Residential Stormwater Management Pilot Project
Downspout Redirection Project

2017

Lake Simcoe Region
conservation authority

LSRCA Urban Restoration Department
Quality Control Information

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Contents

APPENDICES

LIST OF TABLES

LIST OF FIGURES

1.0 Executive Summary

This project investigates the feasibility of running a cost-effective residential stormwater management program that focusses on redirecting downspouts away from impervious surfaces towards areas where infiltration can occur. Surveys of residential areas show that a significant proportion of downspouts are deliberately directed onto driveways and walkways resulting in clean roof run-off water flowing across dirty paved surfaces directly to stormwater drains. Redirecting downspouts away from paved surfaces to nearby pervious areas has the potential to be a simple, low cost solution to reducing stormwater volume in a residential setting.

Looking at one sample catchment in Barrie, this project considered two different approaches to entice homeowners to redirect their downspouts. The first approach investigated the effectiveness of using outreach methods to elicit voluntary action by homeowners to redirect downspout outlets towards a pervious area. This endeavour could be especially effective in areas with sandy soils and good natural infiltration rates.

The second approach, and the main focus of this report, involved offering landowners a significant incentive (i.e. offering to do the work for them at no cost) to redirect. This approach, called the Downspout Redirection (DR) Project is compared to previous efforts towards volume reduction and stormwater education through LSRCA's Landowner Environmental Assistance Program's (LEAP) Rain Garden Grant category and the Municipal LID demonstration projects in order to determine the most cost effective approach for stormwater volume reduction.

There were 2 types of DR projects undertaken by a contractor through this incentive; re-directing roof runoff overland to lawn areas via a flexible downspout extender pipe; and re-routing roof runoff under walkways and driveways to a sub-surface infiltration trench as seen below in Figure 1.

Figure 1: Two Types of Downspout Redirection Projects

The overland extensions were a very low-cost initiative. The contractor installed six downspout extenders at $100 each. This resulted in 54.57m3/yr. total stormwater volume reduction which

translated to a cost of $11/m^3. Although they are very inexpensive, the overland extensions have limited application since they can only be added to downspouts which do not outlet onto a walkway. Accordingly, homeowners are less motivated to have an extender installed than they are to have the water re-routed under a main walkway where it is more likely to cause them a safety issue. As well, because the extender is flexible, it could be re-directed once more back onto the driveway at a subsequent date should the homeowner choose to do so.

The infiltration trenches were more expensive and labour intensive than the overland solution, however they were still significantly less expensive than rain gardens and the municipal LID demonstration retrofit projects. The 24 sub-surface infiltration trenches installed had a volume reduction of 279.6m^3/yr. The average cost/m^3 to extend the downspouts under the driveway/walkways and build the infiltration trenches was $80/m^3. The cost of administering this program was estimated to be $18/m^3 which can be applied to the cost of the infiltration trenches for a total of $98/m^3 of stormwater volume reduction.

By comparison, the LSRCA Rain Garden Grant averaged an estimated cost of approximately $166/m^3 of stormwater volume reduction and the Municipal LID RainScaping Demonstration Projects supported an overall estimate of approximately $138/m^3 of stormwater volume reduction. For more details, see **Table 11**. It must be noted that cost muncipal projects will likely decrease significantly over time as they become more routine and additional costs associated with demonstration projects deminish.

As discussed in this report, the cost of $98/m^3 for the infiltration trenches is a very conservative estimate and it is anticipated that this amount could be decreased significantly with program modifications. In **Table 10** an administration cost reduction scenario is provided that would reduce this cost from $18 to $12/m^3. In Section 6.2 there is discussion about Contractor cost savings from aggregating projects in a localized area, gaining greater bulk rates efficiencies and increasing the competitiveness of the bidding process by working with a multi-year schedule and opening up the work to a greater diversity of contractors.

As well, the assumed volume of rainwater infiltrated could be increased (resulting in a cost decrease/m^3 of stormwater volume reduction) with additional monitoring techniques. The numbers used in this report only accounted for the dry storage area of the infiltration trenches. It did not account for the infiltration occurring in the native base material below the trench, which is generally understood to be sandy. Observational evidence during a large storm event indicated that no water flowed out of the overflow pipe. However, because there were no mechanisms in place to verify this, the natural infiltration rate was not added to the volume reduction of $80m^3 for the infiltration trenches.

Finally, the $98/m^3 reflected the costs of the infiltration trenches only and not the very inexpensive overland extenders. A program that is built to install more overland extenders (at $11/m^3) would have a very significant decrease on the bottom line.

Building this DR Program to replace or compliment the rain garden grants could help to overcome a couple of noted criticisms of the Rain Garden program. The first criticism is the perception that the grant pays for people's personal landscaping project. The DR projects do not change the look of the yard; if it was lawn before construction, it would be put back to lawn post-construction. The incentive to sign up for the program would be to correct a safety issue or improve household drainage, not to beautify a yard.

The second concern relates to the relatively low uptake of the grant program. Rain gardens have a somewhat limited appeal based on homeowner's aesthetic preference, their comfort/interest with gardening, and maintenance concerns. It is anticipated that subsequent iterations of this program would follow the recommended approach discussed in this report of concentrating efforts in a highly targeted area (street level) and carrying these projects out in a sequenced manner (see Section 8.3,**Table 12**). Outreach efforts to queue projects annually would be direct and tenacious and would involve approaching both homeowners and management of multi-unit residential complexes in order to offer them a *limited-time offer* improvement to their properties. This approach would result in a significantly higher amount of projects occurring annually and would allow the LSRCA to choose target areas based on ecological outcomes, instead of the "cast-the-net-wide and see who signs up" approach employed through the rain garden grant. Furthermore, a targeted prioritized neighbourhood approach applied to urban areas within the watershed which currently drain to conventional storm sewer systems would allow for greater results-based performance indicators and known stormwater volume reduction targets to be set and achieved.

This report describes results from the works which began in 2015, but which were ramped up significantly in 2017 with financial support provided by the MOECC. Further, through the lessons learned from these works, recommendations are offered towards building this program in subsequent years to allow it to meet its full potential.

Recommended activities to be implemented in subsequent years:

1. Continue the highly targeted prioritized neighbourhood approach;
2. Expand and modify the program into other communities in the watershed;
3. Modify timelines (as per Section 7.3) to gain cost efficiencies from contractors;
4. Hire staff to complete the door-to-door outreach who will install free downspout extenders on properties with willing homeowners;
5. Consider offering the work as a grant;
6. Continue outreach education efforts in order to continue the public dialogue about residential stormwater and household salt management.

Finally, it should be noted that this pilot project produced several valuable lessons-learned with regards to hiring a contractor to redirect downspouts away from paved walkways and driveways. First, landscape contractors are seasonally very busy which should be considered in building multi-year projects. And second, this aggregated approach to completing several projects in the same geographic

area would benefit from having an overarching organization such as the LSRCA to administer. For example, if an individual homeowner had attempted to get a quote for this work, they would have had a very difficult time finding anyone who would be willing to provide a quote at all. Accordingly, if they were successful in getting a quote, it would have been for significantly more money than the estimated $1,000/project. Many contractors are not interested in small projects like a single redirection. There are significant costs and efforts to transport the materials, staff and equipment to the site, therefore the aggregation of projects significantly decreases the overall cost of each project.

1.1 Goals and Objectives

The primary goal for this project was to use the data collected through the works completed during 2015 - 2017 to make sound, tested recommendations towards a future cost-effective, targeted residential grant program. A program that engages Lake Simcoe's residential sector is a vital part of the LSRCA's collective effort to reduce the rates of degradation to waterways caused by inadequate stormwater controls. There were several objectives to support this goal. These included:

1. Investigate the willingness of homeowners to make a relatively simple switch (where applicable) to their downspout configuration;
2. Investigate the effectiveness of different outreach techniques to garner either voluntary action (changing their own downspout configuration) or willingness to sign up for a redirection project;
3. Evaluate the cost-effectiveness of re-direction projects in comparison to other stormwater volume reduction efforts (Rain Garden Grant, Municipal LID Demonstration projects). This objective will be evaluated by determining a stormwater volume reduction/m^3 value in comparison to the cost of running the program (Refer to Section 6.4).

2.0 Introduction

Ultimately, the goal of creating a residential stormwater retrofit program will be to reduce the amount of stormwater from private residences entering into the waterways of Lake Simcoe. This pilot project is designed to encourage homeowners to undertake modifications to their downspouts to allow roof water to soak into the ground in order to reduce the amount of rain water flowing into municipal systems (storm and sanitary sewers) from private households. Outside of regulation, this would ideally be achieved through a combination of incentive based programs and voluntary action.

Targeting the residential sector is important for two key reasons. First, The Lake Simcoe watershed is one of the fastest growing regions in Canada. Based on the Provincial *Places to Grow* Program and municipal official plans, it is projected that the urban area within the watershed will increase by approximately 50% by the year 2041. Increases to impervious areas from urbanization result in increased flooding potential from stormwater if not properly controlled. Urban stormwater is also considered to be one of the largest contributors of Phosphorus and other harmful pollutants to enter Lake Simcoe. Further, the Lake Simcoe Protection Plan Policy 8.8-SA directs the LSRCA (and others) to

promote pilot projects focused on innovation and technology advancement as a means of supporting stewardship activities.

Secondly, homeowners are also voters and taxpayers. If city managers are looking for resources to grow their stormwater management programs, then garnering public support will be essential. Currently, this may prove difficult since there is a lack of understanding and engagement by the general public about the connection between their household's stormwater and a healthy local environment. Moreover, unless a homeowner has personally experienced flooding issues or house foundation problems caused by improper drainage, it is unlikely that they have given any thought to stormwater on their property. As a result, programs need to be developed that focus heavily on proven educational and outreach efforts. In essence, it is difficult to market a *solution* to a problem that people have not recognized as being a problem.

Surveys of residential areas in the Lake Simcoe watershed show that a large proportion of downspouts are directed onto driveways. This results in roof run-off flowing directly to street stormwater drains. In many older urban areas, this uncontrolled stormwater is piped directly to the lake, or even more damaging, directly to a river or creek first. In suitable areas, redirecting downspouts from driveways to nearby pervious areas and infiltration trenches has the potential to be a simple, low cost solution to reducing stormwater without the need for more expensive constructed Low Impact Development (LID) retrofits.

The purpose of this pilot project was to develop a cost effective approach to a residential stormwater management program. As such, the results of this project are compared to two preexisting LSRCA volume reduction initiatives: Landowner Environmental Assistance Program (LEAP) Program- Rain Garden Grant category and the Municipal LID Demonstration Projects. These initiatives are summarized below.

2.1 LEAP Program - Rain Garden Grant

Over the past four years, the LSRCA has been offering residents a grant through the Landowner Environmental Assistance Program (LEAP) designed to incent urban landowners to install rain gardens on their properties. In addition to stormwater volume reduction, rain gardens have the benefit of providing natural habitat in urban areas where it is often scarce. Rain gardens, with their emphasis on native plants will also help water quality and contribute to Phosphorus-reduction goals in addition to the gains made by promoting infiltration and diverting rooftop stormwater away from the municipal storm system.

Conversely, as a way to reduce residential stormwater volume on a scale of significance, rain gardens may not be the most effective LID to meet this goal. Rain gardens tend to be fairly expensive to install and their significance or application is not well understood by the vast majority of homeowners. Accordingly, only a small segment of the watershed's population has installed a residential rain garden

on their property. Between 2012 and 2016 when the LSRCA ran its Rain Garden Grant Program with a significant amount of promotional efforts applied, only 25 Rain Gardens were constructed throughout the watershed.

The cost for a typical rain garden appears to be between $3,500 and $10,000, depending on size and design features. If comparable quantity control could be reached in areas with good natural infiltration rates by simply providing information to landowners that results in them redirecting their downspouts to their lawn, or by installing overland extenders and infiltration trenches at a lower cost, then this Downspout Redirection Program would be deemed cost effective in comparison to rain gardens. This comparative analysis is discussed further in this report in Section 6.4.

There have been concerns raised about the effectiveness of the Rain Garden grant. The first concern is the perception that it pays for a resident's landscaping project. However, it should be noted that the revised program (in 2016) ensured that the grants were used only for the functional, non-aesthetic components of the garden like bio-media, construction costs and native plants. The native plants have distinct ecological benefits by providing much needed habitat for native flora and fauna, along with promoting better infiltration through deep root penetration of tight base materials. However, these benefits may not justify their costs when considering what lot-level control (i.e., downspout redirect as oppose to rain garden, etc.) will provide the best stormwater volume reduction approach.

In contrast to the favourable attitude of the development community, municipalities and regulatory agencies towards improving stormwater volume reduction, homeowners are not motivated by this target. As such, rain gardens have been marketed to a segment of the population who wish to have an aesthetically pleasing garden. The fact that it is "Lake Simcoe Friendly" and good for the local environment has been another motivator for some homeowners to consider installing a rain garden.

Accordingly, this speaks to the second identified concern, mentioned above, regarding the relatively low uptake of the grant program. Predominantly, this low uptake stems back to two key reasons; that only a small amount of people know about them, and an even smaller amount of people have found the right motivation (cost, time, energy, appeal, etc.) to consider installing one. Early efforts to promote the grant focused on the notion that these gardens needed to be aesthetically pleasing in hopes of drawing attention to them. As such, a significant amount of effort was put into promotion across the watershed in hopes of attracting those "early adopters". The result was that uptake was spread across several communities. This was effective in providing a good demonstrative sample distribution of rain gardens across various geographic locations; however, as a volume reduction program, the efforts were just a drop in the bucket.

2.2 Municipal LID Demonstration Projects

In support of evaluating the benefits and limitations of this Downspout Redirection Project, the comparison to the Low Impact Development municipal demonstration projects within the East Holland River Subwatershed is presented below.

A direct comparison can be made for the cost of stormwater volume reduction. Similarly, projected LSRCA staff administration costs to continue to support both programs to meet an average stormwater volume reduction per average project are provided. Qualitative comparisons indicating potential advantages or limitations for each program are also provided for the following categories: phosphorus reduction, influence on behavioural change and plantings are also presented.

A comparison of four large multi-faceted LID demonstration projects implemented in the East Holland River Subwatershed and their associated costs and the amount of stormwater volume treated is presented in Table 1 below.

The total project cost and estimated stormwater volume reduction values presented, support an overall estimate of approximately $134/m^3 of stormwater volume reduction provided through this grant category.

Table 1: Summary of Municipal LID Demonstration Projects – East Holland River Subwatershed

Project	LID Portion of Project Cost ($)	Approx. Total Project Cost	Drainage Area (m^2)	Storage Capacity (m^3)	Estimated Stormwater Volume Reduction (m^3/yr) [2]
Forest Glen Road	$382,000	$1,000,000	11,600	90	2,107 [3]
LSRCA Head Office	$450,000	$480,000	2,200	42.5	717
Aurora Community Centre	$380,700	$1,900,000	16,400	111	7,080
Ray Twinney	$444,000	$444,000	3,542	500	2,459
Average	**$414,175**	**$1,076,000**	**8,436**	**185.9**	**3,091**
Total	**$1,656,700**	**$4,304,000**	**33,742**	**743.5**	**12,363**

Notes:

1. Annual Stormwater Volume Reduction estimate based on information presented in relevant SWM Design reports , along with average annual precipitation for the watershed from the Towns of Aurora, King, Newmarket, East Gwillimbury, Georgina, Whitchurch-Stouffville, and Uxbridge (approximately 857 mm) multiplied by 0.9 (representing the 90th percentile of the average annual precipitation rounded up to be approximately 25 mm).

2. Some adaptation for each estimate is needed, based on the storage volume available for the LID feature(s). For the example below, since the bioswale/filters in the right away were only capable of retaining the 12.5 mm storm the annual stormwater volume reduction for a 25 mm design storm is reduced by half.
Example: Forest Glen Road Stormwater Volume Reduction =
= (Drainage Area * Avg. Annual Precip for East Holland River watershed *weighted runoff coefficient * 0.9) / 2
= 11,600 m^2 * 857 mm *(1 m / 1000 mm) *0.471 * 0.9 /2
= 4214 m^3 / 2
~ 2107 m^3

Although the Municipal LID demonstration projects costs for LID are proving to be higher at this time, it is anticipated that over time vendors and practitioners will gain more experience along with market place competition within southwestern Ontario, potentially driving costs down. LSRCA and other Greater Toronto Area conservation authorities (through the Sustainable Technologies Evaluation Program 'STEP' partnership), are currently engaged with several economic studies to explore cost optimization and long term economic forecasts for LID in more detail.

3.0 Pilot Project Location

The location for this pilot project was in the headwater area of the Kidds Creek Catchment within the city limits of Barrie, Ontario. Kidds Creek is one of six major creek systems which flow through the city into Kempenfelt Bay, Lake Simcoe. These six creeks, along with two smaller creeks and a section in the north-east of the city that drains directly to the lake, make up the geographic area called the Barrie Creeks Subwatershed. (Figure 2)

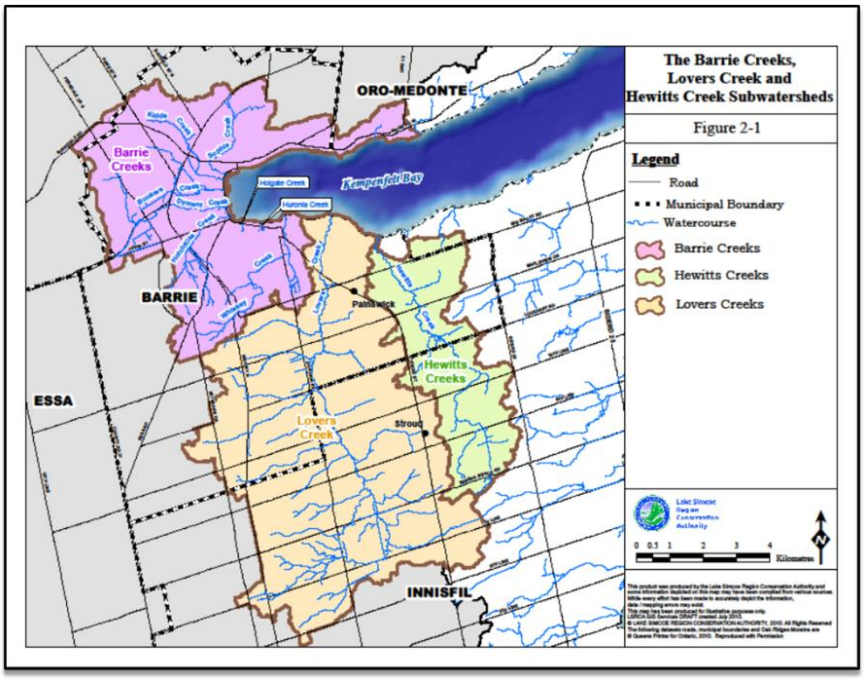


Figure 2: The Barrie Creeks, Lovers Creek and Hewitts Creek Subwatersheds

3.1 About Kidds Creek

Kidds Creek has a total catchment area of approximately 492ha of which 93% is urbanized. Upper Kidds Creek (the entire catchment above (NW) of Highway 400) has been severely impacted by inadequate stormwater controls. The current state of the creek upstream of Highway 400 is poor. Badly eroding streambanks are in need of stabilization and repair. The streambed itself has begun to carve out new channels and threatens municipal infrastructure. Fish species once present in this part of the creek are non-existent. This creek system has been identified as one of the highest priority areas for ecological restoration. Accordingly, work is currently underway to develop a natural channel design and streambank stabilization project to return the creek into a naturally flowing system.

The majority of the creek is surrounded by urban land use. Runoff from this urban area flows directly into the creek with inadequate stormwater quality or quantity controls. As a result, base-flow is minimal and the system is extremely flashy with very high flows from uncontrolled stormwater occurring on a regular basis, causing significant ongoing erosion in the main channel.

For these reasons, this pilot project focused on the households where properties drain into the headwaters of Kidds Creek; an area referred to as the Upper Kidds Creek Catchment (**Figure 3**). There are 2,108 households in the pilot area. The overall project area includes the entire drainage catchment of the upper portion of Kidds Creek, north-west of Highway 400. It comprises all of the land that drains into Kidds Creek through the City of Barrie's Stormwater Management system.

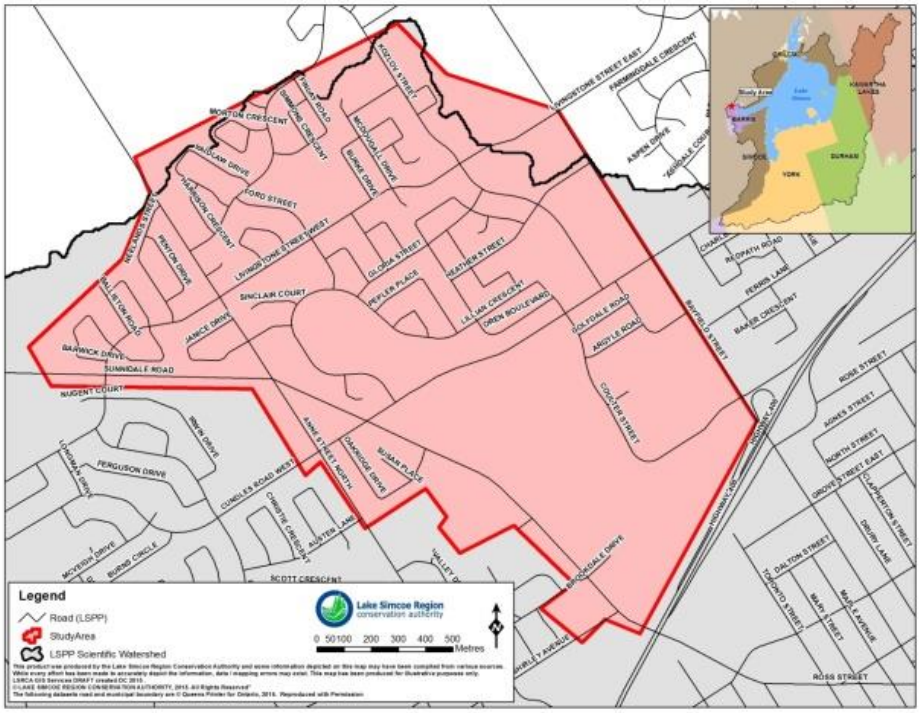


Figure 3: Upper Kidds Creek Catchment, Pilot Project Area

In addition to being a high priority for ecological restoration, Kidds Creek has another significant attribute that makes it an ideal location for this pilot project. Soils in the Upper Kidds Creek Catchment are well drained sandy loams or loamy sands with high to moderate infiltration rates (**Figure 4**). This is vital to the success of this project since, unlike rain gardens or other LID techniques, it was anticipated that there would be minimal soil amendments required in order to promote downward infiltration and achieve stormwater volume reduction targets.

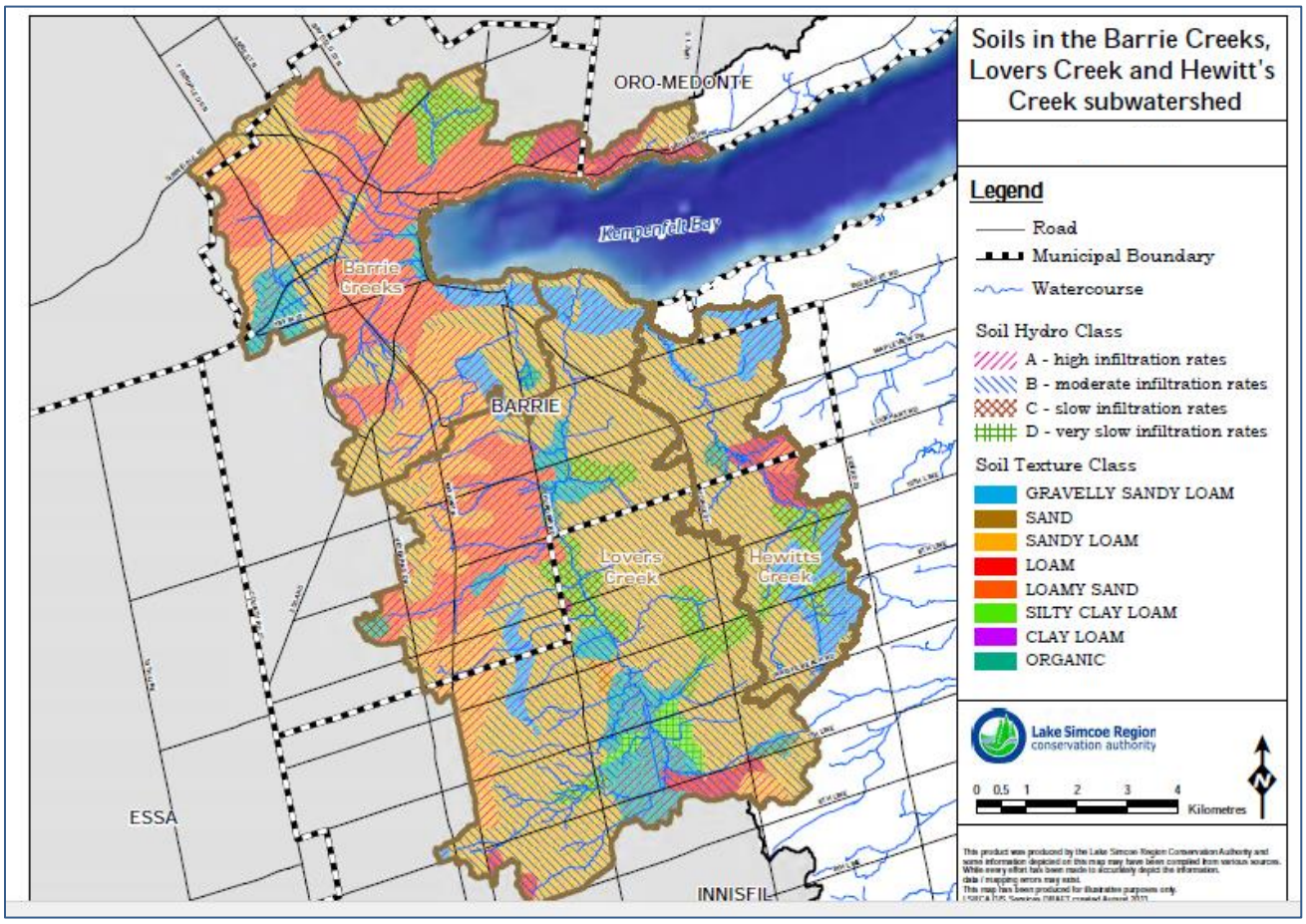


Figure 4: Soils in the Barrie Creeks Subwatershed

3.2 DR Project Locations

Within the Upper Kidds catchment area there were two distinctively different residential types engaged with for this project. The first is a multi-unit "townhouse" style housing unit called Three Links Community Cooperative Housing Inc. The second project type cluster took place in an area characterized by single-family detached homes built in the early 1990's and fairly typical of much of the development that has occurred in that particular part of Barrie.

4.0 Methodology

This pilot project took place over the course of three summers and in 2 distinct Phases. In Phase One (2015 and 2016) background investigations were completed and the beginning of outreach efforts was undertaken. During this phase, outreach focused on homeowners who might voluntarily redirect their downspouts away from paved surfaces. With secured funding from the Ministry of Environment and Climate Change (MOECC), Phase Two moved towards in-the-ground implementation of projects in the late summer of 2017. It was assumed for the sake of this pilot project that the rooftop downspouts on the back and sides of the houses infiltrate into the backyards. For this reason, this study is only directed at households that have front yard downspouts pointed towards the driveways or connected directly to the municipal sewer system.

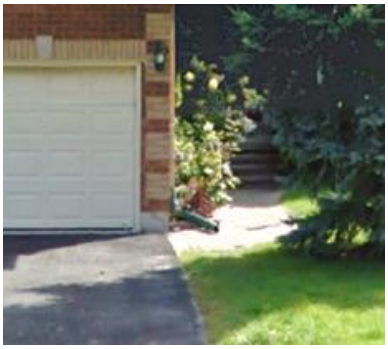
4.1 Phase One: Investigations and Voluntary Action 2015/16

In 2015, LSRCA Stewardship Department summer students began the reconnaissance work in the Upper Kidds Creeks Catchment. They surveyed the roughly 2,200 households from a vehicle and marked on a spreadsheet the "status" of each of the front downspouts. This work showed that approximately 50% of the households had downspouts correctly directed onto a lawn or garden area; thereby allowing for the possibility of infiltration. Of the remaining ~1,100 households, 25% had their downspouts directed into an underground connection and 25% had their front downspouts directed onto a driveway or walkway. It was unknown whether the 25% with the underground connection were infiltrating already through a French drain or an outlet somewhere else on the lawn, or whether these households were illegally connected to the municipal storm drain or sanitary sewer systems. This reconnaissance work also indicated that a further 25% of households had their front downspouts visibly outletting onto their walkways or driveways which conclusively were flowing overland down to the street and into the storm sewer system. Accordingly, the 2015 work provided justification for further inquiry in the following year.

In 2016, two different summer students began the outreach portion of this project. Residents in the target area were mailed a letter (Appendix 1 : 2016 outreach letter) in late June informing them of the goals of the pilot project and letting them know that the students may be visiting them in late July and August. Knowing that they were to be cold-calling people at their homes the students spent the first portion of their contract developing their "script" (Appendix 2: Script). This was vital because some homeowners can be skeptical of cold-calls and door to door outreach. It was important for the students to present themselves as LSRCA staff who were not there to sell anything. The students were outfitted with corporate clothing, a name badge with their photo on it, and drove a clearly marked LSRCA fleet vehicle.

Using a prioritized list of streets in the Upper Kidds Catchment, the students systematically began the work. Working together, street by street, they categorized each household by the type of downspout configuration they had. These broad categories included:

Table 2: Three Categories of Downspout Configurations

CATEGORY 1: SIMPLE FIX 	These were households which have their downspouts directed onto their driveways. It was suspected that most of these downspouts can be easily be redirected onto a permeable part of the property with little to no cost. The existing downspout can either be simply turned towards the grass, or have an extender piece added to it to direct the water to a good location for infiltration.
CATEGORY 2: DIFFICULT FIX 	These households have a front downspout which outlets onto the walkway or driveway between the edge of the garage and the walkway into the house. A simple overland extender pipe would not be a great solution here as it would be a tripping hazard. To address the situation, the landowner would need to consider other "more difficult" solutions that likely would involve hiring a contractor. The contractor would be either a landscaper or a licensed eavestrough specialist to either relocate their eavestrough downspout to another part of the house, or extend the pipe under the walkway through a trenched pipe or over the walkway connected to an arbour framework.
CATEGORY 3: UNKNOWN CONNECTION 	These houses were identified in 2015 as potentially having their downspouts potentially illegally connected underground to the City of Barrie's municipal stormwater or sanitary sewer system. If found to be connected, these projects will likely require hiring a plumbing contractor. The City of Barrie is interested in locating and rectifying these situations, and have been offering a financial incentive to do so (see below: Section 4.1.2- City of Barrie's Disconnect to Protect Program)

Depending on which situation the students encountered, the students were to record the downspout configuration type on their spreadsheet, as well as make comments about any other notable stormwater feature like rain barrels or downspout arbours. Once noted, the students reacted accordingly (see **Table 3** below).

Table 3: Outreach Activities by Downspout Configuration Category

Category	Action taken
1 – Simple Fix	Knock on door in hopes of having a conversation with the homeowner about their downspouts. The students were to impart information that describes the benefits of this simple behaviour change. These benefits can range from the good feeling one gets from the understanding that they are doing something to help their local environment, to helping improve the safety of their property by not allowing water to create slippery areas on their driveway or walkway.
2 – Difficult Fix	In 2016, the students did not knock on these doors, rather they left a 2 sided door hanger that jointly advertised Windfall's RAIN Program and the LSRCA's Rain Garden Grant Program. Funding to re-direct downspouts was not available at this time.
3 – Unknown Connection	In these cases the students were to investigate further to see if they could confirm the outlet point of the downspouts. If they were able to see an outlet point somewhere on the lawn, or if they were able to speak with the homeowner and confirm that the downspout was connected to a French Drain or other infiltration technique, then they were to remove the address from the list of problem houses and add them to the list of houses that are visibly infiltrating their stormwater. If there were suspected illegal connections in place, then the students were to let the landowner know of the City of Barrie's Pilot *Disconnect to Protect* Project through a conversation or by leaving the program material in their mailbox.

As indicated above, the 2016 work included promoting two of our partner's programs; Windfall's RAIN Program and the City of Barrie's Disconnect to Protect Program.

4.1.1 Windfall's RAIN Program

As one of the local Green Communities Canada (GCC) Partners, the Windfall Ecology Centre was delivering a residential stormwater project called RAIN. Through this program, homeowners were offered a free comprehensive home inspection around managing their stormwater. During this visit, they were provided with on-site advice on how to prevent flooding, a free rain barrel and an action plan addressing specific concerns unique to each property.

Each RAIN home visit began by following the path of runoff on a property; roof, eaves troughs and downspouts. A RAIN Guide will then look for existing and potential issues affecting the property, such as grading and slope concerns, paved areas, storm sewer grates and planted areas. Basement flooding is usually a top concern for homeowners, so the RAIN Guide looked at issues that can commonly effect basements, including foundation walls, window wells, floor drains, and sump pumps.

Due to the outreach effort of the LSRCA students, 10 of these RAIN home visits occurred in the Upper Kidds catchment.

4.1.2 City of Barrie's Disconnect to Protect Program

Many City of Barrie homes have a downspout and/or sump pump illegally connected to the sanitary system. This can overwork Wastewater Treatment Facility and cause sewage to back-up during heavy rainfalls. This results in pollution in our lake and more costs to residents. As such, the City of Barrie began efforts in 2016 to locate problem neighbourhoods where these illegal connections exist, and to offer these residents a rebate incentive to disconnect. Initially called *the Sanitary Sewer Inflow Reduction Rebate (SSIRR)*, the Disconnect to Protect Rebate Program provides rebates to qualifying Barrie residents for disconnecting illegal downspout and sump pump/foundation drain connections to the sanitary sewer system.

Through the LSRCA outreach effort in 2016, the students were able to confirm that the vast majority of unknown connections in the Upper Kidds catchment were not illegally connected to the municipal system. By having conversations with homeowners, the students confirmed that the unknown underground connections were actually infiltrating on site either through a French Drain, or by locating an outlet point somewhere on the lawn. This information was passed on to the City of Barrie's Stormwater Engineering Department. Where the students were unable to confirm the connection, they left the pamphlets provided by the city that promoted their Disconnection Rebate program.

4.2 Phase Two: Downspout Redirection Projects 2017

In 2017, funding was received from the MOECC to complete a limited amount of in-the-ground works under the category "difficult fix". In other words, it was to complete projects that would have required a contractor to redirect the downspout away from the impervious surfaces. These projects became informally known as the Downspout Redirection (DR) Projects. There were four basic DR Project activities that occurred over the period of June – October. These included:

1. Signing up a number of homeowners project sites of homes which had been listed as a "difficult fix" through targeted outreach activities to generate a list of potential projects
2. Defining the scope of the work and hiring a suitable contractor
3. Construction; delivering the projects
4. Monitoring success and building a core residential program

Each of these core activities is discussed in greater detail in this section.

4.2.1 Identifying Project Sites – Outreach Activities

As Stewardship Practitioners know, queuing projects can be the most time consuming portion of any initiative. It is increasingly difficult to get the attention of a skeptical population who is bombarded with an abundance of information and advertisements on a daily basis. Furthermore, the great challenge of any incentive-based program is that it is voluntary and requires some degree of effort on the part of the landowner; even if that effort is as minimal as just making a phone call. Incentives can be effective, but it is important to keep expectations low for uptake. Regardless of how good the incentive is, you are competing against the reality that it's always going to be easier for the homeowner to just "not do it".

This project relied on 3 key outreach activities to garner a list of DR Projects:

A. An introductory letter directly mailed to homeowners in the target area;
B. Direct outreach to the manager of a multi-unit housing cooperative;
C. Direct outreach to individual residents on a target street.

A: Introductory Letter

This project relied predominantly on directly targeted outreach activities. A letter was mailed out to 418 Upper Kidds Creek catchment residents whose homes had been identified through the 2016 work as having their downspouts outletting onto a paved surface. This letter asked residents to consider redirecting their downspouts away from a paved area and towards a grassy area or garden where it can soak into the ground. It listed several reasons why this would be a great idea for them to consider. The reasons cited included a free source of landscaping water, reducing impacts to the city from costly downstream flooding, and increasing safety by potentially reducing slippery icy conditions.

Additionally, the letter intended to appeal to people on an emotional level by connecting this behaviour (redirecting downspouts) to the declining state of the creek flowing through Sunnidale Park – a much beloved nearby greenspace central to the identity of the residents in this neighbourhood in Barrie. The letter also offered a reward (a chance to win a decorative rain barrel) to people who voluntarily redirected their downspout. The final assertion in the letter was an offer to help redirect a resident's downspout by doing it for them. As a result of these efforts, three calls were received by residents looking for assistance and an unknown number of homeowners may have redirected their "easy fix" downspout extenders away from a paved surface.

B: Direct Outreach – Three Links

The Three Links Community Housing Cooperative is an 81-unit residential complex near the headwaters of Kidds Creek in Barrie (**Figure 5**).

Figure 5: Three Links Community Housing Co-Op, Kidds Creek Catchment, Barrie

The Co-op Coordinator was contacted directly to discuss the idea of working with the LSRCA on an environmental restoration project with their community. After initial dialogue with the Co-op Board of Directors, it was agreed that LSRCA Staff would attend the next quarterly members meeting and give a presentation to the Three Links Community (approximately 200 members) about Kidds Creek, Lake Simcoe, and the role that stormwater plays.

Next, LSRCA Staff completed a site inventory in conjunction with the Three-Links Site Superintendent to look at downspout configurations and discuss possible sites for redirecting rooftop stormwater to improve retention and infiltration. This inventory indicated that there were 76 potential downspout projects possible at this site. This project inventory was overlaid with pre-existing mapping that showed elevations, contours, and sub-surface infrastructure. It was also confirmed that while this site's entire stormwater infrastructure was privately owned by the Co-Op, it flowed to a single outlet point connected to the municipal storm drain system (**Figure 6**).

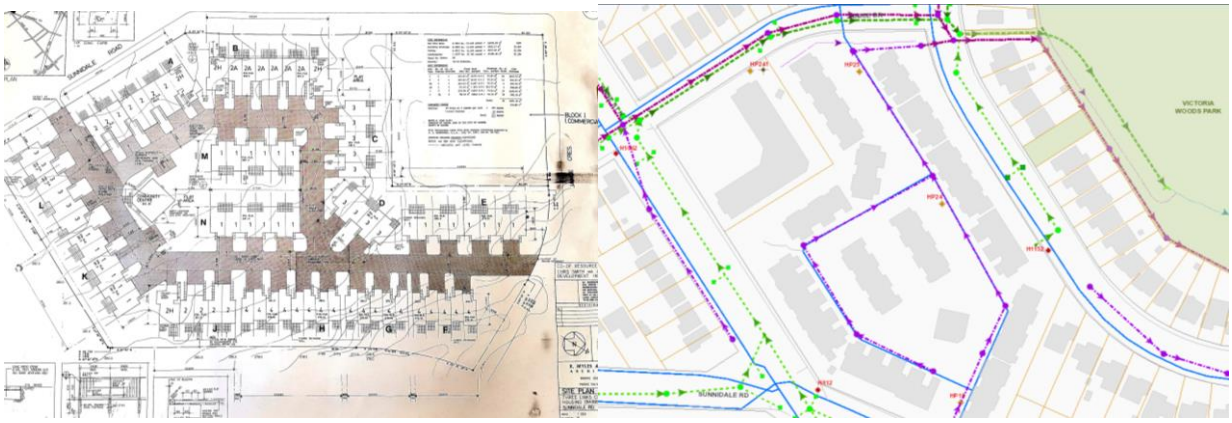


Figure 6: Three Links Co-op Site Plan and Infrastructure

C: Direct Outreach – Residential Area

In addition to the projects generated by the letter and the direct outreach to Three Links, a third approach to generate projects was tested. A team of two LSRCA staff wearing identifiable corporate clothing and carrying a copy of the letter set out to see how many projects they could line up by knocking on doors on a single street.

The residential area was chosen for several reasons; it had a high number of *difficult to redirect* downspouts, it was in the target pilot project area and is comprised of 45 single family detached houses which are fairly representative of houses built in Barrie.

4.2.2 Defining the Scope of the Work and Hiring a Suitable Contractor

Once a list of projects was compiled, the next step was to line up a qualified contractor to complete the work. To do this, LSRCA staff began the work of defining the scope of work to be undertaken within the contract. As a starting point, the next task was to perform a risk assessment (**Table 4**) which looked at how potential liability issues can be circumvented. This risk assessment was used as a basis to create the

General Conditions of the Request for Quote (RFQ) document (Attachment 3). To ensure that the bids were fair and competitive, the RFQ asked contractors to effectively bid on four different downspout configuration scenarios as opposed to a single "bottom line" quote. Emphasis was also placed on their experience and references.

Table 4: Risk Assessment of Downspout Redirection Program

Risk	Mitigation
That by creating a new drainage pathway, flood conditions are created (or perceived to be created) on either the subject property and/or to properties adjacent or surrounding the subject property through these works.	No re-grading of the property will be allowed through these projects. There will be an overflow mechanism built into each project that will direct overflow rooftop drainage to the pre-existing flow path. All projects will direct drainage to a suitable pervious area a minimum of 2m from all structures. All drainage alterations from each downspout will be redirected to an area within the limits of the property owners boundary and shall not drain onto lands owned by other persons or agencies. All projects must maintain and comply with the local drainage requirements of the municipality.
That works by the selected contractor are not to the satisfaction of the participating landowner citing issues of safety, functionality, and/or aesthetics.	Any areas of exposed soil created through the project will be stabilized immediately after construction. Where existing pathways (driveways, walkways, patios) are to be removed to allow for subsurface works, a comparable replacement material is to be reinstated post-construction to the satisfaction of the landowner. Pre and post site Photos are to be taken and retained. That the selected contractor will provide to the LSRCA a certificate of Insurance indicating that they carry liability insurance in the amount of $2 Million dollars per occurrence. They will also prove that they carry the proper WSIB insurance coverage. The contractor must provide 3 references as well as Proof of Ability including the resume of the identified project lead/manager; and a summary of past, relevant project experiences. A Landowner Authorization form detailing the type of work will be created for each project and will be signed by the landowner prior to works being initiated.
That during the works, the contractor works in a manner which is deemed by the	Work must occur in accordance with the City of Barrie work and noise bylaws and will take place mainly Monday to Friday with exceptions to be pre-approved in writing by both parties.

landowner or neighbours as being unsafe or overly disruptive.	All workers will follow all required safety regulations and best practices for the tasks undertaken during this project. The contractor will obtaining locates for any works that involve excavation

4.2.3 Delivering the Projects

The budget would not support completing all of the projects on the list so the next step for LSRCA staff was to re-visit the master list and prioritize to ensure that the best projects were included in the list provided to the contractor. The prioritization exercise consisted of looking at the list through the following filters:

- Geographically in the same general area (closer to each other the better) to provide project "clusters"
- Ensure that there were different "types" of houses (detached, semi-detached, townhouse) that were representative of many of Barrie's residences
- Complete a comparative analysis of roof area (of front yard downspout) to project cost. This was achieved by taking the amounts quoted for the different scenarios and comparing it to the roof area of each downspout.

4.2.4 Monitoring and Inspection

During construction, LSRCA Staff inspected the sites periodically to take photos and ensure that the projects held up to the best practices for Erosion and Sediment Control standards. It was noted during these inspections that the contractor was extremely vigilant about keeping a clean site during and after construction (**Figure** 7).

At this point, LSRCA Staff also mapped the location on the lawns of the clean-out risers knowing that when the grass grew back they would be difficult to find. The riser location maps were measured and triangulated from known points such as the edge of buildings. A copy of this map was left with the homeowners to retain with their household records, and a second copy remains on file at the LSRCA office (Appendix 4: Clean out riser location map).

When all of the DR projects were completed, LSRCA staff visited the project sites during the next significant rain event (October 14, 15) to inspect the overflow outlets. No water appeared to be escaping through any of the inspected overflows at that time.

Finally, a survey was left with each of the homeowners to assess their experience with the project (Refer to Results and Lessons Learned, Section 5.0).

5.0 Results and Lessons Learned

Results from the two initiatives, voluntary and incentive, show that stormwater volume reduction in a residential setting is possible and cost effective. Throughout this pilot project, there were several lessons learned related to these core activities:

1. Garnering a voluntary commitment to have homeowners redirect their own downspouts
2. Lining up DR projects
3. Finding a suitable contractor
4. and Defining the scope of the work
5. Delivering the infiltration trench projects
6. Developing a cost effective residential program

Each is discussed in greater detail below.

Figure 7: "Easy fix" Target for Voluntary Commitment

Figure 8: Clean Construction Site Maintained

5.1 Voluntary commitment to redirect homeowners own downspouts.

Figure 9: Common "difficult fix" Downspout Configuration

One part of the outreach efforts employed during this project was to begin the process of educating homeowners about the importance of having their downspout outlets directed away from paved surfaces. This was in response to a widespread misconception that getting the water to go to the street storm drain system was what they were supposed to be doing as good citizens.

The voluntary commitment was only expected from the households that had an "easy fix"; in particular, properties that had a flexible extender attached to their downspout and directed deliberately towards the driveway (**Figure 9**). For these downspouts, it might take little more than education to make gains. During the 2016 outreach for example, while the students were giving their "pitch", one homeowner walked over and physically moved it off of the driveway and pointed it towards the grassed swale between his and the neighbour's driveways.

Efforts made for the voluntary action initiative included composing and mailing two letters (2016 & 2017), and in some cases a home visit (if the resident was home when the students knocked). It is important to note that change can take time to be adopted and acted upon. Awareness of the existence of a problem in itself does not generally create behaviour change; however, awareness, in many cases, is a lead contributor to behavioural change and action.

It is hard to quantify the results of an outreach effort as it may not translate in direct action immediately. Rather, the effort may be the first step in someone changing their understanding of "where the water is supposed to go" which may result in a voluntary downspout redirection in the future. More importantly, as more of these redirection projects occur, the more likely it is that one will notice the street-level norm that is created, and will make the adjustments on their own.

Unfortunately, the "easy fix" scenarios were not the most common downspout configuration. In the majority of situations, the front downspout outlets onto the walkway or driveway directly in the pathway where people walk, thereby creating a "difficult fix" (**Figure 9**). An overland extender pipe across the walkway to the lawn is not a desirable condition for most homeowners.

5.2 Lining Up DR Projects

Funding for the Downspout Redirection Program was not available at the time of the outreach efforts in 2016 for homeowners who had been listed as having a "difficult fix". Instead, the LSRCA students in 2016 had directed them to either apply for the Rain Garden grant program or Windfall's RAIN Program. From these efforts 6 inquiries for the rain garden program resulted and 11 RAIN home visits were completed by Windfall Ecology. If funding had been available to redirect people's front downspout away from their walkways and driveways, this door-to-door outreach would have been a very effective vehicle to produce a list of interested homeowners. In general, most homeowners dislike this common downspout configuration as it creates slippery areas from water and ice or it presented a tripping hazard from either the extender or the splash pad. Furthermore, this configuration often created foundation drainage issues or slumping pavement near the outlet (**Figure 10**).

Figure 10: Pavement Slumping from Water Ponding at Base of Downspout

With secured MOECC funding in 2017 to redirect these "difficult" downspouts to an area on the property where infiltration could occur, a new list of potential projects needed to be generated. The list of potential DR Projects was created through these three outreach activities:

1. A letter sent out in 2017 offering to do the work for them
2. Direct outreach to the Coordinator of a multi-unit housing Co-operative (Three Links)
3. Direct outreach (door-knocking) to homeowners on a representative street (Residential Area)

5.2.1 Results: 2017 Outreach Letter

The 2017 outreach letter (Attachment 5) was sent to 418 Upper Kidds residents who had been identified as having either an easy or difficult-fix downspout configuration. The purpose of the letter was to further the educational understanding of the important connection between managing your own stormwater and protecting your property and the local environment. The hope was that some of the easy-fix downspouts would be redirected by the homeowners. The second purpose of the 2017 outreach letter was to line up DR projects; outreach letter circulation generated six phone calls from people looking for help. From these six calls, three DR Projects were identified and three were disqualified for various reasons. LSRCA staff visited each of these households, took photos, and used mapping tools to confirm the amount of roof area that would be diverted by each redirect project.

5.2.2 Results: Three Links Co-operative

After getting full support from the Co-op management and residents, LSRCA staff walked the grounds with the Three Links Superintendent to create an inventory of the site. After the full site inventory, it was determined that there was the potential to redirect 76 different downspouts at the Three Links Co-op. Since completing all 76 redirections would significantly exceed the budget of this project, the projects were prioritized based on roof area, cost of redirection and landowner preference. The landowner preference included two areas where negative drainage was directing stormwater towards the foundations of the units. Given that at this one site there were more downspouts available to be relocated than could be accomplished in this year due to budgetary constraints; efforts were spent on lining up projects at other sites knowing that the entire remainder of the budget dollars could be applied here. It is hoped that the rest of the Three Links downspouts will be redirected in subsequent years.

5.2.3 Results: Residential Area

There are a total of 45 houses on the particular street chosen for this work. Of these, 29 houses (65%) have either one or two front downspouts pointed onto the walkway/driveway. Judging by the style and uniform appearance of the houses, it is likely they were all built at roughly the same time and by the same builder. As such, it is probable that all 45 houses were built with the front downspouts outletting between the walkway and edge of garage. Over the years however, 16 homeowners have taken it upon themselves to redirect the downspout to their lawn where it can infiltrate. Most of these downspouts were directed into a French drain system; however, there were a couple of creative solutions that the homeowners had employed. Two homeowners used a deck to cover the downspout and one built an arbour which directed the drain pipe over the walkway and into a garden on the front yard (**Figure 11**).

Figure 11: Creative Solutions for Dealing with Walkway Downspouts

On June 31, 2017 two LSRCA staff members set out to knock on the doors of the 29 houses where the downspouts were yet to be redirected, to describe the project and to offer to have the homeowners put onto a list to have this redirection work done for them at no cost to them. Of these 29 houses, staff members were able to speak with 13 people or 45% (note: this outreach work was undertaken on the Friday before a long weekend; therefore there were more people home during the day than normal).

Beginning with explaining who they were and why they were there, the LSRCA staff members were able to add 10 landowners to the list of participants who wished to be involved in this project. All 10 houses had downspouts outletting at the end of their garage onto a walkway. A portion of these homes (6) also required an extender to be added onto the downspout on the other side of the garage to direct their rainwater onto the swale area between houses.

Of note from the 2016 outreach efforts work in that residential area, 3 houses had downspouts that were listed as an easy-fix. Of which, 2 of them had not redirected, but one had since moved their downspout to be directed onto a grassed area. This could have been the result of the efforts around garnering voluntary action.

5.2.4 Finding a Suitable Contractor and Defining the Scope of the Work

The key to a successful project is finding the right contractor. Several lessons were learned during the process of securing a contractor for this work. First, many landscape contractors start to plan their work season as early as March and may be too busy to consider bidding or taking on a contract such as this. For this DR contract, the Request for Quote (RFQ) was sent out to 38 local landscape companies in June, 2017. This list of contractors had been generated from LSCRA's past efforts to provide Rain Garden Construction training through Landscape Ontario. From this list of 38, 2 bids came in. Fortunately both companies were qualified, and the lower bid was accepted.

When only two bids were received, LSRCA staff called various contractors to inquire as to why they did not submit a bid (**Table 5**). Beyond the issues of being either too busy to even submit a quote or with regards to their capacity to take on additional work, there were also concerns with the cost estimates assumed within the RFQ. The original estimate assumed that these projects would cost approximately $500 each. Upon further inspection, it became clear that a cost of closer to $1,000 each was more likely; and this was only where aggregation of projects in the same general area could be realized. It is important to note that if an individual homeowner had attempted to get a quote for this work, they would have had a very difficult time finding anyone who would be willing to provide a quote at all. Accordingly, if they were successful in getting a quote, it would have been for significantly more money than the $1,000 per project estimated. Many contractors are not interested in small projects like a single redirection. There are significant costs and efforts to transport the materials, staff and equipment to the site.

Table 5: Contractor Response to RFQ

No response	15	40%
Declined: interested, but fully booked	11	30%
Expressed interested in submitting (2 actually did)	4	10%
Declined: project too small or too little money	4	10%
Declined for other reasons	4	10%

Finally, beyond just re-routing downspouts sub-surface through a landscape company this project also explored different options for re-direction by different specialist contractors. The idea of hiring an eaves trough repair/roofing company to re-route the eavestrough to a different part of the house (adjacent to a pre-existing grassed area instead of a paved surface) was explored, but was discarded. Re-directing at eavestrough level would likely be cost-prohibitive. Eaves troughs are carefully sloped and calculated based on roof area. As well, the standard for the diameter of eavestrough pipes has increased since the 1990's. As such, when retrofitting houses built in neighbourhoods older than 1990, the entire eavestrough piping would need to be replaced; not just the section of pipe that required re-directing.

The type of work that this project focused on was the sub-surface, under-the-walkway infiltration trench. This kind of work is best done by a contractor comfortable working with household drainage. It is not essential that the contractor be a landscape designer, since all of these projects simply required lifting and replacing paving stones, laying pipe and gravel, and filling a trench with topsoil and grass seed.

6.0 Delivering the Infiltration Trench Projects

These DR Projects entailed rerouting the roof water that had previously drained onto the walkway or driveway of 24 houses, into an infiltration trench on the homeowner's front lawn instead. This work entailed:

1. **Landowner Communication**

   Re-contacting each of the interested homeowners, describing to them the work that would be completed, and having each of them sign a Landowner Agreement and a form from the Contractor that detailed this work.

   The Landowner Agreement Form indicated the following terms that the homeowner agreed to by signing the form. These included:

   - That the disturbed lawn area was to be restored to existing grade using soil and seed (the contractor would replace with sod instead if requested through a separate agreement struck between the homeowner and the contractor);
   - That the contractor would replace paving stones in as close to original condition as reasonably possible** [1.]

- Re-levelling sunken driveway or walkway (if applicable) or re-grading of existing driveways or walkways was not included in these works;
- Contractor was not responsible for removing and or replacing of plants in affected area
- The property owner will maintain the project structures in good working order and condition for a minimum period of five (5) years;
- The LSRCA and their representatives shall have access to the site where any part of the work is being carried out at all reasonable times during construction and after construction for the purpose of conducting a post project inspection or research;
- That where possible, the contractor will add a flexible downspout extender to side-yard downspout to direct flow overland onto grassed area and away from foundation and driveway;
- That the homeowner agrees to indemnify and save harmless the LSRCA and its members and agree that the LSRCA is not responsible for the workmanship and warranty of the project as completed by the contractor.

****Note:**

1. It was during this step that two homeowners declined the project. This was because of a stipulation in the Landowner Agreement that stated that the contractor was not responsible for replacing paving stones that were damaged during the project. This stipulation was vital to keep in the contract since different houses have a multitude of different styles of paving stones, in differing states of repair. Some pavers were fairly standard and likely readily available and easy to replace, whereas others would have been impossible to replace. Both homeowners who declined were concerned that the paving stones would be damaged and that there would be a cost to them to replace.

2. **Site Photographs**

   Taking numerous site photos and keeping them on file. These photos would be used to compare pre and post work and confirm workmanship of the contractors (Appendix 8- Pre and Post Construction photos). It is good to note here that all of participating homeowners were pleased with the quality of the work. In most cases, it was almost impossible to detect that the pavers had been lifted and replaced.

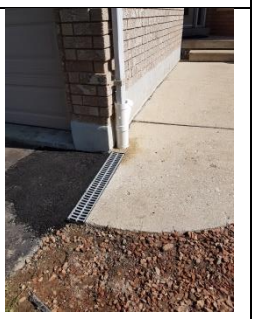
3. **Contractor Construction Phasing**

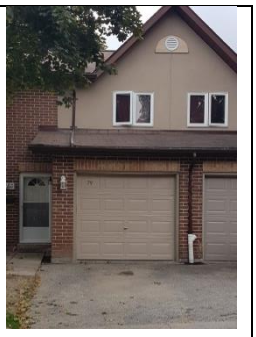
   Contractor completed utilities locates and began the process of crew work scheduling, transporting equipment and materials, and creating a construction staging area for the works

4. **Construction**

   Work began on September 1 2017. There were essentially five types of projects (with some site level modifications) completed which involved the following:

Table 6: Projects Types Completed During 2017 DR Contract

Project type	Cost	Description of work	Photo
Install a Flexible downspout extension and re-route over land to lawn	$100	-Install flexible downspout extender pipe to second downspout (usually on the other side of the garage) and direct outlet towards infiltration strip between driveways	
Install a lawn infiltration trench	$375	-Dig a trench and lay pipe with cleanout riser to specifications (see next section 6.1.2) -insert downspout into a PVC pipe- with overflow and leaf cap -Add topsoil and grass seed and rake to pre-existing grade of lawn	
Under walkway to lawn infiltration trench	$950	-Lift and stack existing paving stones -Dig a trench and lay pipe with cleanout riser to specifications -insert downspout into a PVC pipe- with overflow and leaf cap -Replace and secure existing paving stones -Add topsoil and grass seed and rake to pre-existing grade of lawn	
Through walkway to lawn infiltration trench	$1200	-Cut through poured concrete slab and install grated sidewalk trench -Dig a trench at end of slab and lay pipe with cleanout riser to specifications -insert downspout into a PVC pipe- with overflow and leaf cap -finish area with cold patch asphalt -Add topsoil and grass seed and rake to pre-existing grade of lawn	

Through driveway to lawn infiltration trench	$1400	-Cut through concrete driveway and install grated driveway trench - Lift and stack existing paving stones at walkway -Dig a trench and lay pipe with cleanout riser -insert downspout into a PVC pipe- with overflow and leaf cap -finish area with cold patch asphalt and fill edge of trench drain with polymeric sand -Add topsoil and grass seed and rake to pre-existing grade of lawn	

5. **Prepare Clean-out Riser Maps**
   Map out the location of all of the clean-out risers in relation to known map points (edge of buildings, sidewalks, driveways. Mark on map and leave one copy with each homeowner and retain a file copy (Appendix 10: Sample Clean-out Riser map).

6.1 Infiltration Trench Specifications

These infiltration trenches were all constructed using the typical underground downspout detail with specifications provided in **Figure 12** below.

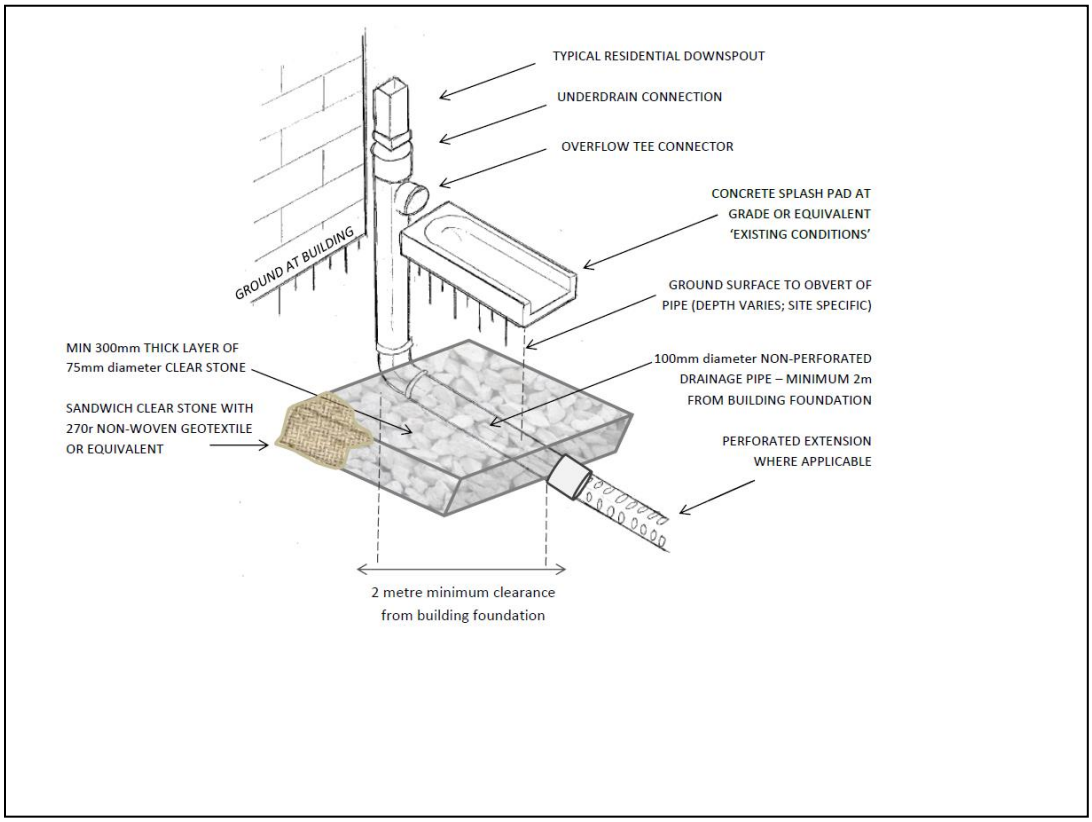


Figure 12: Typical Downspout Detail (as provided in the RFQ document).

For each project, the contractor dug a trench approximately 500mm deep X 350mm wide and 7m in length. They laid 2 metres of non-perforated pipe stretching away from the building foundations and connected it to 5 metres of perforated pipe sandwiched in clear stone and wrapped in geotextile. At the terminal end of the perforated pipe, an elbow extension was installed pointing upwards towards the surface of the lawn. At the terminus of this riser, a cap was screwed on to create a clean-out point if required at some point in the future. This riser location was mapped out and its location provided to each homeowner.

6.2 Stormwater Volume Reduction

There were 2 basic "types' of stormwater volume reduction projects resulting from these downspout redirection efforts:

1. To sub-surface infiltration trenches; and

2. To lawns, with permeable surface where a significant proportion (approximately 70%) of the rooftop water will infiltrate for the maximum rainfall depth (25 mm) considered.

Both downspout redirection stormwater volume reduction efforts consider rainfall event depths of 25 mm (approximately the 90th percentile storm for the Lake Simcoe watershed). The methods to calculate the stormwater volume reductions for both types of downspout redirections are outlined in Sections 6.2.1 and 6.2.2 below.

6.2.1 Infiltration Trenches

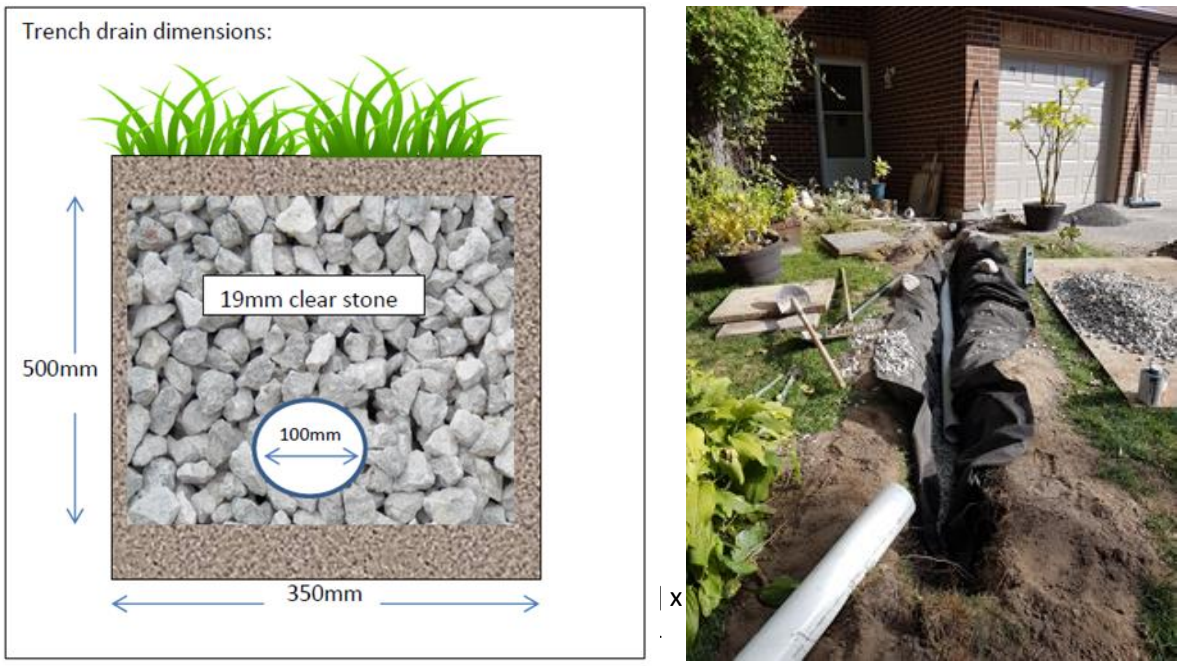
There were 24 houses that have infiltration trenches installed. All of these projects had 2 metres of non-perforated pipe (which is not considered for volume reduction) and a minimum of 5 metres of perforated 100 mm diameter pipe sandwiched in a bed of 75mm diameter clear stone. From this, we are able to make the following key assumption for stormwater volume reduction:

The infiltration trench will provide a known 'dry storage' (or retention capacity), that accounts for the stormwater volume reduction achieved for the feature.

This analysis takes the conservative approach to assume the dry storage accounts for the total stormwater volume reduction only. The soil conditions for all sites where this feature was installed were favourable and present an additional opportunity for significant infiltration below the trench that would result in even higher stormwater volume reduction achieved.

At minimum, a 5 metre length of infiltration trench would have a storage area of 0.347m^3, as outlined in Figure 13 below. There were 24 of the trenches installed, accounting for a total storage volume of 8.328m^3 (**Table 7**).

Figure 13: Infiltration Trench Dimensions and Storage Area



Total storage area/m = 0.0668 x 0.008
= 0.0748 m^2

Storage Volume:
Therefore a 5m length of perforated pipe will have a storage area volume of 0.0748m^2 x 5m = 0.347m^3.

Further to the dry storage created by the infiltration trenches, it was assumed that because the project sites were located in a part of the watershed with sandy loam soils and very good natural infiltration rates, that the surrounding substrate would infiltrate an additional amount of rain. On October 14-15, 2017, it was recorded that there was a 25mm storm event in the City of Barrie. LSRCA staff monitored the project sites and noted that no water appeared to be flowing out of the overflow pipes. Further, in the landowner post-project survey completed in October, participants were asked if they noticed any water coming out of the overflows. No homeowner had witnessed any water flowing out of the overflow and several indicated that they had made a deliberate point of looking for this during the heaviest part of the storm event.

To keep the calculations simple and very conservative however, no assumptions were made about the infiltration occurring within the natural substrate surrounding the infiltration trenches.

Table 7: Summary of Volumes, Costs and Benefits for Infiltration Trench Downspout Redirection

	Project Type 1.	Project cost 2.	Drainage area 3. (m^2)	Runoff Volume 4. (m^3)	Storage capacity 5. (m^3)	Estimated Stormwater Volume Reduction	Cost $/$m^3$

						(m^3/yr) 6.	
1	B	$375.00	43	1.075	0.347	11.65	$32.19
2	B	$375.00	43	1.075	0.347	11.65	$32.19
3	B	$375.00	31	0.775	0.347	11.65	$32.19
4	B	$375.00	26	0.65	0.347	11.65	$32.19
5	C	$950.00	22	0.55	0.347	11.65	$81.55
6	C	$950.00	18	0.45	0.347	11.65	$81.55
7	C	$950.00	17	0.425	0.347	11.65	$81.55
8	C	$950.00	21	0.525	0.347	11.65	$81.55
9	C	$950.00	21	0.525	0.347	11.65	$81.55
10	C	$950.00	39	0.975	0.347	11.65	$81.55
11	C	$950.00	24	0.6	0.347	11.65	$81.55
12	C	$950.00	14	0.35	0.347	11.65	$81.55
13	C	$950.00	14	0.35	0.347	11.65	$81.55
14	C	$950.00	14	0.35	0.347	11.65	$81.55
15	C	$950.00	14	0.35	0.347	11.65	$81.55
16	C	$950.00	14	0.35	0.347	11.65	$81.55
17	C	$950.00	14	0.35	0.347	11.65	$81.55
18	C	$950.00	14	0.35	0.347	11.65	$81.55
19	C	$950.00	14	0.35	0.347	11.65	$81.55
20	F	$1,200.00	22	0.55	0.347	11.65	$103.00
21	F	$1,200.00	26	0.65	0.347	11.65	$103.00
22	E	$1,400.00	41	1.025	0.347	11.65	$120.17
23	E	$1,400.00	36	0.9	0.347	11.65	$120.17
24	E	$1,400.00	45	1.125	0.347	11.65	$120.17
	Average	**$931.25**	**24.5m^2**	**0.611m^3**	**0.347m^3**	**11.65m^3/yr**	**$79.94/$m^3$**
	Total	**$22,350**	**587m^2**	**14.675m^3**	**8.328m^3**	**279.60m^3/yr**	**n/a**

Notes:

1. Project type chart was created in order to get quotes for the RFQ documents
2. Cost was derived from the type of redirection project in relation to the quotes from the Contractor.
3. Roof- top area draining to affected downspout
4. Runoff volume for a 25mm precipitation event representing approximately the 90th percentile average annual rainfall event.
5. Storage capacity calculations explained in **Figure 13** above.
6. Annual Stormwater Volume Reduction estimate based on an average annual precipitation for the watershed from the City of Barrie (approximately 932.9 mm) multiplied by 0.9 (to represent the 90th percentile average annual precipitation in the Lake Simcoe watershed)
   (Avg annual rainfall in Barrie) * [Conversion Factor (mm ->m)] * rooftop drainage area * (Storage capacity of DR feature) / (Runoff volume generated from rooftop per 25 mm event)

6.2.2 Over-Land Extensions

There were a number of downspouts which had previously been pointed towards a driveway, that are now directed onto an area of lawn through the addition of a flexible downspout extender. This was achieved through the combination of outreach efforts through the DR Project contractor adding flexible extenders to a number of side-yard downspouts. For these projects, the following assumption was made to estimate stormwater volume reduction:

Using a modification to the Rationale method formula that Water Resources Practitioners commonly use to estimate runoff, the following adjusted formula is used in the context of the over-land extensions to account for what rooftop-rainfall will infiltrate with corresponding stormwater volume reduction. Given that for 3-4 months of the year the surface of the ground is frozen or partially frozen, a seasonal correction factor should be used. Assuming 30% run-off in 8 of the 12 months and 90% run-off in the other 4, a seasonable run-off factor could be calculated as (0.3*8 + 0.9*4)/12 = 0.50. This equates to 50% run off and 50% infiltration. **$V_{infiltration} = i*A*(1-0.5)$.**

Example:

V infiltration = i * A * (1 – Rc)

= 25 mm * (1/1000 m/mm)* Rooftop area (m^2) * (1 – 0.5)

= XX m^3

Although it is unknown exactly how many downspouts were redirected because of outreach efforts, it is known that the contractor installed six of them (Table 8). The roof area that drains to these six overland green strips via the downspout extender pipe is 130m^2 (average 21.7m^2/roof).

Table 8: Summary of Volumes, Costs and Benefits for Overland-Extension Redirection

	Project Type [1.]	Project cost [2.]	Drainage area (m^2) [3.]	Storage capacity (m^3) [4.]	Estimated Stormwater Volume Reduction (m^3/yr) [5.]	Cost \$/m^3
1	A	\$100.00	22	0.29	9.24	10.83
2	A	\$100.00	21	0.26	8.82	11.34
3	A	\$100.00	20	0.25	8.4	11.91
4	A	\$100.00	27	0.34	11.33	8.82
5	A	\$100.00	23	0.29	9.66	10.36
6	A	\$100.00	17	0.2	7.14	14.01
	Average	**\$100.00**	**21.7m^2**	**0.38m^3**	**9.1m^3/yr**	**\$11.22/m^3**
	Total	**\$600.00**	**130 m^2**	**2.275m^3**	**54.57m^3/yr**	**-**

Notes:

1. Project type chart was created in order to get quotes for the RFQ documents and can be found on in Table 5.

2. Cost was derived from the type of redirection project in relation to the quotes from the Contractor.
3. Roof- top area draining to affected downspout
4. Modification to Rationale formula to account for the infiltration volume, and therefore corresponds to the stormwater volume reduction for this redirect assumes the 50% of the lawn will infiltrate without any impediment (e.g., saturated conditions, inter rainfall-event periods).
5. Annual Stormwater Volume Reduction estimate based on an average annual precipitation for the watershed from the City of Barrie (approximately 932.9 mm) multiplied by 0.9 (to represent the 90th percentile average annual precipitation in the Lake Simcoe watershed)
   (Avg annual rainfall in Barrie) * [Conversion Factor (mm ->m)] * rooftop drainage area * (Storage capacity of DR feature) / (Runoff volume generated from rooftop per 25 mm event)

6.2.3 Costs of Stormwater Volume Reduction

The 24 infiltration trenches projects had a volume reduction of 279.6m^3/yr and the 6 over-land downspout extensions had a volume reduction of 54.57m^3/yr totaling 334.17m^3/yr. The total contractor cost of the in-the-ground projects (excluding administration) was $22,950 (CAD excluding HST).

The average cost /m^3 of the infiltration trenches was $80/m^3 (rounded up from $79.84/m^3) and the overland extensions were $11/m^3.

By comparison, the LSRCA Rain Garden Grant averaged an estimated cost of approximately $152/m^3 of stormwater volume reduction. The total project cost and estimated stormwater volume reduction of the Municipal LID RainScaping Demonstration Projects support an overall estimate of approximately $134/m^3 of stormwater volume reduction.

To more fully compare these three programs, estimations of staff time to administer the programs is required. This is covered in the next section of this report.

7.0 Project Initiation, Coordination and Administration

The purpose of this pilot project was to assess the cost effectiveness of this residential program in comparison to previous efforts with the LEAP Rain Garden grant as well as Municipal LID Demonstration Projects. From the two approaches (voluntary and incentive) for volume reduction, it was clear that a more easily quantifiable way to compare the programs is to look at the known program cost effectiveness of the DR projects. To be conservative about the effectiveness of this program, this analysis will disregard any gains made through the educational outreach activities towards voluntary downspout redirection and will instead focus only on the thirty known DR projects.

Project initiation, coordination and administration efforts are outlined in more detail in the following sections.

To provide a complete cost comparison of the three programs, a review of project estimations of staff time to administer the programs along with recommendations to improve efficiencies is needed, as explored in more detail in Section 7.4.

7.1 Initiate DR Projects

The outreach strategy used to initiate the targeted street-level projects is itemized below:

A) Complete house-level research to determine where the most potential volume reduction gains would be made and focus outreach efforts there
B) Send out an introductory letter explaining the purpose of the project and informing the homeowner that they will be approached directly
C) Focus efforts on directly contacting multi-unit residential complexes that have a single contact point (e.g. Condominium superintendent)
D) Have staff knock on doors of the targeted houses to line up projects. Choose a day of the week and time of day when most homeowners would be home

7.2 Gaining Cost Efficiencies with the Contractor

When choosing a contractor to deliver the projects, note that the following will keep bids lower and gain efficiencies with the amount of projects that could be completed within a set budget:

A) Include in the RFQ a full list of projects with their specific downspout redirection requirements which consider site limitations e.g. install X number of sidewalk trenches through concrete slab walkways, or X number of projects that require lifting and replacing patio stones
B) Note that the administrative work with the homeowners (Landowner Agreement forms) will be completed by the LSRCA
C) Note the project locations. There will be significant cost efficiencies to aggregating projects in close proximity to each other (aggregate projects) because of the high costs/efforts associated with construction staging areas and moving equipment, materials and staff to project sites

7.3 Costs of Administration - DR Projects

It is difficult to compare the true costs of administration of this project to the costs of administering the Residential Rain garden program and the LID Municipal Demonstration Projects as they all were run on very different temporal scales. This project had a much shorter timeline (less than a year) than rain gardens and had a much higher degree of autonomy than the municipal projects. As well, being a pilot project, it was being developed as it was being implemented. For future iterations, less time would be required on program elements that have already been developed. For example, a significant amount of time was spent creating forms and discussing process pertaining to risk and liability. This work, while still subject to ongoing review and scrutiny, would not need to be completed again. As well, much of the field work undertaken by the Watershed Coordinator developing the pilot project could be completed by a more junior staff member in subsequent phases (Table 10: Average Cost of Administration of DR Infiltration Trenches: Cost Reduction Scenario).

Based on lessons learned, the following are projections of recommended approach to what it might cost to implement the next phase of the project (removing the one-off development work discussed above, as well as the efforts that were found to be ineffective or inefficient to the development of the project). The table below (**Table 9**) reflects the administration of just the infiltration trenches, not the voluntary program or the overland extensions.

Table 9: Average Cost of Administration for DR Infiltration Trenches

Task	Staff	Time (hrs)	Rate ($/hr)	Total
A: Research and set targets				
Complete site-level research to determine target street/neighbourhood for outreach efforts	Watershed Coordinator	5	$56	$280
Complete site investigations and determined "type" of project Identify priority projects based on potential roof area treated	Watershed Coordinator	7	$56	$392
Review with Urban Restoration Manager	Urban Rest. Manager	0.5	$70	$35
B: Outreach Activities to create project list				
Compose and send letter to target residents to get additional projects beyond 3 Links	Watershed Coordinator	7	$56	$392
Compose and send letter to target residents to get additional projects beyond 3 Links	Communication Specialist	2	$50	$100
Contact 3 Links and garner support including 4 on-site meetings, presentation to residents, on-site inventory of potential projects	Watershed Coordinator	20	$56	$1,120
Complete direct outreach (door-knocking) to generate project list	Watershed Coordinator	5	$56	$280
Complete direct outreach (door-knocking) to generated project list	Summer Student	5	$15	$75
C: Create RFQ and Select Contractor				
Request for tender created and reviewed	Watershed Coordinator	14	$56	$784
Request for tender created and reviewed	Construction Specialist	1	$59	$59
Send RFQ directly to local contractors (determine who: eavestrough contractors, landscapers, etc.)	Watershed Coordinator	4	$56	$224
Contractor selected Scoring process determined	Construction Specialist	1	$59	$59
Contract administration (RFQ, contractor selection, PSA docs)	Watershed Coordinator	3	$56	$168

Quote Documents Review	Construction Specialist	1	$59	$59
RFQ Package Selection and Award/Approval	Construction Specialist	1	$59	$59
RFQ Package Selection and Award/Approval	Urban Restoration Manager	1	$70	$70
Pre-Construction Meeting	Watershed Coordinator	2	$56	$112
D: Construction				
Project Administration (incl. invoicing reviews/payment, e-filing)	Watershed Coordinator	2	$56	$112
Supervise contracted work Regular inspections and ensure ESC measures are upheld	Watershed Coordinator	6	$56	$336
Landowner Authorization forms signed and site photos taken	Watershed Coordinator	14	$56	$784
Create map of cleanout risers to be left with homeowners	Watershed Coordinator	6	$56	$336
E: measure success				
Collect video footage, photos, testimonials	Watershed Coordinator	1	$56	$56
Complete calculation of roof top areas of all known properties redirected to get potential volume reduction. Complete a cost analysis/volume reduction	Watershed Coordinator	3	$56	$168
Complete calculation of roof top areas of all known properties redirected to get potential volume reduction. Complete a cost analysis/volume reduction	Construction Specialist	1	$59	$59
Create and execute a post work survey of participants to check their satisfaction and measure behaviour change	Watershed Coordinator	2	$56	$112
Create and execute a post work survey of participants to check their satisfaction and measure behaviour change	Communication Specialist	1	$50	$50
			TOTAL	**$6,281**
			Total Volume Reduction (from sum of Table 8 & 9 combined)	**355.98m^3/yr**
			Administrative cost/ volume reduction (rounded to nearest dollar)	**$18/$m^3$**

It is important to note here that the administration costs of this program would be much lower in subsequent years. This was the cost of developing a pilot project. Much of the work in outreach and

lining up projects could be done by junior staff member (Urban Program Assistant) in the future. Below are the line items that could be completed by junior staff in subsequent years.

Table 10: Average Cost of Administration of DR Infiltration Trenches: Cost Reduction Scenario

Item previous completed by Watershed Coordinator at $56/hr.	**Hours**	**Urban Program Asst. Rate $/hr.**	**Total cost for Watershed Coordinator to complete**	**Total cost for Urban Program Asst. to complete**
Complete site investigations and determined "type" of project Identify priority projects based on potential roof area treated	7	$18	$392	$126
Contact 3 Links and garner support including 4 on-site meetings, presentation to residents, on-site inventory of potential projects	20	$18	$1,120	$360
Complete direct outreach (door-knocking) to generate project list	5	$18	$280	$90
Landowner Authorization forms signed and site photos taken	14	$18	$784	$252
Create map of cleanout risers to be left with homeowners	6	$18	$336	$108
		TOTALS	**$2,912**	**$936**
Total Volume Reduction (from sum of Table 8 & 9 combined)				**355.98m^3/yr**
Administrative cost/ volume reduction (rounded to nearest dollar)				**$12/$m^3$**

This switch to a junior staff member completing the large part of the outreach and site visits would have saved $1,976 in administration fees bringing the administration total down to $4,305. This would mean that the administration costs to deliver this program in subsequent years could be readjusted from $18/$m^3$ to $12/$m^3$.

7.4 Comparing "Full-cost" LSRCA Volume Reduction Programs

At a cost of $80/$m^3$ volume reduction for the infiltration trenches and $11/$m^3$ for the overland extenders, the DR Projects have been shown to be significantly less expensive than the Rain Garden Residential Grant at $152/$m^3$ and the Municipal LID projects $134/$m^3$. However, in order to compare the "full cost" of the three volume reduction programs, the administrative costs would need to be calculated and contrasted.

The DR Program and the Rain Garden Program categories have comparable administration costs which are significantly higher than the Municipal RainScaping Demonstration Projects. However, there are a significant number of value-added benefits to these programs that are not realized in the municipal

projects. These benefits are discussed in the following section in detail (Section 7.2 Additional benefits of the DR Program).

As summarized in **Table 11** below, the rain garden grant category has demonstrated a comparable (yet still higher) average cost for stormwater volume reduction, at $152/m^3 versus the average Municipal LID project at $134/m^3. However, in the cost estimate for project administration per stormwater volume reduction for a raingarden grant project is significantly higher, at $14/m^3 versus $4/m^3 for an average Municipal LID project. It must also be noted that the municipal LID demonstration projects treated runoff from roads and parking lots; as such there is also considerable benefit due to phosphorus reduction when compared to treating roof runoff.

Table 11: Summary Cost per Stormwater Volume Reduction Comparisons for DR/ Rain Garden Residential Grant/ Municipal LID demonstration projects

Project	Average Cost of Stormwater Volume Reduction	Cost Estimate for Project Administration per Stormwater Volume Reduction	Total Project Cost per Stormwater Volume Reduction
Residential Rain Garden Category in LEAP Program	$152/m^3	$14/m^3	$166/m^3
LID Municipal Demonstration Projects	$134/m^3	$4/m^3	$138/m^3
Downspout Redirection Project: Infiltration Trenches	$80/m^3	$18/m^3	$98/m^3
Downspout Redirection Project : Overland Extenders	$11/m^3	See note 1.	$11/m^3

Note:

1. The overland extenders were a spin-off benefit to the administrative efforts of the DR Infiltration Trenches. The homeowners who signed up for the infiltration trenches to be installed under their walkway were offered the opportunity to have a free flexible downspout extender attached to their other front yard downspout (on the other side of the garage) in order to redirect roof water to the grassed swale strip in between properties. Moving forward, it is recommended that this activity (attaching extenders) be carried out by staff at the point of door to door outreach.

8.0 Recommendations for Program Development

A DR Program has the potential to form the basis of a cost-effective urban residential stormwater volume reduction strategy. It is recommended that it be continued and further developed in the coming years.

8.1 DR Program Survey

To ensure that this program was meeting its objectives, a short survey was undertaken with the participating homeowners (Appendix 10). The intention of the survey was to gain insight into three key areas in order to advance program development: how well the contractor did; the effectiveness of outreach efforts used; and the willingness of homeowners to pay a percentage of the project. Below is a summary of the results from the surveys.

- The survey was over the phone with all participating homeowners (10 respondents comprised of the 3 homeowners who answered the call to action from the outreach letter, the 6 homeowners contacted at their door, and the Co-op Coordinator who spoke on behalf of the tenants of the 13 participating units at Three Links)
- All of the homeowners indicated that they were satisfied with the quality of work completed by the contractor. As discussed in the section of this report around volume reduction (Section 5.5.1 - Infiltration Trenches), most homeowner took interest in whether or not water was backing up out the overflow pipe during a big rain event; and none of them noticed rainwater coming out the overflow.
- Interestingly, all of the homeowners indicated that they would have willingly paid for a portion of the project. Half indicated that they would have been willing to pay a marginal amount to participate (10- 20%); and the other half said that they would have been willing to pay for up to 50% of the project; it's still a good deal.
- The letter appeared to be an effective means of helping people to understand the intention of the project. For the door-knocking direct outreach people felt generally that it was not too much of an intrusion and were fine with this approach as long as it was during daylight hours and that the staff were clearly identifiable as being with the LSRCA.
- The reasons given for homeowners participated in this project, the following were ranked highest (the most important) to lowest (not important):
    1. To help the creek or Lake Simcoe
    2. To fix a safety issue (slippery area, tripping hazard)
    3. To be a leader in my neighbourhood and/or to do the right thing
    4. This was a free home improvement project
    5. To improve the look or aesthetics of my home

  Other reasons given included:
  - To make the lawn better; more water for it
  - To fix the drainage which is currently flowing towards the foundation of the house

8.2 Additional Benefits of the Proposed DR Program

The following are a list of benefits beyond stormwater volume reduction that could be realized through this program.

Salt Reduction

The actual amount of salt reduced through this program will be difficult to quantify, but it stands to reason that private landowners will reduce their use of road-salt for melting and traction as the downspouts are no longer draining where people walk. A follow up survey could occur in the spring of 2018 and homeowners will be asked about water from the overflow, ice buildup, and whether they believed that they reduced their use of salt.

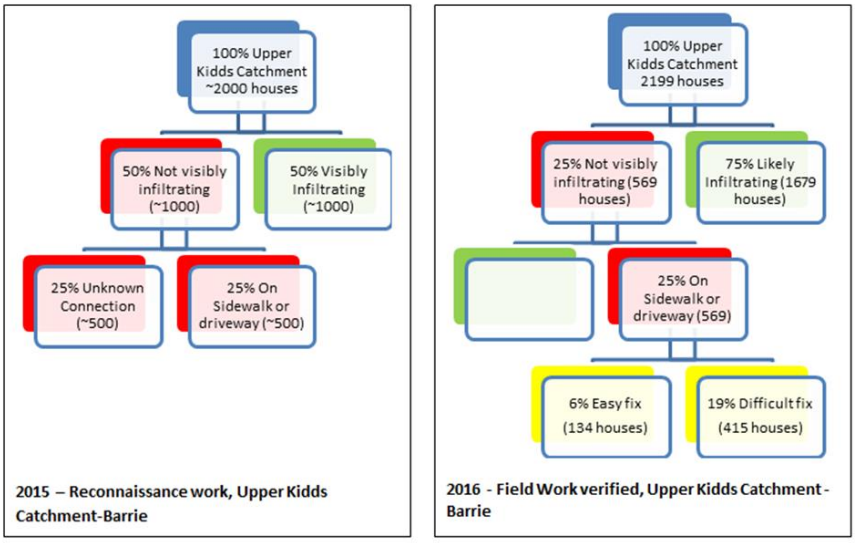
Environmental Education

The crux of this program is in the direct outreach efforts that result in conversations on the landscape about residential stormwater. Participants in this project all report that prior to the outreach, they had not previously thought about how their stormwater affects the health of the local environment. Interestingly, in the survey under the heading "reasons for participation" homeowners ranked *Helping Lake Simcoe and Kidds Creek* highest. This awareness could have significant spin-off benefits such as potentially easing the way for the implementation of Municipal Stormwater Utility Fee Programs, or in other household environmental improvement projects such as installing rain gardens or reducing winter road salt use (as discussed in previous section). Accordingly, because of the educational presentation to the Three Links Co-op community, management have voluntarily committed to making a product change away from winter road-salt to a more lake-friendly ice melting product for the rest of their site.

Conduit to Other Programs – Both LSRCA and Partner's

An additional benefit to a door-to-door outreach campaign is the information collected with regards to locating areas where illegal connections to municipal services may exist. For example, during the 2015 reconnaissance work, approximately 25% of the houses in Upper Kidds Creek were identified as having an unknown underground connection. It was suspected that these downspouts could have been connected to the City of Barrie's stormwater or sanitary sewer systems. In 2016, the students were tasked with taking a closer inspection at these underground connections. What they noted (either by witnessing where the downspout actually outlet onto the yard or through conversations with the homeowners who indicated that they were connected to a subsurface French Drain on the property), was that that this was not a problem in this area. As such, the students moved that 25% of households from the category of "Not visibly infiltrating" to the category of "Likely infiltrating" (**Figure 14**). This information was sent to the City of Barrie for their records.

Figure 14: Results from Activities to Ground-Truth Potential Locations of Illegal Municipal Connections



8.3 Recommended Timelines and Activities for Future Program

Timing:

One of the most important aspects to consider when implementing subsequent phases is timing of activities. This will ensure better program uptake while allowing cost efficiencies to be realized through better planning with Contractor schedules.

Table 12: Recommended Timelines and Activities for Future Program

ACTIVITY	Year 1				Year 2				Year 3			
QUARTER	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
A: Research and set target	■				■				■			
B: Outreach Activities		■	■			■	■			■	■	
C Contractor Selection				■				■				■
D: Landowner Agreements					■				■			
E: Construction						■	■			■	■	

A: Research and set targets

- Define geographic area for program (with good infiltration rates and insufficient SWM controls)
- Meet with Municipalities to align with their priority areas
- Look for multi-unit residential with single owner
- Set project targets based on goals/budget
- Identify priority projects based on potential roof area treated
- Results from previous year's work tabulated and process adjustments made (if needed)

B: Outreach Activities with extenders installed

- Letter to households introducing project
- Hire 2 temporary staff to install overland extenders (free item) and undertake direct outreach offering subsidized "help" to complete walkway work
- Gather a list of potential projects to be completed in following year with site photos; simple infiltration testing

C: Select Contractor for next year

- Contract administration (RFQ, contractor selection, PSA docs)

D: Landowner Agreements prepared and signed

- Scope of understanding of work
- Liability and insurance

E: Construction

- Aggregate project sites to allow for efficient and cost effective work plan

8.3.1 Recommended Activities to be Implemented in Subsequent Years (funding dependent)

1. **Continue the highly targeted approach.**
   Efforts are concentrated on a small number of houses/streets and multi-unit complexes located within the same geographic area. Choose sites that have the greatest potential volume of stormwater infiltrated including multi-unit residential complexes.

2. **Expand and modify the program into other communities in the watershed.**
   Modify the size of the infiltration trenches to be larger in areas where soils are tighter. A larger trench (wider, longer or deeper) could easily be constructed without a significant increase in cost. The most expensive aspect of this project from the contractor's perspective is machine/staff time. A larger trench would increase material costs marginally (more stone); but would not cause a significant increase in overall costs. As such, a second phase of this pilot project could occur in Newmarket or Aurora. It would be recommended that in area where tighter soils are expected that the infiltration rates are validated using a Guelph Permeameter. Additionally, a simple soil auger to estimate depth of clay pan is recommended.

3. **Modify timelines (as per Table 12) to gain cost efficiencies from contractors.**
   Stagger the program to fit with timing realities of Contractor schedules. By initiating the RFQ process in the winter season for work to be completed in the following summer, it is likely that more contractors will bid and cost efficiencies will be realized.

4. **Hire staff to complete the door-to-door outreach who will install free downspout extenders on properties with willing homeowners.**
   Working in a team of two, junior staff members will complete the direct outreach efforts on the target streets in order to sign homeowners up for DR infiltration trenches. During these home visits, have staff install flexible downspout extenders, where applicable, to redirect stormwater away from buildings and impervious surfaces to a pervious area. Willing homeowners would receive the extender and the installation for free providing they are willing to sign a hold-harmless waiver. The extender pipes could be labelled with a waterproof sticker that graphically depicts where the pipes should outlet.

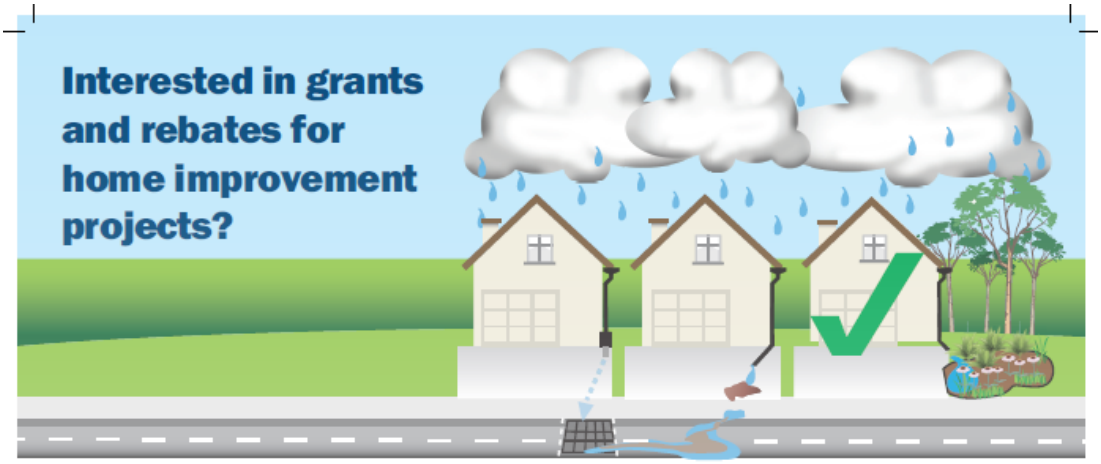
5. **Consider offering the work as a grant.**
   The survey results indicated a willingness of the homeowners to pay for a portion of the project costs. This would be effective in reducing overall program costs, but also changes the impression of the project away from "the LSRCA's project on my property" towards the homeowner recognizing this as their own project that was supported by the LSRCA.

6. **Continue outreach education efforts in order to continue the public dialogue about residential stormwater.**

   Outreach efforts such as the letters did not have a large impact on the numbers of homeowners willing to redirect their downspouts. However, because composing and mailing out a letter is an inexpensive endeavour, even if only a small number of people engage, the payoff is worthwhile. Outreach should be expanded recognizing that behaviour change usually requires repeated effort to be effective.

10.0 Appendices

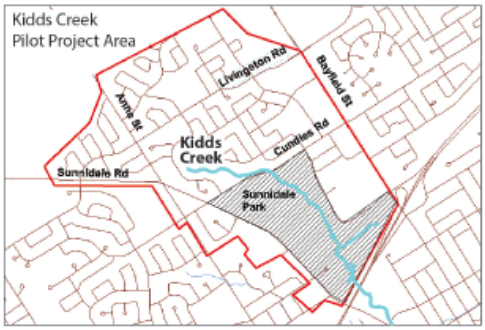
Appendix 1: 2016 Outreach Letter



We'll be in your neighbourhood this summer and would love to talk to you!

Because you live in a priority neighbourhood, Lake Simcoe Region Conservation Authority (LSRCA) staff will be knocking on your door to share details about property improvement programs available to you.

You'll know it's us, because we'll be wearing LSRCA uniforms, name badges and will be carrying identification cards.



Why are we offering these programs?

Because we want to improve the health of Kidds Creek and Lake Simcoe, and you can help!

In your neighbourhood, rain runs across hard surfaces like rooftops and driveways, flows into the stormwater drain on your street, and eventually makes its way into Kidds Creek. Kidds Creek runs through Sunnidale Park and carries rainwater and pollutants into Lake Simcoe, often causing flooding along the way due to the high volumes of rainwater flowing into the Creek.

By taking advantage of these FREE programs, you can help us reduce the amount of polluted stormwater reaching Kidds Creek!

If you're interested, we'll provide you with information about:

- The LSRCA Rain Garden grant
- RAIN Home Visits Program by Windfall Ecology Centre (a free home visit to help you manage stormwater on your property, including how to prevent basement flooding)
- The City of Barrie's Sanitary Sewer Inflow Reduction Rebate (SSIRR) Program

If you'd like to learn more about these programs, feel free to contact Andee at **a.pelan@LSRCA.on.ca** or **905-895-1281 ext.244**, or visit www.LSRCA.on.ca/landowner-assistance/kiddscreek.

Lake Simcoe Region conservation authority

Windfall ecology centre

The City of BARRIE

Appendix 2: Script

Downspout Redirect Script Final Copy

Hello, how are you?

Person 1: We are here from the Lake Simcoe Region Conservation Authority, we're not selling anything, we are actually just working on an environmental project in the area. The goal of this project is to restore Kidds Creek which flows through Sunnidale Park and to protect the health of Lake Simcoe which it eventually flows into. How we are trying to do this is by getting as much water from peoples roofs into the ground as possible and avoid it going into the storm sewers.

Person 2: All the storm sewers in this area flow directly to Kidds creek, so erosion from the water has actually washed away all the habitat, so nothing can survive there right now. So what we're trying to get people to do is to angle their downspouts onto a permeable surface like a garden or the lawn so water will travel with ground water, as opposed to the storm sewers. So the water will actually enter Kidds Creek a lot slower, colder and cleaner.

Person 1: We have some examples here of proper downspout extensions, as well as some information from the City of Barrie who is working with us on this project (Hand sheets, discuss and give further information as needed).

Person 1: We appreciate you talking to us

Person 2: Thanks for your time

Appendix 3: 2017 Outreach Downspout Redirect Letter

Hello neighbours,

Have you ever walked the trails in Sunnidale Park and noticed the beautiful creek that flows through it? It's one of my favorite spots in Barrie to get out and enjoy nature with my daughter. The creek that flows through Sunnidale Park is called Kidds Creek and it's the waterway that connects your house to Lake Simcoe. Unfortunately, because of the amount of stormwater entering the creek, this important natural area is in trouble!

You see, the rainwater that comes off your rooftop flows down your driveway and into the storm drain. That stormwater picks up pollution along the way and enters into Kidds Creek completely untreated.
I am writing to you today to see if you would consider redirecting your front downspout away from your paved surface and towards a grassy area or garden where it can soak into the ground. If we all do this one simple thing then we can help protect Sunnidale Park, the fish in Kidds Creek, as well as the health of Lake Simcoe.

In addition to helping keep your local creek and lake healthy, there are many other great reasons to re-direct your downspout away from paved areas. These include:

- Gives you a free source of clean water for your lawn or landscaping
- It reduces the impacts to our city of costly downstream flooding
- Can make your property safer by reducing slippery icy areas where you walk

You Could Win this Rain Barrel!

If you are able to easily redirect your downspout on your property into a rain barrel or towards your lawn or garden while still directing it away from your and your neighbour's house foundations, then please do so. Let me know when you've redirected and I'll enter your name into a draw to win a decorative rain barrel. Tips on how to redirect your downspout safely and properly can be found at http://www.lsrca.on.ca/landowner-assistance/kiddscreek.

If redirecting your downspout appears difficult or costly please contact me as you may qualify for time sensitive funding. Don't worry our staff will do the work, all you need to do is call us today!

All the best,

Andee

Andee Pelan

LSRCA Watershed Coordinator,
Lake Simcoe Region Conservation Authority
a.pelan@lsrca.on.ca | 905.895.1281 x 244 | www.LSRCA.on.ca

Lake Simcoe Region conservation authority

Appendix 4: Sample Landowner Agreement Form

Lake Simcoe Region Conservation Authority (LSRCA)
Residential Downspout Redirection Pilot Project 2017
Site Plan, Terms and Conditions

Landowner Contact Information

Name(s): Joe Sampleton

Mailing Address: _____ Town: Barrie

Postal Code: _____ Email: _____

Telephone: (Home) _____ (Work) _____ (Fax) _____

Street & Street Number: 10 Penton Drive

Property Tax Roll Number: _____

How did you find out about this program? _____

Site Plan

Describe current condition of downspout to be redirected:

-
-
-
-

Sketch of current condition:

Appendix 5: Pre and Post Construction Photos

Appendix 6: Downspout Redirect Survey

Lake Simcoe Region
conservation authority

www.LSRCA.on.ca

Date

Ms. Jane Doe
Address

Re: Downspout Redirection Pilot Project

Dear Ms. Doe,

Thank you for your participation in the Downspout Redirection Pilot Project. Your choice to redirect your downspout will not only help to improve the health of Kidds Creek and Lake Simcoe, but will also help to gather valuable information on how to best design and implement this program in the future to our watershed community.

We value your opinion! In the next few days I will be calling you personally to conduct a short five minute survey about your experience with the project. Enclosed you will find a copy of the survey questions, so that you have the opportunity to review them in advance. Your honest responses are important to us. Please be assured that your name and responses will be kept confidential.

Do you have any questions? You are welcome to call and leave a confidential message on my private voicemail at 1-800-123-4567 ext. 123.

Thank you again for your time and participation in the Downspout Redirection Pilot Project. I look forward to chatting with you in the very near future.

Regards,

Name, Title
email

120 Bayview Parkway
Newmarket, Ontario L3Y 3W3
Member of Conservation Ontario

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