998; Stem et al., 2005; Theobald, 2013; Trimble & Plummer, 2018; Woodhill, 2000). More recently, there is an emerging trend to include social dimensions in environmental management and M&E efforts (Bennett, 2016; Clayton et al., 2013; Gelcich & O'Keefe, 2016). Specifically, there is increasing recognition of the importance of engaging stakeholders in environmental management, including the M&E phase.

This chapter brings together the findings of Study One and Study Two and ends the thesis. The first section provides a summary of the complexities and questions being asked about stakeholder perceptions and M&E. The second section synthesizes the overall findings in relation to the key questions. The concluding section provides critical reflections about the research, including limitations and delimitations of the studies, recommendations for future research and practice, as well as specific recommendations for the NPC.

Exploring some of the complexities and unanswered questions associated with stakeholder perceptions in M&E is central to this thesis. Tensions exist regarding appropriate incorporation of stakeholder perceptions in environmental management and M&E in different contexts. While stakeholder perceptions are being emphasized as highly valuable information in environmental management, few studies have attempted to reconcile stakeholder perceptions with different approaches of M&E. In terms of a conventional M&E approach, it is unclear how different stakeholder groups perceive KPIs related to M&E for viewpoints, as well as the influences that affect stakeholder perceptions of KPIs. In terms of a participatory monitoring and evaluation (PM&E) approach, there is little evidence showing exactly how engaging in a PM&E process effects and influences stakeholder perceptions of KPIs for trails.

As such, the overarching purpose of thesis was to examine stakeholder perceptions of KPIs for environmental management, as well as the influences that affect stakeholder

perceptions of KPIs. Two objectives were associated with this purpose. The first objective, to examine inter-group differences in the perceptions about KPIs, was addressed in Study One by comparing stakeholder perceptions at twelve different viewpoint locations across the iconic landscape of Niagara Parks. Surveys administered on site to two stakeholder groups: residents and tourists. The second objective, addressed in Study Two, was to examine the influence of engaging in PM&E on stakeholder perceptions of KPIs for trails. Stakeholders participated in formative phases of a PM&E workshop, and perceptions were examined through the use of a pre and post survey and sorting exercise.

4.1 Synthesis and Discussions

This section synthesizes the overall findings in relation to the key questions posed above. The findings focus on the three common intercepts between Study One and Study Two. Brought together, the findings from the thesis both relate to scholarship on stakeholder perceptions of KPIs for environmental management and effective M&E systems, and contribute to the aforementioned knowledge voids. The overall findings from the thesis follow and are presented in terms of differences in stakeholder perceptions of KPIs, the influences that affect stakeholder perceptions, and the use of stakeholder perceptions in environmental management and M&E.

4.1.1 Differences of Stakeholder Perceptions of KPIs

Research that examines intergroup differences is not novel in environmental scholarship, with research exploring how groups differ in their values (e.g. Burger, 2002), to their aesthetic preferences (e.g. Le Lay et al., 2013). However, it is also important to consider how different groups perceive KPIs for environmental management, as this can provide insight into preferences for management actions, and ultimately enhance future management decisions (Albert et al., 2013; Danielson et al., 2000; Forster et al., 2017;). Overall, both studies in the thesis showed how different stakeholders perceive KPIs for environmental management in a park and recreational trail settings. Findings suggest that stakeholder perceptions of KPIs can be significantly different depending on the environmental contexts and the M&E approaches used.

Study One findings suggest that groups, specifically residents and tourists, do not significantly differ in how they perceive overall KPIs for environmental management of viewpoints. However, the environmental managers generally had lower overall ratings of KPIs for viewpoints compared to visitors (residents and tourists). In Study Two, stakeholders had diverging perceptions of KPIs for trails at the outset of a PM&E workshop, meaning that stakeholders ultimately held different perceptions regarding the importance of different KPIs for trail management. When these findings are considered together, it becomes evident that stakeholder perceptions can widely differ in different environmental contexts. While it is often assumed that different stakeholders, or even individuals, hold different perceptions of environmental management and therefore associated KPIs, these results emphasize that it is impossible to assume exactly how different stakeholders perceive specific KPIs in terms of viewpoint or trail management.

In Study One, and in terms of a more conventional M&E approach, visitor perceptions of KPIs for viewpoints tended to converge, whereby residents and tourists both perceived overall KPIs for viewpoints similarly and positively. This finding is indicative of early landscape literature, which suggests that certain landscapes and visual elements, such as water features or lush greenery, tend to be generally accepted as aesthetic by members of the public (Angileri & Toccolini, 1993; Arriaza et al., 2004; Bergen et al., 1995; Bulut and Yilmaz, 2007; Svobodova et al., 2011). Therefore, in this context, and in terms of overall or more general perceptions of KPIs, environmental managers of these viewpoints may consider that visitors to these sites generally perceive KPIs similarly. However, when exploring visitor stakeholder perceptions at a more refined level (KPI sub-variables), there were apparent differences in the perceptions held by residents and tourists. Again, these findings are congruent with landscape literature which suggests that landscape perceptions can be affected by previous cultural and personal experience of the observer (Svobodova et al., 2011). While overall perceptions of KPIs for viewpoints tend to be similar among stakeholder groups, nuanced differences between stakeholder groups become apparent when exploring more refined levels of perceptions towards KPIs. These findings highlight the importance of exploring different stakeholder perceptions within a more conventional M&E approach. Identifying and understanding different perceptions can help

environmental managers improve their management strategies by incorporating solutions that address the specific priorities or concerns of different groups (Forster et al., 2017; Reed, 2008).

Moreover, these findings illustrate the potential conflict that often play out with regard to conventional M&E approaches to environmental management, which tend to focus on "expert" opinions to inform environmental management actions, while ignoring the preferences or perceptions of other stakeholder groups who use the site (Estrella et al., 2000; Shah et al., 2006; Guijt et al., 1998; Rossi et al., 1999). In terms of KPIs for viewpoints, the environmental managers of these sites tended to have diverging perceptions of KPIs when compared to visitor groups. Therefore, environmental management decisions based on the perceptions of these site managers may not adequately address the priorities and needs of other stakeholder groups or users of these environments (Duffield & Coppock, 1975; Gold, 1980; Scott, 2006).

In terms of a more participatory M&E approach, stakeholder perceptions of KPIs for trails ultimately diverged at the outset of the PM&E process. For example, some stakeholders placed higher emphasis on KPIs related to vegetation, while others placed higher emphasis on KPIs related to accessibility. These differences in perception were largely based on each stakeholders' past experience using or observing the site, therefore, it is unsurprising that each stakeholder placed different emphasis on specific KPI criteria at the outset of the PM&E process. However, by engaging in a PM&E process, stakeholders experienced a change in their perceptions of KPIs, resulting in greater convergence of perceptions after the workshop took place. The findings from this study highlight the importance of engaging stakeholders in environmental management and M&E processes. First, these findings can inform on potential areas of disagreement and driving factors for disagreements between groups. It is especially important to acknowledge these differences and disagreements between stakeholders, and adequately address the concerns and priorities of all stakeholders in environmental management planning (Forster et al., 2017). This ultimately leads to more comprehensive management decisions that address local needs and priorities (Dougill et al., 2006; Reed, 2008). Thus, understanding stakeholder perceptions of KPIs is particularly important for building consensus among stakeholders, especially in the context of the trend towards multi-stakeholder governance

approaches and participatory approaches for managing environments (Albert et al., 2013; Burger, 2002; Eagles et al., 2013; Forster et al., 2017; Warner, 1997).

The findings from this thesis highlight the importance of including the social dimensions, such as different stakeholder perceptions, in environmental management and M&E efforts. Different stakeholders hold different perceptions regarding KPIs related to the management of specific environments. In this study, this includes visitor perceptions and environmental managers perceptions of KPIs for viewpoints in a more conventional M&E approach, as well as stakeholder perceptions of KPIs for trails in a PM&E approach. Due to this diverse variety of potential perspectives, environmental managers cannot assume how different stakeholders will perceive environmental management strategies and related KPIs. Therefore, it is important to collect this type of information and use it to inform and enhance environmental management decisions.

4.1.3 Influences affecting stakeholder perceptions

There are many factors that can influence stakeholder perceptions of an environment, such as past experiences, personal values and beliefs, and so on (Brabyn; 1996; Forster et al., 2017; Jorgensen, 2011; Scott, 2003). It is important to consider the specific factors influencing stakeholder perceptions, as it may have important implications for environmental management decisions. Additionally, understanding what influences stakeholder perceptions provides a mechanism to ultimately shape behaviour by humans, because the impact that people have on a natural environment through behaviours are indirectly influenced by perceptions (Bertolas, 1998; Burger, 2003; Forster et al., 2017; Margoluis & Salafsky, 1998; Pendleton et al., 2001; Steg & Vlek, 2008). Overall, both studies in the thesis provide evidence for factors that influence or affect stakeholder perceptions of KPIs for viewpoints and trails.

In Study One, certain demographic factors influenced stakeholder perceptions of KPIs for viewpoints. Age, gender, and education factors were found to influence stakeholder perceptions of some KPI items. For example, older people tended to rate the overall accessibility of viewpoints lower than younger people. Additionally, the management style of the sites significantly influenced stakeholder perceptions of viewpoints, whereby the sites that had a

prescribed management style had overall higher ratings of all KPI items when compared to low-unmanaged sites. Finally, site type also influenced stakeholder perceptions of KPIs. Specifically, visitors perceived park site types as having better accessibility and amenities than all other site types, and scenic lookout site types as having better vegetation than other site types. In terms of view quality, park site types were perceived as having the lowest view quality compared to historical/interpretation sites and scenic lookout sites.

These results provide some important insights into the factors that influence stakeholder perceptions of KPIs. First, the results confirm that certain socio-demographic characteristics can impact perceptions of KPIs for viewpoints, which is already apparent within visual perception and landscape literature (Angileri & Toccolini, 1993; Lyons, 1983, Misgav, 2000; Sklenicka and Molnarova, 2010; Svobodova et al., 2011; Virden, 1990). However, these specific results provide evidence regarding what types of demographic information influences stakeholder perceptions of KPIs specifically, which can then be targeted through future management actions. Additionally, certain site characteristics, such as the current management practices as well as overall function of the site influence stakeholder perceptions of KPIs. Again, these considerations are important for effective environmental management of viewpoints, as management practices and site types with higher overall KPI ratings can then act as a general guide for the management of other viewpoint sites. These results provide some important considerations of stakeholder perceptions that may affect management decisions. While tourist and resident groups generally perceive overall KPIs similarly, and in a positive manner, there are specific factors that influence stakeholder perceptions of KPIs, and in turn, viewpoint environments more broadly.

Study Two specifically set out to determine whether engaging in a PM&E process can influence stakeholder perceptions of KPIs for environmental management of trails. Scholars have studied other intervention, education, and interpretive programs in an environmental context on the influence on visitor knowledge and beliefs (e.g., Beaumont, 2001; Marion & Reid, 2007; Powell & Ham, 2008), however, few studies have investigated exactly how engaging in a PM&E process can influence stakeholder perceptions of KPIs for trail management, and environmental management more broadly. Study Two provides some initial evidence, from which future research may draw (see Section 3.5) regarding the much larger questions of PM&E processes

and perceptions of environmental management/KPIs. Findings from Study Two suggest that participation in a PM&E process may be an effective tool for influencing how stakeholders perceive KPIs, in this case for trail management. Findings agree with PM&E literature (Alwaer & Clements-Croome, 2010; Estrella & Gaventa, 1998; Jackson & Kassam, 1998; Sokol-Oxman, 2015), which suggest that engaging in a participatory process brings stakeholders together to try to reach a consensus about environmental management goals, indicators for success, and monitoring and evaluation. The findings also reveal the practical value of engaging in a PM&E process geared towards environmental management and planning, as stakeholders who see different aspects of a problem come together and constructively explore their differences, to search for unique solutions to wicked problems (Gray, 1989). As stated by Jackson and Kassam (1998, p. 2), "it is precisely by sharing the different types of knowledge they bring to the evaluation process- and the new knowledge they create together- that citizens and professionals can generate analysis that will render interventions more capable of yielding significant and lasting results". Through the PM&E process, stakeholders can reach consensus about environmental management goals, with a higher likelihood of solutions being implemented and widely supported (Emerson et al., 2012; Ulibari, 2015). Additionally, not only does the PM&E process work to reach consensus among stakeholders, but findings from this research suggests that individual stakeholders involved in this participatory process can actually experience a real change in their perceptions of KPIs. In this sense, PM&E can be considered a learning process that creates the conditions conducive to action and change (Estrella & Gaventa, 1998). This is a unique contribution to the literature, and will likely have implications for PM&E scholarship, and for practitioners considering new environmental management approaches that include participation from stakeholders (Butler & Hvenegaard, 2002).

4.1.4 Perceptions of KPIs for Environmental Management and M&E

The social dimensions of monitoring and evaluation systems are essential considerations in a range of environmental management contexts, one example being parks and recreational trails. Including stakeholder perceptions of KPIs related to environmental management can overcome some of the barriers associated with conventional M&E approaches (see sections 2.1 & 3.0), which often focuses on the examination of quantitative indicators, such as biological measures and outcomes (Shah et al., 2006), while ignoring the social, political, cultural

components (Bennett, 2016; Stem et al., 2005). While ecological assessments are evidently important, effective environmental management systems cannot rely solely on ecological information. Environmental management also requires a social lens, and there are various insights and benefits to be gained through such a lens (Bennett et al., 2017; Clayton et al., 2016; Clayton, Litchfield, & Geller, 2013).

Stakeholder perceptions are a unique addition to improving adaptive and collaborative environmental management. Perceptions of relevant stakeholders can provide important insights into observations, understanding, and interpretations of social and ecological impacts and outcomes of environmental management actions (Bennett, 2016; Forster et al., 2017). Specifically, knowledge of how different stakeholder groups perceive KPIs for environmental management, as well as the influences affecting stakeholder perceptions especially valuable, as it allows managers to achieve a more comprehensive perspective on which to base environmental management decisions (Berkes et al., 2003; Forster et al., 2017; Huntington, 2000; Stem et al., 2005; Reed, 2008; Richard et al., 2004). By considering local interests and concerns at an early stage, environmental management projects can be designed using a variety of perceptions and ideas, and in this way, increase the likelihood that local needs and priorities are successfully met (Dougill et al., 2006; Reed, 2008). It is also argued that the inclusion of relevant stakeholder perceptions enables environmental management decisions or interventions that are better adapted to the specific local environmental and socio-cultural conditions, further increasing their capacity to meet local needs and priorities (Reed, 2008; Shah et al., 2006).

The findings from Study One reveal that different visitor groups to Niagara Parks perceived KPIs for viewpoints similarly. In general, visitors to these viewpoint sites consider KPIs for viewpoint management in a positive manner. However, these perceptions differed from the environmental managers perceptions of the KPIs across these sites. Specifically, environmental managers had lower overall ratings of KPIs for viewpoints, whereas the visitor groups had higher overall ratings. Similarly, Study Two revealed that different stakeholder groups may initially have diverging perceptions of KPIs for trail management, however, through engaging in the PM&E process, stakeholders perceptions shift to become more congruent amongst each other. Considered together, the findings from both studies highlight the variety and diverse perceptions that stakeholders may hold in regard to KPIs for environmental management.

While it may be expected that different stakeholders hold different perceptions regarding KPIs, the findings from these studies provide specific insight into the exact perceptions that different stakeholders hold, as well as the influences that affect stakeholder perceptions in two specific environmental contexts within Niagara Parks. Overall, stakeholder perceptions are highly dependent on the specific environmental context (e.g., scenic viewpoints vs trails), the M&E approach being used (conventional vs participatory), as well as the environmental management practises utilized in these environments. Due to the complex nature of stakeholder perceptions, environmental managers cannot simply assume how different stakeholders perceive KPIs for environmental management. As such, the findings of both studies support the current literature advocating towards a shift away from expert-led management and M&E approaches, towards the inclusion of social dimensions and stakeholder perceptions in environmental management (Abbot & Guijt, 1997). The complexity of social-ecological systems requires a range of perspectives (Berkes et al., 2003). Integrating social evidences, specifically perceptions, with ecological evidence, can provide a more holistic understanding of social-ecological systems, and contribute variation in perspectives (Berkes et al., 2003; Forster et al., 2017). These findings also contribute to this scholarship, suggesting that in addition to considerations of resources, management objectives, and time (Cook et al., 2010; Yasué et al., 2010), alignment of stakeholder perceptions need to be a focus for effective environmental management (Warner, 1997).

An important consideration stemming from this research is the appropriate incorporation of stakeholder perceptions in environmental management in different contexts. Within literature it is recognized that different levels of engagement of stakeholders are likely to be appropriate in different contexts, depending on the objectives of the work and capacity for stakeholders to influence the outcomes (Estrella & Gaventa, 1998; Reed, 2008). The findings from these studies illuminate a possible route forward to begin to incorporate more social dimensions in a meaningful way. In terms of viewpoint management, findings suggest that visitors perceive overall KPIs similarly. As such, a more conventional approach to environmental management, where stakeholders are not directly involved throughout the management process, may be most suitable, given that the environmental managers integrate these overall perceptions in

management decisions. In terms of trail management, different users and stakeholders seem to have more diverse perceptions of KPIs. In order to untangle and align these perceptions, a participatory approach to environmental management and M&E may be more useful. Essentially, there is no one M&E approach that fits all environmental efforts, however the findings from this study provide preliminary evidence on how to effectively conduct M&E in different contexts, using different approaches.

4.2 Conclusions

Key research questions, arising from scholarly tension regarding approaches to M&E (Bennett, 2016; Danielsen et al., 2010; Forster et al., 2017; Pullin & Knight, 2003), the trend toward the inclusion of the social-dimensions in environmental management approaches (Bennett et al., 2016, 2017; Clayton et al., 2016), and the need to engage key stakeholders in M&E and environmental management (Estrella & Gaventa, 1998; Hockings et al., 2000; Jackson & Kassam, 1998; Margoluis & Salafsky, 1998; Njuki et al., 2006; Stem et al., 2005), framed the inquiry. Specifically, social dimensions of M&E are considered essential considerations in a range of environmental contexts, one example being parks and recreation trails. As environmental managers are now challenged to demonstrate positive results in these environments, it is especially important to develop a more robust understanding of the processes which comprise this type of undertaking. In response, this research aimed to examine stakeholder perceptions of KPIs for environmental management, as well as the influences affecting stakeholder perceptions of KPIs. This purpose was achieved through two objectives. The first objective examined inter-group differences in the perception of KPIs for viewpoints. The second objective explored the influence of engaging in a PM&E process on stakeholder perceptions of KPIs for trails.

The overall results contribute to the theoretical and empirical understandings of stakeholder perceptions of KPIs for environmental management. In relation to this overarching purpose, overall findings from both studies emphasize the need to consider the social dimensions of environmental management, and especially the perceptions of key stakeholders in terms of management preferences and related KPIs. Ecological information undoubtably plays an important role, but complexity in social-ecological systems requires the recognition of qualitative

understandings and the role of social information (Berkes et al., 2003). Specifically, stakeholders or visitors hold different perceptions and preferences about environmental management actions and associated KPIs. Due to the complex nature of stakeholder perceptions, environmental managers cannot make assumptions about the preferences or perceptions held by people regarding KPIs related to environmental management. Typically, traditional M&E methods focus on more quantitative ecological indicators (Adams & Sandbrook, 2013; Bennett, 2016; Forster et al., 2017). However, stakeholder perceptions offer a unique addition to this information, and there are many associated benefits to incorporating stakeholder perceptions in environmental management such as increased likelihood that local needs and priorities are met. As such, there is value in both ecological and social information for the management of ecological systems, as these two types of data combined can provide more comprehensive picture of environmental management strategies.

Study One and Study Two highlight the advantages of collecting social information on how different groups perceive environmental management actions and KPIs, and underline the importance of social components to the ecological management of an environment. Public perceptions offer insight into observations, understanding, preferences, and interpretations of social and ecological impacts or outcomes of management actions (Bennett, 2016), which may differ from the perceptions held by the managers of these environments. Study Two revealed detailed insights regarding the influences of engaging in a PM&E process on stakeholder perceptions of KPIs, which ultimately allowed stakeholders to reach consensus on overarching management goals and associated KPIs and resulted in a real change in perception among stakeholders. The thesis has especially demonstrated the importance of examining stakeholder perceptions of M&E and KPIs, to provide a more comprehensive understanding of M&E approaches that emphasize stakeholder participation, and how this information can be incorporated into environmental management planning. Finally, the thesis reinforces the need to strengthen and deepen the contribution of primary stakeholders as active participants in environmental initiatives and M&E, so as to manage their environments in the most effective ways (Dreiss et al., 2017).

The results of this thesis can contribute to fostering more effective environmental management strategies, through a deeper understanding of how different stakeholders perceive KPIs for environmental management in both a parks and recreational trail setting. Through the collection and incorporation of stakeholder perceptions, environmental managers have a more comprehensive picture on which to base management decisions. In turn, management decisions may be better adapted to specific local environments, with attention to important socio-cultural conditions. Through the collection of this information, environmental managers will be more aware of local needs and priorities, which can be addressed in future management decisions. In terms of PM&E specifically, decision making strategies may have a higher likelihood of being implemented and supported by local stakeholder groups, which ensures long-term planning success of these types of initiatives. Additionally, by engaging stakeholders in environmental management and M&E, communities more broadly can benefit, as stakeholders build local level adaptive capacity, and learn to manage their environments in the most effective ways.

4.2.1 Critical reflections about the research

Limitations are restrictions or constraints to the research that are out of the researcher's control but that may affect internal validity (Ellis, 2009). While best efforts were made to overcome identified limitations, the restrictions of a master's level thesis prevented the ability to address all limitations. One noteworthy limitation was the small sample size of the key stakeholders in Study Two. The participants were recruited through a key person who was able to identify individuals consistent with the requirements of the study (section 3.2.4). The low number of participants was due to the lower than expected interest and registration for the workshop, as well as scheduling conflicts with key stakeholder groups. Best efforts were made to increase participation with incentives and single-day design of the workshop, however, the numbers remained low. However, as Q methodology does not require a large number of participants to obtain significant data for the purpose of identifying perspectives (Brown, 1980), the goals of the study were achieved. A second limitation that needs to be recognized is the absence of key stakeholders in the PM&E workshop. Initially, five different stakeholder groups were contacted to participate, however only three were able to commit to the workshop. Additionally, key NPC collaborators were ultimately unable to participate in the workshop as

well. Due to the partnership between Brock University and the Niagara Parks Commission, The EESI, two NPC collaborators helped design various aspects of the workshop with the researcher. Therefore, as a way to eliminate bias, these individuals could not participate in the PM&E workshop. This is a limitation to the research because PM&E is typically designed so that all relevant stakeholder groups can be represented and share their unique perspectives from which management decisions will be made. Time constraints and coordinating different stakeholder groups is challenge associated with PM&E, which requires open and transparent communication at the beginning of the PM&E process to clearly outline the expectations stakeholders should have when engaging in this type of undertaking. Especially in a park governance structure with a hierarchy of decision makers, it would be important to clearly outline and decide on the stakeholders who will participate at the outset of the PM&E process. Lastly, an important note regarding potential limitations associated with PM&E is related to the inherent design of the process, which requires stakeholders to regularly meet face-to-face to accomplish each stage of the process. Especially in light of the current COVID-19 pandemic, these types of participatory processes may become more difficult to accomplish safely and in a timely manner. In terms of this research, and specifically Study Two, data collection involving a PM&E workshop occurred three weeks before a provincial wide lockdown, which restricted any public events or social gatherings of more than five people (Ontario Newsroom, 2020). These types of restrictions, although necessary, would seriously limit PM&E approaches, and could pose some negative environmental effects if current PM&E management practices are disrupted. However, the practice of PM&E may still be possible with some modifications, such as incorporating appropriate social distance and other safety measures for in-person meetings, or utilizing technology such as video conferencing for certain phases of the process.

Due to the nature of this study, the delimitations associated with this research are also important to distinguish, as boundaries must be set in terms of the scope of the study (Ellis, 2009). The decision to focus on the formative stages of the PM&E process in both studies can be considered a necessary delimitation due to the short timeline of this research as well as the specific focus of deepening the understanding of stakeholder perceptions of KPIs. As the development of KPIs occur within the first three phases of the M&E process, this research is focused on M&E up until this point. In line with this, the researcher provided stakeholders with a

pre-composed list of KPIs from which to consider each study site. This method was chosen as a way to streamline the analysis of stakeholder perceptions of site-specific KPIs, and to ensure that participants consider the site KPIs holistically. More specifically, Study Two engaged the participants in three out of seven key phases of the PM&E process. This may be considered a limitation of the study because the PM&E process is typically iterative and non-linear, requiring stakeholders to continually engage in the monitoring and evaluation of a particular program or intervention over time (Margoluis & Salafsky, 1998). This study was not longitudinal, and therefore specific dynamics of the PM&E process which could impact stakeholder perceptions could not be observed, including continuous communication, building trust, and higher levels of negotiation or flexibility. Moreover, as the participants in this study only met for one PM&E session, the participants did not experience the full benefits associated with the PM&E processes, including the experience of learning and building adaptive capacity, solving problems or interpreting results, taking corrective action as a result of what they learned, as well as a general increased feeling of ownership and accountability for project activities (Abbot & Guijt, 1998; Jackson & Kassam, 1998; Margoluis & Salafsky, 1998; Shah et al., 2006).

4.2.2 Recommendations Stemming from the Research

Several avenues for scholarship and practice stem from this thesis. Recommendations offered in this section generally address the use of stakeholder perceptions in environmental management and M&E approaches, with the context of viewpoints and trails highlighted throughout. The recommendations presented here are in addition to the specific recommendations discussed in Chapter Two and Three. Site specific recommendations are also made.

4.2.3 Recommendations for Future Research

This thesis provides empirical evidence about the differences in stakeholder perceptions of KPIs for environmental management in a park and trails context, but much more is needed to meaningfully address the tensions in the scholarship that framed this study. In particular, there is a need for more evidence on different approaches to M&E and the relationships between stakeholder perceptions and environmental management actions. How groups perceive

environmental management and related KPIs should also be a focus for scholarship and practice, as these perceptions are a necessary component for more enhanced and effective environmental management and M&E systems.

First, the conceptualization and operationalization of perceptions in environmental management should continue to be explored and refined, benefitting from the existing extensive research on perceptions in the cognitive and social psychology domains (Brössel, 2017). While causal links between how people perceive and subsequently interact with their environment and/or the links between perceptions and other factors were beyond the scope of this thesis, they are opened opportunities for future research to investigate. For example, the focus of investigations could include the connections and reciprocal relationships between how people perceive different viewpoints, and their beliefs, values, and behaviours; strengthening the understanding of and evidence for the connections between perceptions and other factors (Jefferson et al., 2013), and how this influences their support or preferences for environmental management actions. In addition, the findings from this study suggest that certain sub-groups of stakeholders may hold more subtle differences in perceptions regarding KPIs for environmental management (e.g., old vs young groups). Future research should investigate different sub-types within intergroup differences. For example, multiple studies have found that people's proximity to an environment can have an impact their perceptions of such environment. In a study by Milfont et al. (2014), it was found that people living in closer proximity to a New Zealand shoreline expressed greater belief in climate change, due to their experiences and observations of their home environment. In another study by Swofford and Slattery (2010), they found that overall support for wind energy decreased among those living the closest to the wind farm, while those living farthest away indicated much stronger support. As environmental perceptions can be impacted or influenced by the distance in which people live, which in turn highly impacts local support for environmental management actions, it may be a worthwhile to explore differences in the perception of residents based on proximity to Niagara Parks.

Second, future research should explore the use of different M&E approaches to better understand what works best in different environmental contexts. While efforts have been made to develop practical and consistent M&E systems within and between disciplines (Bamberger et al.,

2016; Naidoo, 2012; Reed, 2008; Stem et al., 2005), tensions arise regarding how to conduct M&E because real-world conservation projects operate in complex and dynamic contexts, and thus different M&E needs require different approaches (Bennett, 2016; Stem et al., 2005). As Reed (2008, p. 2419) states "different levels of engagement are likely to be appropriate in different contexts, depending on the objectives of the work and the capacity for stakeholders to influence outcomes (Richards et al., 2004; Tippett et al., 2007)". The findings from this research offer exploratory insights into the different participatory methods that can be used by environmental managers to achieve different management goals. However, future research should continue to investigate these methods and the different contexts under which they are more effective.

4.2.4 Recommendations for Practice

This thesis also provides practical evidence highlighting the importance of including social dimensions, such as stakeholder perceptions, in environmental management and different M&E approaches. As such, there are noteworthy practical recommendations pertaining to effective environmental management and M&E approaches, with specific reference to scenic viewpoints and trails.

First, in terms of using a more conventional approach for managing or conducting M&E for scenic viewpoints, an important recommendation stemming from this research is the incorporation of visitor perceptions of KPIs in addition to the environmental managers' perceptions of these sites. Similar to other studies by Svobodova et al. (2011) and Le Lay et al. (2013), the environmental managers and visitors to the NPC viewpoints tend to have different perceptions regarding the overall adequacy of the KPIs at viewpoints. While this may be expected, as environmental managers tend to have higher familiarity and knowledge of these environments, it is just as important to consider the priorities and needs of other stakeholder groups who use these environments. For example, visitors in this study tended to rate maintenance lower than any other KPI variable. This type of information can inform NPC's future management decisions, such as prioritizing the overall maintenance at these viewpoint sites. As stakeholder perceptions can vary, and there are multiple different users of scenic

viewpoint sites, it is especially crucial to move away from strictly expert-led approaches, towards the inclusion of stakeholder perceptions in environmental management and M&E.

Next, Study Two contributes to informing and improving collaborative and participatory processes in environmental management and PM&E. One recommendation is that practitioners should further explore differences in stakeholder perceptions of KPIs, particularly at the outset of the PM&E process when stakeholder perceptions tend to diverge. Areas of disagreement and driving factors for disagreements between groups can be useful to inform environmental management planning and design (Forster et al., 2017). It is especially important to acknowledge these differences and disagreements between stakeholders, and adequately address the concerns and priorities of all stakeholders in environmental management planning, in order to establish comprehensive management decisions that address local needs and priorities (Forster et al., 2017; Reed, 2008). Additionally, due to the increase in the use of recreational trails due to Covid-19, these environments may experience devastating ecological and social impacts. It will be even more critical that stakeholders and users of these environments can share their concerns and experiences to more adequately address these complex problems. The results of this study provide insight into the specific perceptions that stakeholders have regarding KPIs for trails. While these initial results can be used to inform management decisions and strategies, it is important to continuously engage key stakeholders in these types of processes. NPC might also consider including the perspectives of additional stakeholder groups who were unable to participate in this research study. As a recreational trail, this site is used by a variety of groups, and there has previously been existing tension between groups regarding the use of the site. For example, some residents believe that use to the site should be reduced, and bouldering limited, to reduce negative environmental impacts. Active members of the bouldering community might offer a different perspective of KPIs for trails, such as the ways in which bouldering fosters environmental stewardship in the Niagara Glen trails. Therefore, it is recommended that the NPC use these findings to understand different stakeholder perceptions of KPIs for trail management, and continue to explore stakeholder perceptions, in order to appropriately reflect stakeholder priorities and concerns, mitigate conflict between groups, and ensure the support of key stakeholders to enable the long-term success of management planning.

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Appendices

Appendix 2-1: Study One Questionnaire

This questionnaire is comprised of three sections - please complete each section by selecting the answers to each question that you feel best applies. The first section asks demographic questions. The second section asks you to rank a variety of key performance indicators (KPIs) as they relate to your viewing experience in Niagara Parks. The last section requires you to reflect upon your viewing experience using the KPIs. Please answer the questions in your own opinion and to the best of your ability. Your responses will remain anonymous and confidential. You have the right to withdraw from the questionnaire at any time and may do so by clicking the close button. The questionnaire should take approximately 10 - 15 minutes to complete.

Section 1: General Information

The following section is designed to gather basic demographic information. Please complete the following questions by selecting the answer that most closely applies to you.

1. How old are you?

    a) 18-24
    b) 25-29
    c) 30-34
    d) 35-39
    e) 40-44
    f) 45-49
    g) 50-54
    h) 55-59
    i) 60-64
    j) 65+

2. Are you:

    a. Male
    b. Female
    c. Other _____

3. Where do you currently live?

    a. Reside or own property immediately adjacent to the Niagara Parkway
    b. Niagara Region
        i. Please provide your postal code: _____
    c. Another area of Ontario (outside of the Niagara Region)
    d. Another Canadian province or territory (outside of Ontario)
    e. Outside of Canada

4. What is your highest level of education (completed)?

    a. High school diploma or equivalent
    b. Vocational/technical school
    c. Some college/university
    d. Associate degree
    e. College diploma
    f. Bachelor's degree
    g. Master's degree
    h. Doctoral degree
    i. Professional degree (MD, JD, etc.)
    j. Other _____

5. Are you currently employed?

    a) Employed full or part time
    b) Unemployed
    c) Retired
    d) Homemaker
    e) Self-employed
    f) Unable to work
    g) Student

6. How often have you visited this site in the past?

    a) First time
    b) A few times (2-3 visits total)
    c) Once a year
        i. Please indicate the year you started visiting the site _____
    d) A few times a year
        i. Please indicate the year you started visiting the site _____
    e) Few times a season
    f) Weekly or daily

7. What is the main purpose of your visit today?

    a) Hiking
    b) Biking
    c) Educational purposes
    d) Picnic
    e) Geocaching
    f) Cultural/heritage reasons
    g) Sightseeing
    h) Enjoying nature/scenic nature viewing
    i) Other _____

The remainder of this survey focuses on your personal perceptions of KPIs for a viewpoint in Niagara Parks. KPIs are criteria used to measure the success or performance of an environmental management approach. An example of a KPI for a viewpoint may include the amount or quality of vegetation at the view location. The Niagara Parks Commission has over seventy designated viewpoints along the Niagara River, characterized by extensive scenic visual landscapes, often seen through an opening, avenue, or passage. This research is aimed at understanding stakeholder perceptions of the KPIs across a variety of these viewpoints.

Section 2: Ranking Viewpoint KPIs

Date: Location #:

8. Please rank the following KPI items in order of most important to least important for this viewpoint, where 1 is the most important and 5 is the least important. Consider both the view you are looking at, as well as the location immediately surrounding the view.

a) Accessibility (i.e., the site is adequately accessible seasonally, differing modes of transportation, etc.) ____
b) Amenities (i.e., there is adequate signage, seating, washrooms, etc.) ____
c) Vegetation (i.e., presence of vegetation, preferable type, health, etc.)____
a) Viewpoint condition/maintenance (i.e., the viewpoint is groomed to your liking) ____
b) View quality (i.e., the view and location are high quality, memorable view, associated with historic or cultural elements, etc.)

Section Three: Perceptions Regarding Viewpoint KPIs

In this section, we will unpack the KPIs that you have just ranked in the previous section. Indicate your preference for each item listed using the scale provided. Questions will ask you to consider the specific view you are looking at, or the viewpoint (area immediately surrounding the view). Questions referring to the overall location mean you should consider both the view and the viewpoint when answering.

Accessibility

To what extent do you agree with the following statements about accessibility at this viewpoint:

9. This viewpoint is adequately accessible (i.e. this site can be accessed by individuals with differing physical abilities, differing modes of transportation, etc.):

a) Strongly agree 5
b) Agree
c) Neutral

d) Disagree
e) Strongly disagree 1

10. It is important that this viewpoint is accessible by vehicle:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

11. It is important that this viewpoint is accessible by pedestrians:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

12. It is important that this viewpoint is accessible by cyclists:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

13. It is important that this viewpoint is accessible by public transportation:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

14. It is important that this viewpoint is accessible in all seasons (year-round):

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

15. It is important that this viewpoint is accessible for people with limited physical mobility:

a) Strongly agree
b) Agree

c) Neutral
d) Disagree
e) Strongly disagree

16. Please indicate your preference for increasing the accessibility of this viewpoint:

a) Highly preferred
b) Somewhat preferred
c) Neutral
d) Limitedly preferred
e) Least preferred

16a. If you chose a or b in the previous question, please indicate any additional ways in which you would like to access this viewpoint:

a) Vehicular access
b) Pedestrian access
c) Cycling
d) Public transit
e) All seasons
f) Wheelchair/mobility device access
g) Other _____

Amenities

To what extent do you agree with the following statements about the amenities at this viewpoint (amenities refer to the resources or facilities continuously offered to the general public for their use and/or enjoyment, such as restrooms, information displays, benches, etc.):

17. The amenities or facilities available at this viewpoint are of adequate quality:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

18. It is important that this viewpoint has adequate seating (i.e. benches, picnic area, etc.):

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

19. It is important that this viewpoint has adequate signage (directional, interpretive, informational, etc.):

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

20. It is important that this viewpoint has adequate parking:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

21. It is important that this viewpoint has adequate bicycle amenities (i.e. bike rack, bike rentals, bike repair):

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

22. It is important that this viewpoint has washroom facilities:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly Disagree

23. It is important that this viewpoint has food and beverage facilities:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

24. It is important that this viewpoint has amenities for children (play equipment, safety features, etc.):

a) Strongly agree
b) Agree

c) Neutral
d) Disagree
e) Strongly disagree

25. Please indicate your preference for modifications/additions to the amenities at this viewpoint:

a) Highly preferred
b) Somewhat preferred
c) Neutral
d) Limitedly preferred
e) Least preferred

25a. If you chose a or b in the previous question, please indicate the type(s) of amenities you would prefer to have located at this viewpoint:

a. Interpretative and education signage
b. Directional signage
c. Parking
d. Washrooms
e. Food and beverage
f. Seating (benches, picnic area, pavilion, etc.)
g. Play equipment
h. Guided tours
i. Increased safety features
j. Other _____

Vegetation

To what extent do you agree with the following statements about the natural environment at this location:

26. The natural environment at this location is of adequate quality:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

27. It is important that this location contains native vegetation (native vegetation is considered plants that are indigenous or local to the Niagara Region):

a) Strongly agree
b) Agree
c) Neutral

d) Disagree
e) Strongly disagree

28. It is important that any non-native vegetation at this location are limited or controlled (non-native vegetation are considered plants that have been introduced to the local area from their native range, either purposefully or accidentally):

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

29. It is important to have a diversity of species within this view:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

30. It is important that there is canopy cover at this viewpoint (ground area shaded by trees):

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

31. Please indicate your preference for modifications to the vegetation at this location (e.g. planting new trees, invasive species removal, etc.):

a) Highly preferred
b) Somewhat preferred
c) Neutral
d) Limitedly preferred
e) Least preferred

31a. If you chose a or b in the previous question, please indicate the way(s) in which you would like the vegetation modified at this location (e.g. planting new trees, invasive species removal, etc.):

a) More native vegetation
b) Less invasive vegetation
c) Greater diversity of vegetation
d) More canopy cover

e) Other _____

Viewpoint Condition:

To what extent do you agree with the following statements about the condition of this location:

32. This location is adequately groomed and maintained (to your personal preference):

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

33. It is important that there is a wide-open or unobstructed view:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

34. It is important that there is some natural vegetation within the view:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

35. It is important that there is vegetation framing the view (there is vegetation on either side of the view, creating a "framed" opening to view through):

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

36. Please indicate your preference for modifications to the condition of the vegetation at this location (i.e. you prefer a different grooming style then the one that currently exists):

a) Highly preferred
b) Somewhat preferred
c) Neutral
d) Limitedly preferred

e) Least preferred

36a. If you chose a or b in the previous question, please indicate the level of maintenance or grooming preferred at this view:

a) Well-groomed
b) Groomed
c) Moderately groomed
d) Open space (a panoramic view with no obstruction)
e) Natural
f) Framed (vegetation on either side of the view, creating a "framed" opening to view through)

Scenic Quality:

To what extent do you agree with the following statements about the overall view and viewpoint quality:

37. The overall scenic quality at this location is adequate:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

38. An important quality of this location is its association with NPC heritage, cultural attraction, or hospitality features:

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

39. It is important that the elements within the landscape are consistent throughout the view (i.e. in a predominantly rural landscape, there are no industrial buildings in view):

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

40. It is important that the elements in this view are distinctive and exceptional (i.e. there is an obvious focal point in the view that you are drawn to, such as a view of the falls) :

a) Strongly agree
b) Agree
c) Neutral
d) Disagree
e) Strongly disagree

41. Please indicate whether you typically prefer a location to have a single focal point or multiple focal points within the view:

a) Single focal point
b) Multiple focal points

42. Please indicate this view's overall quality improvement potential (recall your previous answers and the feasibility of implementing your preferences at this viewpoint):

a) Very high (significant environment improvement potential, easy to accomplish)
b) High (moderate environment improvement potential, somewhat easy to accomplish)
c) Intermediate (moderate environmental improvement potential, neither easy or difficult to accomplish)
d) Low (low to no environmental improvement potential)

Thank you for participating in this questionnaire!

Appendix 2-2: Relationship Between Demographic Information and Overall KPI Perceptions

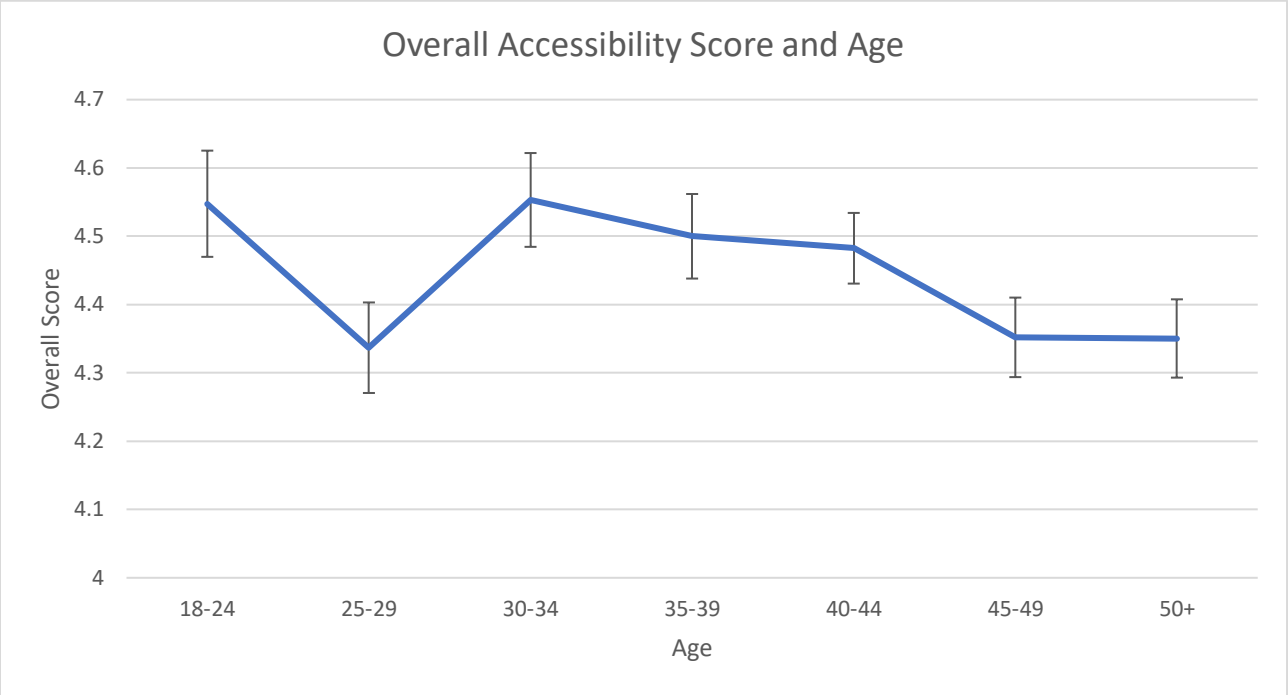

Figure A.2.1: Overall score for accessibility based on age group with standard error bars

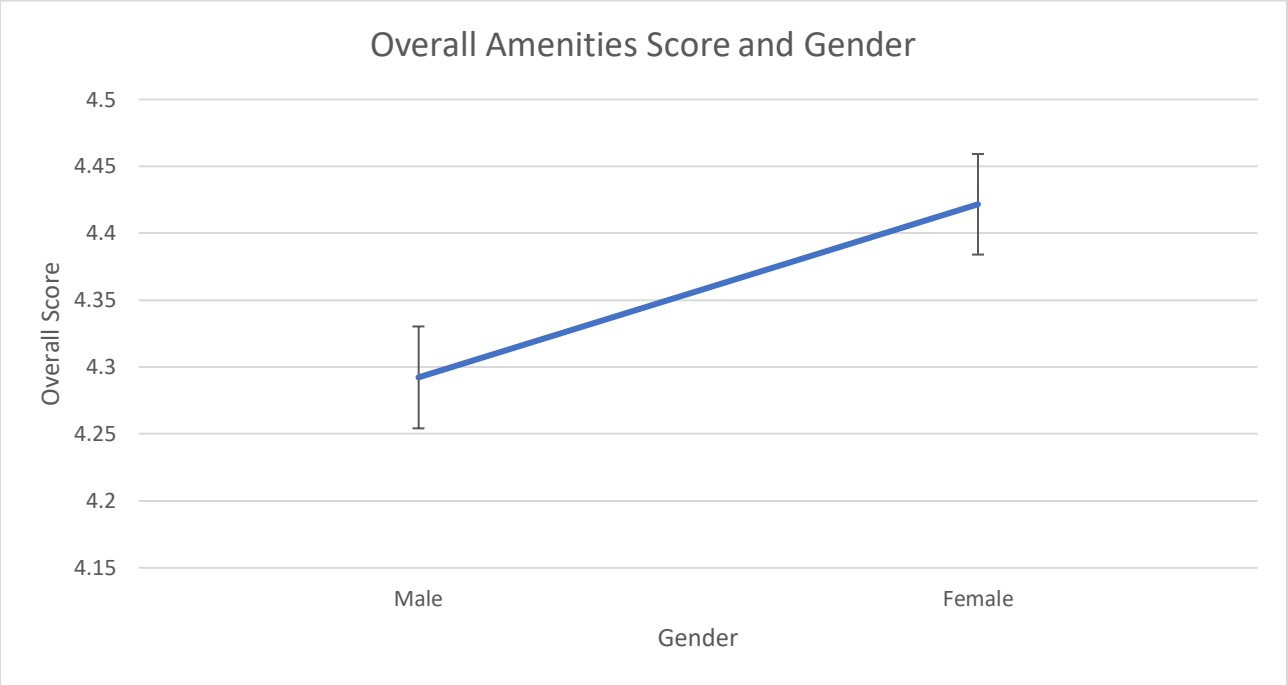

Figure A.2.2: Overall score for amenities based on gender with standard error bars

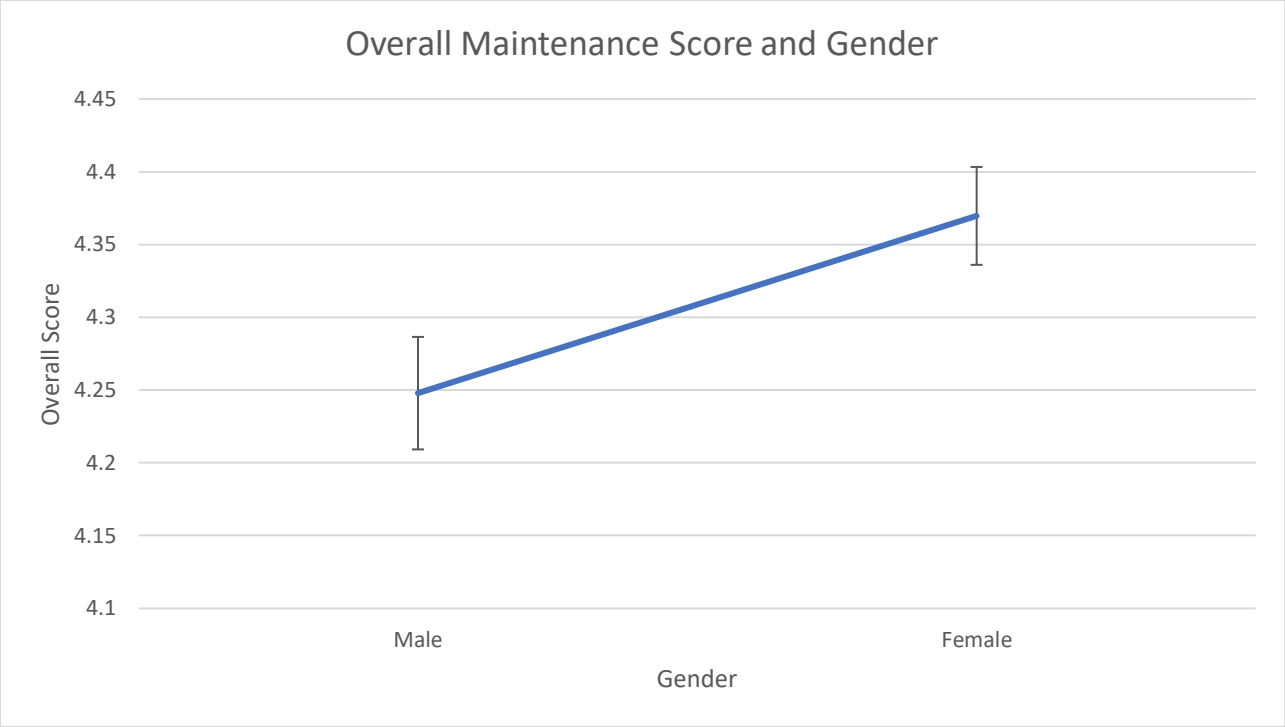

Figure A.2.3: Overall score for maintenance based on gender with standard error bars

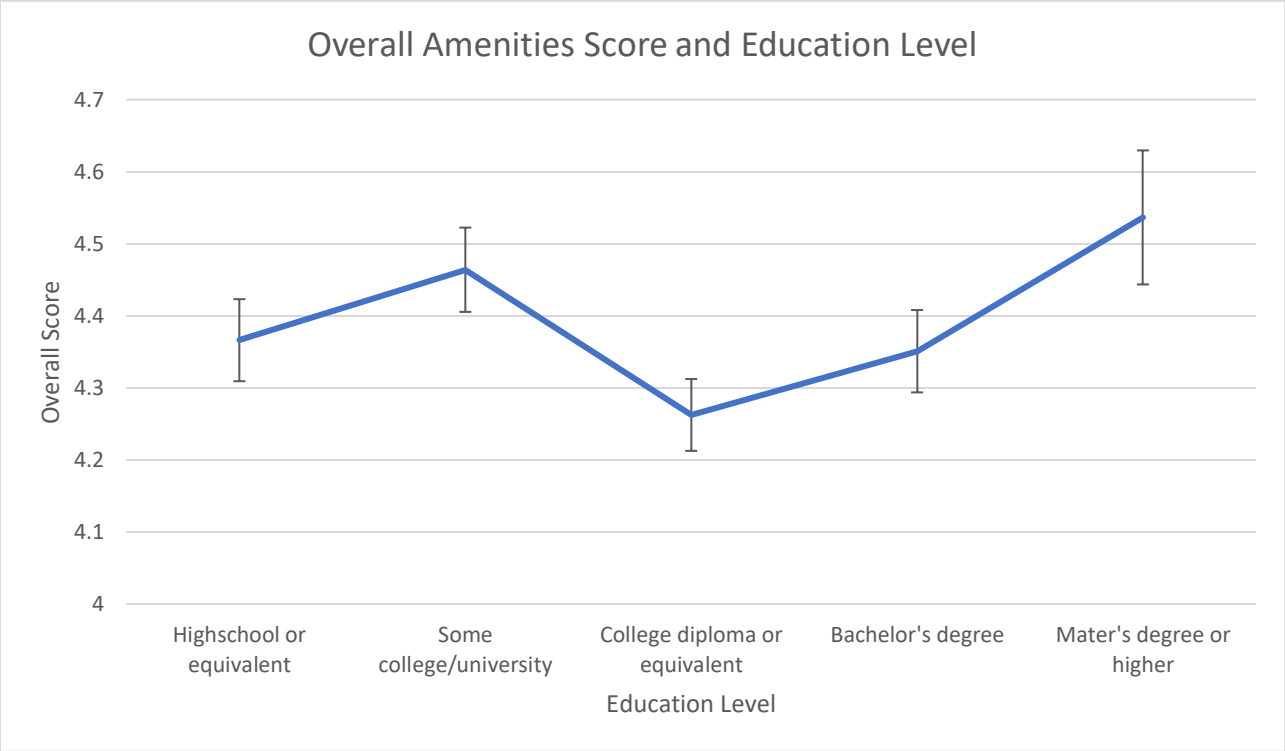

Figure A.2.4: Overall score for amenities based on education level with standard error bars

Appendix 2-3: Relationship Between Management Style and Overall KPI Perceptions

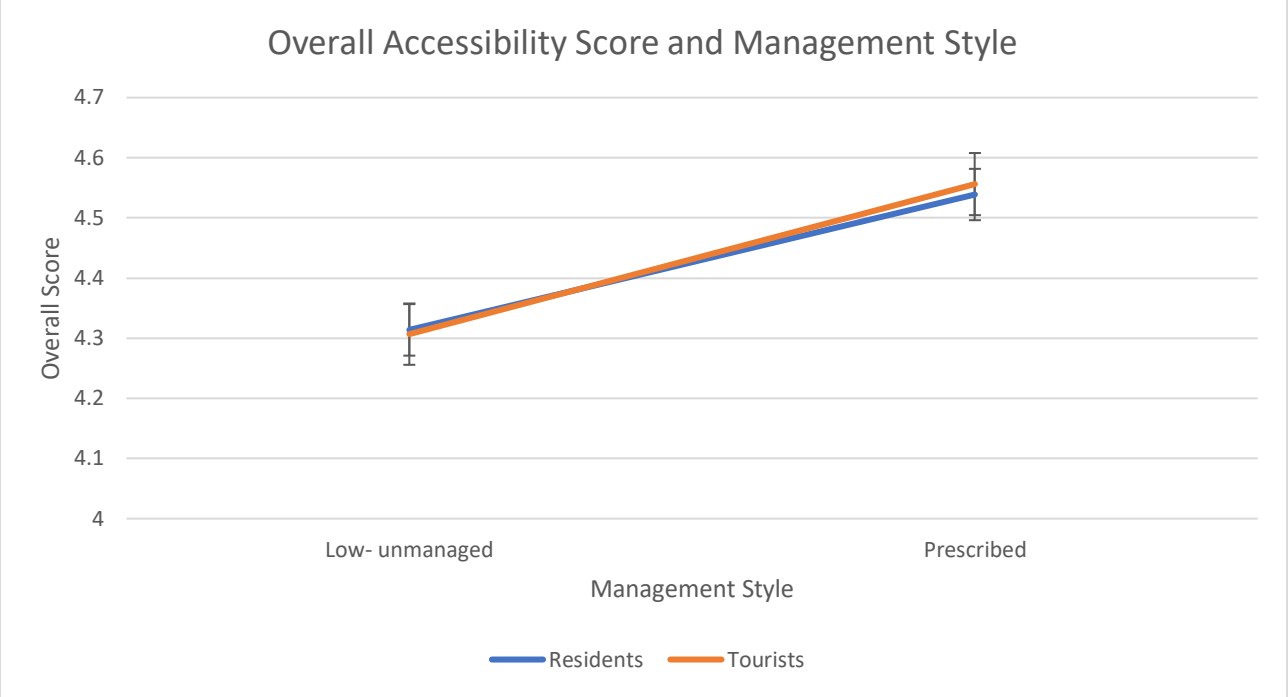

Figure A.2.5: Resident and Tourists' overall score for accessibility between two management styles with standard error bars

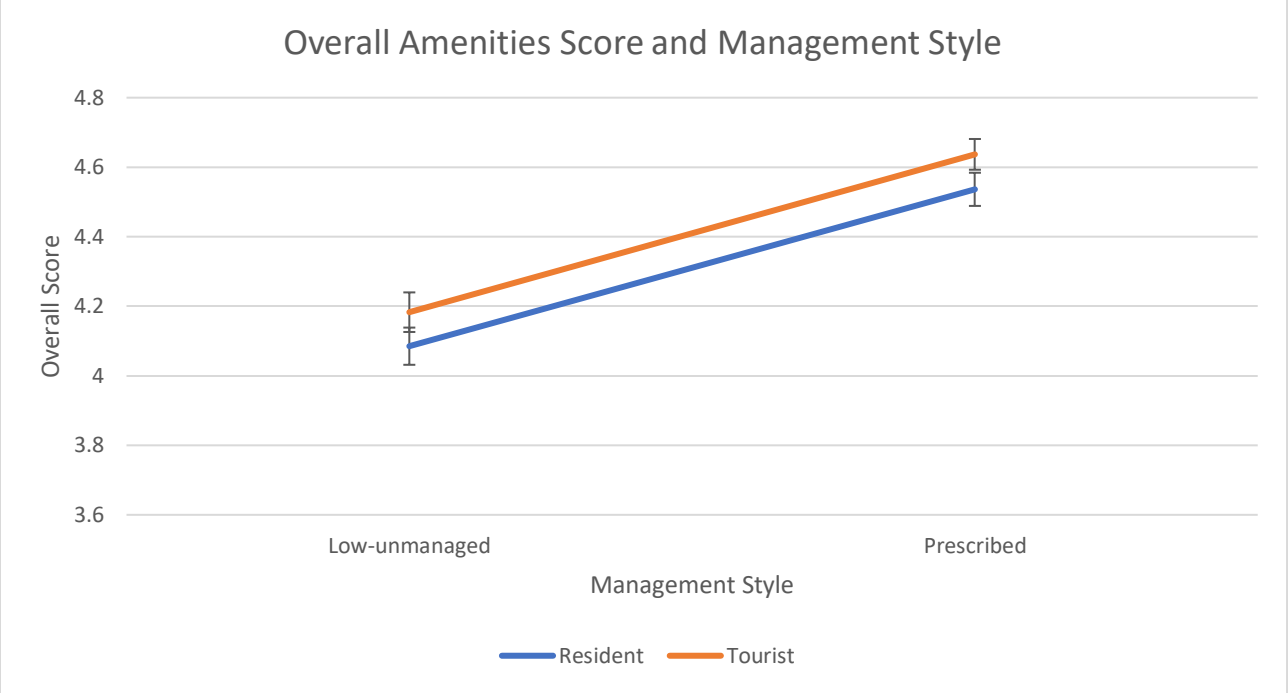

Figure A.2.6: Resident and Tourists' overall score for amenities between two management styles with standard error bars

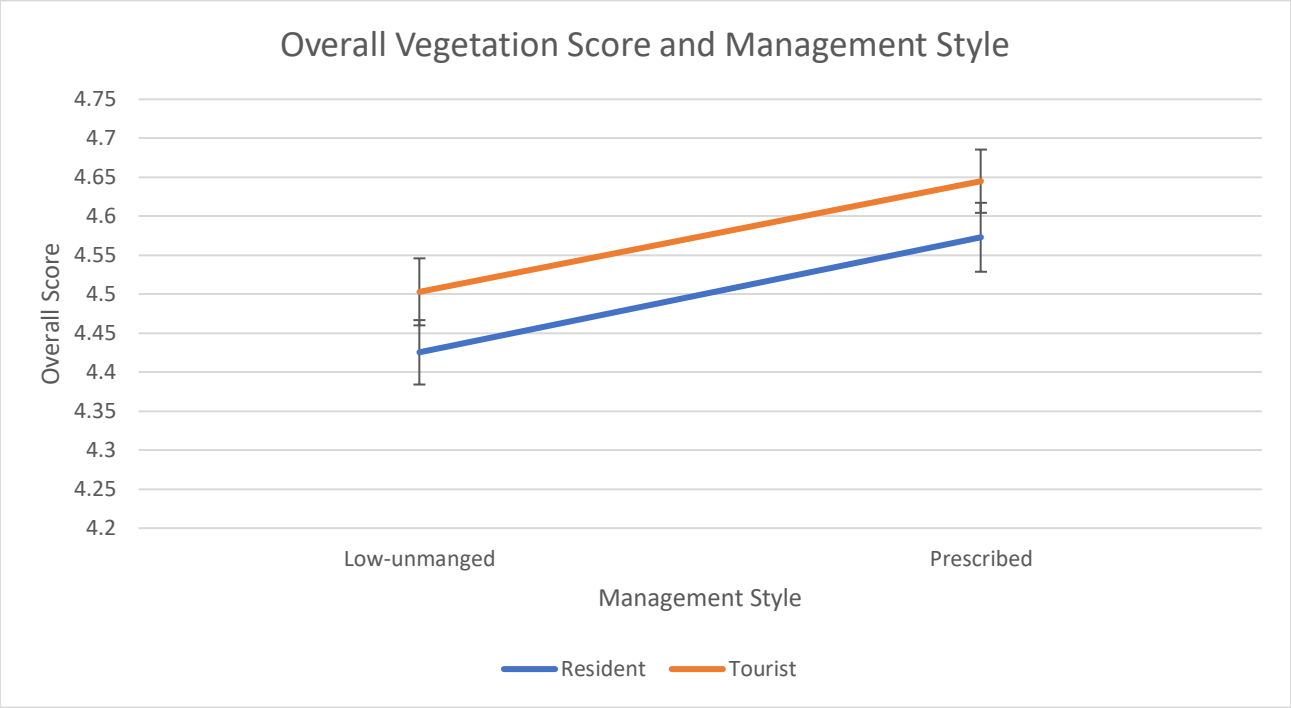

Figure A.2.7: Resident and Tourists' overall score for vegetation between two management styles with standard error bars

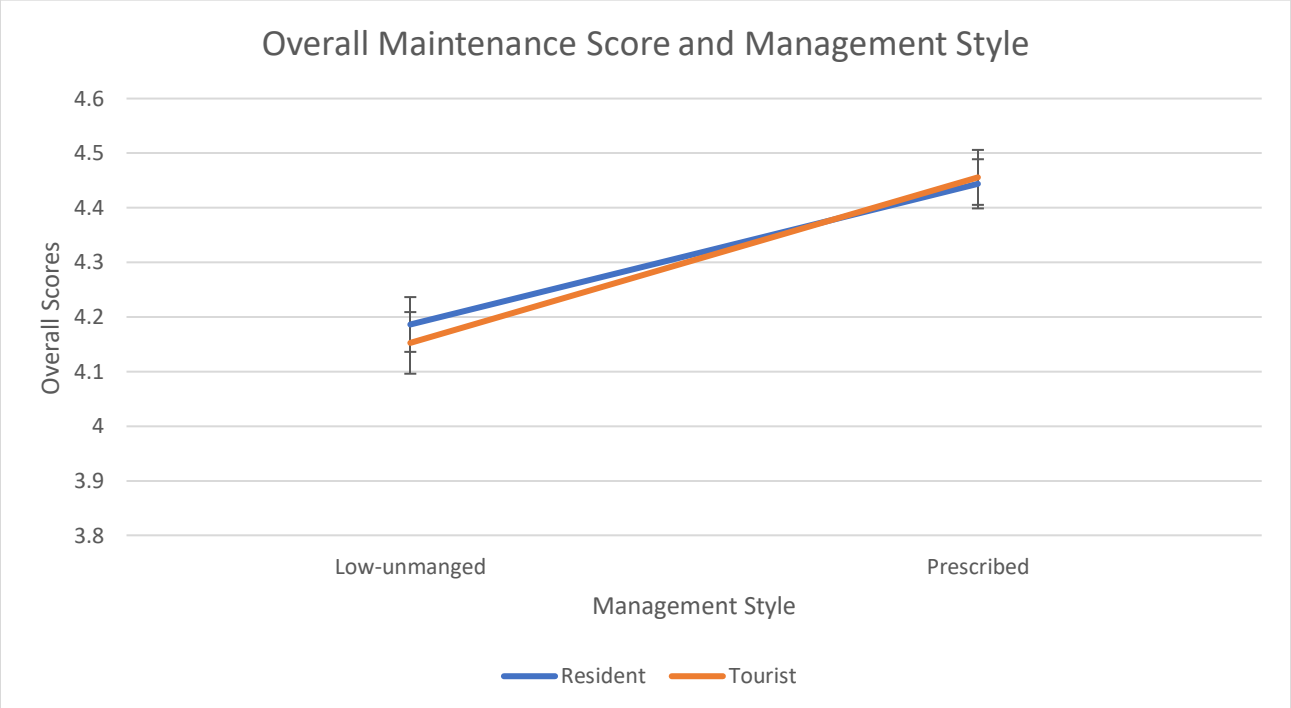

Figure A.2.8: Resident and Tourists' overall score for maintenance between two management styles with standard error bars

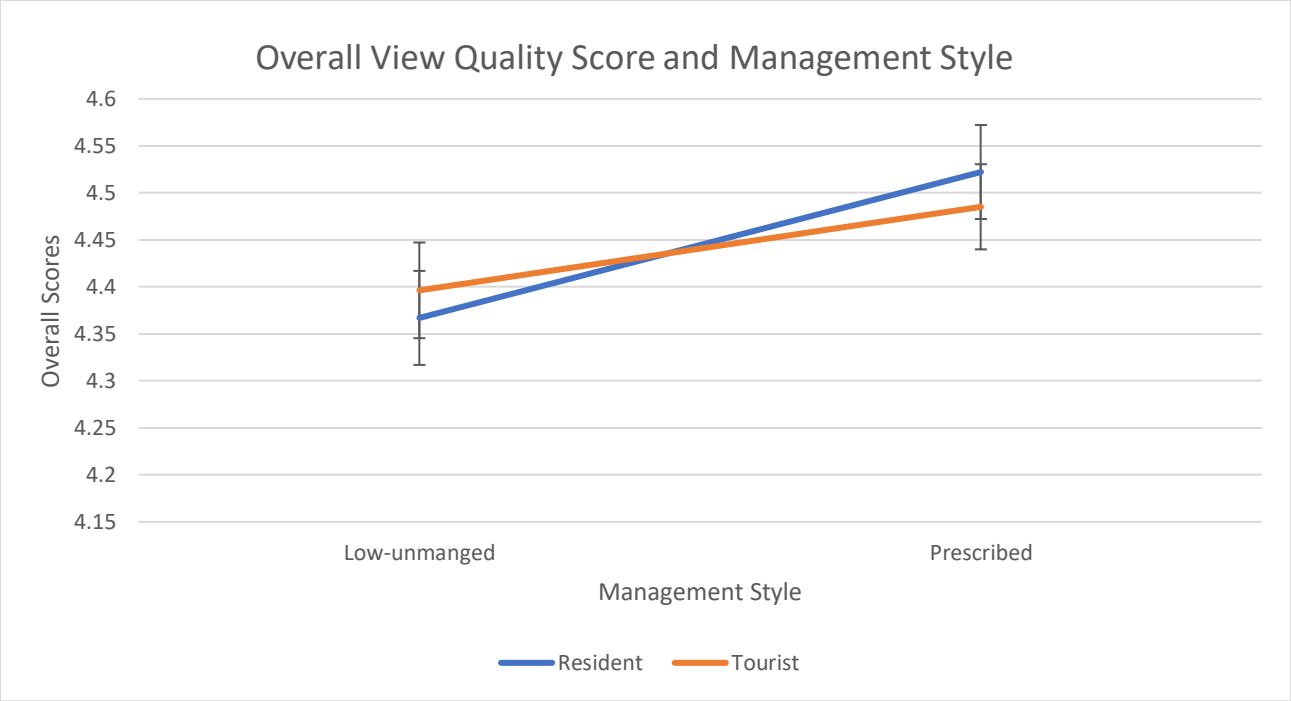

Figure A.2.9: Resident and Tourists' overall score for view quality between two management styles with standard error bars

Appendix 3-1: List of KPI Definitions

1. Vegetation Cover: the amount of soil that is covered by green vegetation

2. Non-native Species Cover: the amount of soil that is covered by non-native vegetation (plants that have been introduced to the local area from their native range, either purposefully or accidentally)

3. Canopy Cover: the amount of ground area shaded by trees

4. Tree Health: overall health of the tree, i.e. healthy, in decline, recently, dead, or old dead

5. Vegetation Trampling: degradation/damage of vegetation due to use of trail by humans or animals

6. Tree root exposure: the amount of roots of a tree exposed due to unfavourable conditions, such as soil erosion, cramped conditions, poor access to nutrients, etc.

7. Bare Soil: the amount of soil that is not covered by vegetation

8. Soil pH: the measure of acidity or alkalinity of soil

9. Soil Compaction: soil densification caused by applied stress

10. Soil stability: the capacity of a trail to limit the redistribution and loss of soil resources by wind and water

11. Trail/Soil erosion: the displacement of soil caused by erosive agents such as water, ice, snow, air, plants, animals and humans (consider both topsoil erosion and more extreme degradation leading to mineral soil exposure)

12. Trail muddiness: the sloppy, dampness or general wetness of the soil impacting the surface of the trail

13. Excessive trail widening: widening of the surface of the trail, often due to erosion or users avoiding obstacles such as water or rocks

14. Cultural resource deterioration: overuse, defacement, or theft of cultural resources

15. Litter: presence of improperly disposed garbage on or around the trail

16. Carrying capacity: the ability of a site to absorb recreational use without deterioration of natural resources and the quality of the visitor experience

17. Visitor conflict due to incompatible use: real or perceived incompatibility of use which negatively influence visitor experience, e.g. the variety of potential uses of trails (hiking,

biking, bouldering, etc.) creates conflict between visitors

18. Visitor conflict due to overcrowding: a user's perceived sense of crowding on the trail, affecting the satisfaction of a user's recreational experience

19. Visitor displacement: visitors choose to no longer use a recreation site (or resource), or use different areas of the trail, because of sensitivity to crowding or other impacts

20. Threats to visitor safety: anything that may risk the safety of visitors on the trails, such as poor or uneven surfaces on the trail

21. Unsanctioned trails/Social trails: informal trails created by visitors

22. Vandalism (type, location, extent and loss of functionality): evidence of deliberate destruction of or damage to public or private property

23. Signage: presence of appropriate signs/trail markers vs. presence of damaged signs/trail markers, i.e. directional signs, educational, etc.

24. Accessibility: the degree to which the trail can be accessed by individuals with differing physical abilities

25. Limited access due to physical barriers on trails: unintentional barriers making it difficult for visitors to use the trails, i.e. fallen branches, large puddles, large rocks, etc.

26. Scenic views: a pleasing and purposeful view of natural scenery, such as hills, water, or other natural features

27. Noise pollution: harmful or excessive levels of noise, as from airplanes, traffic, industry, etc.

28. Presence of structures: structures created by humans, such as stairs, powerlines, buildings in view, unnatural light sources, etc.

Appendix 3-2: Workshop Agenda

Date of workshop: March 5, 2020

1. Introductions to:
    a. The research (PM&E, KPIs and purpose of the study)
    b. Researcher (name, affiliation as a master's student at Brock University, program)
    c. Participants (go around the table and introduce themselves)

2. Guided hike/short walk to view the conditions of the trails:
    a. Guide by NPC collaborator who is responsible for environmental management of sites across NPC
    b. During hike, Corey discusses the current trail management system, and any specific laws or regulations that need to be considered in management

3. Q sort 1 and Questionnaire (first data collection point)
    a. Go over instructions and hand out material
    b. Participants individually complete the Q-sort and Questionnaire (30-45 minutes)

4. "Go-round" (needs assessment and appraisal step)
    a. This step can serve as an opportunity for all stakeholders to reflect/share their own experience with the trails, such as positive aspects of trail condition/trail management as well as areas that need improvement.
    b. 1-3 minutes per person, allowing any participants to 'pass' if they are not comfortable contributing.
    c. Items listed by participants written on a chart distinguishing between the positive aspects of the trail and the aspects that need improvement (see below)

e.g.

Positive/ Good Condition +	**Needs Improvement-**
Cleanliness of trails	Crowding on trails

5. Group consensus regarding a streamlined criteria list: (planning and project design)
    a. Through a group discussion of the current management and identified needs, participants come to an agreement on 3-4 overarching management goals to
    b. Next, participants determine the most important criteria related to achieving the goals through a consensus building exercise (see below)

"2, 4, 8, etc. Consensus"
This exercise can take around 1-1.5 hours with 10-12 people. It will help a group reach a decision that everyone can live with. Usually works best with imposed time limits for every stage

of the discussion (10-15 minutes). Write the overall goals on a flipchart for all participants to see and refer back to during their discussions

a. Start in Pairs. Each pair discusses the list of options and is asked to agree on their top KPI priorities (in this case, KPI criteria).
b. Each pair then comes together with another to form a group of four. The two pairs compare their lists of top priorities and agree on a joint top three.
c. Each group of four comes together with another to form a group of eight. Again, each group takes its list of priorities and reduces it to an agreed upon list of KPI criteria.
d. Repeat until the whole group has come back together. Hopefully 5-10 clear priorities have emerged.

6. Stakeholders brainstorm measurable KPIs for the criteria list developed in previous step:

"Brainstorm"
a. Write the 5-10 KPI criteria on the flipchart in columns. Ask the group to brainstorm ideas on how to actually measure each of the criteria (a notetaker can write down all of the ideas under each column)

Veg. Cover	Invasive Sp.	Vandalism	Overcrowding	Tree Health

b. Break up into initial groups from the previous workshop exercise (2-3 people per group). Small group discussion about which measurement for EACH KPI criteria should be used and why.
c. Spokesperson from each group will explain the measurement they chose and why. If conflicting views between groups arise, they can be discussed as a whole. Pro and Con chart for conflicting measurement options may be used to help reach a consensus.

7. Summarize and present the overall objectives, criteria list, and related KPIs back to the stakeholders

8. Reminder for participants that the second sorting activity and questionnaire will be sent via email to them one week after the workshop date (March 12, 2020).

Appendix 3-3: Pre Q-sort Data of Participants

Table A.3.1: Pre-workshop Q-sorts of participants

Sort Value	P1	P2	P3	P4	P5	P6	P7
-4	24	24	13	18	8	28	27
-3	27	14	11	28	27	17	24
-3	14	19	28	21	9	20	12
-2	17	17	14	27	12	18	19
-2	28	28	9	12	3	24	25
-2	7	27	12	17	7	12	26
-1	19	2	7	22	10	6	3
-1	20	8	2	7	6	9	23
-1	6	10	6	10	19	23	8
-1	15	3	5	26	24	7	28
-1	13	18	27	9	28	1	17
0	5	26	10	19	25	10	7
0	9	1	19	8	13	26	20
0	21	15	17	2	26	27	18
0	18	22	21	25	23	25	10
0	22	4	8	14	4	8	21
0	8	6	26	16	14	3	6
1	3	9	22	13	1	13	9
1	10	11	15	15	2	11	11
1	23	7	3	4	11	4	22
1	16	16	1	11	16	5	13
1	2	12	23	1	15	2	15
2	4	23	16	23	17	15	16
2	12	21	18	24	5	14	4
2	1	25	4	3	21	21	1
3	11	13	25	5	18	19	2
3	26	5	20	6	22	22	14
4	25	20	24	20	20	16	5

Appendix 3-4: Post Q-sort Data of Participants

Table A.3.2: Post-workshop Q-sort of participants

Sort Value	P1	P2	P3	P4	P5	P6	P7
-4	27	27	9	28	1	12	27
-3	8	28	19	12	18	18	26
-3	28	10	3	17	4	9	23
-2	17	8	18	2	6	6	19
-2	24	19	6	23	3	8	25
-2	14	17	12	27	7	7	12
-1	6	14	5	22	8	1	6
-1	18	18	7	6	27	3	24
-1	19	6	4	14	28	25	28
-1	1	3	8	25	25	24	8
-1	20	24	10	10	9	28	10
0	23	11	27	7	14	27	9
0	22	12	13	9	10	26	20
0	7	1	25	8	26	17	11
0	5	7	28	19	24	23	3
0	10	25	26	18	19	20	18
0	13	15	14	15	23	19	21
1	2	23	15	1	2	10	17
1	3	22	1	26	11	4	7
1	4	4	2	11	12	5	13
1	15	2	11	3	22	2	22
1	25	26	17	24	13	11	15
2	21	9	21	21	21	21	1
2	9	5	23	5	5	13	4
2	11	13	22	4	15	15	16
3	12	21	20	13	17	22	14
3	26	16	16	16	20	14	2