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DUAL- USE UNDERGROUND STORMWATER FACILITIES

SOCIO-ECONOMIC ANALYSIS AND ASSESSMENT FRAMEWORK

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Executive Summary

This study examines the socio-economic characteristics of underground stormwater retention facilities, herein referred to as Dual-Use Stormwater Facilities (DUSFs) with a park on top and open water storm sewer ponds, herein referred to as stormwater management (SWM) ponds. There are socio-economic differences between the two types of stormwater management facilities. We examine how the facilities are similar and different and the extent to which there are socio-economic benefits and costs associated with either facility. We observe what the socio-economic benefits and costs mean for decision making. We offer a socio-economic decision-making framework that can assist decision makers in deciding whether stormwater management through a DUSF with a park on top would be in the public interest.

We note the obvious difference in that a pond is a fixed singular use facility and consumes valuable land for only that use, compared to the space above a DUSF having many potential public uses, such as active or passive park space, and/or commercial uses, such as parking. We acknowledge that there are other engineering, cost and environmental considerations that are outside of the scope of this study.

Based on the literature and associated research, SWM ponds and DUSFs with a park on top are assessed using five key socio-economic parameters:

- Socio-cultural;
- Economic valuation;
- Property value;
- Health and safety risk, and;
- Opportunities for engagement.

To simplify the scope of this analysis and conduct a comparison, we compared stormwater management facilities as a functional SWM pond versus a functional DUSF with a park on top. That is to say, neither type of stormwater facility is presented in its best or worst light. Given this, our research found that socio-economic and socio-cultural distinctions can be drawn between the two types of facilities.

Specifically, in terms of socio-cultural distinctions, the polling data indicates that underground stormwater management facilities with a park on top are preferred by all respondents and by all cultures at a rate of 97% of those surveyed. Additional research showed that culturally diverse newer immigrants are more likely to live in rental housing and have less access to private space; they are users of the public park spaces and will put a premium on access to park space. Thus, the underground stormwater facility with a park on top provides much needed public space for residents.

The economic analysis addresses economics beyond costs and monetary values. It poses the question: how much value does a specific type of stormwater facility bring to a municipality and its residents, beyond dollar cost considerations? Specifically, what are the intrinsic values?

Both types of stormwater facilities have *aesthetic values*. It is difficult within the scope of this research to find data leading to distinct aesthetic differences, other than to point out that a dry or poorly maintained pond may be less aesthetically pleasing than a park at the same seasonal stages of their cycle. Although not within the scope of this research, public engagement on aesthetics assists the understanding of aesthetic values. Thus, aesthetics is included as one of the criteria for comparative decision making.

Existence and use values are such that people may or may not use a facility, but they value the facility because they know it is there, it *exists*, and can be used if desired. Both ponds and parks offer passive uses, but only parks can offer active uses. Distinctions arise with a DUSF with a park on top, as it allows a diversity of use, including active uses. In terms of *use* economics, municipalities would account for how much their residents would pay for the active use (e.g. active recreation space) if it wasn't provided through a DUSF. Alternatively, municipalities would compare the municipal cost of independently creating the active park space, if it was not provided by a DUSF. Thus, the underground stormwater facility with a park on top performs better in terms of *existence* and *use* values.

Quantitative values address whether there are enough ponds or parks and whether there are enough of the right types of these facilities. The number and location of stormwater ponds are defined in advance of a community development through the Master Environmental Servicing Plan. Parkland dedication requirements are defined by the Ontario Planning Act and the types and specific park uses are normally defined through Municipal Parks and Recreation Master Plans. With respect to a generic deficit or surplus of park space, this analysis is relevant to the needs of specific municipalities. Where stormwater management facilities exist that are also part of a park, we were unable to obtain municipal information regarding the oversupply or undersupply of parks. Thus, this part of our report is inconclusive, except to say the deficit or surplus of park space in a municipality is an important criterion for decision making and is included in the proposed evaluation framework.

Our survey research shows that with respect to property values, people perceive that a DUSF with a park on top is positive for property values compared to a SWM pond in their community. Eighty-five percent of respondents felt that open stormwater ponds would have a negative effect on property values. Open stormwater ponds were seen to result in a mean percentage decrease in property values of 15 percent. Conversely, 82 percent of survey respondents felt that DUSFs with a park on top would have a positive effect on property values by a mean increase in property values of 17.2 percent. While these findings are consistent with international research, drawing exact conclusions about property value effects involves research entailing significant complexity and was not part of this study.

Further, public deaths associated with a pond or park facility is a compelling socio-economic criterion. Increased municipal activity involving fencing and declaring SWM ponds as no-trespass areas is indicative of a negative socio-economic effect. By accessing data from the Ontario Coroner's office and selected municipalities, we conclude that the health and safety risks of open SWM ponds are significant. Our survey respondents agreed, where 99 percent of respondents noted that a DUSF with a park on top is the safer option. Health and safety data also indicates there are significant socio-economic differences between ponds and underground storm sewer water storage facilities. We also examined health

considerations relevant to waterfowl attracted to ponds, such as geese. The attraction of waterfowl increases the public health and safety risk, which will be further explained within this report.

We also examined opportunities for community engagement for both DUSFs with a park on top compared to SWM ponds. We conclude that DUSFs with a park on top offer more opportunities for community engagement than ponds, with examples provided later in this report.

More importantly, international research concludes that community involvement in designing and maintaining park space builds social capital. Social capital can be quantified and monetized. For example, the broader community can take on planting and clean-up activities as volunteers that would otherwise be a cost to the municipality. Thus, DUSFs present opportunities for the park to become part of the community character and also provide options for building social capital, compared to the constraints and possible liabilities imposed by stormwater ponds.

We conclude that from a socio-economic perspective, an underground stormwater storage facility with a public park on top:

- ◇ Is preferred by the public compared to a SWM pond, with a 97 percent approval from the surveyed group;
- ◇ Is intrinsically safer and is seen to be safer by the public, with a 99 percent agreement on the issue from the surveyed group. Health and safety are significant socio-economic considerations;
- ◇ Is perceived to result in higher property values by 82 percent of the surveyed group;
- ◇ Contributes to the parkland needs of a Municipality and the needs of diverse cultural groups;
- ◇ Offers the potential of meeting deeper intrinsic economic values of users specific to spiritual, *existence* and *use* values;
- ◇ Is about the same, or can be made to be the same with respect to aesthetic values;
- ◇ Through public engagement programs, offers better opportunities to build social capital within surrounding communities; which is a value that can be monetized;
- ◇ Meets the need for parkland dedication under the Ontario Planning Act.

1.0

Introduction

The environment is central to land use planning and development. As a component of this, it is critical that all water bodies remain healthy. Fortunately, the choices available on how to care for the aquatic environment also has benefits for the socio-economic environment.

For example, when there is precipitation such as rain and snow, the water is typically stored and cleaned before it is released to streams or other receiving water courses. There are two primary ways to clean the water within urbanized areas: one way involves directing the water to open storm sewer water management (SWM) ponds. The second, involves directing the storm sewer water to underground storage – also referred to as dual use stormwater facilities (DUSFs).

The environmental, engineering and cost considerations involved in selecting SWM ponds versus directing the stormwater to underground storage have been identified (SCS Consulting Group, 2021). For example, in December 2021 Malone Given Parsons completed a report for the City of Vaughan that examined the short - and long-term costs of DUSFs and open stormwater ponds (City of Vaughan, December 2021). Lesser known are the socio-economic advantages and disadvantages of both options. Having this information is important, as there may be circumstances where dollar costs for DUSFs are higher, but quantitative and qualitative socio-economic benefits point to DUSFs as the preferred option.

The past decade has seen an increased need for efficient land use and compact design, leading to increased municipal consideration of underground stormwater management systems (SCS Consulting Group, 2021). Given this, the analysis of socio-economic benefits and preferences is vital.

To assist decision makers, this report provides a quantitative and qualitative comparison of the socio-economic analysis aspects of SWM ponds versus underground stormwater storage systems. It also provides an evaluation framework that can be applied by decision makers to help compare whether SWM ponds or DUSFs are preferred from a socio-economic perspective. Given the research on DUSFs as parks we also draw conclusions of these facilities as counting for parkland under the Ontario Planning Act.

Background

Hardy Stevenson and Associates Limited (HSAL) was retained by DECAST Ltd. in January 2022. DECAST, a precast concrete manufacturer, is a leader in the Canadian infrastructure market, specializing in water transmission, bridges, storm and sanitary, tunneling and engineered precast products including underground stormwater management facilities. HSAL are social scientists, environmental and land-use planners, geoscientists, community engagement practitioners and facilitators involved in research, public engagement and approvals pertaining to water and waste water, energy, transportation and associated infrastructure across Canada. Oraclepoll Research Limited was retained by HSAL to administer a survey. Oraclepoll Research Limited is a multilingual research and analytics company that provides public opinion polling, market research, program evaluation and consulting services.

DECAST Ltd. identified the need to assist their clients with a better understanding of the socio-economic aspects of underground stormwater storage. Specifically, while DUSFs may have higher costs, DECAST sought to explore and understand:

- Whether the socio-economic benefits of DUSFs would balance the differences in cost compared to SWM ponds;
- If the socio-economic benefits of DUSFs lead to these facilities having greater cost effectiveness, when social cost and benefits are included;
- What are the similarities and differences of SWM ponds versus DUSFs with a park on top from a social, economic and cultural perspective;
- Would one solution have greater or lesser benefits;
- Would the park associated with DUSFs meet the need for Parkland Dedication as described in the Ontario Planning Act?

Previously, SCS Consulting Group and GEI Consulting Engineers and Scientists were retained by DECAST to identify the environmental benefits of DUSFs with respect to the safety of an enclosed facility, operational costs, effluent quality, and opportunities for flexible greenspace, parkland, and built-up above ground land uses. The analysis in this report builds on this previous research and expands the understanding of these facilities by applying a socio-economic lens.

HSAL was also tasked to prepare a socio-economic evaluation framework that can assist municipalities and other decision makers to measure and compare the benefits of SWM ponds versus directing stormwater to underground storage. The framework was tested and modified based on case studies.

This report shares the literature, analysis, research data and findings used to draw conclusions.

Scope

Large-scale DUSFs are a relatively new technology employed to enhance the sustainable management of stormwater. Numerous studies cited in this report have investigated the environmental and design implications of underground stormwater management systems. They highlight the benefits of DUSFs in providing improvements to environmental conditions, human safety and flexible land use options for the surface area.

To our knowledge, this is the first in-depth analysis of the socio-economic benefits and costs of DUSFs and first socio-economic comparison of open storm sewer water ponds versus underground storm sewer water storage systems with a park on top in Ontario.

Figure 1 Underground Storage Facility Installation

Facilities Definition: We start the analysis by defining the stormwater facilities that will interact with the socio-economic environment. Supporting technical research cited above and elsewhere is listed in the bibliography and characterizes the physical attributes of open storm sewer water ponds and underground storm sewer water facilities. Maintenance abilities, life cycle cost, environmental effectiveness, effluent quality, types of parkland use enabled by stormwater facilities are assessed in the cited reports.

Underground stormwater management facilities are not all designed or constructed to the same standard. The above ground applications of these facilities need to be determined on a site-by-site basis. For applications with parks and trees on top the appropriate products must be selected, such that they offer structural stability and facility longevity in accordance with their application.

We understand that alternative stormwater facilities can be defined broadly, but we sought to compare the facilities on a like-to-like basis. Each facility has cycles and multiple attributes. For example, people living in the vicinity of these facilities and other users will experience the facilities over various seasons and through various maintenance cycles. In late summer, the open storm sewer water pond may be dry. At the end of a maintenance cycle, it may have litter or visible sediment accumulation. In the spring, the pond may have attractive aesthetics based on ample water, vegetation and water fowl. The socio-economic effects of the facility will vary depending on the point of the cycle

Open storm sewer water ponds may be independently located, situated adjacent to a park, situated in other land uses such as in a residential or industrial area. They can be simply designed as a functional pond or designed with aesthetic features with the support of landscape architects. While these facilities can be seen in their best and worst light, our scope of work did not involve assessing the socio-economic

aspects of all possible circumstances and landscape architecture and design. A functional open storm sewer water pond was selected for comparison

By way of comparison, underground stormwater management facilities are not experienced visually. Members of the public may or may not be aware that the underground stormwater facility exists in that location, but will experience the facility as an above ground active or passive park for example. Section 7.0 of the Dual-Use Stormwater Facilities Policy Paper by Malone Given Parson's Report prepared for the City of Vaughan provides an extensive list of possible uses (City of Vaughan, December 2021). Again, while important, our scope of work did not involve assessing the socio-economic aspects of all possible circumstances of active or passive park use. Thus, this comparative analysis is focused on the underground stormwater facility functioning as an active or passive park.

Figure 2 Park and playground on top

The assessment of the full range of socio-economic benefits will depend on how the pond or park facility is designed and its use. However, to complete a like-to-like comparison, this study defines a standard SWM pond and the above ground aspects of the DUSF, as an active or passive community park feature[1]. Although it may not be designed as a park, it can provide better value to the residents, or can be part of a park.

Socio-Economic Environment Definition: People will experience open stormwater management ponds and underground storm sewer water facilities from a variety of perspectives. For this study, we selected five broad socio-economic criteria we believe best define how people may experience the facilities (see **Appendix A - Methodology**). For each, we conducted a literature review to understand the characteristics of the socio-economic criteria. Professional judgement was also applied. A comparative analysis of the facilities was conducted and findings are presented in **Chapter 4 Socio-Economic Analysis**.

Social Cultural factors are selected as an evaluation criterion because each facility has cultural meaning, depending on the characteristics of the cultural group experiencing the facility. Some cultural groups may place higher or lower value on either facility depending on their belief system and needs. We explore whether having one type of facility versus the other may be more important to the needs,

[1] Some municipalities will not allow pedestrian access near SWM ponds based on the safety concerns. Others incorporate the maintenance access roads around a pond into their trail systems to link roads to valleys. In no case is any part of a wet pond block considered "park" land from a park dedication perspective, although the trail or visual aspect of the pond may serve that function.

traditions, customs, and behaviors of specific cultural groups. **Section 4.1 Socio-Cultural** discusses and compares each feature using these criteria.

While economic studies involve cost comparisons, dollar cost is only one aspect of economic valuation. An additional assessment of intrinsic economic values involves the consideration of *aesthetic* values, as seen through the aesthetic qualities of landscape features. For example, water, flora and fauna all have aesthetic values. *Existence* and *use values* also need to be considered. In this case, community members may or may not use a facility, but the park still has value because people know it is there and available for use. *Quantitative* values involve the assessment of the number, abundance or scarcity of ponds or parks available to the community. The number of facilities can be counted and an assessment can be made on whether there is an under or over-supply of water features or park facilities. *Spiritual* values are also articulated clearly. For example, Indigenous people and people of certain faiths identify the value of a landscape in a way that has importance for their spiritual tradition. Both open storm sewer water ponds and DUSF park facilities may have important passive space for reflection and contemplation. **Section 4.2 Economic Valuation** discusses and compares each feature on the basis of each of these economic values.

Section 4.3 Property Values, addresses the perceived effect of open storm sewer water ponds and underground storm sewer water facilities on property values. An in-depth assessment of the influence of each facility on property values would involve gathering and analysis of thousands of data points, and the contribution of property appraisers, land economists and statisticians. This type of in-depth assessment is beyond the scope of this report. Instead, this report provides a simplified assessment of *perceived* property values based on the results of a Greater Toronto and Hamilton Area (GTHA) wide survey completed by Dr. Paul Seccaspina and Oraclepoll Research Limited staff.

While previous studies point to the differences in health and safety, we have elevated the importance of health and safety as part of the socio-economic analysis of open SWM ponds versus DUSF with parks (GEI Consulting Engineers and Scientists, 2021) (SCS Consulting Group, 2021). The potential for death and injury in an open SWM Pond is a very significant socio-economic criterion. In addition to HSAL interviews and a literature review, data from the Ontario Coroner's Office provided HSAL with important insights. **Section 4.4 Health and Safety Risk** presents the data and health and safety analysis of the difference of open stormwater management ponds and underground storm sewer water facilities.

Socio-economic outcomes are also determined by the process of interaction with local community members. The physical facility may have both a benign socio-economic effect on a local community and the strengthening effect. Either facility might be supported or not on the basis of how the public is engaged in the design of the facilities and involved in long term pond or park facility management. For example, *'friends of the park*' groups can be found across North America. The process of engaging the community builds *social capital*. Social capital can be quantified and monetized. To understand this criterion and apply it in the assessment of the facilities, we assessed the comparative potential for each facility to be positively influenced through public engagement programs and the potential for the engagement to build social capital. **Section 4.5 Opportunities for Engagement**, addresses opportunities and constraints posed by each facility for community satisfaction through engagement.

Chapter 5 Socio-economic Evaluation Framework is a framework for assessing open stormwater management ponds versus underground storm sewer water facilities at a proposed site. Effectively, which facility would be more appropriate from a socio-economic perspective and how do we assess the choice? Based on the research in Chapter 4, evaluation criteria and measures are identified and listed. A framework is proposed for applying the criteria and measures. Further, case studies were completed to test the application of the framework under different circumstances.

Socio-Economic Analysis

4.1 Socio-Cultural

The socio-cultural analysis examines how open stormwater management ponds and DUSF with a park on top are valued and have meaning from a socio-cultural perspective. We probed the question of whether socio-cultural characteristics may lead to preferences of one facility over another?

The Oraclepoll research indicated that all respondents and thus, people of every culture, valued underground stormwater facilities with a park on top. After describing each facility, Question 1 asked: Which would you prefer to have in your community? Respondents self-identifying by race and or ethnicity represented eight ethnic, cultural and racial backgrounds in addition to being Canadian. There was 97 percent support for underground storm sewer water facilities with a park on top – which is a surprisingly strong result. As a result, we could not distinguish whether there is a difference in preference based on socio-cultural characteristics, because all racial and cultural groups prefer underground storm sewer water facilities with a park on top.

However, there are differences in how people from differing cultures, races and ethnicity have access to private and public natural areas. The Oraclepoll survey results indicate that members of some cultural groups are predominantly renters versus owners. Thus, these cultural groups are less likely to live in dwellings with private recreation space, e.g., yards.

The analysis is shared below.

4.1.1. Literature Review

Cultural values influence how space is used, perceived and appreciated. Due to immigration, urban intensification and mixed-use development policies, the awareness and value of outdoor public spaces is shifting. The shift is in the direction of culturally diverse residents becoming more frequent users of public park spaces and amenities in line with how demographic, cultural and racial character of the Greater Toronto and Hamilton Area (GTHA) has evolved and is evolving. It is therefore important to compare SWM ponds and DUSFs with a park on top, based on the social and cultural needs of community members.

We begin our analysis by identifying the range of cultures that likely interact with park facilities in the GTHA. We look at differences in housing tenure among various cultural groups. We advance the premise that people living in rental and/or condominium housing will place more importance on access to public park facilities because their existing residential space does not provide it. As such, we draw the conclusion that underground stormwater management facilities with park on top appear to better satisfy this demand compared to open stormwater management ponds.

To examine who are the users of park facilities versus open ponds, we considered research on users of Conservation Areas sponsored by the Toronto Region Conservation Authority (TRCA) (IndEco Strategic

Consulting Inc., 2016)[2]. TRCA commissioned IndEco Strategic Consulting Inc. and Environics Analytics (Environics) to complete a market segment analysis to understand the demographics of user communities within TRCA's jurisdiction. The analysis examined users within the 10 watersheds (and the Lake Ontario waterfront) and six member municipalities.

TRCA research notes the cultural characteristics of users of watersheds and Conservation Areas. We note that the TRCA research pertains to nature parks that are considerably larger than a park associated with an underground storm sewer water facility. However, the research has similarities and is useful in that it indicates the broad characteristics of residents expected to use parks associated with underground storm sewer water facilities.

The research indicates that people in TRCA's watersheds are ethnically diverse and younger. That said, park day users tend to be older, more educated, and less ethnically diverse than the general population. IndEco and Environics research also indicates:

> *The ethnic makeup of the TRCA's jurisdiction is extremely diverse, with 51% of the population being immigrants and 50% of the population identifying as a visible minority. The most common cultural groups identifying as visible minorities are South Asian (30%), Chinese (23%), and Black (15%)* (IndEco Strategic Consulting Inc., 2016).

Seeing culture through language, the research also indicates:

> *Due to the diverse nature of the TRCA's jurisdiction, 46% of the populations' native language is a non-official language (i.e., not English or French). The most common first languages, outside of an official language, are Chinese dialects, Italian, Panjabi, Tagalog, and Spanish* (IndEco Strategic Consulting Inc., 2016).[3]

Based on the postal codes of parks users - Members and Day Users (MDU), TRCA was able to identify demographic characteristics, language and immigration status of park users. The research found:

> *58% of TRCA MDUs are non-immigrants, while 42% are immigrants. This means that 9% more of TRCA MDUs are Canadian-born when compared to the TRCA market as a whole. Additionally, 47% of MDUs have a mother tongue that is a non-official language and 41% identify as a visible minority, which is respectively 1% and 9% less than the population as a whole.*

While this statistic observes that TRCA MDUs are composed of a higher percentage of Canadian-born non-immigrants when compared to the TRCA's entire population, the high percentage of immigrant users is noted and important. Specifically, the research indicates a high percentage of ethnically and culturally diverse people visit parks. Thus, we can conclude that across the GTHA, the cultural makeup

[2] The TRCA parks are not active parks. They are open naturalized areas. The park space above an underground tank will likely be programmable active or passive park space.
[3] Note: Chinese dialects include Mandarin, Cantonese and other regional dialects (e.g. Suzhou, Nanchang, etc.)

of community members likely using parks associated with underground storm sewer water facilities with a park on top will be both ethnically and culturally diverse. At ponds, for example, people may sit and view or possibly walk around the pond; however, ponds, as defined, offer limited options for the needs of cultural communities, as they do not provide the space for family and community gatherings.

Through Oraclepoll research, we further explored the demand for park space, in terms of whether the accommodation of cultural communities provides access to private natural space (lawns). Access to private space was measured through residency in owned vs rental housing data. Residency tenure was cross tabulated against ethnicity. Our premise is, renters have the least access to private natural space and will place more value on access to public space.

While the Oraclepoll survey did not ask about housing type, it did examine housing tenure and found that the highest home ownership occurred among the White, Caucasian and European origin communities at 75.5 percent. In contrast, the Black, African American or Canadian African communities have the lowest home ownership at 59 percent and 41 percent renters.[4] Hispanic / Latinx communities are at 37.5 percent renter and East Asian (China, Japan, Korea, Vietnam) communities are at 37.3 percent renter. Table 1 tabulates housing tenure against ethnicity.

Table 1 Housing Tenure

Own / Rent Compared to Ethnicity			
		Q7. Do you or does your family own your home or rent?	
		Own	Rent
Q6. People come from many different ethnic, cultural, and racial backgrounds. In addition to being a Canadian, what is your self-identified race or ethnicity?	White / Caucasian / European origin	75.5%	24.5%
	Black / African American or Canadian / African	59.0%	41.0%
	Hispanic / Latinx	62.5%	37.5%
	South / SE Asian (India, Pakistan, Indonesia, Philippines)	72.0%	28.0%
	East Asian (China, Japan, Korea, Vietnam)	62.7%	37.3%
	Middle Eastern / North African	70.4%	29.6%
	Indigenous / Metis	55.6%	44.4%
	Mixed	70.0%	30.0%
	Refused	76.5%	23.5%

Based on the premise that renters may have a greater demand for public park space, the data indicates some racialized communities are more likely to be renters. Thus, there is a higher demand for parks in

[4] Indigenous and Metis have the lowest home ownership but the survey participation response numbers are small.

general and those associated with DUSF with a park on top among these ethnically and culturally diverse communities.

4.1.2. Analysis

There is a range of cultures seeking park space. Diverse cultural groups are strong users of parks. Density, number of persons per household, personal access to green space and being owners versus tenants are relevant to the value that various cultural groups place on parks versus ponds.

That said, all cultures said they prefer underground storm sewer water facilities with a park on top versus stormwater management ponds. This leads to the conclusion that underground stormwater management facilities with parks on top have a better ability to satisfy diverse cultures seeking park space than a storm sewer water pond, as it does not provide any[5] other public benefit than stormwater retention.

In summary, both active and passive park spaces on top of underground storm sewer water storage facilities will have higher value as seen through a cultural lens, than spaces that have restricted uses, as may be the case with traditional SWM ponds.

4.2 Economic Valuation Analysis

Determining how to value open SWM ponds and DUSFs with a park on top involves more than assigning monetary costs. A full examination of the 'value' of facilities that have lower monetary costs may, under a full economic valuation, have higher economic value. However, given the scope of this study, we have taken the opportunity to identify and discuss economic attributes, rather than complete an economic valuation analysis. While some of the values such as aesthetics and spiritual values can be defined, the quantification of these values is difficult. Further, the analysis of the economic values pertaining to open SWM ponds versus DUSFs with parks on top involves a fine analysis of the similarities and differences of each, which would involve in-depth research beyond the scope of this study. That said, for subsequent studies, there is considerable potential scope for quantifying and monetizing the full range of economic values.

We refer to research conducted in the United States that has quantified and monetized many of these values. For example, the Trust for Public Land looked at five cases of where these and other park attributes have been quantified and monetized using examples from Washington DC, San Diego, Boston, Sacramento and Philadelphia (The Trust for Public Land, 2009).

The broader economic values in play and discussed are:

- ◇ *Aesthetic* value;
- ◇ *Existence* and *use* value;
- ◇ Quantitative value; and
- ◇ *Spiritual* value.

[5] Aesthetic values are considered equal for both SWMs and DUSFs.

Existence and *use, aesthetic* and *spiritual* values may be better discerned through public engagement programs as discussed in the following sections. For example, through the presentation of a series of landscape design options, questions would be posed to the public through public engagement asking which facility – open SWM pond versus DUSFs with a park on top - is more aesthetically pleasing and why? For those members of the public who have spiritual values, they would share their views of which facility better provides the opportunity to express spiritual values and why? For example, *do I feel that this is a good place for personal worship, contemplation and reflection?* The discussion of opportunities for engagement about SWM ponds and DUSFs with a park on top occurs in Section 4.5.

Even with noted measurement limitations, the broader economic criteria help to understand the breadth of considerations that assist decision making and inform the following framework. The criteria are discussed below:

Aesthetic value: It is difficult within the scope of this research to find public preference data leading to distinct aesthetic preferences. Both types of stormwater facilities have *aesthetic values*. Landscape design can contribute to people viewing a park as noisy or tranquil, having opportunities for crime or safe places and opportunities for physical activity and gathering.

SWM ponds and underground storm sewer water storage facilities are valued by local communities and vary by how local residents perceive their aesthetic qualities and utility. Although not within the scope of this research, public engagement about aesthetics assists the understanding of aesthetic values.

Several distinctions can be drawn between an open SWM pond and DUSFs with park facilities.

Figure 3 Open stormwater Pond in Milton

Figure 4 DUSF offers potential for a park

First, both facilities can be designed to be aesthetically pleasing. The use as a 'pond' however, would appear to circumscribe how a SWM pond needs to be designed to function properly, compared to a park that would allow for more landscape design options. Simply, a DUSF, with a park on top provides more land, uses and a flexible landscape design.

Second, a dry or poorly maintained pond will be less aesthetically pleasing than a DUSFs with a park that would be properly maintained by municipal services.

Figure 5 Example of debris in the stormwater pond

Figure 6 Example of household items and litter

***Existence* and *use* value:** *Existence* and *use* values are such that people may or may not use a facility, but they value the facility because they know it is there and can be used if desired. Both ponds and parks could offer passive uses (e.g. trails around the pond). Distinctions arise between a pond and a park since a park can also offer active uses, and in general allows for a variety of uses to be considered

whereas a pond does not. Thus, the underground stormwater facility with a park on top performs better in terms of *existence* and *use* values, because a broader variety of active uses are also possible.

Existence and *use* values have additional characteristics. *Existence* and *use* values also depend on a person's stage of life, quality of the park (perceived sense of safety, aesthetics, and utility) and characteristics of a pond. Lifestyle choices such as recreational walking, and wider context i.e. pandemic restrictions, also influence society's collective value of the utility of an open space. In the case of SWM ponds compared to DUSFs, open space, utility, proximity, and access may be the primary determining factors in how a resident perceives the value.

Turning to US research on direct use values, although referring to larger parks, the Trust for Public Land (Trust for Public Land, 2009) examined direct use value in Boston. They found:

> *While city parks provide much indirect benefit, they also provide huge tangible value through such activities as team sports bicycling, skateboarding, walking, picnicking, bench sitting, and visiting a flower garden.*
>
> *The model used to quantify the benefits received by direct users is based on the "Unit Day Value" method developed by the U.S. Army Core of Engineers. Park users are counted by specific activity, with each activity assigned a dollar value by economists familiar with prices in the private marketplace.*
>
> *These and many more "direct uses" were measured in a telephone survey of Boston residents and were then multiplied by a specific dollar value for each activity. Based on the level of use and those values, it was found that in 2006, Boston's Park and recreation system provided a total of $354,352,000 in direct use value.*

While our research was not scoped to complete a similar quantification and monetization, the Trust for Public Land study showed that parks have monetary value for a municipality. We can further hypothesize that a DUSF with a park on top would perform better than a stormwater sewer pond in terms of direct use values.

Quantitative value: *Quantitative values* address whether there are enough ponds or parks and whether there are enough of the right types of these facilities. Measuring quantitative values pertaining to ponds or parks involves counting whether there are enough of these facilities and enough of the right facilities to meet the needs of the population. If there is an undersupply of parks in a municipality, then an underground stormwater facility with a park on top would meet this need.

We were unable to obtain municipal information regarding the oversupply or under supply of parks for the municipality used in the case study. This information would be required in any municipality to complete the analysis of the value of a proposed underground stormwater facility with a park on top. Providing parks where there is an undersupply has a cost to the municipality. Providing the park through the design of the DUSF or accepting the financial and parkland contribution attributed to the DUSF under the Planning Act appear to achieve the same objective as the municipality installing a park to address the undersupply of park space. In some cases, whether there is or is not a parkland

oversupply issue, DUSFs are still more valuable because they can also be used to place parking lots on top, or other locally needed infrastructure.

While this research sought to understand the extent to which there is a surplus or deficit of parkland in the case study communities, the lack of data makes this part of our research incomplete.

Spiritual value: People assign *spiritual values* to both ponds and parks. Both offer opportunities for reflection, worship and contemplation. The scope of this research did not allow us to quantify spiritual value. Quantification would best occur through public engagement and dialogue.

In summary, taking a broader view of the intrinsic economic values of an underground stormwater facility with a park on top compared to a stormwater sewer pond brings into play a distinct set of criteria. Some criteria where quantitative data can be obtained is easier to measure. Measuring which facility would perform best based on *existence* and *use, aesthetic* and *spiritual* criteria requires facility-specific studies and would be assisted through community engagement. In conclusion, underground stormwater facilities with a park on top appear to offer greater flexibility for allowing the broader economic values to be achieved.

4.3 Property Value Analysis

SWM ponds and DUSFs with a park on top may create positive or negative property values for nearby residents.

4.3.1. Literature Review

Many fields look at the effects of land uses on property values (for example, aggregates, group homes, mining, transportation and the real-estate industry). That said, property valuation is one of the most challenging and complex areas of land economics. Drawing definitive conclusions requires deep analysis of many variables and statistical techniques involving multi-variate analysis. Further, there are many sub-components of the analysis of property value effects that, in themselves, are separate areas of study (stigma, hedonic[6] price model statistical analysis, perceived risk).

Despite widespread acknowledgment that proximity to parks leads to higher real estate values, actual assessments are limited and may change depending on specific geographic areas. For example, on the

[6] A hedonic price model is an economic tool that measures the price of a particular good or product upon the premise that the price is affected not only by the internal characteristics of the product itself but by the external factors that affect it. For example, the price of a house is determined by both the physical properties of the house (size, appearance, features, condition) as well as external and environmental factors (accessibility to schools and shopping, level of water and air pollution, value of other homes, etc.). A hedonic model is used to estimate the extent to which each factor affects the price of the house (source: Investopedia). The word “hedonic” is derived from the Greek word “hedonikos,” which is defined as characterizing or pertaining to pleasure (source: Dictionary.com). (Hemson, 2013)

most intense side of this scale would be highly developed Hong Kong (analysis of 1471 transactions), where an urban parkland assessment study found value uplift of over 16.88 percent broken into 14.93 percent for accessible park and 1.95 percent for a view (C.Y. Jim, 2010). Between studies in Hong Kong and select places in United States (New Haven) and England (Darlington and Reading) the overall availability of open space in the area (within as much as one mile radius), directly correlates to the actual and measured real estate value increase. Pricing is elastic so cities where there is a deficit or perceived lack of available parks are more likely to produce a price premium for proximity to parkland.

Figure 7 Playgrounds can be built on top of DUSFs

The Trust for Public Land also notes the difficulty in establishing a park-by-park, house-by-house valuation. Instead, they chose to establish the conservative value of five percent as the amount that parkland adds to the assessed value of all dwellings within 500 feet of parks. Variables cited include, excellent parks can add 15 percent to the value of a proximate dwelling and on the other hand, problematic parks can subtract five percent of home value. The total assessed value of properties near parks was multiplied by five percent (as a conservative estimate) and then by the tax rate, yielding the increase in tax dollars for the municipality attributable to park property (Trust for Public Land, 2009).

A well vetted Ontario study by PVCI (Property Valuators Consultants Inc, 2012) indicated that attribution of very high or very low property values to an external influence should be viewed with caution. Changes in the economy, interest rates, housing demand created by new housing coming onto the market or not, have a much more dominant causal effect on property values. Indeed, significant community changes creating stigma and disruption may influence property values from one to six percent.

For the consideration of an underground stormwater facility with a park on top compared to a stormwater sewer pond, one variable is the characteristic of the stormwater facility. Through enhancements to the character of the facility, or the lack thereof, property values can be influenced positively or negatively. For example, making a SWM pond a permanently managed water feature could enhance its value, as would providing specialized flora and landscape design for an underground storm sewer water storage facility with park on top.

Given that this study is not a dedicated analysis of the effects of storm sewer water storage on property values, as that would require a separate report, HSAL, working with Dr. Paul Seccaspina and Oraclepoll, developed a simplified way of identifying property value effects by measuring *perceptions of property value effects.* Measurement occurred by designing and implementing a GTHA - wide survey.

4.3.2. Analysis

Survey Method. A survey was conducted by Oraclepoll Research Ltd in March 2022 as part of an omnibus telephone survey (see **Appendix B – Survey Questions**). Text from the Oraclepoll Research Limited Report are presented below (see **Appendix C - Oraclepoll Research Limited Research Report**).

A total of N=850 interviews were completed among Ontarians. Respondents were screened to ensure that they were residents of Ontario, 18 years of age or older. Quotas were set to ensure that the sample was reflective of the demographic and geographic composition of the population. Adjacent is a breakdown of the total sample by area or region. In terms of sample size and error rates, the margin of error for the total N=850 sample is ± 3.4%, $\frac{19}{20}$ times.

Toronto	N=335	39%
Peel	N=162	19%
York	N=129	15%
Hamilton	N=86	10%
Durham	N=77	9%
Halton	N=61	7%
Total	***N=850***	***100%***

All surveys were conducted by telephone using live operators at the Oraclepoll call center facility using computer-assisted techniques of telephone interviewing (CATI) and random number selection (RDD). The dual sample frame random database was inclusive of cellular and landline telephone numbers. Twenty percent of interviews were monitored and the management of Oraclepoll Research Limited supervised 100 percent. Interviews were completed between the days of March 16th to March 23rd, 2022.

As GTHA residents may not be familiar with stormwater storage facilities, a statement was read that described a SWM pond and an underground storm sewer water storage facility with park on top. The statement follows:

"When there is precipitation such as rain and snow, the water is typically stored and cleaned before it is released to streams or other receiving water courses. There are two ways to clean the water: the first involves directing the water to open stormwater ponds. The second way involves directing the storm sewer water to underground storage. Both have advantages and disadvantages."

"Open storm sewer water ponds can provide an attractive water feature; however, the open water can be a safety risk and may attract birds and mosquitoes. When they are dry, ponds can be a gathering spot for litter and lead to unpleasant smells. Open storm sewer water ponds can only be used as a pond and are not accessible for recreation despite occupying valuable land. Underground storm sewer water storage can store stormwater and the above ground space can be used for other purposes, such as public parks, sports fields or playgrounds. Water stored underground can be used for landscape irrigation, fire protection, dust suppression, and ornamental ponds or fountains. Underground storm sewer water storage does not have the same bird and insect issues, or litter and safety risks as open stormwater ponds."

Two questions were asked before the property value questions pertained to their preference for either facility and their views of the safety of each facility (See **Appendix C**). The responses to these questions are addressed in other parts of this report.

All respondents were then asked questions about perceived property value effects. They were first asked if SWM ponds would have a positive or negative impact on property values. Those that responded positive and negative were then asked to specify the percentage amount they perceived that property values would either increase or decrease. Respondents were read the following statement:

"Both open water storm sewer ponds and underground storm sewer water storage with a park on top may have positive or negative effects to property values. In your opinion, which water storage option would have positive or negative effects on neighbourhood property values?"

85 percent or N=718 that said that SWM ponds would have a negative effect on property values. 14 percent said they were unsure. One percent said that SWM ponds would have a positive effect. The responses are within the margin of error and represent the opinion of GTHA residents.

Participants were then asked for their opinions about the property value effects of underground stormwater storage facilities with a public park on top. 82 percent of survey participants felt that underground storm sewer water storage facilities with a public park on top would have positive property value effects. 17 percent of the participants were unsure, and one percent felt they would have negative effects.

The survey then continued to test perceptions of respondents regarding property value effects. SWM ponds were perceived to result in a drop in property values of 15 percent (mean), whereas, underground stormwater storage facilities with a public park on top was perceived to have a positive property value effect of 17.2 percent (mean).

4.3.3 Findings

The research indicates that residents of the GTHA perceive that underground storm sewer water storage facilities with associated park facilities have a positive effect on property values compared to SWM ponds. Acknowledging that an in-depth analysis of measured property value as cited earlier may limit positive changes to measured property values of one to six percent, it is interesting to note the higher influences based on perceived property values. That said, the results are statistically significant on the direction of change between the two types of facilities and the perceived amount of property value change of 15 to 17.2 percent.

4.4 Health and Safety Risk Analysis

This section provides a deeper analysis of the health and safety aspects of SWM ponds versus underground storm sewer water storage facilities. Previous studies suggest open SWM ponds are potential human health and safety hazards. It has also been suggested that attracting waterfowl into higher density urban areas creates a nuisance such as noise and contaminating excrement. Here we examine health and safety risk in terms of: human health and nuisance effects on human health.

4.4.1. Literature Review

Open stormwater management ponds can be perceived by the general public as recreation areas given their natural aesthetic. Located within family-oriented housing developments makes them a further temptation for recreation by youth. A key finding of this research focuses on the contaminants in the stormwater (salt, road materials, chemicals, etc.) making the ice unstable compared to natural ponds. Among socio-economic effects deaths and other health and safety risks are the most significant. Given that underground DUSFs are physically enclosed and have zero access to the public, our focus is on SWM ponds. We appreciate the assistance we have received from the Drowning Prevention Research Centre and the Ontario Coroner's Office to complete this part of the research.

In 2020, examples of drowning fatalities included two young men in Richmond Hill who were swept from one pond into another via an open storm drain with one of the two men dying as a result, an eleven-year-old boy in Milton falling through a frozen stormwater management pond, and a thirty-year-old man in Belleville drowning while swimming across a SWM pond as 15 people had an outdoor gathering during the COVID-19 pandemic. During the winter of 2021, numerous municipalities issued media warnings: Vaughan, Bradford, Georgina, London, Whitby, Red Deer Alberta as some examples. Further, some municipalities such as the Cities of Vaughan and Markham also issued trespass orders to residents. **Appendix D – Newsletters** provides examples of SWM related newsletters.

Despite their natural aesthetics, SWM ponds function as watershed infrastructure and have characteristics that are different from natural ponds, which makes them unsafe for recreation. They are engineered to receive water throughout the year with drainage including road salt, and other run-off contaminants (Lake Simcoe Region Conservation Authority, 2011). They are also:

- ◇ Built with a constant flow of water in and out of the system all year around, some including clearly visible open drainage systems
- ◇ Designed with steep sides and depths of one to three meters, some ponds covering large surface areas (City of Toronto, 2015)
- ◇ Dry stormwater ponds may be designed with alarm systems for municipal staff to monitor flooding which produces a temporary safety risk (City of Toronto, 2013)

Depending on the watershed and development requirements, stormwater ponds can be large bodies of water with an undercurrent and too deep to stand up in. In the winter, contaminants, constant flow, and air pockets destabilize ice even as it appears thick enough to hold weight.

4.4.2. Analysis

Original research data on perceptions of safety was provided by the Oraclepoll survey. In the GTHA, the Oraclepoll found that perceptions of safety are overwhelming (99 percent) in favour of closed access DUSFs compared to ponds. It would appear obvious that access to open water and the system itself presents a safety risk, and the following photos taken at Earl Bales Park in Toronto, Ontario, a 3.2 ha system with a three-meter depth, illustrate this dramatically.

In Ontario, there are on average 152 drowning fatalities per year and 64 percent occur in open water (lake, pond, waterway) (Drowning Prevention Research Centre, 2021). HSAL received data from the Ontario Coroner's office on open water fatalities from the past decade between 2001 to 2020. While natural bodies of water and engineered structures were not distinguished, about 17 percent of open water fatalities occurred in the Greater Toronto and Hamilton Area (Office of Chief Coroner's and Ontario Forensic Pathology Service, 2022). This confirms that the risk of open water drowning does exist in highly urbanized areas and supports the findings above.

In Ontario, non-fatal drownings are close to 3.6 times that of fatal drownings (Drowning Prevention Research Centre, 2021). This type of drowning can range in severity as the potential for brain damage increases, with a devastating impact on families. Recent trends are a rise of non-fatal drownings, for example, between 2010-2019, hospital visits for non-fatal drownings increased by 23 percent, from 3.5 per 100,000 people to 4.3 per 100,000. Furthermore, while most Canadian drownings happen in the spring and summer, there is evidence that the risk of winter drownings is on the rise in countries of the northern hemisphere. A peer-reviewed study of 4000 winter drownings over the span of 26 years in northern countries documents an increase in incidents and correlates it to increasingly drastic freeze-thaw temperature patterns with unstable ice conditions (Sharma S. Blagrave K. Watson SR, 2020). These temperature changes lower the quality and stability of ice conditions in a way that can not be detected by thickness of the ice. Combined with the functional characteristics of SWM ponds, this further raises the risk of falling through iced-over SWM ponds while engaging in winter activities. In fact, the study suggests even Indigenous groups with a history of ice-related activities are at a higher risk due to a false sense of confidence. Tanks are inaccessible to residents trying to perform these activities and therefore these risks do not apply.

Community Health

SWM ponds were introduced in the 1990s as a best practice for managing stormwater in new developments. Several other considerations have emerged in the way this infrastructure integrates into developments.

As discussed above, well maintained stormwater management ponds may add aesthetic value as open space. However, they do not provide recreational and active play opportunities and further, they also attracting waterfowl that can be a nuisance in dense urban settings. Several other considerations have emerged in the way the SWM infrastructure integrates into developments.

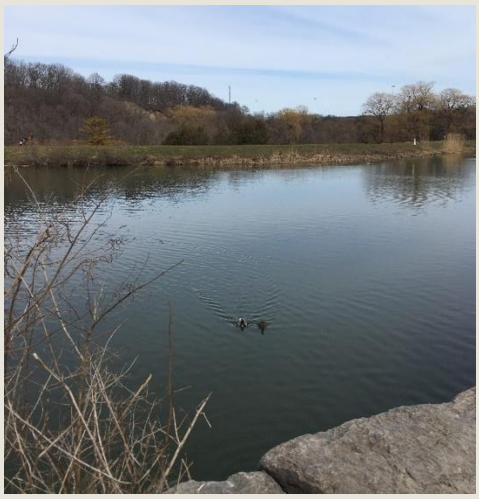

Figure 8 Earl Bales Park stormwater pond in park setting

Figure 9 Stormwater pond with signage

Figure 10 Earl Bales Park stormwater pond outflow

Stormwater management ponds with naturalized designs attract Canada geese and mallard ducks to urban areas. Canada geese, which tend to pose the greatest nuisance and create contamination due to excrement, are attracted to ponds, especially ones beside grass areas versus more natural ponds with tall vegetation (Smith, 2006).

In terms of nature influencing socio-economic benefits due to human interactions, non-native goldfish in SWM ponds also recently made news headlines in the municipalities of Orillia, Port Perry, and Bradford West Gwillimbury. In a stormwater infrastructure performance study, Lake Simcoe and Region Conservation Authority found these invasive animals in 11 ponds (from over 350 SWM ponds and counting) in their watershed. Invasive species can change the environments they are introduced into. The presence of goldfish was correlated with lower infrastructure performance due to turbidity and possibly increased sediment load (Lake Simcoe and Region Conservation Authority , 2020). When considering the primary function of quality control SWMs is to remove suspended solids by sedimentation, goldfish are impairing the performance of these ponds (Lake Simcoe and Region Conservation Authority , 2020). Part of the carp family, goldfish can outcompete native fish if they escape into to the natural habitat that stormwater management aims to protect (King, 2018). Moreover, goldfish in particular can "destroy natural aquatic habitats such as lakes and rivers" (University of Toronto Scarborough news, 2021). Located within residential areas, the animals were likely released from home aquariums, so human use and misperceptions of the ponds were at play. In addition, the source of the goldfish is likely deliberate release from or for religious / cultural practices (Lake Simcoe Region Conservation Authority, 2011). This is not possible with tanks, where there is no access for people to throw in their invasive species.

Figure 11 Geese around a partially fenced stormwater pond at Jane and Major Mackenzie, Vaughan

Figure 12 Signage about safety, geese, and invasive species

4.4.3. Findings

Community health includes physical health and safety, mental and psychological health. Open spaces and aesthetically pleasing places are well known positive contributors to physical and mental health. However, the interactions between people and that space define the risks.

Stormwater ponds often have the aesthetics of natural ponds, but their engineered design and environmental service make them unsafe for recreational uses. The accessibility of locating stormwater ponds within subdivisions, even with fencing and bylaws, adds further challenges. Drowning fatalities and near-death incidents are risks that no municipality desires – recently increased efforts in winter bylaw enforcement at SWM ponds are evidence that municipalities take liability risks seriously. Combined with increasingly dramatic weather patterns that further destabilize winter ice conditions and

induce extreme summer storms, the risks associated with locating open structures within new subdivisions will likely increase as populations both increase and diversify.

SWM ponds that are integrated with other open land uses such in Earl Bales Park, the interaction between park users and the infrastructure is an established norm. Visitors appreciate it as a passive space that is part of a trail system, and waterfowl are controlled by the design of the landscape. This limits the potential nuisance of Canada geese and misuse, introduction of carp, to the natural waterway the infrastructure aims to protect. This is not the case in many ponds, however, that are not as well integrated as Earl Bales Park.

In assessing the health and safety risk analysis of SWM ponds versus underground storm sewer water storage facilities, DUSFs provide significantly more socio-economic benefits.

More recent studies have been completed as it relates to community connection and well-being. This will be discussed in the next **Section 4.5 Opportunities for Community Engagement**.

4.5 Opportunities for Community Engagement

We examined the extent to which the interaction of open water storm sewer ponds SWM's (stormwater pond) vs dual-use stormwater facilities (DUSFs) with a park on top has the potential for maximizing community satisfaction and building social capital.

4.5.1 Literature Review

Stormwater ponds are designed to fulfill engineering standards. There is limited or no opportunity for community engagement in direct use or the design and selection process.

In contrast, DUSFs provide a flexible above ground space that allows municipalities to define the use by either addressing a pre-existing need in the community, a cumulative need in the municipal Parks strategy, or engaging residents (existing and anticipated) to determine the local needs and desires. Across Canada and the GTHA, there are many examples of how park planning transforms both the space and the residents through community engagement. One of the greatest values achieved through community engagement is the creation of social capital (Ellery, 2019).

Figure 13 Dollar Hamlet Park, Markham

Current literature suggests social capital forms part of the foundation for community well-being, and by broader extension, resilient communities (Toronto Foundation and Environics Institute, 2021). Quantifying this important value is beyond the scope of this study, however HSAL acknowledges that social capital forms the basis for many health, social, and economic development strategies. These are socio-economic benefits that go beyond monetary value but which municipalities across Canada strive to achieve.

Park design processes also offer an opportunity for municipalities to respond to cultural needs. For example, Dollar Hamlet Park in Markham incorporates a pebble path that reflects the municipality's Diversity Action Plan titled "Everyone Welcome" (Park People, 2016). The flexibility to engage with residents and incorporate features as cultural expressions, reflecting the character of local demographics are not available with engineered stormwater pond installations. In fact, inclusive design goes beyond planning processes to enhance user experiences, thereby maximizing their community satisfaction.

In the US, The Trust for Public Land provides both a theoretical and quantitative explanation of why social capital is important (The Trust for Public Land, 2009). They observe that "the more webs for human relationships a neighbourhood has, adds to the value of a neighbourhood and by extension to the whole city. Perhaps more significantly, the acts of improving, renewing or even saving a park can build extraordinary levels of social capital" (The Trust for Public Land, 2009, p. 9).

Using Philadelphia as an example, they observe that "while the economic value of social capital cannot be measured directly, it is instructive to tally the amount of time and money that residents devote to their parks as a proxy for socio-economic value" (The Trust for Public Land, 2009, p. 10). So, engaging the community in learning and activities related to park design and park maintenance will build quantifiable social capital within a community, boosts the civic life of a city and is measurable economically (volunteer hours x value of volunteer hours + public donations = economic value).

4.5.2 Analysis

Stormwater management ponds are designed based on engineering standards and measures to achieve the environmental service of holding and cleansing stormwater. This limits their design flexibility as they serve one function. Many are aesthetically pleasing and offer residents a park-like open space for passive recreation (e.g. trails around the ponds), however this is pre-defined and limiting. In fact, limited to, no access, due to safety risks present residents with a space they may want to use and engage with, but cannot access. Thus, the pre-defined limitations of SWM ponds limit community engagement and satisfaction.

DUSFs do not have this constraint. DUSFs have been used in many municipalities to make efficient use of land with a wide range of amenity and design opportunities (Malone Given Parsons, 2021). The facilities themselves are designed based on engineering standards, and to perform their stormwater management function, yet unlike SWM ponds, their function does not limit the ways in which they can contribute to opportunities for community engagement. HSAL furthers this work by identifying the connection that flexible aboveground space provides to developing social capital and community well-being, as results of engagement activities. A highly valued (cost saving) public objective is met through the community engagement process associated with designing the space to the user satisfaction in seeing a final product that reflects local demographics.

4.5.3 Findings

DUSF provide the flexibility of above ground publicly accessible space that makes it possible to reach for foundational socio-economic attributes such as community well-being, inclusion, and a wider range of needs to enhance user satisfaction. The potential for building social capital is a socio-economic attribute that is beneficial for every municipality. These are highly valued public opportunities associated with a DUSF facility with a park on top that cannot be achieved by a single function stormwater management pond. South Unionville Square Park is an example that is part of a larger park and trail system.

Figure 14 South Unionville Square Park is an example of park over a DUSF, Photo credit: Vincent LQ [Photo] https://canada247.info/explore/ontario/york_regional_municipality/markham/south_unionville_park_west.html

4.6 Summary of Findings

Given the research and analysis in Section 4.0, we draw the conclusion that there is strong public support for DUSFs with a public use on top such as a passive or active park, compared to a traditional open SWM ponds. The new space on top of a DUSF offers all residents and communities additional public active and/or passive space.

We identified a broad range of socio-economic values associated with DUSFs with a park on top, beyond monetary and commercial values. Overall, applying these values provides an important distinction between the socio-economics of open SWM ponds and underground stormwater facilities with a park on top. The exception would be aesthetics which are similar or can be made similar for both types of facilities. '*Existence*' and '*use'* values can be quantified.

While '*quantitative*' values inform the socio-economic value of an underground facility with a park on top, we were not able to access data on municipal parkland deficits or surpluses. We can conclude that underground facilities with a park on top should be counted as a park for Parkland Dedication purposes under the Ontario Planning Act.

'*Spiritual values*' are relevant to determining value however, given the scope of this research we were not able to complete a comparison of the two facilities. That said, we were able to draw the conclusion that underground storage facilities with a park on top provide more space and flexibility for related public uses.

In examining the socio-economic aspects of property values, both international research and direct Oraclepoll research completed as part of this report indicated that underground facilities are contributors to increased property values.

The strongest socio-economic distinction between DUSFs with a park on top, compared to SWM ponds comes through an examination of health and safety risks. The difference was not lost on survey respondents who strongly supported the underground stormwater management facility with a park on top as the safer option. Given the extent that underground storm sewer water storage facility performs significantly better, municipalities will need to factor this risk into the calculation of whether the cost differences should even be calculated in relation to human health risks.

International research points to community engagement programs associated with planning and managing parks as contributing to social capital. In this case, local *friends of the park* -type residents would be completing park design and management activities that might otherwise be a cost to the municipality.

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Socio-Economic Evaluation Framework

From Ontario's Provincial perspective, both the Policy Statement, 2014 and Provincial Growth Plan, consolidated 2020, provide support for an "equitable distribution" of parks and open space; this is associated with suggesting alternative solutions for parkland acquisition (Garrett, 2016). Municipalities have and are actively responding with alternative parkland dedication strategies. This on-going discussion is beyond the scope of this study. However, HSAL acknowledges that the flexibility of DUSFs for creating additional parks shifts the dialogue; a comparison of the socio-economic benefits between a DUSF and a SWM pond adds depth.

This chapter offers an evaluation framework to assist decision-makers in choosing appropriate infrastructure for new or re-development scenarios. HSAL uses the criteria developed through and analysis from **Chapter 4 Socio-Economic Analysis** in combination with a review of municipal park planning processes from several Canadian cities to develop evaluation criteria, measures and indicators. There is specific emphasis on the GTHA due to the high land values and intensification strategies, and greater pressure for each new development to add benefits for the community.

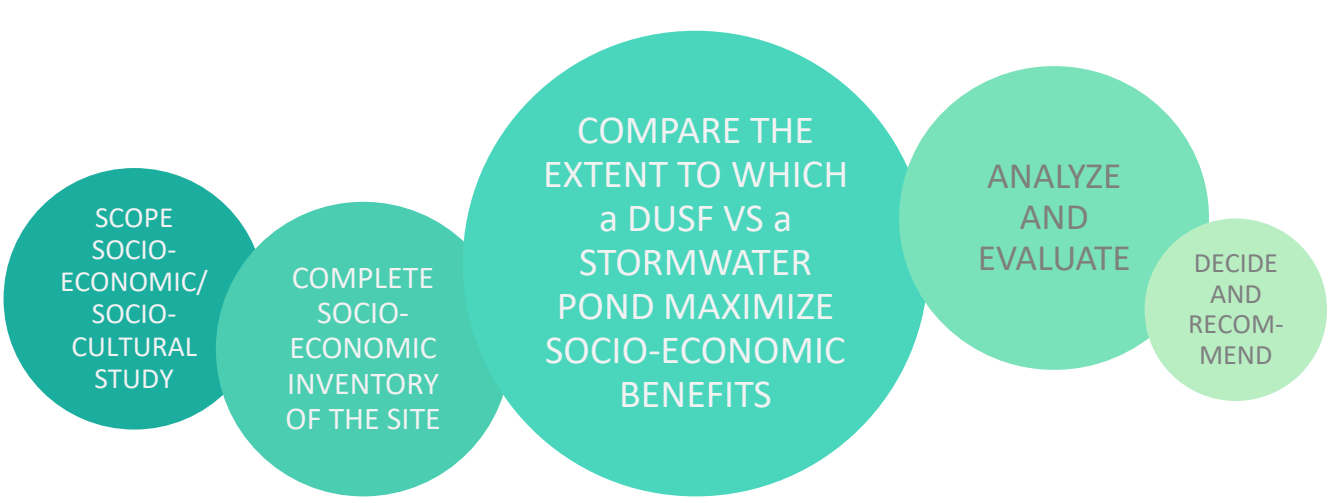
HSAL believes this framework can be used to assist decision makers in deciding to approve a SWM pond or underground storm sewer water storage facility based on their appropriate use.

We identify:

- criteria for assessing the socio-economic benefits and costs of a DUSF
- a method of evaluating socio-economic trade-offs

Figure 15 depicts the methodology in evaluating socio-economic analysis. Please see **Appendix E – Site Inventory** regarding the completion of this step.

Figure 15 Socio-Economic Evaluation Method



5.1 Evaluation Criteria and Measures

The socio-economic analysis distinguished dual-use stormwater facilities (DUSFs) and open water storm sewer ponds (stormwater pond) using a range of economic values that went beyond monetary and commercial values. They included socio-cultural, intrinsic economic, property, and health and safety values. The value of parks in creating social capital and connection was also explored. In park planning, many of these values are expressed in open space and parks strategies and visionary documents that translate the values into specific objectives.

To build an evaluation framework, HSAL referenced municipal park planning reports from District of Saanich and City of Vancouver in British Columbia, along with the City of Toronto as background. Key objectives for approving a park are determined by municipal objectives: **site and environmental values, community need, economic considerations, and urgency** (District of Saanich, British Columbia, 2012). Regardless of socio-economic background, park services should be enjoyed by everyone in a municipality. By applying best level of service standard and seeing parks through an environmental justice lens, the City of Vancouver's city-wide review of their parks and recreation Chapter 2: Inventory and Analysis (Vancouver Board of Parks and Recreation, 2018) identified these core values:

- **Access:** quantity of parkland in the system is based on municipal standards (parkland per capita, park deficit) and physical access (e.g., transportation and linkage to green space and assets such as schools, institutions)
- **Quality:** park typology (e.g., size), distribution and investment in parks across the municipality, and range of amenities across the system
- **Inclusivity:** identification of social, environmental, and ecological challenges in the municipalities to unveil vulnerabilities and pathways towards inclusivity (e.g., welcoming atmosphere)

Both objectives and values described above are considerations for planning a municipal park system, and HSAL applies them at the site level to answer the question, how do DUSFs or stormwater ponds meet community needs? These desired municipal values were used to developing criteria, indicators and measures for a new facility assessment tool for testing on development scenarios.

5.1.1 Open Space and Park Asset Assessments

Based on municipal values and objectives discussed above, the following table lists socio-economic criteria, indicators and measures that municipalities may apply when assessing DUSF with a park on top, compared to stormwater ponds. This framework is an example of how socio-economic analysis may assist in the decision-making process. However, appropriate facilities need to be assessed and engineered on a site-by-site basis as well as peer reviewed by municipal engineering and planning departments to confirm adherence to site specific criteria.

Table 2 New Facility Assessment Tool

Criteria	Indicators	Measure
Assess Socio-Cultural Values		
Demographics – What are local demographic needs for a facility?	Estimate number of people who would access to the space (Lives or works within 500 m)	Characteristic of demographics within a walking distance (1 km)
Cultural Need – What is the socio-cultural demand for parks and facilities?	List existing facilities in the municipality and in a 1 km radius List park-related cultural needs	Whether there is an inventory of park types and facilities that meets community cultural needs
Access – What is the extent to which cultural groups have access to facilities?	Overview of park and culture distribution in the municipality Municipal Park standard (deficit or surplus) List major cultural groups	Does the current municipal parks system suggest areas of pressure, especially in meeting cultural needs
Benefits - Will the facility benefit existing and potential users?	Number of people OR units OR new jobs/business within 500 m to 1000m Consult developer	Designated or proposed land use along with anticipate users
Expression - Would the cultural values of facility users be enhanced?	Observe existing users of the space and describe their activities Consult Ward Councillor	Cultural practices of anticipated user groups.

Criteria	Indicators	Measure
Economic – Are there benefits for non-residents?	Observe non-resident users and evidence of activities i.e., encroachment, and walkers List and describe linkages to trails, transit, natural heritage, etc.	Economic spin-off potential of a new park or facility
Access and Socio-Economic Values		
Financial Benefit – Is there a potential for economic returns? What is the cost?	Size of the space, engineering potential, environmental features, and connection to organizations with potential to monetize or program the space	Design and recreation program potential of the new space. Financial costs and benefits. Quantification and monetization of intrinsic values.
Aesthetic – What might be the aesthetic value associated with the space?	List type of pre-existing features List constraints and opportunities, such as engineering constraints and views Survey public preferences	Integration and/or enhancement with surrounding area. Preferences arising from public engagement.
Property Value - Is there potential for improvement?	Estimate of revenue potential Define area i.e., revitalization area, local community, etc List recent municipal investments	Characterize existing neighbourhood and current property values
Social Capital – What is the potential for building social capital?	Characterize the existing and/or new neighbourhood (buyers, homeowners, renters) See above, organizations who may program the space	Demographic trends that indicate a need or benefit from increased social capital. Type of infrastructure best suited to gathering, volunteering, and building a sense of place?

Criteria	Indicators	Measure
	Review age distribution to identify and define vulnerable groups	
User Benefit – What facility fits this community?	Proximity to views, transit, homes, schools, community centres, other facilities	Characterize the existing and new community to anticipate future users
Assess Health and Safety		
Risk – What is the potential for an elevated human health and safety risk?	Location and access within the site List existing natural heritage List mitigation needs	Health and Safety relationship to surrounding land uses and access to facility
Risk - Environmental risk?	Proximity and linkages to features	Relationship to surrounding natural features
Nuisance – What is the potential?	Review list of linkages and proximity to infrastructure, homes, institutions Design constraints at the site	Relationship to surrounding land uses and design options
Assess Additional Municipal Objectives		
Other disciplines – Operations, Engineering etc.	Cost / Benefit analysis Potential revenue	Municipal operations
Contribution - Is the facility filling a gap/deficit? Will it contribute to the infrastructure?	Municipal Standards State of the system – deficit/requirements	Policy objectives

5.2 Socio-Economic Evaluation: Case Study

The City of Markham was chosen as a base for testing the evaluation framework for assessing the value of dual-use stormwater facilities (DUSFs) and open water storm sewer ponds (SWM's) (stormwater pond). Markham's demographics is similar to both the District of Saanich and City of Vancouver. There is a diverse population of people (2021) with a high percentage of visible minority groups from Chinese and South Asian ethnicities (Town of Markham, 2022).

Table 3 describes demographic characteristics of the selected municipalities.

Table 3 Demographic comparison of Municipalities (townfolio website)

	District of Saanich	Vancouver	Markham
Population (2021)	114,148	631,486	328,966
Median Income	$77,282 ($60K – >$150)	$65,327 (with disparity)	$89,028 ($60K – >$150)
Median Age	44.7	38.9	41.1
Area	Core, Suburb, Rural	Core	Core, Suburb, Rural

Compared to the other municipalities, Markham income levels are skewed towards $150K and up, however there is a range of incomes between lower middle income and upper income groups. While Vancouver has been intensifying for decades and equity issues are obvious. Markham, located on the northeast fringe of the GTHA, is making strides to transition towards a compact form.

For each scenario, HSAL completed a site inventory and desktop research to quantify the indicators as best as possible. Based on indicators, an assessment of DUSF and SWM pond was done to evaluate how each option met the criteria.

5.2.1 Case Study Scenarios

Robinson Glen is a ***new greenfield development*** on agricultural land at the urban edge. Both stormwater management facilities and parkland dedication are required for approval of the subdivision application. The Robinson Glen block is 182.6 hectares and includes a greenway with Robinson Creek (part of the Rouge Watershed Protection Area). DUSFs are anticipated at two locations north of Major Mackenzie Drive East, Facility #1 at the northwest corner of Major Mackenzie Drive E. and McCowan Road, and Facility #2 mid-block north of Major Mackenzie Drive E. Major Mackenzie currently has bus transit, no parking, and townhouses facing from the south side. The

Figure 16 East edge of Robinson Glen site, north of Major McKenzie Drive

established neighbourhood of Berczy Village is south of the block and includes two public schools in the east end, close to Kennedy Road. Angus Glen Community Centre and Angus Glen Golf Club are in the block to the west of Robinson Glen (City of Markham, 2018). The municipal vision recognized the existing greenway as a key organizing feature with an integrated stormwater management pond to enhance natural heritage features and dual-use open spaces, include underground stormwater systems, referred to as "urban open space stormwater". Table 4 evaluates DUSF and stormwater ponds adapted from criterion in **5.1.1. Open Space and Asset Assessment**.

Table 4 Evaluation of DUSF and stormwater ponds at the Robinson Glen Development, Markham

		Measures	
Criteria	**Indicators**	**Dual-Use Stormwater Facility**	**Stormwater Pond**
Assess Socio-Cultural Values			
Demographic – What are the local demographic needs for a facility?	○ Existing surrounding area: ○ Immigrant (62%) Non-immigrant (35%) and Visible minorities (90%) ○ Top countries of origin: China, Hong Kong, Sri Lanka ○ Facility #1: West of Robinson Creek, adjacent single detached ○ Facility #2, Mid-block, adjacent proposed mixed use high rise within 500 m ○ Ages 40 – 64 years (38%); 10 – 19 years (15%)	Multi-generational, transition to new families, cultural enclave – preference for flexible design	Open space offers predefined space, limited cultural and lifestyle options
Cultural Need – What is the demand for parks and facilities?	○ Angus Glen Community Centre nearby, proposed secondary and elementary schools within 500 m (Facilities 1 and 2) ○ Passive and active space required	New and nearby institutions with potential for programming	Uncertain
Access – What is the extent to which cultural groups have access to facilities in the area?	Further investigation - City of Markham	Further investigate	Further investigate

		Measures	
Criteria	**Indicators**	**Dual-Use Stormwater Facility**	**Stormwater Pond**
Benefits – Will the facility benefit existing and potential users?	○ Single detached and townhouses in surrounding neighbourhoods, numbers to be confirmed ○ Facility #1: West of Robinson Creek, adjacent single detached ○ Facility #2, Mid-block, adjacent proposed mixed use high rise within 500 m	Yes	Limited
Expression - Would the cultural values of facility users be enhanced?	○ Agricultural greenfield – no existing visitors ○ Passive and flexible uses – consult Councillor, City staff, local organizations ○ Ward 6: Amanda Yeung Collucci, support for parks and recreation	Flexible parks favoured – based on analysis and existing demographics	Limited
Economic – Are there benefits for non-residents?	○ Facility #2 with mixed-use, high rise, and townhouses, and closer to amenities such as Angus Glen Golf Course and the community centre, to draw non-residents foot traffic. ○ Proposed higher order transit on Major McKenzie Drive	Yes Existing bus stop, potential higher order transit	Limited Nuisance and safety risks. Mitigation required
Assess Socio-Economic Values			
Financial Benefit – Is there a potential for economic returns?	○ Robinson Glen Block Community Design Plan: Markham Future Urban Area (Nov 2018) ○ Large sites for potential park or pond ○ Adjacent creek leading north along greenway	Yes. Access to amenities, linkage, and transit access	Limited Possible inefficient land use
	○ No or limited design constraints		

		Measures	
Criteria	**Indicators**	**Dual-Use Stormwater Facility**	**Stormwater Pond**
Aesthetic – What might be the aesthetic value associated with the space?	○ On Major Mackenzie Drive with proposed regional rapid transit to Richmond Hill, facing townhouses with no set back – potential for future street animation	Flexible design in urbanizing area	Maintenance required for higher visibility open area
Property Value – Is there potential for improvement?	○ Existing surrounding neighbourhood have evenly distributed incomes between $40K – over $200K ○ Average households, 3-4 people ○ Average home $1.3 million (TRREB 2021), mostly single detached, executive towns – already high for Markham. ○ Socio-economic analysis would suggest potential for higher value placed on DUSF with park on top ○ Proposed higher order transit on Major McKenzie Drive	Facility #1, Further investigate market, single detached homes in an already high-priced area. Facility #2, Potential higher value - townhouses and apartments adjacent to amenities, (tennis, playground, skateboard park, off leash)	Limited Limited, plus potential for nuisance.
Social Capital – What is the potential for building social capital?	○ As noted in Property Value – demographics suggest a need to build social capital in a new community ○ Programmable space with potential for outreach to new residents best for building sense of place. ○ Ward 6: Amanda Yeung Collucci, support for parks and recreation	New population, young families, and multi-generations	Limited Less flexibility for people to connect

		Measures	
Criteria	**Indicators**	**Dual-Use Stormwater Facility**	**Stormwater Pond**
User Benefit – What facility fits this community?	Proposed secondary and elementary schools within 500 m (Facilities 1 and 2) along with residential	Park accommodates multi-generational and cultural needs	Limited
Assess Health and Safety			
Risk – What is the potential for an elevated human health risk?	○ Embedded in the community ○ Adjacent to and accessible from major roads ○ Fencing required, especially beside mixed-use buildings	Appropriate	Potential risk
Risk - Environmental nuisance?	Adjacent to small watercourse	None	Design and mitigation required
Nuisance – What is the potential?	Adjacent to and accessible from Major McKenzie Dr. and McCowan Rd. with potential for nuisance	Appropriate at #1 and #2	Potential nuisance
Assess Additional Municipal Objectives			
Other Disciplines – Operations, Engineering, etc.,	Cost/benefit - City of Markham	Further investigation	Further investigation
Contribution – Is the facility filling a gap/deficit? Will it contribute infrastructure?	○ Parkland dedication or cash in lieu required for new developments as per standard ○ Deficit/Surplus - City of Markham	Parkland contribution	Stormwater facility - no contribution under current policies
Overall appropriateness and value		***Appropriate with potential added value for Markham***	**Lesser value potential for Markham**

5.2.2 Findings

Robinson Glen is a new and diverse community that will be located in an area traditionally associated with park use. HSAL recognizes the limitation of painting any group of citizens with blanket statements. Any cultural group will include a diverse set of needs and preferences. However, for the Chinese population in particular, a higher level of isolation and limited connectedness has also been suggested (Toronto Foundation and Environics Institute, 2021). This suggests a higher need for congregating spaces to facilitate a sense of place and connection. Parks are effective congregating spaces for this cultural

group, the value of providing a park space would be higher than an open space with limited engagement potential.

Aesthetically, both tank and pond options could enhance the views from Major Mackenzie Drive and provide flexibility for providing amenities to the residential community and gathering space that invites users outside of the immediate community. In terms of safety, the prime locations in view of a major arterial road would require mitigation of human behaviour for safety risk, i.e., fencing and signage. There may also be nuisance risks to both through traffic and residents which would need mitigation in design and maintenance program.

Overall, the socio-economic analysis supports the City of Markham in continuing to investigate and negotiate establishment of DUSFs with a park on top in the new Robinson Glen site.

5.2.3 Additional Scenarios

Figure 17 Tributary of Rouge River on Kingdom Developments property

DUSFs with a park on top offers stormwater management solutions for a variety of sites and scenarios across Canada. Other scenarios also available in Markham included a constrained urban infill and a stormwater management capacity expansion in an industrial area. Full analysis and investigation would be required and is outside the scope of this study, however HSAL provides an overview of how DUSFs may be fit with these scenarios.

Kingdom Developments: Kingdom Developments is proposing an urban infill/intensification site south of Highway 7 east of Birchmount Road. It is within proximity to a creek tributary of the Rouge River watershed, and the land is constrained by existing large format retail. The site is also close to the Highway 7 corridor with high order transit, and numerous mid-to-high rise developments. The use of DUSFs may enhance public access to the natural creek, and potentially facilitate trail development in combination with more active facility development. Further investigation of this site may find that enhanced access to the Rouge River natural heritage also enhances economic returns in both contributions to parkland, local tourism, and additional benefits of programming to a natural park system. Depending on the level of constraint and landscape design options, expanding pre-existing stormwater ponds may create a barrier or may integrate. Further investigation of the site would be required. Whichever facility is more appropriate, this site's potential to create views and access to natural heritage along a major intensification and transit corridor offers opportunities for linkage that would create value for Markham. Both socio-economic and uplift value could be worth investigating.

6.0

Conclusions

The foregoing socio-cultural and socio-economic analysis indicates that when socio-economic considerations are added to engineering, cost and environmental studies, a deeper set of cultural, social and intrinsic economic benefits can be attributed to dual-use stormwater facilities (DUSFs). Specifically, the ability of DUSFs to provide active and/or passive park uses is the primary source of socio-economic benefits. Applying these potential socio-economic benefits to the evaluation of whether open water storm sewer ponds (stormwater pond) or underground stormwater storage facilities with a public park on top can provide important distinctions between the two facilities. In terms of implications for decision making, a full socio-economic valuation as discussed above may complete the assessment of whether the DUSF versus pond is the preferred choice.

Given that this is the first study examining the socio-economic benefits of the two options, we point to several areas throughout the text where additional research would provide data that would firm up the distinctions between the two.

That said, we can conclude that an underground stormwater storage facility with a public park on top (DUSF):

- ◇ Is preferred by the public compared to a SWM pond, with a 97 percent approval from the surveyed group;
- ◇ Is intrinsically safer and is seen to be safer by the public, with a 99 percent agreement on the issue from the surveyed group. Health and safety are significant socio-economic considerations;
- ◇ Is perceived to result in higher property values by 82 percent of the surveyed group;
- ◇ Contributes to the parkland needs of a Municipality and the needs of diverse cultural groups;
- ◇ Offers the potential of meeting deeper intrinsic economic values of users specific to *spiritual, existence* and *use* values;
- ◇ Is about the same, or can be made to be the same with respect to aesthetic values;
- ◇ Through public engagement programs, offers better opportunities to build social capital within surrounding communities; which is a value that can be monetized;
- ◇ Meets the need for parkland dedication under the Ontario Planning Act.

Criteria, indicators and measures can be developed and usefully applied to evaluate whether a SWM pond or underground stormwater storage facility with a public park on top is the best option from a municipal perspective. Examples of these criteria are presented and tested through a case study.

References

(n.d.). Retrieved from Townfolio: https://jointownfolio.com/

Altus Group Economic Consulting. (2019, February 19). *Study of Parkland Dedication and Cash in Lieu Policies in the GTA.* BILD GTA. Toronto: BILD GTA. Retrieved from BILD GTA: https://bildgta.ca/Assets/Final%20Report%20-%20BILD%20Parkland%20Study%20Feb%2022_Embargoed.pdf

C.Y. Jim, W. Y. (2010). External effects of neighbourhood parks and landscape elements on high-rise residential value. *Land Use Policy, 27*(2), 662-670.

City of Markham. (2018, November). *North Markham Future Urban Area*. Retrieved from The Official Site of the City Markham: https://www.markham.ca/wps/portal/home/about/city-hall/city-projects-initiatives/current/north-markham-future-urban-area/07-north-markham-future-urban-area

City of Toronto. (2013). *Stormwater Pond Safety.* Toronto: City of Toronto. Retrieved from https://www.toronto.ca/legdocs/mmis/2013/pw/bgrd/backgroundfile-56476.pdf

City of Toronto. (2015). *Landscape Design Guidelines for Stormwater Mangement Ponds.* Toronto.

City of Toronto. (2016). *Parks Services: 2016 Performance Measurement & Benchmarking Report.* Toronto: City of Toronto. Retrieved from https://www.toronto.ca/wp-content/uploads/2018/05/906b-Parks2016-PMBR-Final-AODA.pdf

City of Vaughan. (2021, Feb 3). *Reminder: Stormwater ponds are not for play*. Retrieved from City of Vaughan: https://www.vaughan.ca/news/Pages/REMINDER-Stormwater-ponds-are-not-for-play.aspx

Crompton J., &. N. (2020). The Impact on Property Prices of the Proportion of park-like space in the proximate area. *World Leisure Journal*.

District of Saanich, British Columbia. (2012). *Parks, Recreation and Culture Master Plan: Appendix B Performance Measures and Indicators.* Saanich: District of Saanich.

Drake, J. Y. (2016). Performance of an Underground Stormwater Detention Chamber and Comparison with Stormwater Management Ponds. Water,. *MDPI AG. , 8*(5), 8(5), 211. . Retrieved 02 27, 2022, from Retrieved from http://dx.doi.org/10.3390/w8050211

Drowning Prevention Research Centre. (2021). *Ontario Non-Fatal Drowning Report 2021.* Retrieved 03 09, 2022, from https://www.lifesavingsociety.com/media/354152/nonfataldrowningreport2021-20210820.pdf

Drowning Prevention Research Centre Canada. (2020). Drowning Report. Ontario, Canada. Retrieved 03 03, 2022, from https://www.lifesavingsociety.com/media/327287/lifesaving_drowning-2020_on_en_2020-06-13.pdf

Dunn, T. (2022, Feb 17). *CBC News*. Retrieved from 'Countless generations' skated on Markham ponds. But try it now and you're 'trespassing'.: https://www.cbc.ca/news/canada/toronto/countless-generations-skated-on-markham-ponds-but-try-it-now-and-you-re-trespassing-1.6354055

Ellery, P. J. (2019). Strengthening Community Sense of Place through Placemaking. *Urban Planning, 4*(2), 237-248. Retrieved from https://www.cogitatiopress.com/urbanplanning/article/download/2004/2004

Garrett, J. T. (2016). *Thriving Places: A Case Study Toolkit of Urban Parks and Open Spaces in the Greater Golden Horseshoe.* Toronto: Park People. Retrieved from https://parkpeople.ca/custom/uploads/2019/05/Park-People_Thriving-Places.pdf

GEI Consulting Engineers and Scientists. (2021). *Conservation Authority Policy Analysis & Environmental Benefits Related to Underground Stormwater Storage.* Markham: City of Markham.

Harnik, P. a. (2009). *Measuring the Economic Value of a City Park System.* Chicago: The Trust for Public Land.

Inc., I. S. (2016). *TRCA Community Engagement Assessment Report.* Toronto: Toronto and Region Conservation Authority.

Irwin, E. (2002). The Effects of Open Space on Residential Property Values. *Land Economics, 78*, 465-480.

King, M. (2018, 08 18). *'Thousands' of goldfish live in area stormwater ponds and that's a problem*. Retrieved from OrilliaMatters: https://www.orilliamatters.com/local-news/thousands-of-goldfish-live-in-area-stormwater-ponds-and-thats-a-problem-1016779

Lake Simcoe and Region Conservation Authority . (2020). *Assessing-Stormwater-Management-Pond-Performance.* Newmarket: LSRCA. Retrieved from https://www.lsrca.on.ca/Shared%20Documents/reports/Assessing-Stormwater-Management-Pond-Performance.pdf

Lake Simcoe Region Conservation Authority. (2011). *Stormwater Pond Maintenance and Anoxic Conditions Investigation.*

Lake Simcoe Region Conservation Authority. (2022, Feb 18). *Skating on Stormwater Ponds*. Retrieved from Lake Simcoe Region Conservation Authority: https://www.lsrca.on.ca/Pages/Skating-on-Stormwater-Ponds.aspx

Malone Given Parsons, S. C. (2021). *Dual-Use Storm Facilities Policy Paper.* Vaughan: City of Vaughan.

Mississauga. (2022). *Parks Plan.* Mississauga: City of Mississauga. Retrieved from https://www.mississauga.ca/wp-content/uploads/2022/03/10085651/Parks-Plan.pdf

Newmarket Today. (2021, Jan 17). *Local news*. Retrieved from NewmarketToday.ca: https://www.newmarkettoday.ca/local-news/heres-why-its-dangerous-to-skate-on-newmarkets-stormwater-ponds-3266624

O2 + Design Inc. with Gladki Planning Associates, H. C. (2019). *Parkland Strategy: Growing Toronto Parkland.* Toronto: City of Toronto, Parks Forestry and Recreation.

Office of Chief Coroner's and Ontario Forensic Pathology Service. (2022, 02 28). Coroner's Death Investigation Data . Toronto, Ontario, Canada.

OREA. (2012, August 15). *News and Press Release*. Retrieved from Ontario Real Estate Board: https://www.orea.com/News-and-Events/News-and-Press-Releases/Press-Releases/August-15-2012

Park People. (2016). *Thriving Places: A case study toolkit of urban parks and open spaces in the Greater Golden Horseshoe.* Toronto: Park People. Retrieved from https://parkpeople.ca/custom/uploads/2019/05/Park-People_Thriving-Places.pdf

Piggot, M. L. (2011, May 9). *Feature: A promising start to plans for Churchill Park* . Retrieved from Raise the Hammer: https://www.raisethehammer.org/article/1371/a_promising_start_to_plans_for_churchill_park

Reed, C. (2019, 3 7). *Designing Social Spaces that Foster Vitality, Equity, and Community*. Retrieved from The Stoss Journal: www.stoss.net/journal/2019/3/7/flexible-open-space-plazas

SCS Consulting Group. (2021). *Underground Storage vs Traditional SWM Pond.* Markham: City of Markham.

Sharma S. Blagrave K. Watson SR, O. C. (2020). Increased winter drownings in ice-covered regions with marmer winters. *PLoS ONE, 15*(11). Retrieved from https://doi.org/10.1371/journal.pone.0241222

Smith, C. D. (2006). *Waterfowl management in stormwater.* University of Waterloo, Environment and Resource Studies. Waterloo: University of Waterloo.

Statistics Canada. (2021, 02 15). *Measuring Proximaty to Services and Amenities: An experimental set of indicators for neighbourhoods and localities.* Retrieved from StatsCan: https://www150.statcan.gc.ca/n1/en/pub/18-001-x/18-001-x2020001-eng.pdf?st=v7Yf4gVf

Stevenson, M. H. (1997). Precious Values: Integrating Diverse Forest Values into Forest Management Policy and Action (Ontario). *Journal of Sustainable Forestry, 4*(3-4), 171-183.

Toronto Foundation and Environics Institute. (2021). *Toronto Social Capital Study.* Toronto: Toronto Vital Signs. Retrieved 04 12, 2022, from https://torontofoundation.ca/wp-content/uploads/2021/05/TF-SocialCapitalStudy-Final-Clean-min.pdf

University of Toronto Scarborough news. (2021). Retrieved from https://utsc.utoronto.ca/news-events/breaking-research/ontarios-growing-goldfish-problem

Vancouver Board of Parks and Recreation. (2018). *Vancover's Parks and Recreation: Inventory and Analysis, Chapter 2: Parks.* Vancouver: Vancouver Board of Parks and Recreation. Retrieved from https://vancouver.ca/images/web/vanplay-inventory-and-analysis-full-report.pdf

Zack Taylor, J. V. (2008). *Shaping the Toronto Region, Past, Present, and Future.* Toronto: Neptis Studies on the Toronto Metropolitan Region.

Appendix A Methodology

Open spaces include naturalized landscapes, forested areas, agriculture, open space (meadow) and parkland. Often open spaces are referenced without differentiation. To identify and define the value of stormwater ponds and parks as public amenities, HSAL used a combination of desktop methods, site visits, and analysis.

Desktop Methodology

- Literature and media review (existing studies and confirmation of findings)
- Statistically significant opinion poll (resident perception of open spaces)
- Socio-economic Analysis (findings and applicability of criteria)
- Criteria development for site evaluation (adaptation of municipal park planning)
- Case study (application and testing of criteria)
- Summary (next steps for applying a socio-economic framework)

Statistically significant opinion poll (Appendix B and Appendix C)

- Hypothesis: That diverse residents of the GTHA prefer DUSF to open ponds as a stormwater management solution in a changing urban setting
- Survey design: In collaboration with the experts at DECAST, descriptions and questions were developed to identify GTHA as the representative catchment area, capturing demographics such as ethnicity and age, and registering participants as homeowners or renters.
- Method of Field Implementation: Statistically significant poll was conducted in the Greater Toronto and Hamilton Area using Oracle Poll to measure the perceived value of parkland/open space by residents.

Socio-Economic Assessment Framework

For this study, HSAL developed a framework for locating DUSFs based on combination of findings from the socio-economic analysis and processes currently used in municipal parks master plans and green space strategies.

Literature found that value of public spaces goes beyond perception to include quantifiable cultural expectations and needs. These were combined with current park planning methods to develop a framework including criteria, measures, and indicators. Testing included development of a site inventory for field use and testing the framework on one case study. Based on an initial assessment of two sites, one was chosen based on the anticipated best value for DECAST and the municipality. This socio-economic assessment framework may be used to evaluate the suitability of DUSFs for potential future locations.

Steps in producing the case study:

- Site Inventory of two sites: intensification infill and greenfield
- Initial analysis to identify sites for testing socio-economic framework, including site context
- Data gathering from secondary plans, site inventory, demographics, etc.
- Criteria and indicators review and comparison of facility options
- Summary of the assessment

The case study presents an example of how to determine and discover the potential value offered by stormwater management facilities. However, specific municipal planning and engineering consideration would be required on a site-by-site basis.

Appendix B Survey Questions

SURVEY QUESTIONS

PREAMBLE

When there is precipitation such as rain and snow, the water is typically stored and cleaned before it is released to streams or other receiving water courses.

There are two ways to clean the water: the first involves directing the water to open storm sewer water ponds. The second way involves directing the storm sewer water to underground storage. Both have advantages and disadvantages.

Open storm sewer water ponds can provide an attractive water feature; however, the open water can be a safety risk and may attract birds and mosquitoes. When they are dry, ponds can be a gathering spot for litter and lead to unpleasant smells. Open storm sewer water ponds can only be used as a pond and *are not accessible for recreation despite* occupying valuable land.

Underground storm sewer water storage can store stormwater and the above ground space can be used for other purposes, such as public parks, sports fields or playgrounds. Water stored underground can be used for landscape irrigation, fire protection, dust suppression, and *ornamental ponds or fountains*. Underground storm sewer water storage does not have the same bird and insect issues, or litter and safety risks as open stormwater ponds.

1. Which would you prefer to have in your community? [**check one**]
   a. Open water storm sewer pond _____ (Q1a)
   b. Underground storm sewer water storage with public park on top _____ (Q1b)

2. Which would be safer for your community? **[check one]**
   a. Open water storm sewer pond _____ (Q1a)
   b. Underground storm sewer water storage with public park on top _____ (Q1b)

3. Both open water storm sewer ponds and underground storm sewer water storage with a park on top may have positive or negative effects to property values. **In your opinion, which water storage option would have positive or negative effects on neighbourhood property values?**

   A. Let me begin with an open water storm sewer pond. Will this have a positive **OR** negative effect on property values: [**check one, get a response to Q2a OR Q2b**]

   A1. Positive _____(Q2a) AND

By what percent? _____%

or

A2. Negative _____(Q2b) AND

By what percent? _____%

A3. Don't know/ not sure _____(Q2c)

B. And now, how about underground storm sewer water storage with a public park on top. Will this have a positive **OR** negative effect on property values: [**check one, try to get a response to Q2a OR Q2b**]

B1. Positive _____(Q2a) AND

By what percent? _____%

or

B2. Negative _____(Q2b) AND

By what percent? _____%

B3. Don't know/ not sure _____(Q2c)

4. Age? **[check one]**
   - A. 18 - 35 _____(Q4a)
   - B. 36 - 55 _____(Q4b)
   - C. 56 - 70 _____(Q4c)
   - D. 70+ _____(Q4d)
   - E. No answer _____(Q4e)

5. Gender? **[check one**]
   - A. Male _____(Q5a)
   - B. Female _____(Q5b)
   - C. Other _____(Q5c)
   - D. No answer _____(Q5d)

6. People come from many different ethnic, cultural, and racial backgrounds. In addition to being a Canadian, what is your self-identified race or ethnicity?

   _____

7. Do you or does your family own your home or rent? [**check one**]
   A. Own ____(Q9a)
   B. Rent ____(Q9b)
   C. Neither ____(Q9c)

The survey is now complete. Thank you for completing the survey.

Appendix C Oraclepoll Research Limited Report

HARDY STEVENSON AND ASSOCIATES

GTHA Omnibus *Survey Report*

oraclepoll RESEARCH

March 2022

Table of Contents

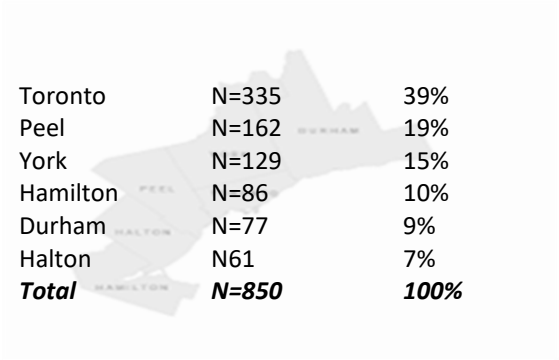
Methodology & Logistics

Overview

The following represents the results of a March 2022 omnibus telephone survey of N=850 residents, 18 years of age or older, from the Greater Toronto and Hamilton area (GTHA) conducted by Oraclepoll Research Ltd. The findings contained in this report are from the questions subscribed to by Hardy Stevenson and Associates Limited. The indicators covered issues related to open storm sewer water ponds and underground storm sewer water storage.

Study Sample & Error Rates

A total of N=850 interviews were completed among Ontarians. Respondents were screened to ensure that they were residents of Ontario, 18 years of age or older. Quotas were set to ensure that the sample was reflective of the demographic and geographic composition of the population. Adjacent is a breakdown of the total sample by area or region. The margin of error for the total N=850 sample is ± 3.4%, $\frac{19}{20}$ times.



Toronto	N=335	39%
Peel	N=162	19%
York	N=129	15%
Hamilton	N=86	10%
Durham	N=77	9%
Halton	N61	7%
Total	***N=850***	***100%***

Survey Method

All surveys were conducted by telephone using live operators at the Oraclepoll call center facility using computer-assisted techniques of telephone interviewing (CATI) and random number selection (RDD). The dual sample frame random database was inclusive of cellular and landline telephone numbers. Twenty percent of interviews were monitored and the management of Oraclepoll Research Limited supervised 100%.

Logistics

Interviews were completed between the days of March 16th to March 23rd, 2022.

Underground & Open Water – Preference

All N=850 respondents were first read the following descriptive statement and were then asked if they preferred to have an underground stormwater storage or an open water storm sewer pond in their community.

"When there is precipitation such as rain and snow, the water is typically stored and cleaned before it is released to streams or other receiving water courses. There are two ways to clean the water: the first involves directing the water to open storm sewer water ponds. The second way involves directing the storm sewer water to underground storage. Both have advantages and disadvantages."

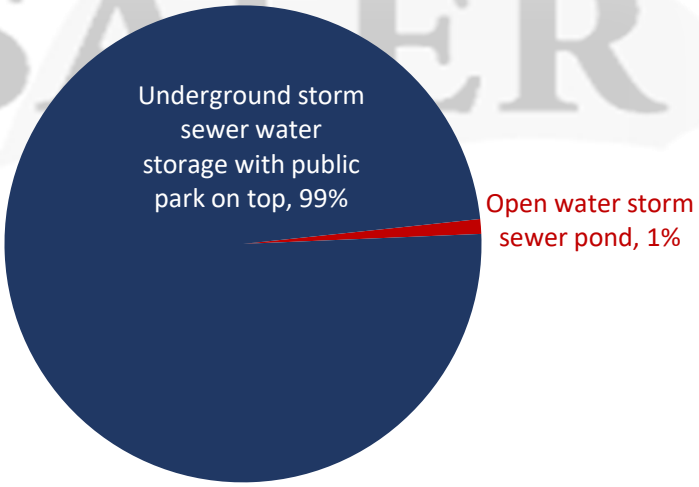
"Open storm sewer water ponds can provide an attractive water feature; however, the open water can be a safety risk and may attract birds and mosquitoes. When they are dry, ponds can be a gathering spot for litter and lead to unpleasant smells. Open storm sewer water ponds can only be used as a pond and are not accessible for recreation despite occupying valuable land. Underground storm sewer water storage can store stormwater and the above ground space can be used for other purposes, such as public parks, sports fields or playgrounds. Water stored underground can be used for landscape irrigation, fire protection, dust suppression, and ornamental-ponds or fountains. Underground storm sewer water storage does not have the same bird and insect issues, or litter and safety risks as open stormwater ponds."

Q1. Which would you prefer to have in your community?

Underground & Open Water – Safer

Next, all N=850 respondents were asked which option would be safer for their community.

Q2. Which would be safer for your community?

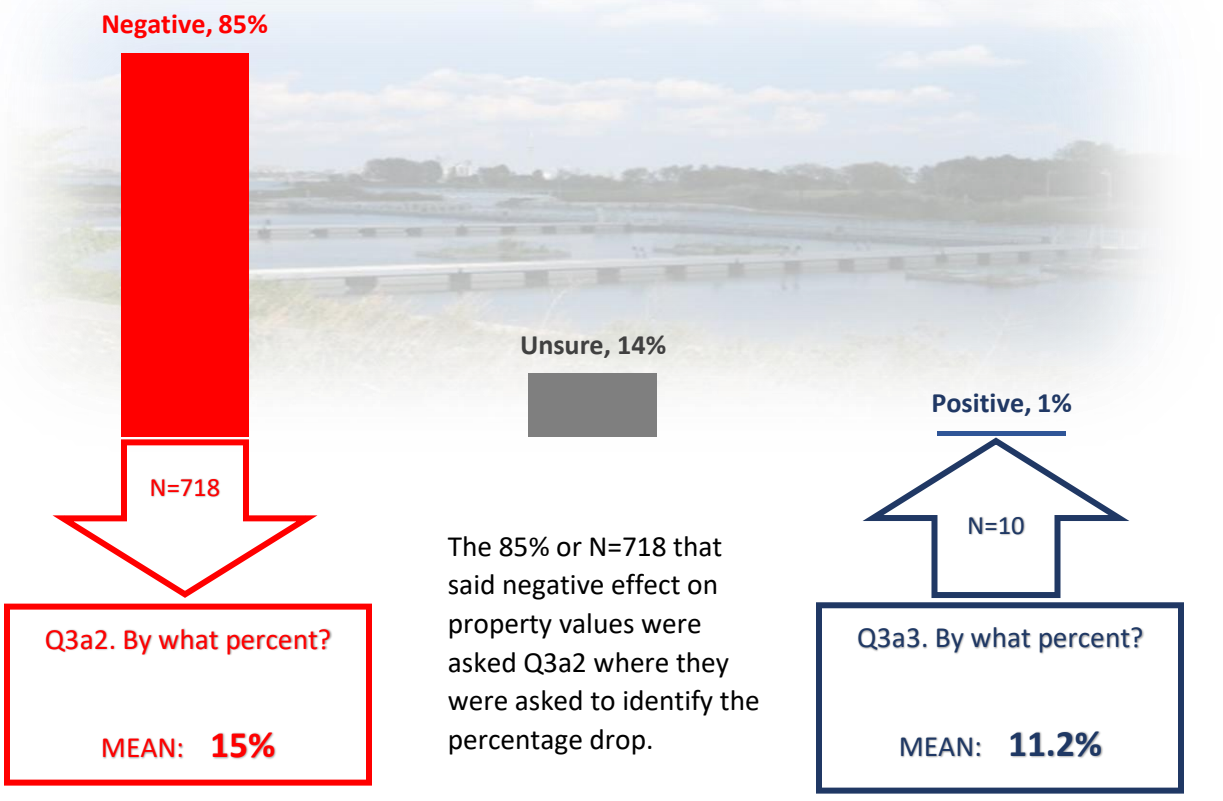


Open Water Storm Sewer Pond – Effect on Property Values

All respondents (N=850) were first asked if open water storm sewer ponds would have a positive or negative impact on property values. Those that responded positive, and negative were then asked to specify the percentage amount values would either increase or decrease.

"Both open water storm sewer ponds and underground storm sewer water storage with a park on top may have positive or negative effects to property values. In your opinion, which water storage option would have positive or negative effects on neighbourhood property values?"

Q3a1. Let me begin with an open water storm sewer pond. Will this have a positive OR negative effect on property values:



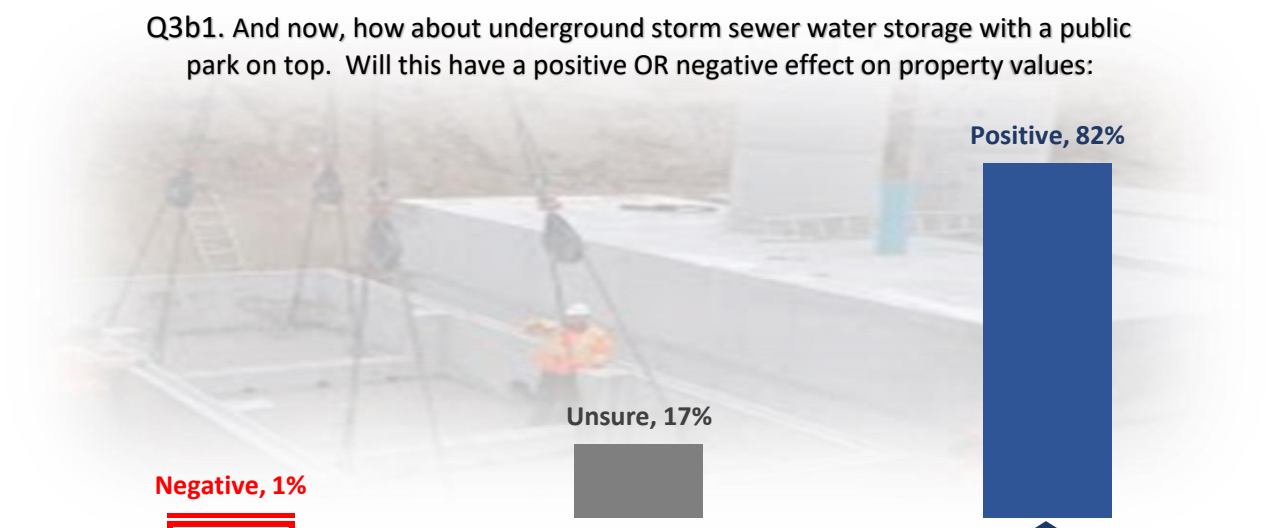
The 85% or N=718 that said negative effect on property values were asked Q3a2 where they were asked to identify the percentage drop.

Those what responded positive (1%, N=10) proceeded to Q3a3 where they were asked to name the percentage increase.

Underground Storm Sewer Water Storage – Effect on Property Values

The N=850 were then asked if underground storm sewer water storage would have a positive or negative impact on property values. Those that responded positive, and negative were then asked to specify the percentage amount values would either increase or decrease.

Q3b1. And now, how about underground storm sewer water storage with a public park on top. Will this have a positive OR negative effect on property values:



The 1% or N=7 that said negative effect on property values were asked Q3b2 where they were asked to identify the percentage drop.

Those what responded positive (82%, N=696) proceeded to Q3b3 where they were asked to name the percentage increase.

Demographics

Q4. Into which of the following age categories do you fall into?

	N	%
18-35	248	29%
36-55	208	24%
56-70	241	28%
70+	109	13%
Refused	44	5%
Total	**850**	**100%**

Q5. Gender

	N	%
Male	413	49%
Female	437	51%
Total	**850**	**100%**

Q6. People come from many different ethnic, cultural, and racial backgrounds. In addition to being a Canadian, what is your self-identified race or ethnicity?

	N	%
White / Caucasian / European origin	493	58%
Black / African American or Canadian / African	61	7%
Hispanic / Latinx	24	3%
South / SE Asian (India, Pakistan, Indonesia, Philippines)	107	13%
East Asian (China, Japan, Korea, Vietnam)	75	9%
Middle Eastern / North African	27	3%
Indigenous / Metis	9	1%
Mixed	20	2%
Refused	34	4%
Total	**850**	**100%**

Q7. Do you or does your family own your home or rent?

	N	%
Own	611	72%
Rent	239	28%
Total	**850**	**100%**

Appendix D Newsletters

VAUGHA NEWS

Stormwater ponds are not for recreational use

Explore other outdoor activities available in Vaughan

Warmer weather may have you excited to spend time outdoors in Vaughan, but please stay clear of stormwater ponds. The City of Vaughan is reminding everyone that swimming, boating, fishing and other play are not safe in and around stormwater ponds due to the constant flow of water in and out of the pond, multiple pollutants and unpredictable water levels. The bottom of these ponds is very soft, and anyone who enters, including pets, may quickly get stuck.

If you're looking for a safe place to swim, visit vaughan.ca/**swim** for information on recreational swimming or swim classes at community centres. You can also visit vaughan.ca/**PlayVaughanLocal** for a guide to the wide variety of fun outdoor activities available in the city.

The following activities are also not permitted on or near stormwater ponds:

- planting gardens or cutting grass on pond property
- storing yard materials on pond property
- disposing of grass clippings, yard waste or garbage on pond property or into the pond
- disturbing plants and vegetation around the pond
- disposing of pet fish in the pond
- disposing of swimming pool water and chemicals on pond property or in the pond

It is recommended that gates to access pond property from fenced yards not be installed without first reviewing your land survey and seeking legal advice on property rights issues.

Individuals found dumping their household garbage at stormwater ponds are subject to a maximum fine of $50,000 per offence. If you witness illegal dumping or littering, report it to Access Vaughan at 905-832-2281 or accessvaughan@vaughan.ca. You may also report it through Service Vaughan.

The City is committed to protecting the environment and fostering a sustainable future while delivering Service Excellence, as outlined in the Council-approved 2018-2022 Term of Council Service Excellence Strategic Plan.

To learn more about the City's stormwater ponds, watch this video or visit vaughan.ca/**stormwater**.

For updates and news as they happen, subscribe to Vaughan News and follow the official corporate channels on Twitter, Facebook, Instagram and LinkedIn.

VAUGHA NEWS

Do not play in or around stormwater ponds

They are not made for swimming, boating and fishing

Although the City of Vaughan's many stormwater ponds may look inviting – residents are reminded to keep away from them. These facilities are not made for play or recreational use of any kind!

Stormwater ponds are human-made bodies of water created to gather and retain rainfall and surface water runoff temporarily before slowly releasing it back into the environment.

In anticipation of milder spring weather, residents are reminded that swimming, boating, fishing and other play are not safe in and around stormwater ponds due to the constant flow of water in and out of the pond, multiple pollutants and unpredictable water levels. The bottom of these ponds is very soft, and anyone who enters, including pets, may quickly get stuck.

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Appendix E Site Inventory

SITE INVENTORY

DATE: _____
TIME: _____

ADDRESS/LOCATION: _____

Designation: _____Area:_____

Existing Use [Circle one]: Commercial Industrial Agricultural Forest Pond (Wet / Dry) Other

---

☐ 1. Access [Circle Applicable]

- Street Parking
- No Parking
- Frequent Transit
- Infrequent Transit
- Sidewalk
- No sidewalk
- Other

Notes:
_____
_____

☐ 2. Connections [Circle Applicable]

- Trail to Park
- Forest
- Bike Lane
- Bike Trail
- Arterial Road
- Side Street

Notes:
_____
_____

☐ 3. Adjacent Area

- > 20 years old
- New Development
- < 20 years old
- Vacant Land
- Watershed

Describe Views:
_____
_____
_____

☐ 4. Residential within 500 m [Circle Applicable]

- Detached
- Semi-detached
- Low rise
- High rise
- Townhouses
- Other i.e., LTC

Notes:
_____
_____

☐ 5. Existing Users [Circle Applicable]

- Individuals
- Couples
- Families
- Groups
- Students
- Workers

Notes:
_____
_____

☐ 9. Community Use [Circle Applicable]

- Littered
- Vandalized
- Desire Paths
- Undisturbed
- Encroached
- Planted
- Other

Notes:
_____
_____