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Bureau d'assurance du Canada

NORTH HURON

THE WINGHAM RAIN BARREL STUDY

A JOINT PROJECT BETWEEN INSURANCE BUREAU OF CANADA AND THE TOWNSHIP OF NORTH HURON, ONTARIO | 2009–2011

June 2011

CONTENTS

1. EXECUTIVE SUMMARY

Insurance Bureau of Canada (IBC) conducted the Wingham Rain Barrel Study in the Township of North Huron , Ontario, from 2009 to 2011. IBC initiated this pilot to test, in real world conditions, the challenges and the impact on water system infrastructure of installing a large cluster of rain barrels in a community to help manage stormwater.

This pilot was part of IBC's mandate to explore ways to help communities adapt to climate change. In particular, the pilot as designed to investigate a way to reverse the trend of increasing water-related losses linked to climate change. These losses now account for 40% of personal property insurance claims, the largest claims category, and well ahead of fire losses at 20%.

The pilot project broke new ground in North America; a literature review revealed that no other attempt had previously been made to systematically introduce rain barrels to every household in a community and to subsequently measure the impact of that distribution.

The project proved successful on several fronts. A strong working partnership quickly developed between IBC and the Township of North Huron where Wingham is located. IBC undertook barrel supply and distribution at no charge to residents along with communications support and monitoring and analysis of data. The Township collected data on water flow and weather, provided technical support, helped with barrel distribution and supported media events.

Another success was the widespread acceptance of the project by the community, which demonstrates the strength of the communications efforts. Residents of almost all of the 1,000 households in Wingham picked up rain barrels during two weekend distribution events.

Program monitoring, however, revealed that this initial acceptance did not translate into full compliance with the project goals. Only 58% of distributed barrels were installed (yet this is the highest percentage of installed rain barrels in any community). Of those installed, very few were regularly emptied after rain events, which resulted in less than optimal rainwater capture.

Still, installation alone had a positive impact on stormwater management for an unexpected reason. In the process of installing barrels, 70% of the community's downspouts were disconnected from the sewer system, which meant less rainwater flowing into that system. As a result, there was a 5% reduction in the ratio of rainwater to volume of water pumped at the sewer treatment plant between 2009 and 2010.

There is need for a mechanism for ensuring that rain barrels are emptied after rain events to allow them to refill during the next event. A simple solution would be to install a gravity-based drain valve on the hose at the bottom of every rain barrel. This would allow the slow release of water into the soil over 24 to 33 hours after a rain event without the need for homeowner intervention. Analysis of rainwater and barrel-filling data shows that if the Wingham barrels had been equipped with slow-release valves to allow them to empty and refill with each rainstorm, they would have captured 25% of rainwater that fell on roofs equipped with barrels during the period monitored.

IBC looks forward to implementing these lessons learned at another pilot project in a second community in the near future.

2. BACKGROUND

Insurance Bureau of Canada (IBC) is the national industry association representing Canada's private home, car and business insurers. The industry has become concerned with the increasing amount of sewer backup, urban flooding and water damage in Canada. In fact, water-related losses are now the predominant type of loss, to the extent that water losses account for 40% of personal property insurance claims. This far exceeds the 20% of claims related to fire losses, which until recently was the largest claims issue. The dramatic shift to water-related losses has happened within the last 10 years.

In many communities across the country, the municipal storm and sanitary sewer infrastructure is aging or was not designed for current conditions and can no longer cope with the increased frequency of intense rain. Regular maintenance of the infrastructure is essential, and in many cases significant changes are required. IBC has been working on a number of initiatives to help governments and communities deal with the infrastructure issue and to help individuals prevent losses due to water damage.

The Rain Barrel Pilot Project is a community program that was initiated to test the hypothesis that the large-scale use of rain barrels throughout a community can have a significant impact on the amount of water being absorbed into the infrastructure system.

Previous Research on Rain Barrels

When IBC extensively reviewed the literature about projects both in Canada and in the United States, we were unable to find examples of communities in which such a systematic program existed. The reach of most comparable programs was 5% or 6% of households. This would likely to have little or no impact on the volume of water diverted.

Many cities in Ontario – including Guelph, Kingston, Kitchener/Waterloo, Ottawa, Peterborough, Toronto and Windsor – have implemented rain barrel programs to help reduce loads on sewer infrastructure. It is generally agreed that when used appropriately, rain barrels may contribute to reductions in direct stormwater runoff and may be used as an integral part of stormwater management plans. However, the programs that have been implemented so far have been voluntary, and therefore concentrated cluster coverage has been very difficult to achieve.

Two programs from the United States were also considered for the design of the current study: the Nine Mile Run basin project in Pittsburgh, Pennsylvania, and the Shepherd Creek project in Cincinnati, Ohio. However, both programs were implemented on a small scale and the participation rates were very low, making measurement a challenge.

The studies showed that future projects would need to ensure the widest possible distribution, proper communications support and the accurate monitoring of results. To that end, IBC and the Township of North Huron developed an extensive pilot that included widespread distribution, communications processes and monitoring techniques.

Questions for the Pilot Project

Once a literature review identified knowledge gaps about the large-scale use of rain barrels, IBC structured the Rain Barrel Pilot Project to address those gaps. When considering how to develop the project, two main questions were posed:

1. Would the implementation of rain barrels in a majority of households within a community have an impact on the water sent to the pumping station, either by volume of water or in the delayed time it would take for that water to reach the station?
2. Would household use of rainwater from barrels significantly reduce the volume of treated water required by individual households or the community?

Site Selection

IBC used the following criteria to help locate the best possible test site:

- A small community of about 1,000 households;
- A locale with stressed combined storm and sanitary sewer infrastructure;
- A municipality that had not planned to improve its infrastructure during the project duration;
- A group of households equipped with individual water meters to allow the measurement of fresh water consumption;
- A location with reliable historical rain records;
- A location with reliable pump station records;
- Administrative and political leaders who would support the project; and
- A community in close proximity to Toronto to allow for convenient interaction and supervision.

The project leader developed a shortlist of three municipalities in southwestern Ontario and met with municipal leaders of those areas. Wingham, Ontario, in the Township of North Huron, was chosen as the site that best fit the criteria. Officials and residents of Wingham embraced the project wholeheartedly and provided outstanding support.

3. PROJECT RESPONSIBILITIES AND THE INSTALLATION PROCESS

Partnership Roles

Insurance Bureau of Canada and the Township of North Huron divided responsibilities to execute the Rain Barrel Pilot Project in Wingham.

INSURANCE BUREAU OF CANADA

- Provided 1,000 rain barrels to be distributed at no cost to each household in Wingham
- Provided communications support, which included the following:
    - News conference to announce the program.
    - Two weekend events to distribute the rain barrels to residents – organized in cooperation with the Township of North Huron.
    - Paid media to advise local residents about how to use the rain barrels.
    - Paid media to advise residents about how to store their barrels in winter.
- Surveyed the houses to monitor how many rain barrels were installed,
- Paid for analysis of the data collected,
- Provided personnel for rain barrel installation blitzes,

TOWNSHIP OF NORTH HURON

- Collected pumping flow data at station,
- Provided data (flows, weather, water meter) to measure the program,
- Contributed to the distribution of rain barrels and kept a list of addresses,
- Supported media events,
- Installed a weather monitoring station at the pumping station,
- Provided technical expertise for measurement,

Rain Barrel Installation Process

Rain barrels were available for free to all residents coming to collect them at a local community centre and providing proof of residence. Their names and contact information were recorded. Barrels were distributed on April 18, May 9 and May 27, 2009. People were notified that the Township of North Huron would help them install their barrels free of charge.

See Appendix A and Appendix B for geographic information system (GIS) maps that show rain barrels distributed and installed in 2009.

By the end of July 2009, when the survey was conducted, households comprising 60% of the residential roof surface had been equipped with a rain barrel. Unfortunately, there was very little rain activity that summer, and therefore no significant data was available for analysis of intense rain events. The project was extended therefore into the next summer. People in the community who had collected a rain barrel in 2009 were advised about how to store it for the winter in preparation for the next season.

During the spring of 2010, another 100 rain barrels were distributed to houses wanting a second rain barrel, and a new survey was conducted to find out how many of the original rain barrels were still installed.

In the summer of 2010, enough rain fell to be able to collect data to measure the effectiveness of the rain barrels.

4. COMMUNICATIONS SUPPORT

The Rain Barrel Pilot Project was supported by a significant communications effort, with both earned and paid media. The communications initiatives were deployed in three phases:

PHASE 1 – PRE-LAUNCH

Prior to the launch, communications efforts focused on the municipal staff and elected officials; meetings were held with public works staff and the town clerk to determine the role each organization would take, and to anticipate residents' questions and prepare spokespeople.

PHASE 2 – LAUNCH

A news event was organized to announce the program. Paid newspaper ads informed the public about the times and dates of distribution and instructed people on the use of barrels. Another media event was organized at the Wingham civic centre to promote and distribute rain barrels.

PHASE 3 – POST-LAUNCH

Paid newspaper and radio ads promoted rain barrel installation blitzes; paid newspaper ads reminded residents to install their rain barrels; paid newspaper ads thanked residents for their participation, as did a community barbecue in a local park with local leaders. Later in the fall season, another newspaper ad provided tips on winterization of the barrels.

5. TOWNSHIP OF NORTH HURON (SECTOR WINGHAM) TECHNICAL DESCRIPTION

Description of the Study Area

Wingham, Ontario, is situated in North Huron County, within the Maitland watershed, and is governed by the Maitland Valley Conservation Authority (MVCA). The watershed is located in the southwestern part of the province on Lake Huron (Figure 1).

Figure 1: Location of the Maitland watershed in southwestern Ontario (MVCA.on.ca, 2011)

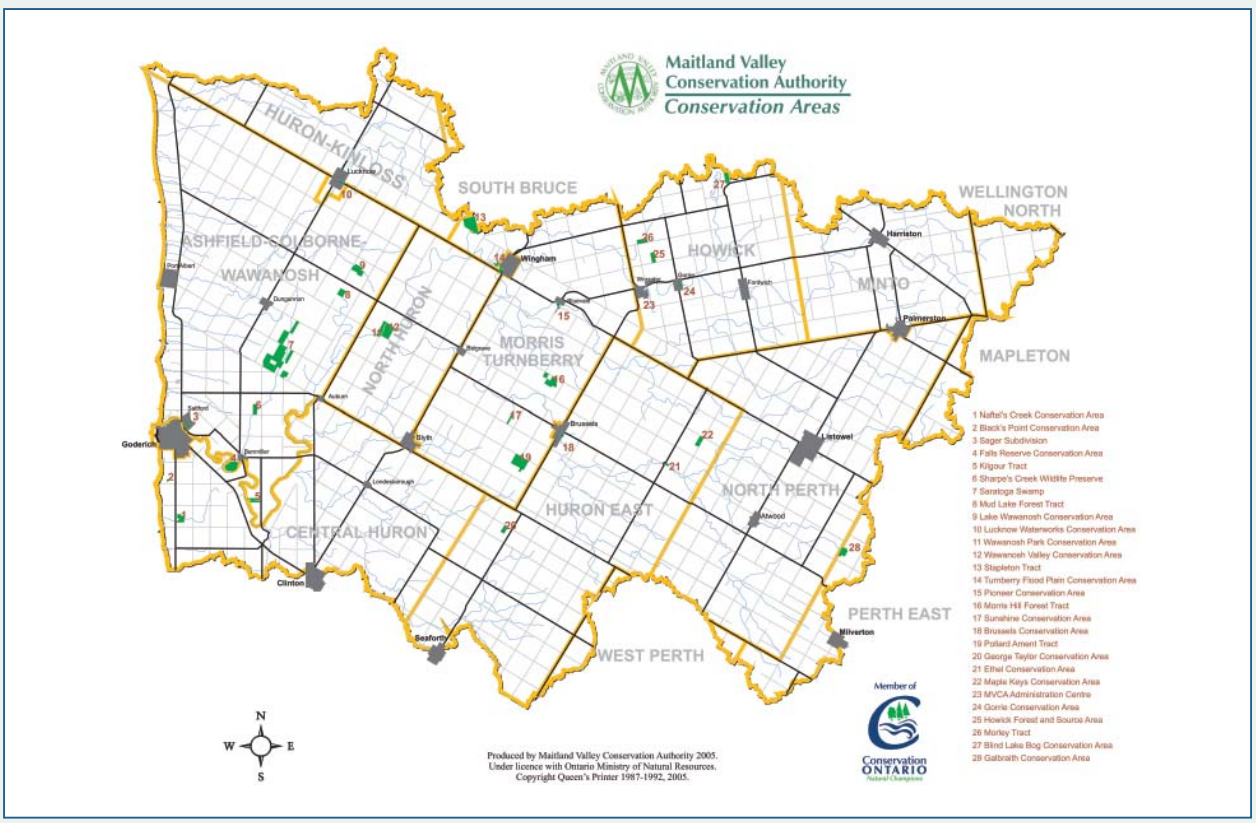


Figure 2: MVCA conservation area jurisdiction in southwestern Ontario (MVCA.on.ca, 2011)

Figure 3: Maitland Valley and Nine Mile watersheds (adapted from MVCA.on.ca, 2011)

The MVCA conservation area is 3,266 square kilometres, comprising two major watersheds: Maitland and Nine Mile (Figure 2). The Nine Mile watershed is 243 square kilometres and drains into Lake Huron at Port Albert. The Maitland watershed is 2,592 square kilometres and comprises five major sub-basins: North Maitland, South Maitland, Little Maitland, Middle Maitland and Lower Maitland (Figure 3). The Maitland River is 150 kilometres long and flows through the Maitland watershed and eventually drains into Lake Huron at Goderich.

Wingham is a small community with a population of approximately 3,000 people and is part of the North Maitland and Middle Maitland sub-basins at the intersection of the North Maitland and Middle Maitland rivers. In 2001, the town of Wingham amalgamated with the village of Blyth and the Township of East Wawanosh to form the Township of North Huron. Surface water quality of the sub-basin is considered to be relatively healthy.

SOIL COMPOSITION

Wingham soil is mainly composed of well-graded glacial tills of sand and gravel. These soils have good drainage properties. However, sub-surface geology is not constant over the basin and there is a small area composed of finer grained silts characterized by a slower infiltration rate. This area is more susceptible to rainwater pooling.

Infiltration rates usually decline rapidly in the early part of a heavy rainstorm event when the rain can clog soil. Fast, intense rainfalls are less likely to infiltrate properly, therefore causing increased runoff.

Storm and Sanitary Network

The North Huron Public Works Department is responsible for the storm and sanitary network and municipal drainage. The following section provides a brief description of the current systems.

COMBINED SEWER SYSTEM

Many newer cities are designed to convey sewage and stormwater separately. The town of Wingham, however, has a combined sewer overflow system that accepts both raw sewage and stormwater runoff together. Although stormwater runoff is only one component contributing to high flows, it is largely responsible for basement flooding and raw sewage discharge during intense, high rainfall events.

The town of Wingham had previously allowed roof downspouts to drain directly into municipal sanitary sewer pipes, and some downspouts are still connected. During wet weather, the water loads from these downspouts can exceed the system's capacity, causing pipes to overflow raw sewage directly into the Maitland River. The discharge of large volumes of raw sewage can have negative environmental, biological and social effects. During the Rain Barrel Pilot Project, many of these downspouts (70%) were disconnected from the sewer pipes.

Appendix C shows the households where downspouts were disconnected from the sewer system during the rain barrel installation process.

SEWAGE TREATMENT PLANT

The Wingham Sewage Treatment Plant (STP) treats raw sewage for E.coli and other pollutants based on criteria set out in the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA). Generally the effluent components comply with the requirements of COA and the Ministry of the Environment. A summary of the Wingham Sewage Treatment Plant is outlined in Table 1.

Table 1: Yearly Sewage Treatment Plant Summary

	2009	2010
Sewage Treatment Plant Capacity (cubic metres per day)	3,400	3,400
Capacity Exceeded? (for full year, including time before rain barrel installations)	Yes	No
Average Annual Capacity	87.6%	56.9%
Possible Contributors to High Water Loads	Sump pumps illegally hooked into sanitary system	Sump pumps illegally hooked into sanitary system
Possible Contributors to Low Water Loads		i) Downspout disconnections through rain barrel installations ii) decrease in water table iii) local industry closing

6. DATA COLLECTION

Data was collected from various sources for use in the analysis of rainwater storage. The details of the data directly used in the project are shown in Table 2.

Table 2: Data Collected and Used in Study

DATA TYPE	UNIT	TIME PERIOD	RESOLUTION	SOURCE	NOTES
Rainfall	millimetres	2007–2010	Hourly	Maitland Valley Conservation Authority	
STP Pumping Rates	litres per second	2008–2010	By the Minute	Township of North Huron	
Wet Well Level	metres	2006–2009	By the Minute	Township of North Huron	Occasional missing values (all years); data not provided for 2010
Rain Barrel Installations	1 barrel per location	2009	–	Township of North Huron geomatics	See Appendix A map
Downspout Disconnections	1 barrel per location	2009	–	Township of North Huron geomatics	See Appendix B map
Rain Barrel Specifications	–	–	–	Homedepot.ca	

RAIN BARREL DATA FOR THE PROJECT

- Maximum potential capacity of stormwater diversion for a single event if all barrels were installed and properly used: 205,000 litres
- Number of barrels distributed in 2009 and 2010: 924
- Number of barrels installed in 2009: 458 (49.6%)
- Number of barrels installed in 2010: 534 (57.8%)
- Roof area: 111.5 square metres
- Average roof eaves services total area of the roof
- Each downspout collects 33% of the total water from the eaves

RAIN BARREL FILLING

During the first rainfall event of 2009, the rain barrel could be expected to fill as seen in **Figure 4**.

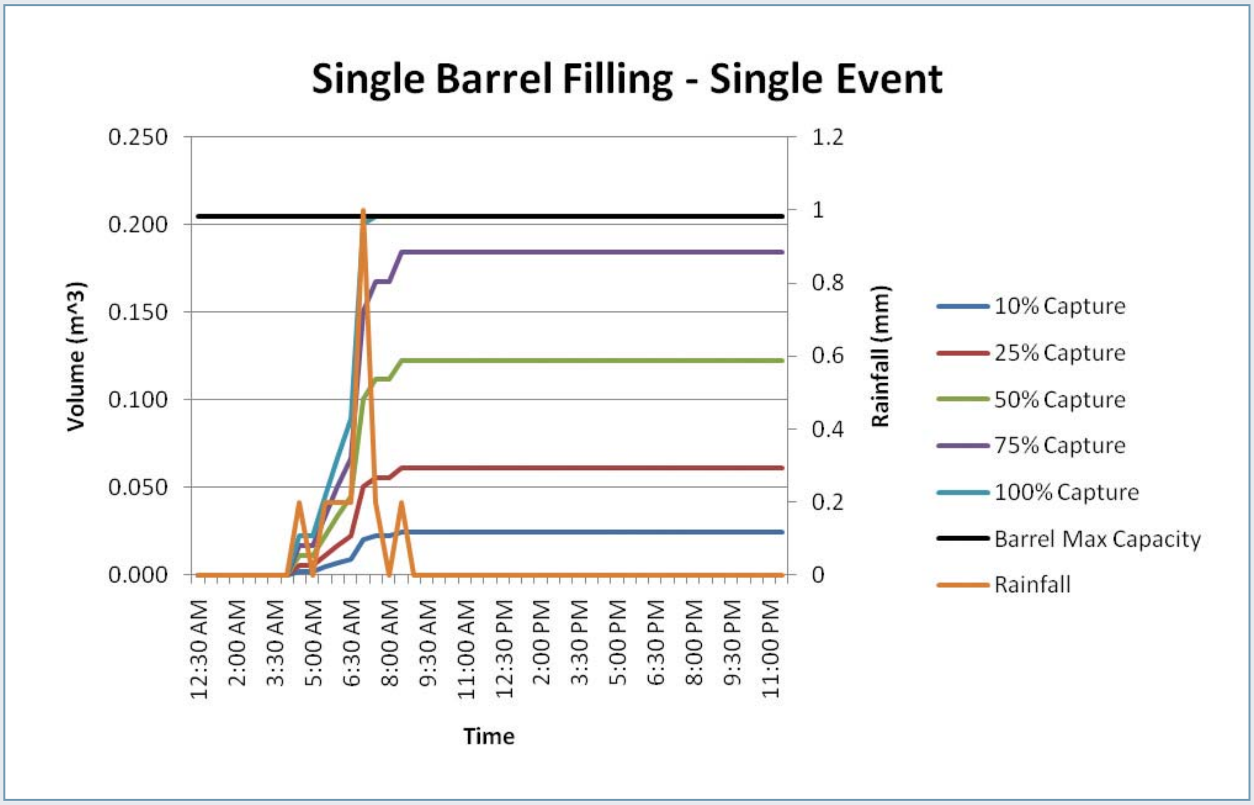


Figure 4: A single rain barrel filling in the first rainfall event of 2009; different percentages of capture

In Figure 4, different rates of rainfall capture are presented to observe the effect of these different rates on the time it takes rainwater to fill a barrel. If it captured 100% of the rainwater falling onto the roof, the barrel would fill up within a few hours of the rain starting. However, it is more likely that only 50% to 75% of the rainfall would be captured because of inherent losses in the system, such as water falling over the roof and leaks in the gutter system. Therefore, the barrel would not actually be filled from the first rainfall. At all capture rates though, the barrel would fill in the second rainfall.

Each barrel would have had the potential to store up to 9,100 litres of water in 2009. However, this volume was not captured because the barrels were not emptied by residents.

EFFECT OF USING GRAVITY DRAIN VALVES

A gravity-based drain valve, or gravity cap (a cap pierced with a small hole), could be inserted onto the hose at the bottom of a rain barrel to allow the slow release of water into the soil. This could affect the flows all season long. Figure 5 depicts performance that could have been achieved with a 1 millimetre diameter hole in a barrel in the 2009 season.

The barrel typically reaches maximum capacity a few times during a season, which results in overflows from the barrel. However, with a gravity drain valve, the water would be released from the barrel over a long period – between 24 and 48 hours, depending on the elevation of the barrel. For example, when equipped with a 1 millimetre valve, a barrel would be emptied over a 33-hour period at ground level and over a 25-hour period at a 5-inch elevation.

Because the ground would still be saturated from the rainfall event, not all of the rainwater discharged from the barrel would infiltrate into the ground – some would run off to the sewer or directly to the river. However, because the barrel would be releasing the water slowly and in a controlled manner, the volume distributed over the period would not put as much stress on the system.

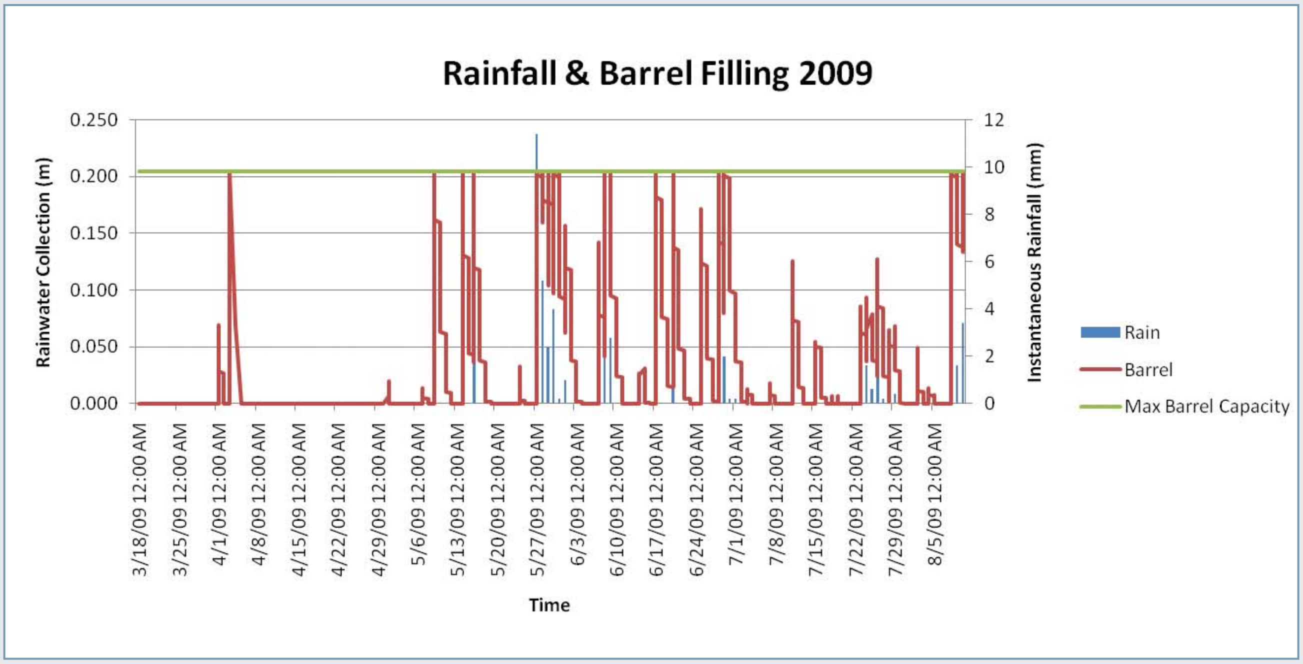


Figure 5: A single rain barrel equipped with a gravity drain valve over spring/summer season

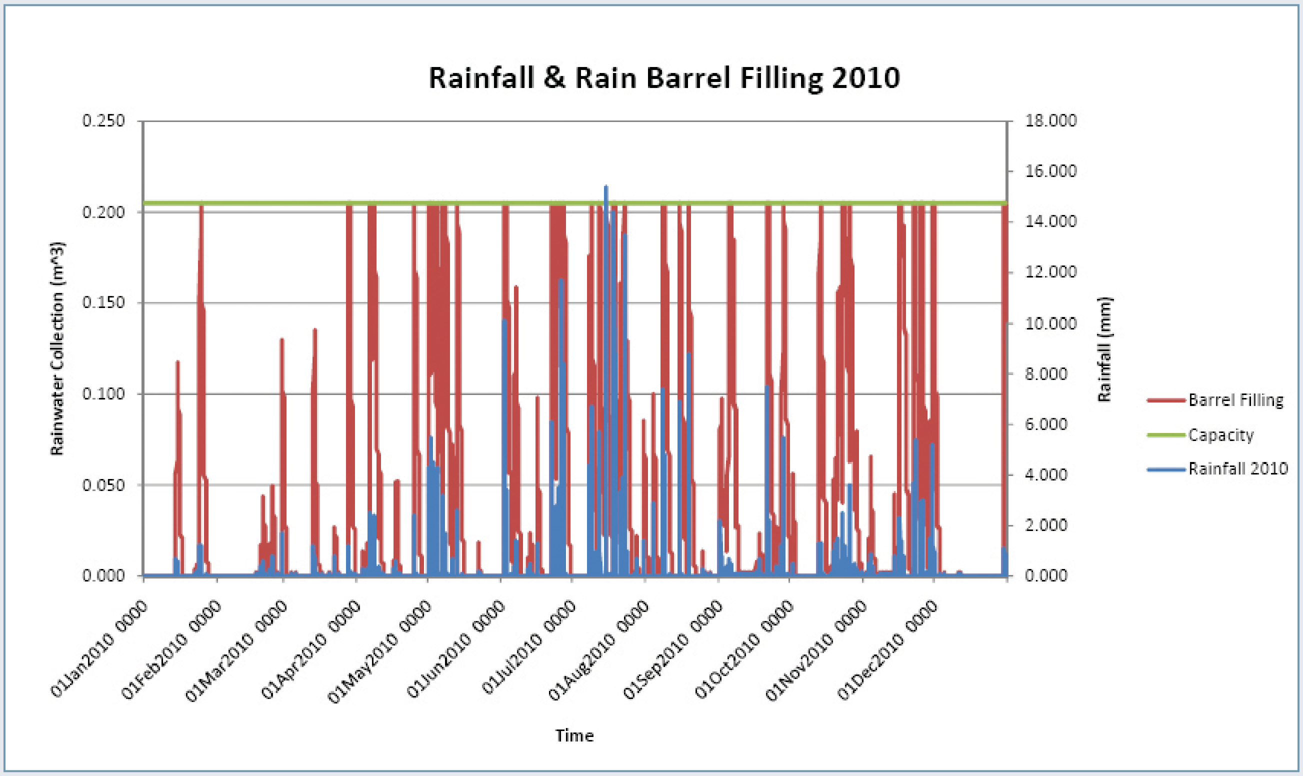


Figure 6: Amounts expected from a single rain barrel with a 1 mm gravity drain valve during the 2010 season

DOWNSPOUT DISCONNECTION DATA FOR THE PROJECT

Rainfall events were compared before and after the disconnection of downspouts. The downspouts were disconnected as part of the barrel installation process. The selection of events was based on the following criteria:

- No significant rainfall within 24 hours before an event
- Complete rainfall records maintained
- Complete sewage treatment plant flows records maintained
- Similar timing/season

7. IMPACT OF RAIN BARRELS

Use of Rain Barrels to Divert Water

In 2009, a reduction of approximately 26% from 2008 was observed in water flows at the sewage treatment plant (see Table 5). In 2010, a reduction of approximately 5% from 2009 was observed. (The large difference in these percentages is due to the fact that water tables were high in 2008 due to flooding in Wingham.)

There was also a reduction in sewage overflows. However, it is unlikely that the reductions were a direct result of rain barrel use. Based on surveys conducted during the project, most residents were not emptying their rain barrels after rainfalls; therefore, no more water could be captured from subsequent events. It is more likely that the reductions were due to combined changes in the water table and the disconnection of downspouts from the system for the duration of the pilot project. See the section below "Influence of Downspout Disconnections."

Installation of Rain Barrel Gravity Drain Valves

The benefit of rain barrels could have been greater if the barrels had been emptied after each rain event in order to maintain their maximum temporary storage capacity. The most cost-effective and likely way to address this shortcoming would be to devise and install a gravity drain valve, which would automatically empty the barrel without the resident having to do it.

Based on the rain precipitation levels of 2009 and 2010, we estimate that if the rain barrels in Wingham had been equipped with gravity drain valves, they could have collected more than 4.5 million litres of water – the equivalent of two Olympic-sized swimming pools. We also conclude that the collection potential is greater in a dry year as opposed to a wet year because the barrels would overflow less often.

Table 3: Estimated Capture Using Gravity Drain Valve with Rain Barrel

YEAR	TOTAL POTENTIAL WATER CAPTURE (LITRES) *(assume all rain falling is collected)*	ESTIMATED WATER CAPTURED IN BARRELS WITH 1 MM DIAMETER DRAIN VALVE (LITRES)
2009	17,133,000	4,641,000
2010	18,700,000	4,670,000

Using a gravity drain valve as an integral part of the rain barrel would be a cost-effective solution to the problem of residents not emptying the rain barrels.

Influence of Downspout Disconnections

During the pilot project, downspouts were disconnected from the sewer system in order to install the rain barrels. Seventy per cent of households that installed rain barrels had the downspouts disconnected from the sewer system as part of the installation process.

The disconnections can prevent localized flooding by diverting rainfall away from the house and onto lawns and gardens. It reduces the amount of water flowing directly into the sanitary system. This could have many positive effects: It could delay the time at which the peak is seen at the sewage treatment plant (since it's not being conveyed as quickly); reduce the peak flow (depending on downspout practices and infiltration rate of the soil); and decrease the volume of water being pumped at the sewage treatment plant.

An additional benefit to downspout disconnection is that increased infiltration from diverting rainwater onto lawns can replenish groundwater flows. Soil acts as a natural filter so as the water infiltrates, it also is purified of many contaminants, especially when directed to infiltration trenches, vegetated swales or rain gardens.

In comparing the rainfall events, 2008 water flows to the sewage treatment are more than three times greater than 2009 and 2010 for small/average rainfall events (Table 4).

This suggests that downspout disconnection is likely contributing to reduced sewage treatment plant flows for smaller precipitation events. The downspout disconnection does not noticeably affect flows for large events, possibly because even though rainfall is now being diverted into the soil, the soil is already saturated and cannot absorb more water.

Table 4: Pumped Volumes for Small/Average Rainfall Events

YEAR	STP VOLUME (LITRES)
2008	9,400,000
2009	2,900,000
2010	1,700,000

Overall, both 2009 and 2010 experienced more rainfall but less sewage flows than 2008 (Table 5). This may be attributed to the disconnection of downspouts in 2009 and 2010.

Table 5: Annual Sewage Treatment Plant (STP) Volumes and Annual Rainfall Amounts 2008–2010 for the period June 1 to November 30

YEAR	TOTAL STP VOLUME JUNE 1 TO NOV. 30 (LITRES)	TOTAL RAINFALL JUNE 1 TO NOV. 30 (MILLIMETRES)
2008	383,000,000	78
2009	182,000,000	283
2010	366,000,000	522

The data supplied for the table also support the premise that downspout disconnection reduces sewage treatment plant flows for small to average-size events. The 2009 season experienced a greater number of dry days; however, the rain events were intense, with insufficient infiltration and larger overland flows. The 2010 season was consistently rainy, with smaller events captured by infiltration; higher rainfall but lower sewage treatment plant volumes were experienced.

8. LESSONS LEARNED AND SUGGESTIONS FOR FUTURE PROGRAMS

A number of lessons were learned through the Rain Barrel Pilot Project in Wingham. These lessons will allow for the development of more effective initiatives in the future.

Distribution and Installation of Rain Barrels

The distribution of free rain barrels was a huge success, with over 900 rain barrels picked up during the pilot phase. The barrels were provided free of charge, and information about distribution, installation and usage was circulated in local papers and on radio stations.

There is room for improvement with the number of barrels actually installed. To confirm the installations, IBC sent a team of students to the addresses where the rain barrels had been distributed to check if they had been installed.

Near the end of the summer in 2009, 458 barrels had been installed in the community, both by residents themselves and by Public Works staff in installation blitzes. This means that 514 barrels had not been installed. In informal interviews, residents were asked why they had not installed their barrels. Reasons for not installing included that they didn't know the barrels needed to be installed, they gave their barrels to a relative outside of the community, they found the barrels too hard to install or they would "get to it" later.

SUGGESTIONS FOR FUTURE PROGRAMS

The issue of free distribution of rain barrels to residents should be reviewed to increase the installation rate. One option would be to distribute the rain barrels for a nominal fee of $25, which would be reimbursed once the barrel has been properly installed on the property. This would increase the installation rate and lessen the likelihood that the barrels would be passed on to people outside the municipal limits.

Another benefit of this option would be to allow residents to get more than one rain barrel if they chose, thereby at least partially offsetting the households that didn't use any.

Effectiveness of Rain Barrels to Increase Delays and Volumes of Water Pumped

The initial storage capacity of the rain barrels was not maintained because residents either did not use the water from the barrels or did not empty their barrels. This tells us that, in future, methods must be found to ensure that the rain barrels are emptied following a rainfall.

SUGGESTIONS FOR FUTURE PROGRAMS

To ensure that the storage capacity of the rain barrels is maintained, rain barrels could be equipped at distribution with a gravity drain valve, which would release the water at a slow rate out of the barrel and into the property's yard. A 1 millimetre valve would release the captured water over approximately a 24-hour period, depending on the elevation of the barrel. This initiative would add a minimal cost of only 60 cents per barrel to the project.

Equipping barrels with a gravity drain valve would allow rain barrels to drain and be empty for subsequent rainfall events.

Disconnection of Downspouts

When teams conducted visual surveys of rain barrel installations, they noticed that because of the installation of the barrels, 70% of downspouts in the community had been disconnected from the storm/sanitary infrastructure. As highlighted earlier, the disconnection of downspouts diverts water from the sewer system. However, similar to the problem of people not emptying their rain barrels, residents are unlikely to disconnect their downspouts unless they do so as part of the process of installing the rain barrel.

SUGGESTIONS FOR FUTURE PROGRAMS

To ensure that the maximum potential is achieved from the diversion of water through downspout disconnection, the focus for installation of rain barrels could be in those areas within the project where there is a high rate of downspout connection.

Use of Treated Water

One hypothesis was that residents would use the collected rain water for gardens and lawns instead of using water purchased through the municipality. However, surveys conducted in Wingham indicate that only a small percentage of the collected water was used. When water meter data were collected and analyzed, no significant reductions were noted, either for the total water used by the municipality or for the individual homes equipped with a rain barrel.

Also, people tended to use the rainwater as an additional water source for use in their gardens and lawns and not as an alternative to treated water.

SUGGESTIONS FOR FUTURE PROGRAMS

To encourage people to use the water from the barrels instead of treated water may require an education campaign to convince residents of the advantages of using the rain barrel water. Some information about this could be included in future communications about the project.

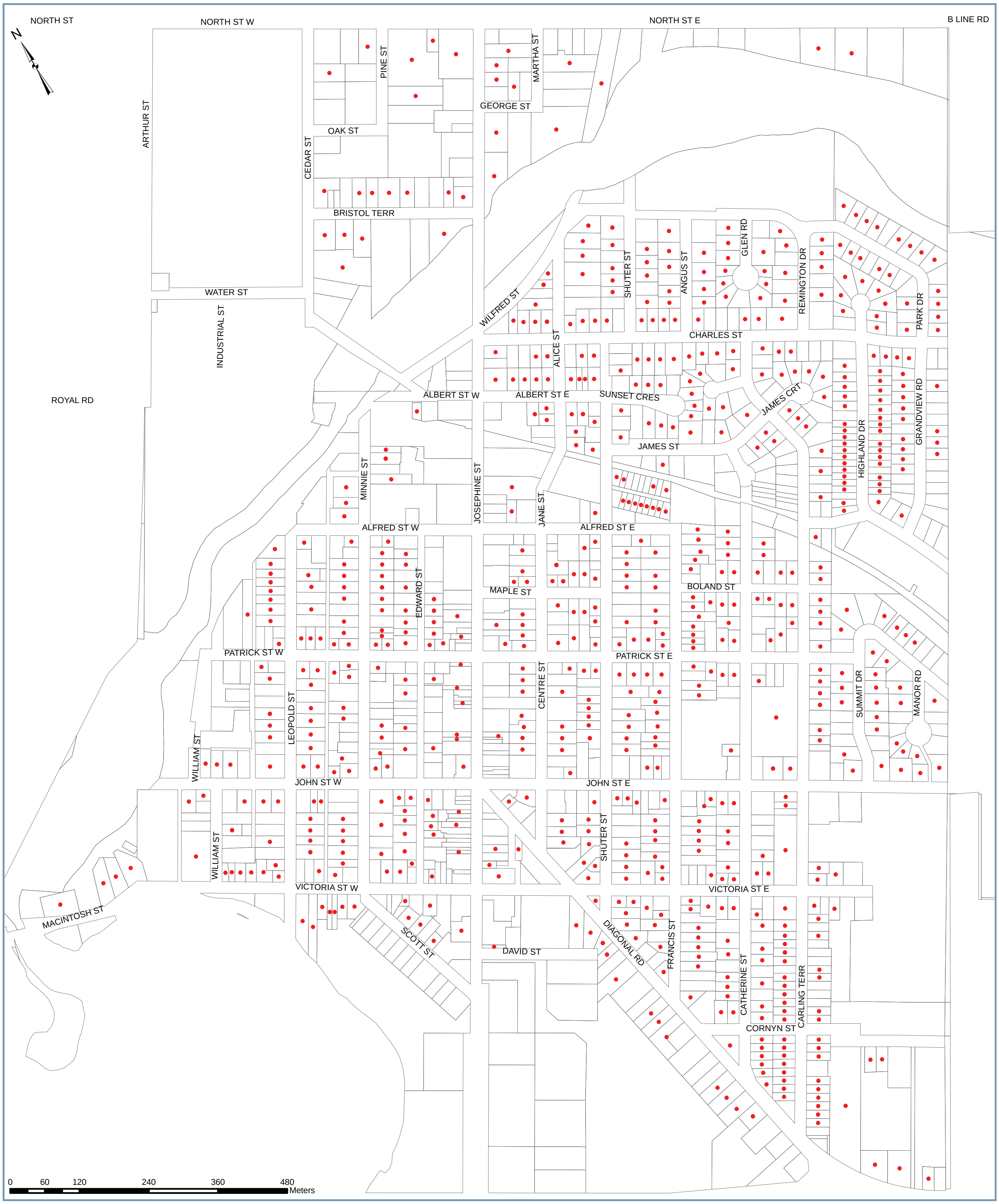
9. NEXT STEPS

IBC will communicate key messages about the results of the program to the residents in the Wingham community.

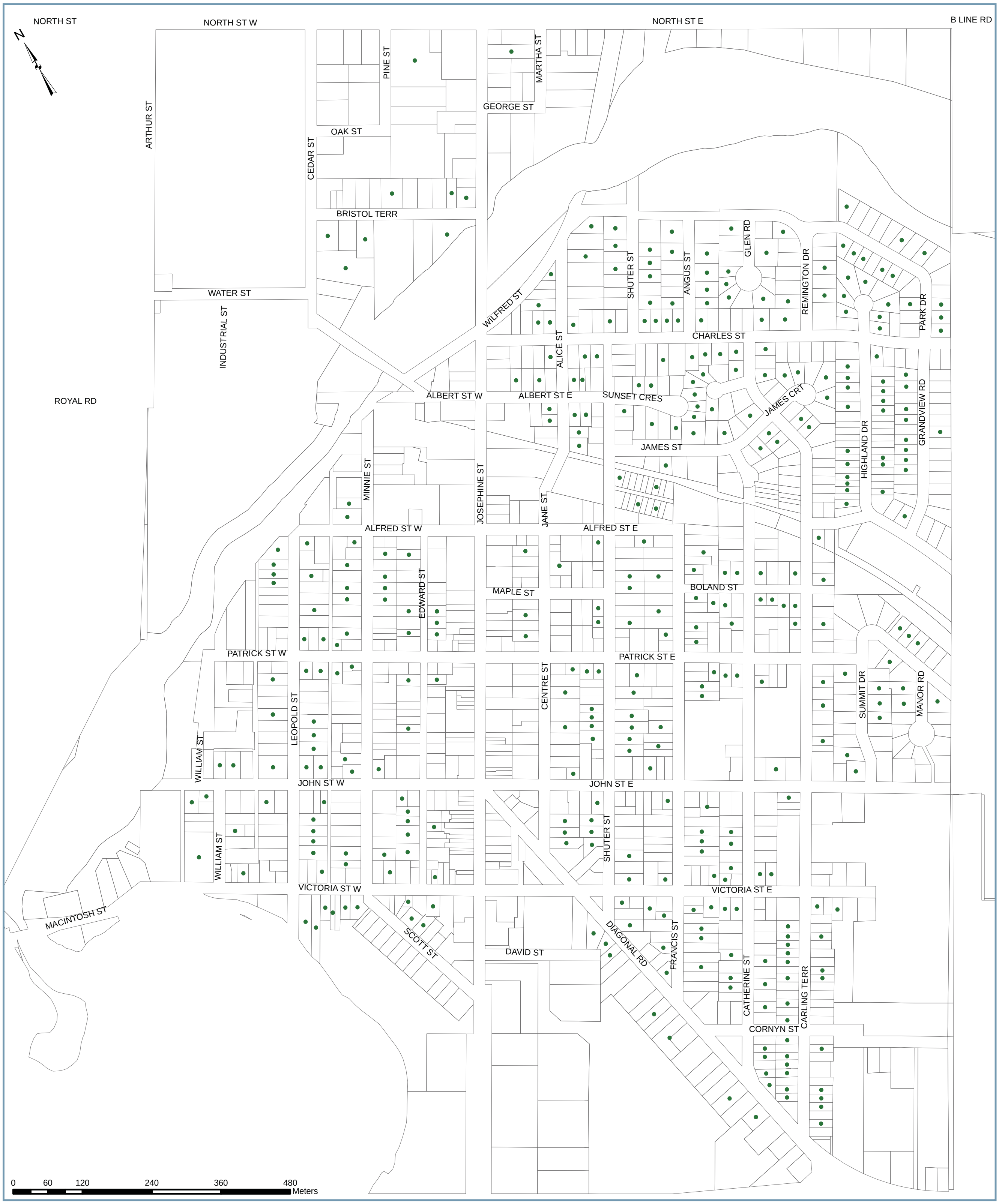
All households in Wingham will receive gravity drain valves and information about how the valves could help them use their barrels more efficiently.

Consideration will be given to initiating a second pilot program in another community to implement the lessons learned, including the use of a gravity drain valve, and continue to measure the effectiveness of the program.

APPENDIX A – Rain barrels distributed in 2009



APPENDIX B – Rain barrels installed in 2009



APPENDIX C – Downspouts disconnected from the sewer system