

September 21, 2011

Controllers vs. Tune-Up? Where Are the Real Savings Opportunities?

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Abstract

Since visual assessment of a property can be misleading in regards to over-watered landscapes, it is important that irrigation audits be performed on the large consumers of water found in the industrial, commercial and institutional (ICI) sector. The impact of outdoor irrigation audits demonstrate that while eliminating over-irrigation has no negative impact on the health of the lawn, it does result in significantly lower water bills for the customer. The Region of Peel began by implementing a pilot program at eight ICI facilities. Detailed audits focused on zone-by-zone water use analysis, hardware correction and irrigation schedules.

Keywords

Audit, Central Control, ICI, Irrigation, Outdoor, Peak Day, Region of Peel, Smart Controller, SMART Watering Systems, System Improvements, System Upgrades, Veritec Consulting.

Background

When it comes to water consumption, water treatment plants are typically designed to meet summer time peak demands. Often the cause of these peak demands is heavily attributed to outdoor irrigation. Outdoor irrigation itself is not a negative practice rather it is the idea conveyed by many North American water agencies that lawns need 1 inch of water per week. The 1 inch of water per week message can be misunderstood that this quantity is to include both natural rainfall and irrigation. During dry periods when there is no rainfall, the entire 1 inch must be supplied via irrigation. This implies that if people were to only irrigate 1 inch per week then we would eliminate peak demand problems. This is not the case. In 2008 the OWWA (Ontario Water Works Association) developed a *Water Use Reduction Manual* to identify effective ways to reduce peak day demands. Since the primary cause of peak day demands is irrigation, the manual focused on ways to reduce irrigation impact. The Region of Peel used these reduction strategies to supplement peak day research and analysis and to identify potential water savings through the implementation of its ICI Outdoor Irrigation Audit Pilot Program.

Research

The initial focus was to assess how much people in the GTA (Greater Toronto Area) are currently irrigating and then to quantify the potential water savings if customers limited irrigation to 1 inch per week. Data analysis was attained from different sources including:

- Gross billing data
- Single-family billing data
- District Metered Area (DMA) monitoring data
- Individual household monitoring
- Hose-bib metering

The results for all data sets analyzed indicated that the average single-family home was applying about 8-10 mm (about 1/3 of an inch) of irrigation per week to their lawns and gardens; far less than the target of 1 inch per week. Research also identified that many customers with automatic irrigation systems apply greater than 1 inch (in some cases 3 or 4 inches) per week. With the volume of irrigation being a function of application rate and area being irrigated, then larger lawns require more water. Since the average homeowner applies less than 1 inch per week, the logical focus for the Region of Peel was to concentrate on Industrial, Commercial and Institutional (ICI) properties that are large and have automatic irrigation systems.

Program Development and Implementation

The 2009 Peel study used water billing data to identify sites with large summer to winter water use ratios. Suitable sites then were selected and sub-meters and data logging equipment were installed to determine the current level of irrigation. Data obtained through the sub-meters and controller records were used to calculate the depth of water to each zone per week based on the flow rate and schedule. In order to assess the functionality and efficiency of irrigation, a system audit was performed at the participating sites by SMART Watering Systems Inc. and Veritec Consulting. The audits focused on looking at spray heads, nozzles etc., type of controller, schedule and type of landscape being irrigated. Two levels of potential water savings were identified:

1. **System Improvements:** Optimize current irrigation system i.e., install proper spray heads/nozzles, pressure regulation, properly adjust irrigation schedules and repair faulty equipment and/or leaks.
2. **Control System Upgrades:**
 - **Smart Controller:** adjusts irrigation schedule based on local ET (evapotranspiration) values. Most systems are wirelessly linked to a weather network and adjust zone run times on a nightly basis based on current ET.
 - **Central Control System:** Central control systems receive irrigation schedule changes through a remote system or by human adjustment. This allows for changes in the system in one or more zones to account for local conditions or forecasted

precipitation. Centralized control systems also allow for real-time flow measurements that may reduce water loss to leaks caused by vandalism or other damage.

Table 1 below displays an example of metered data and calculated savings from a single ICI customer. This highlights the potential for water savings on a zone by zone basis through system improvements and system upgrades.

Zone Number	Area, m ²	Landscape Type	Flow rate, L/min	run time min/cycle	cycles/week	mm/week	inches/week	m ³ /year	Leak Observed	Potential Savings, m ³ /yr		
										Hardware Savings ¹	Additional w/ Smart Controller ²	Additional w/ Central Controller ³
1	180	MIXED	80	30	3	40	1.58	144		98	18	23
2	101	SHRUBS	100	15	3	45	1.76	90		64	10	13
3	180	TURF	63	15	3	16	0.62	57		11	18	23
4	814	TURF	149	30	3	16	0.65	268	✓	61	83	103
5	1,231	TURF	209	30	3	15	0.60	376	✓	64	125	156
6	1,255	TURF	211	30	3	15	0.60	380	✓	61	128	159
7	2,123	TURF	202	30	3	9	0.34	364			40	94
8	1,958	TURF	143	30	3	7	0.26	257				9
9	485	TURF	155	15	3	14	0.57	140		16	49	62
10	83	TURF/TREES	85	15	3	46	1.81	77		55	8	11
11	44	TURF/TREES	119	15	3	123	4.84	107		96	4	6
12	575	TURF/TREES	124	15	3	10	0.38	112			24	39
13	649	TURF/TREES	163	15	3	11	0.44	147			48	64
14	1,612	TURF	78	30	3	4	0.17	140				
15	1,644	TURF/TREES	180	30	3	10	0.39	324			73	115
Total Annual Irrigation Demand, m³/year =								2,982				
Total Estimated Annual Savings, m³/year =										527	629	876
Percentage Savings =										18%	21%	29%

Table 1. Zone summary of ICI outdoor irrigation data. Data was obtained from a participating audit site for 2009 within the Region of Peel, ON.

Throughout the test sites it was determined that in zones where the customer applied approximately 12 mm (1/2 inch) of water per week, the grass was still green. It was decided that a baseline of 12 mm per week would be set for ICI sites that used standard controllers.

Evaluation

Many of the ICI customers had been operating their outdoor irrigation with a ‘standard’ controller and not a ‘smart controller’. Operation in each zone was performed on a pre-set run time on pre-set days (e.g., 40 minutes/day, 3 days/week). The drawback to this approach is that run times are often set at the start of the irrigation season to provide sufficient water during the most severe summer conditions. The tendency with this setup is to over-irrigate unless manually adjusted. Paired with this, leaks were observed on multiple sites and without correction would account for significant water losses.

Recommendations were provided to each of the pilot ICI customers. In the summer of 2010, following a 20 week season, the post monitoring of irrigation demand was conducted and data

was collected. The results from the ICI pilot customers all indicated significant water savings; shown in four specific examples:

Microsoft

Table 2. Pre vs. Post Irrigation Demands

Microsoft	
PRE	
PRE Irrigation Demands per 20-week season	5,994 m ³
Area of Irrigation	10,073 m ²
Weekly Irrigation Demands	30 mm/week
Maximum Target (estimated) savings	4,715 m ³
POST	
POST Irrigation Demands per 20-week season	2,128 m ³
Weekly Irrigation Demands	11 mm/week
Savings	
Actual water savings	3,866 m ³
Percentage water savings	64%
Percentage of Target Savings Achieved	82%

Microsoft implemented a monitored Central Control System and focused on corrections recommended for system improvement. This included pressure regulation, rotary nozzle upgrades and sprinkler adjustment/replacement. Equipment upgrades and repairs to sprinkler system infrastructure resulted in a water savings of 3,866 m³ (1,020,624 US Gallons). The weekly irrigation application was reduced from 30 mm/week in 2009 to 11 mm/week in 2010 resulting in a water savings of 64%.

Meadowvale Corporate Centre

Table 3. Pre vs. Post Irrigation Demands

Meadowvale (2000 Argentinia Road)	
PRE	
PRE Irrigation Demands per 20-week season	10,463 m ³
Area of Irrigation	21,125 m ²
Weekly Irrigation Demands	25 mm/week
Maximum Target (estimated) savings	7,244 m ³
POST	
POST Irrigation Demands per 20-week season	4,503 m ³
POST Irrigation Demands per 20-week season	11 mm/week
Savings	
Actual water savings	5,960 m ³
Percentage water savings	57%
Percentage of Target Savings Achieved	82%

Meadowvale Corporate Centre installed a Centralized control system and made corrections recommended for system improvements. This included pressure regulation, wiring repairs and sprinkler head relocation. Equipment upgrades and repairs to the sprinkler system infrastructure resulted in a water savings of 5,960 m³ (1,573,440 US Gallons). The weekly irrigation

application was reduced from 25 mm/week in 2009 to 11 mm/week in 2010 resulting in a water savings of 57%.

Psion Teklogix

Table 4. Pre vs. Post Irrigation Demands

Psion (irrigate 18 weeks/year)	
PRE	
PRE Irrigation Demands per 20-week season	2,504 m ³
Area of Irrigation	12,935 m ²
Weekly Irrigation Demands	10 mm/week
Maximum Target (estimated) savings	1,263 m ³
POST	
POST Irrigation Demands per 20-week season	1,643 m ³
POST Irrigation Demands per 20-week season	6 mm/week
Savings	
Actual water savings	861 m ³
Percentage water savings	34%
Percentage of Target Savings Achieved	68%

Psion Teklogix made minor schedule changes in 2009 and applied slightly less irrigation than predicted. Changes in the irrigation schedule (applied by the existing smart controller) resulted in a water savings of 861 m³ (227,304 US Gallons). The weekly irrigation application was reduced from 10 mm/week in 2009 to 6 mm/week in 2010 resulting in a water savings of 34%.

Delta Meadowvale Resort

Table 5. Pre vs. Post Irrigation Demands

Delta Hotel	
PRE	
PRE Irrigation Demands per 20-week season (6,634)	15,097 m ³
Area of Irrigation	17,943 m ²
Weekly Irrigation Demands (21)	42 mm/week
Maximum Target (estimated) savings	12,908 m ³
POST	
POST Irrigation Demands per 20-week season	4,860 m ³
POST Irrigation Demands per 20-week season	14 mm/week
Hours of Operation per 20 week season	
Savings	
Actual water savings (1,774)	10,237 m ³
Percentage water savings	68%
Percentage of Target Savings Achieved	79%

Delta Meadowvale Resort made significant changes to their schedule through installation of a smart controller. A master valve installation also reduced water loss from mainline leaks. Changes and system improvements resulted in a water savings of 10,237 m³ (2,702,568 US Gallons). The weekly irrigation demand was reduced from 42 mm/week in 2009 to 14 mm/week in 2010 resulting in a water savings of 68%.

Conclusions

Healthy, green lawns are possible with reduced water application amounts of 10-15 mm (less than 1 inch per week) with no sacrifice to curb appeal. Savings are achieved from both system improvements (maintenance) and system upgrades (“smart” or central controllers). The greatest potential for water savings may be related to proper maintenance and scheduling. This can be achieved through assessment and infrastructure improvement of the irrigation sprinklers, pipes and valves.

The Region of Peel has experienced some positive results since the implementation of its ICI Outdoor Irrigation Audit Pilot Program. The average savings per participating site was greater than 3,000 m³ of water per year. In response to the positive results achieved in the pilot program, the Region has now made the Outdoor Irrigation Audit Program available to all facilities in Peel.

Research will continue to find the best way to estimate and identify potential savings, monitor and verify savings and finally sustain savings.

Acknowledgements

Bill Gauley, Veritec Consulting.

References

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