Changes to the Irrigation Paradigm: The City of Calgary Parks as a Case Study

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Abstract

A decade ago the City of Calgary Parks business unit began investigating central control systems. That process lead to an evolution in the perception and thinking around irrigation and water. The ensuing paradigm shit, from being irrigation system focused to water management focused, has been validated by recent drought and concerns about future weather trends and water availability.

This paper highlights the changes and processes that The City of Calgary underwent, and analyses how these influenced further changes and resulted in cyclical feedback loop. It also demonstrates through examples how other municipalities could undergo a similar process resulting in more effective and efficient use of our finite water resources.

Past and current practices will be discussed in relation to how these have positively or negatively affected Calgary Parks move toward efficient and effective water management and the shaping of the new paradigm.

Background

The City of Calgary is located in the southern part of the Province of Alberta in Canada. It is situated 100 km (60 miles) east of the Rocky Mountains and 300 km (180 miles) north of the border between United States and Canada. Calgary has a population of approximately 1,000,000 and covers an area of 721.73 square kilometers (278.54 square miles). The city is home to Canada's oil and gas industry together with telecommunications and computer related businesses.

Calgary has approximately 3,000 parks covering 7,822 ha (19,328.51 acres). Of those, 2,000 parks have irrigation services and some form of irrigation system. The total park area with irrigation equals 2,290 ha (5,700 acres). Systems range from hose connections, galvanized turf valve and quick coupler, manual hydrant and canon, manual pop-up to automatic pop-up with wireless central control. Calgary Parks water bill in 2001 was over $1.6 million for 3.9 million cubic meters (1,377,368 CCF) of irrigation water.

Beginnings

In 1993 Parks staff began to wonder about the long-term availability of cheap water. This was liked to the question of when the cities growth would be slowed or limited by the availability of water for human consumption and hence applying pressure on large users of irrigation water. It was determined at that time to begin looking at ways to reduce water use. Central control was seen as one way to possibly reduce the water consumption of irrigation systems.

Parks had just moved from building manual pop-up irrigation system to electric automatic in 1991. Building parks that would be watered during daylight hours when wind and evaporation were at it's highest was becoming unacceptable to conservation watch-dogs. To a small group it was looking like parks should be proactive and plan for the management pressures that the future would bring now and save tomorrows high retrofitting costs. Staff began investigating central control systems reading promotional literature and periodical articles. After approximately six (6) months a decision was made to evaluate some competitive products and conduct field-testing.

Request For Proposal

In mid 1993 a Request For Proposal (RFP) was issued by the City of Calgary to prospective manufacturers and distributors. The RFP highlighted what criteria would be used in the evaluation, and the general features and expectations that Calgary was interested in. Parks worked together with the Information Technology Services department in drafting the RFP. As part of the RFP, contenders would have to agree to install evaluation equipment in city parks for a minimum of one year and have that equipment actively operate the irrigation systems in those parks. For systems that utilized remote field managers and satellites in concert with the central computer, the manufacturer would have to provide ample equipment to demonstrate how all components contributed to the overall operation of the system. Venders would have to provide assistance setting up office and field hardware and the initial programming of irrigation programs.

Four (4) manufacturers answered the RFP. The evaluation proceeded in two phases. First the written proposals and supporting documentation was evaluated. Documentation was extensive and was reviewed exhaustively. References and contacts were checked and interviewed in detail. Once the first phase was completed the evaluation moved to the second phase of field-testing the equipment. Sites that represented the diversity of types and sizes of Calgary parks were selected. Each manufacturer had sites representative of the complete mosaic. Equipment was installed on site with representatives of both Calgary Parks and the manufacturer and their distributor. Once equipment was ready in the field, computers at the main office were configured and irrigation programs written and dispatched to the field.

System Evaluations

Testing the various central control systems became more than just a product evaluation exercise. Each system was tested against what the RFP and promotional literature said that it would do. The different products were also put through different operational procedures and their performance compared against what Parks believed it needed these systems to be able to accomplish. As time passed it became evident that some systems could not meet the expectations set by the literature. Some features were found to still under development and not field operational. Still others were found to be proposed but with no quantifiable work done on them.

At the same time, Parks was finding that its vision about what it wanted in these systems was being clarified and shaped by the results of the evaluation. Certain features were becoming very important and others demonstrating potential for future integration into different lines of business in the corporation. For example, the communication medium becomes very important if the system will be implemented in a city where is extensive holdings of land that will have to be retrofitted with the

Figure 1: Central control system at Kingsland Dry Pond.

system. Bringing telephone service to existing parks in cities with underground wiring often requires excavation sometimes across streets, which can be very expensive. Bringing electric power to a site can also be cost prohibitive. In Calgary we have seen these costs easily run from $5,000 to $15,000.

Other features were tested and found to significantly impact the usability of the system. Some of these included real-time weather station interfacing for ET calculations, low flow monitoring, conditional programs, sensors, inputs and computer networking.

At the end of the trials a successful system was selected and the unsuccessful candidates removed their equipment. With some manufactures the decision was swift. With others, the results were reviewed more closely before a decision was made. In 1994 the final decision was announced and The City of Calgary selected their future central control system manufactured by Motorola Inc. and marketed at the time as the Toro MIR5000.

Thinking Changes

As Calgary Parks installed central control in their first few parks a change began to occur. Some individuals were realizing that though central control systems were a major part of reducing water use in park irrigation systems in a predictable and consistent manor there was something more. If an organization is installing central control in order to conserve water and make irrigation more efficient then they will have to start looking beyond the central control hardware and software for some of the help.

For the City of Calgary this meant rethinking the business that the irrigation staff were in. For decades staff believed that if a park was built then it must have an irrigation system built in it. We call this being in “the business of irrigation”. If however, your mandate becomes conserving water, has your business not changed? Our answer to this question is “yes” and we therefore say that the business now becomes “water management”. So here starts the paradigm shift and the cyclical process that implementing central control can take you on, if you are serious about water conservation.

For Example: In the old paradigm, all parks in a neighborhood would be built with irrigation systems. In the new paradigm parks would be evaluated on the bases of the adjacent land base and the amenity they need to provide to the community. From that evaluation the need for irrigation, or not, would be determined.

Case #1: A park is to be built in a neighborhood. The park is located at the head of a residential collector road leading into the community. It is flanked by residential homes or community service business (i.e. convenience store). In this setting an ornamental park would be well suited. An irrigation system would be an integral part of this parks

development. Water conserving technologies would for the basis of equipment selection and design decisions.

Case #2: In the same neighborhood another park is to be built. This park is located along a residential road with houses on each side and across the street. The back of the park is boarder by a natural area that ends with an escarpment over looking a small creek. Historically, in Calgary, this park would have been constructed as an ornamental park with a full irrigation system. Because of the water management focus development inspectors now ask the question: What is the best focus of this park? Does an ornamental park make sense in this location? Should this park be naturalized and serve as an extension and leader to the natural area? By building the park as an extension of the natural area two positive results are achieved. First the natural environment is integrated into the community. This inclusion in the community causes less separation between human kind and our natural environment. Second and most importantly to our new paradigm we conserve water through the most effective means, not irrigating if we don't have to.

Other changes occurred in Calgary Parks because of the water management focus. Traditionally water for irrigation was flat rated. If a park had an irrigation service the area of the was multiplied by one inch of water per week times 16 weeks of irrigation. With flat rates increasing Parks wanted to be sure that it was only paying for the water it was really using. Calgary Parks recognized that it had some parks with only a single quick coupler on a 0.3 ha (0.74 acre) site. It was obvious that with this configuration the whole park was not being irrigated to the amount being billed. Staff also recognized that staffing and budget reductions had lead to some parks with manual systems not being watered and therefore water being billed for but not actually used.

In 1997 Calgary Parks and Waterworks partnered to meter the 2000 existing irrigation services and meter all new park developments as they are constructed. Meters were evaluated for their accuracy and suitability for use by Waterworks for billing and their low flow accuracy (40 GPM on 6" meters) for leak detection in future central control systems. In the end and after problems with a previous manufacturer the City of Calgary settled on Hydrometers (meter/master valve combination) by ARAD. To date Parks has installed approximately 1200 hydrometers and will install the remaining 800 by the end of 2003 if capital budgets and cost sharing programs allow.

The Growing Toolbox

As conserving water became more important, the challenge of saving more water has grown. If we were saving water by watering at night because of lower wind speeds and reduced evaporation they were there other ways we could reduce our water consumption. Signals from Hydrometers installed on central control sites enable flow monitoring. Flow monitoring can detect leaks from broken pipes, damage irrigation heads, non-closing valves and systems that been tampered with.

In order for central controlled sites to only apply the actual amount of water necessary to meet plant demands Parks is building a weather station network. Weather stations are constructed in various parts of the city where weather is known to vary. Controllers in the local area are fed weather information from the closest weather station and the daily evapotranspiration (ET) rate is calculated

prior to the programmed irrigation cycle. To further conserve water remote field managers (Remote Terminal Units) are fitted with rain switches. These switches, through a change of state, tell the control system that there is a local rain event occurring and the controller suspends irrigating, further saving water and improving public profile. This suspension affects all satellites under the management of the RTU. Freeze sensors are also fitted on the system. This helps prevent frost damage to plant material and also prevents the icing of sidewalks and pathways and potential legal battles.
Parks is developing partnerships with Waterworks Recreation and the Fire Department for the sharing of its weather data and the further development of the weather network. The Fire department wants the data to do real-time fire hazard prediction and fire behavior modeling. Plans are underway to install weather stations at Fire Stations where Park Depots do not exist. For Waterworks, Parks will be building a web site where weather and ET data together with irrigation recommendations will be posted. This information will allow residential and commercial users to adjust their watering practices and controller settings in order to reduce their operating costs and help conserve water.

Calgary Parks move to a water management focus has led to its new role as an internal corporate consultant for irrigation water users such as Calgary Recreation, Calgary Roads and Calgary Transit. Parks was a key partner in the writing of Calgary's new bylaws for water rationing and the recognition of water managed properties as a ally in the battle to reduce water waist.

Paybacks and Results

A water management focus brings many paybacks to the business unit. These include not only reductions in water use and water costs but reductions in operating costs, improvement in turf and plant health, and reductions in herbicide and pesticide use. A random check of water use at 13 sites of various sizes, uses and designs demonstrated a water use reduction of 44.3% as compared to our water allotment. Table one shows the results of six of the sites. The results were substantially greater than what we used to promote the switch to central control but consistent with what we had been told by the manufacturer.

Table 1: Water use comparison.

Park Name	Water Used	Area	Flat Rate	Saving
355 Sandarac Dr. NW	13,081.2 cu. M	6.142 Ha	24,568 cu. M	**46.7 %**
4 Schooner Landing NW	631.9 cu. M	0.225 Ha	900 cu. M	**29.8 %**
20 Sunpark Drive SE	11,422.5 cu. M	7.260 Ha	29,040 cu. M	**60.6 %**
150 Millrise Dr. SW	10,786.9 cu. M	3.580 Ha	14,320 cu. M	**24.7 %**
1120 Prominence Hill SW	10,504.2 cu. M	4.526 Ha	18,104 cu. M	**41.9 %**
727 Coach Bluff Cres. SW	527.2 cu. M	0.217 Ha	868 cu. M	**39.3 %**

We also found that sites exhibited improved turf quality and an overall improvement in plant health under central control. Figure2 shows the turf quality at an existing park with a hydraulic valve in head system that has been problematic to maintain and operate. Figure 3 shows the improved turf at a similar site, 150 Millrise Drive SW, which was retrofitted with central control. This site also achieved a 24.7% reduction in water use as shown in Table 1.

Figure 2: Turf on site without central control

Figure 3: Turf on site retrofitted with central control.

The comparison is not to suggest that central control is a miracle worker that will fix all ills with park irrigation systems, but rather to show that the water that is being used may not be effectively applied. The results can be harmful to the business unit's image with the public and council. With central control instructions are carried out as designed and in the most effective way possible.

Central control has saved the City of Calgary labour costs. A park with a manual pop-up irrigation systems costs Calgary Parks $1,877.00 / ha / year ($759.92 / acre / year) to water the site. This cost includes travel time between neighboring parks and the task of turning on gate valves to activate sprinklers. A quick coupler / water cannon system costs parks $2,675.00 / ha / year ($1,083.00 / acre / year) to water the site. The cost of watering a park with central control for the City of Calgary is $334.30 / ha / year ($135.34 / acre / year) including staff to program and monitor the central computers and field technicians to troubleshoot and service the field equipment. These watering costs do not include the cost of water, which was separated out and discussed earlier.

Future Directions

The shift to a water management paradigm is leading Calgary Parks in some new directions. In coming years we are looking at developing a reserve fund where the savings from reduced water use will be reinvested in further water management projects such as retrofitting quick coupler systems into automatic pop-up systems using central control. Parks also wants to start an irrigation audit program, following Irrigation Association guidelines, to determine the amount of water inefficiency and invest savings into the retrofitting of existing systems. Calgary Parks also wants to establish a regular program to audit sites so that systems remain operating at their peak efficiency so that water and budgets are not wasted.

Adopting a new paradigm has led parks towards the development of a Water Management Strategic Plan. The plan will include best management practices and guidelines for the development of

performance based construction specifications. This plan will also influence park planning through the development of policies related to the appropriate use of irrigation in parks. It is expected that in the not too distant future irrigation systems will have to meet specific targets for distribution uniformity and inspectors will not approve parks that fail a water audit.

Conclusion

Central control has changed the way Calgary Parks looks at irrigation and sent the business unit headlong into the world of water management. This change is showing in our staff. Long time employees find it hard to adapt to and understand the changes that are taking place. Many cannot grasp the technology that is now being used and a new type of worker is emerging. The municipal employee of the future in Park Water Management work units may include technologists trained in electrical, electronics, instrumentation or computers with Irrigation Association training and certification.