Executive Summary

Impervious surfaces are an undeniable component of development: asphalt, roofs and other materials cover the earth's surface, preventing the natural infiltration of water. As the urban fabric extends, cities must manage massive quantities of displaced stormwater. Conventional stormwater management (SWM) and high levels of imperviousness lead to degraded streams and watersheds. New approaches to SWM include addressing it at multiple scales, requiring change in regulations and distance from conventional approaches. This study sets out to answer: **What are the primary determinants of residential imperviousness? What planning tools or exercises best implement its reduction for improved watershed health?**

This study details impervious surface coverage in three neighbourhood types in the City of Peterborough, Ontario, using a geospatial analysis in a GIS. This alongside review of literature and pertinent policy will form meaningful and progressive recommendations for the City of Peterborough to reduce impervious surface coverage at the lot level to mitigate impacts on water resources.

This report is structured into four chapters, each of which works towards answering the questions posed above. The first chapter sets the tone for the whole report, outlining the research topic, location and process. It also provides an overview of the topic of impervious surfaces, focusing upon its relationship to watershed health. Theories behind traditional stormwater management (SWM) and conventional development approaches are overviewed, alongside is an introduction to the ideals behind alternatives to traditional SWM.

Chapter two overviews the method used to analyze impervious surfaces in the City of Peterborough. This chapter follows the direction of Stone's (2004) research for Madison Wisconsin and Pisani's (2006) SURP masters report for Kingston, Ontario.

Chapter 3 provides the analysis component of this report. It outlines the quantitative results from a geospatial analysis using GIS and the presiding policies that may be useful in implementing change for future developments or mitigating the impacts of existing ones. The quantitative analysis conducted in this report produced similar results to those found by Stone (2004) and Pisani (2006). This was interesting, particularly in the case of Stone's (2004) research, as the sample size and duration of study were quite different. Accounting for the sources of impervious surface coverage on residential properties explored both descriptive and explanatory statistics. Roof area comprised the majority of the impervious surface coverage

across all three housing types. The results from the regression analysis indicate there is some relationship between total imperviousness and parcel design attributes. The adjusted R-Square value of 74.8% means that the model can explain 74.8% of the variation in total impervious cover:

Total Imperviousness = 11.2 + 7.70 Frontage + 5.18 Setback + 0.233 Lot Area

Upon interpretation of the model, for each one-meter increase in frontage, imperviousness can be expected to increase by 7.7 m^2. Front-yard setback follows frontage, as one-meter increase in setback translated to a 5.18 m^2 increase in impervious surface coverage. A one square meter increase in lot area translated to just under a quarter of a square-meter increase in total imperviousness. This result is similar to Stone's study where lot size had the least weight on total impervious coverage. This model, outlining frontage and setback as key determinants of total site imperviousness form a solid foundation upon which to modify existing policies and regulations to reduce site imperviousness.

Chapter 4 outlines a set of recommendations for the City of Peterborough that may be applicable to other Cities, outlining changes that can be adapted to ensure minimal impact on water resources. These recommendations are presented in light of implemented best practices elsewhere. The following is a summary of the primary recommendations:

1. **Reduce Imperviousness land coverage through zoning;**
2. **Include Imperviousness cover in the Official Plan;**
3. **Managing stormwater in existing developments;**
4. **Not all pervious surfaces are created equal, plan for effective pervious coverage; and**
5. **Opportunities for further research beyond the lot level: Utilize a multiple-scale approach to SWM.**

This study and analysis of a small sample of residential properties in the City of Peterborough confirms that land-use-regulated elements of residential lot design, namely frontage, setback and lot coverage weigh heavily on the amount of total imperviousness a property may contain. This presents opportunity for lot level changes via a combination of land use and landscaping technology based approaches to achieve better site infiltration and reduce the cumulative impacts of imperviousness. This body of knowledge and understanding regarding design attributes affecting site imperviousness provide opportunity for change and improvement at the lot-level.