CASE STUDY 3

HASTINGS AVE.

RESIDENTIAL FLOOD PROTECTION AND STORMWATER COLLECTION

This Hastings Ave. ARB system installation proved to have excellent collection metrics, diverting more than 7,000 L over five months. In one week alone, the system demonstrated an ability to divert 1,070 L. The householder, Lindsey, wanted her system primarily to prevent contamination of local streams and lakes and to address basement flooding. For the most part she did not use the water for gardening purposes, but did use it to water the backyard lawn.

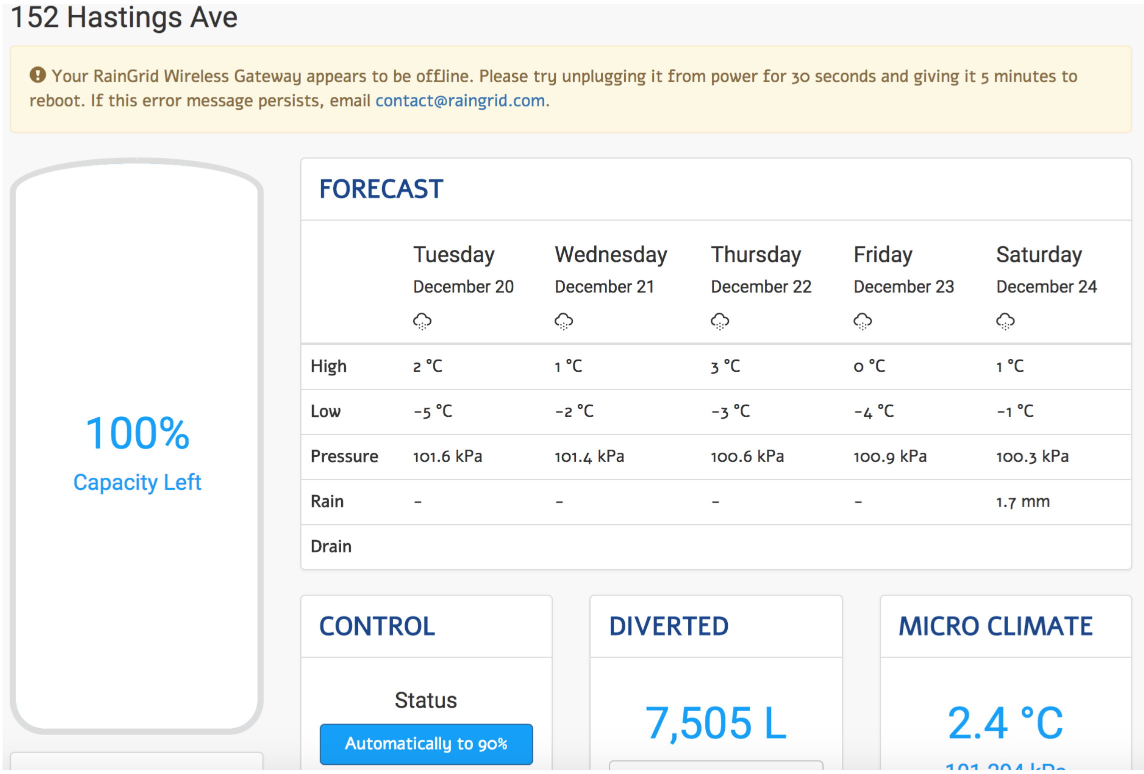

Figure 3.1: The total rainwater diversion for Hastings Ave. for the 2016 season.

The dashboard in fig. 3.1 shows the total amount of stormwater diverted was 7,505 L (middle bottom of dashboard).

INSTALLATION OF ARB SYSTEM

Rain Barrel: The 500 L rain barrel was installed on the concrete patio against the fence on the north side of the property about 4 m (12 ft.) from the back of the house (see fig. 3.2). The rain barrel had to be delivered through the residence because there was not enough clearance between the houses. Some gutter work was done by the homeowner to bring the downspout from the south side to the north side of house. The roof collection surface was estimated at approximately 6 x 7.5 m (20 x 25 ft.), or 46.5 m2 (500 sq. ft.). A standard 7.5 x 5 cm (3 x 2 in.) downspout, running along the back fence and fitted to our customized storm funnel, connects to the diverter box. This backyard has an excellent drainage profile, due to sandy loam soil and no tree cover over the roof collection area.

Overflow, Bypass and Drainage: A 6 m (20 ft.) garden hose runs from the rain barrel discharge tap to the backyard, and an overflow/bypass capacity drains to the backyard by a flexible 10 x 10 cm (4 x 4 in.) extender pipe (see fig. 3.2). Soils are sandy loam and drain very quickly. No soaker hose was used on this system.

Automated Controller, Plug-in Modem, and Solar Panel: The plug-in modem installed inside the house and was located approximately 9 m (30 ft.) from the ARB. The solar-power panel had good solar exposure (more than five hours a day) and was fitted directly to the rain barrel.

Operational Notes: Data collection ended on November 19 as opposed to November 26, due to the reoccurring issue of communications failure between the rain barrel controller and the modem.

Results: Initially (that is, in July and August) the collection totals were high despite filter clogging and storm-surge issues. However, there were technical issues with the sensor connection and reoccurring internet-connectivity failures during critical collection times (storm events). Had we been able to avoid these incidents, we estimate an additional 2,000 L could have been collected in the early stages of the pilot. Even so, until September 18 the rain barrel was filling fully during each significant rain event. However, after September 18, filter maintenance was not done by the homeowner and we saw a significant drop in collection rates. Had the filter issue been addressed, we predict a much better capture rate and an additional 2,000 L would have been collected during October and November, bringing our anticipated collection total to approximately 11,500 L over the June 23 to November 26 data collection period.

Challenges:

1) Clogged filters and storm-surge overflows, resulting in missed collection opportunities.

2) In-storm ARB-system communications failure was a regular issue.

Solutions:

1) Storm-funnel installation and early-season filter-maintenance notifications.

2) Improve internet connectivity by increasing range of the communication chip, decreasing distance from the controller to the plug-in, hard wiring internet connection and or using POI (power over internet) to ensure reliable functionality during storm events.

Figure 3.2: Installed rain barrel and overflow/bypass drainage at Hastings Ave.

Figure 3.3: Positioning overflow/bypass along the fence to the Hastings Ave. backyard.

2016 STORMWATER COLLECTION RESULTS

HASTINGS AVE. ARB SYSTEM INSTALLATION

Total Annual Estimated Stormwater Collected, Stored and Diverted:

(Based on 10-Month Season)

20,000 L

Data Collection Duration:

5 months (June 23 to November 26)

Average Verifiable Monthly Collection:

1,500 L

Average Monthly Collection Estimate:

2,000 L

Total Verifiable Stormwater Collected, Stored and Diverted from Storm Sewers:

7,505 L

Total Estimated Stormwater Collection, Storage and Diversion:

* See Discussion Section *Figure 3.5*

10,000 L

Amount of Collected Water Intentionally Used on Garden:

80% or approximately **6,000 L**

Minimum Estimated Amount of Stormwater Infiltrated on Property:

(Not including overflow or bypass volumes)

10,000 L

HOUSEHOLDER EXPERIENCE

Discussion of Householder Usage Patterns with 2016 Data from ARB Online Dashboard: Lindsey was an eager and active participant in the ARB system pilot project. She arranged to have the rain gutters and downspout moved to the other side of the house to facilitate a better rain barrel position. She was available and patient from the time of the installation of the ARB system and through the ongoing issues around Internet connectivity. Lindsey was a regular user of the online dashboard primarily to monitor the collection metrics, and said she checked the dashboard once a week. Most of the rain barrel drains were scheduled by the algorithm and automated. That said, Lindsey indicated that 80% of the water collected was used on the backyard in order to replenishing the water table and local streams. She would have used all of the water collected if the dashboard had have been operational during key storm events.

High capture rates (especially when the filters were well maintained) showed that the installation maximized collection capacity for this property. When exploring the reasons for reduced collection later in the season, we discovered that Lindsey had only cleaned the filter once all season.

Householder Satisfaction: Lindsey had a high level of the satisfaction with the ARB system, giving it a 8 out of 10 for usefulness and 4 out of 5 for ease of use. She indicated flood prevention as a key reason for participating the pilot project. Regular filter cleaning in the spring would have been necessary to ensure maximum collection and to minimize overflow from the diverter box. This ARB system installation suffered from regular communications failures during rain events. This made in-storm control and monitoring by the system administrator difficult and also means some collection data was missed. The householder did not rely on the water for gardening as much as others, so was not as affected by system downtime.

Comments: System failure due to sensor and Internet-connectivity issues led to householder frustration especially when RainGrid maintenance was inconsistent and late.

Recommendations: Filter maintenance must be scheduled and done quickly once reduced collection is indicated on the online dashboard. Filter notifications to the householder could be done by automated email or text.

2016 DATA FROM ARB DASHBOARD – The lessons.

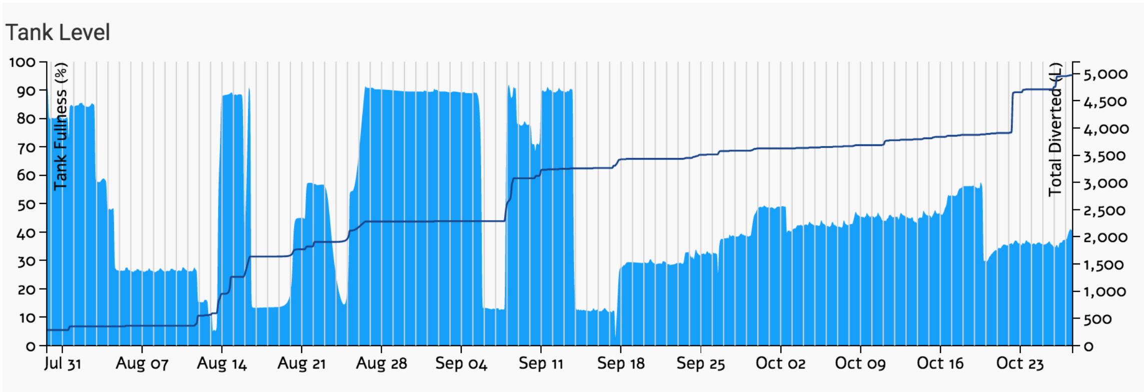

Figure 3.4: Rainfall-collection, tank-level, and water-use/drainage metrics for Hastings Ave., from July 30 to October 27.

As seen in fig. 3.4, collection rates over July, August, and most of September—that is, when filters were clean—were vey high. After September 18, filter clogging led to a severe drop in collection efficiency.

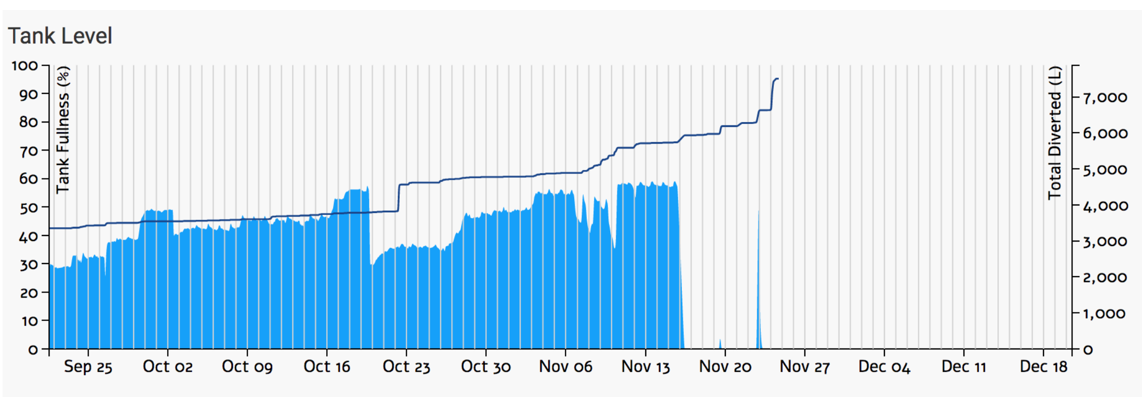

Figure 3.5: Rainfall-collection, tank-level, and water-use/drainage metrics for Hastings Ave., from September 20 to November 16.

As can be seen in fig. 3.5, collection rates from September 18 through November 15 were about 20 to 30% of what they were when filters were cleaned. We extrapolate that an additional 2,500 L of stormwater would have been collected over the September, October and November period bringing the total estimated collection over the 5 month pilot duration to about 10,000 L.

Recommendation: To send out an automatic notification to the homeowner as soon as a drop in collection efficiency is detected, asking them to check and clean the system.

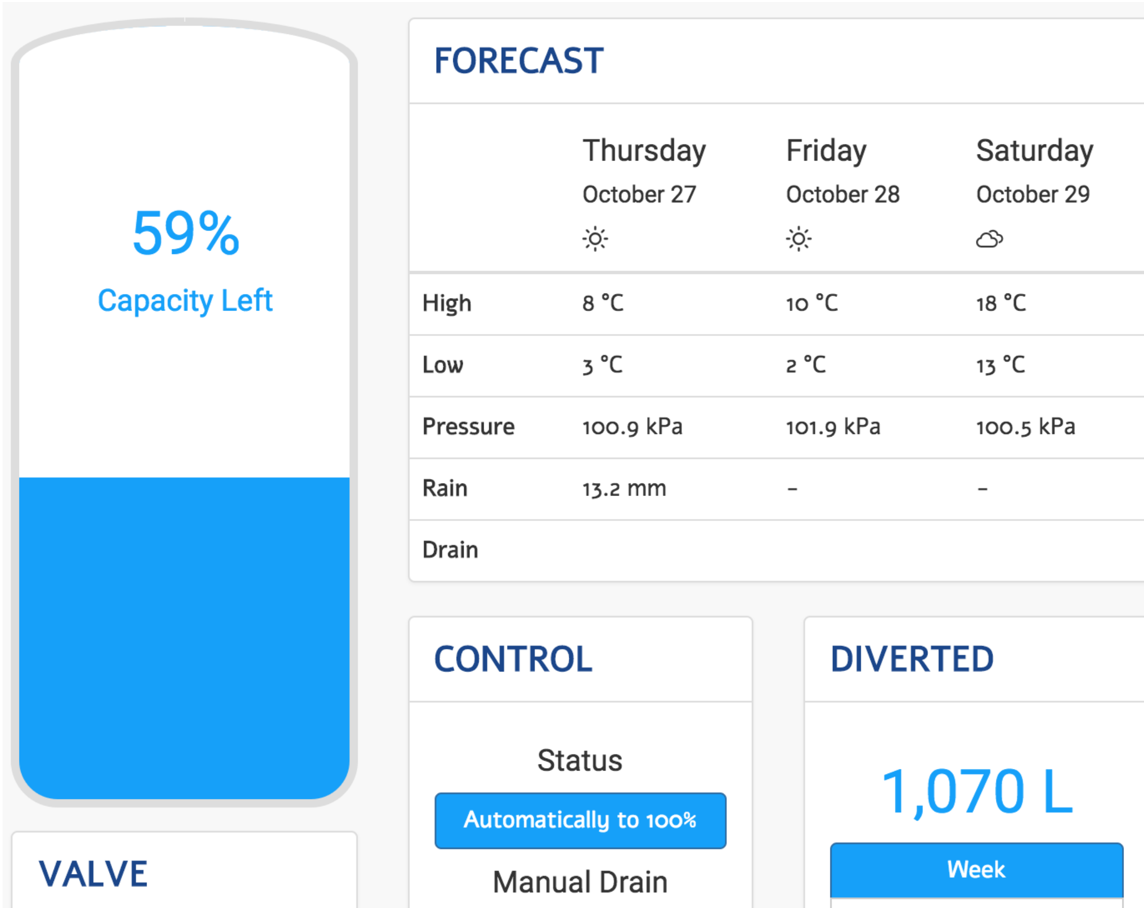

Figure 3.6: Weekly Collection Total of 1,070 litres:

As seen in figure 3.6 dashboard picture despite reduced stormwater collection volumes due to clogged filters during October the Hastings Ave ARBS managed to collect and divert more than a 1,000 Liters in one week.

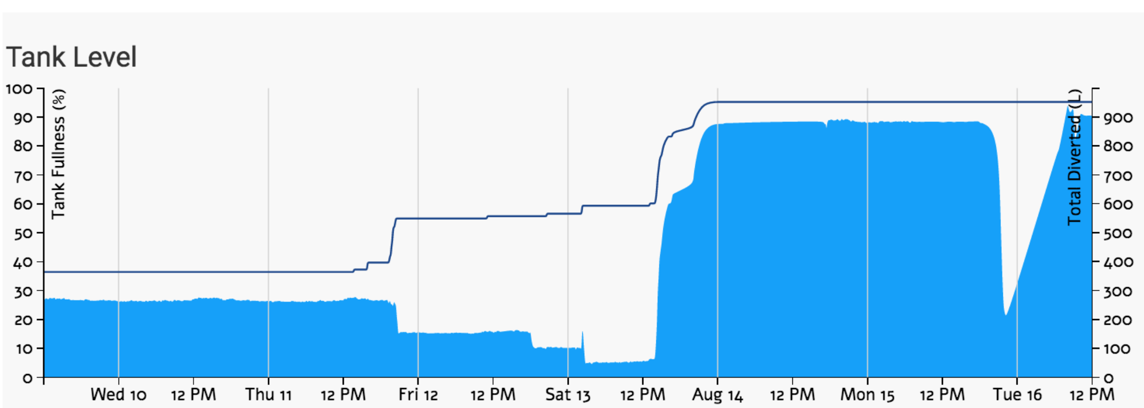

Figure 3.7: Shows tank level during 2 rain-storms and rain barrel filling to 90% capacity, draining and filling again over a 72 hour period.

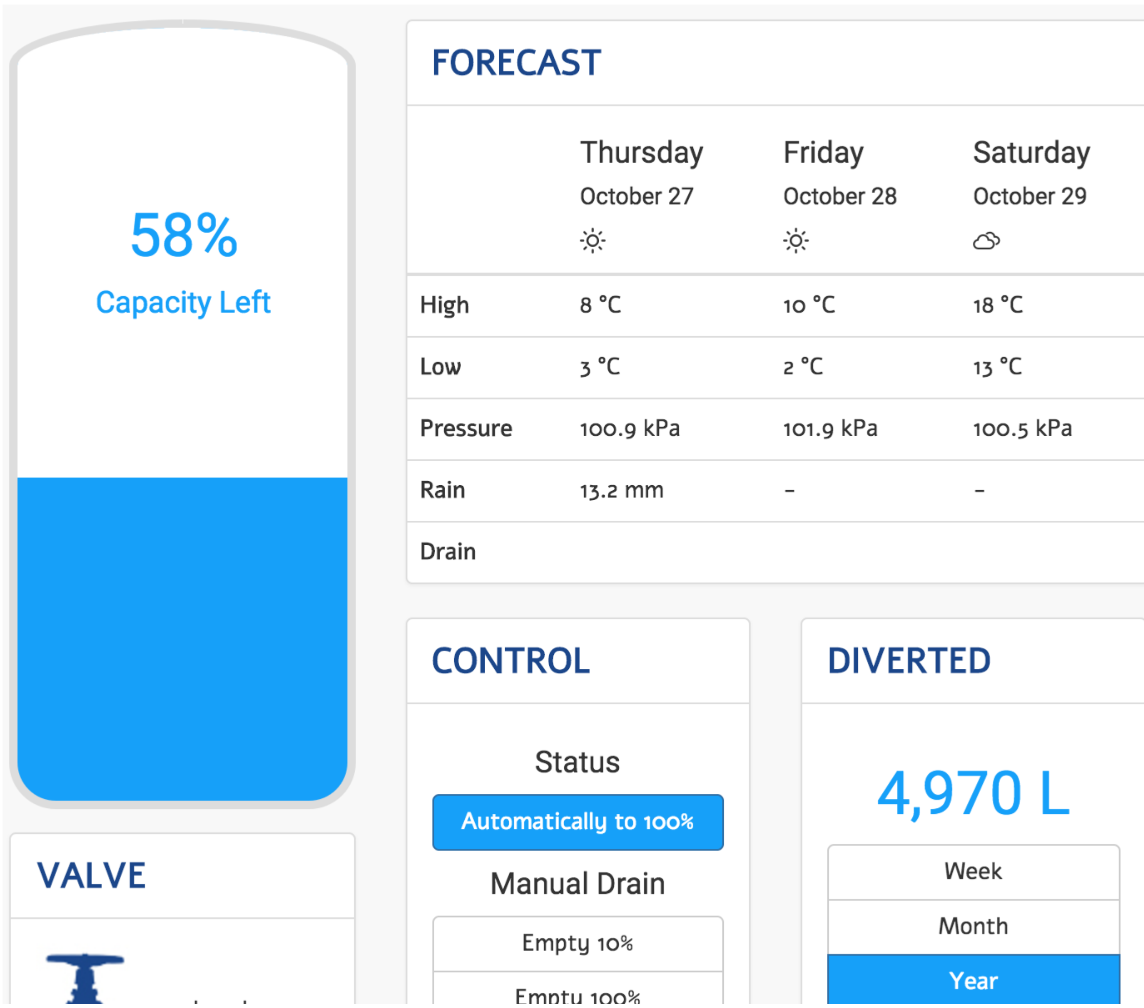

Figure 3.8: Total Collection Volume From June 26 to Oct 27