# Sports Turf Manager

*for safe, natural sports turf*

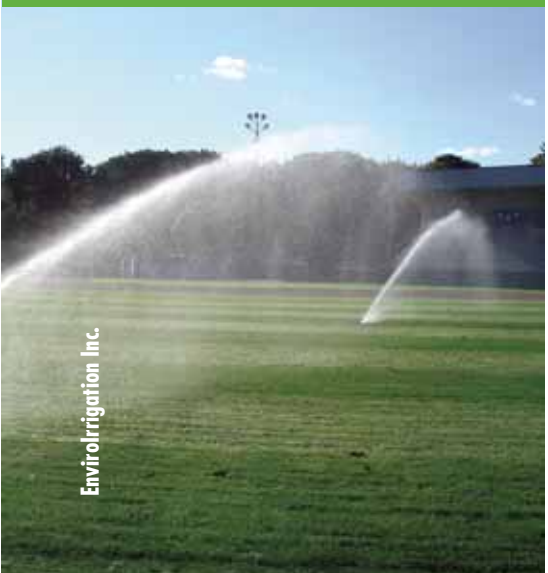
1987-2007
CELEBRATING
★ 20 YEARS ★

**Summer 2007**
VOLUME 20, NUMBER 2



## Turf & Water

**See pages 13-26 for extensive coverage of STA's second full-day water workshop held March 29 in Halton. Sessions ranged from the overall watershed perspective right down to individual soil profiles of sports fields.**




# Editorial – Be Prepared

THE REALITY OF CHEMICAL USE BY R.W. SHEARD, PH.D., P.A.G.

**According to their 2006 annual report,** environmental issues continue to be of major concern for the members of the Nursery-Landscape and Turfgrass Subcommittee of the Ontario Horticultural Crops Research and Services Committee of OMAFRA. Seventeen municipalities in Ontario have enacted "no pesticide by-laws" and more are pending. The report states that "the increasing number of municipal pesticide bans is proof that the activists are not accepting IPM accreditation." IPM is not being accepted as a reasonable measure to reduce the reliance on pesticides, in part because of information gaps in monitoring and for detection techniques and thresholds.

Even where such legislation is not in effect, the choice of control measures is decreasing. Many of the older formulations of pesticides are being withdrawn voluntarily or as a result of PMRA's re-evaluation which is leaving large gaps in the choices for pest management. Companies who produce biopesticides are reluctant to invest in the development of these products as their potential uses are too small to meet the requirements to register their products in Canada. It is not clear whether the biopesticides will be accepted by municipalities who have enacted the no pesticide bylaw. This is in effect further reducing the industries incentive to finance their commercialization.

When will the activists call for a chemical-free environment in addition to a pesticide-free environment?

Following the Walkerton event, nutrient and water quality have become an...➟ page 6

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328 Victoria Rd. S., RR 2, Guelph, ON N1H 6H8
Tel: (519) 763-9431, Fax: (519) 766-1704
E-mail: info@sportsturfassociation.com
Web: www.sportsturfassociation.com



**PUBLISHER**
New Paradigm Communications
R.R. #8, Owen Sound, ON N4K 5W4
Tel. (519) 371-6818, Fax: (519) 371-5789
E-mail: joy@npc-solutions.com

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**STA OFFICE HOURS**
Lee Huether is in the office from 9:00 a.m. to 2:00 p.m. Tuesday through Friday. The office phone number is (519) 763-9431. At other times, a message may be left on the voice mail system. Please include the vital information of name, telephone number with area code, and time of calling. The office may be reached at any time by faxing (519) 766-1704 or via e-mail.

# The President's Desk – Gord Dol

Summer is finally here and the business of managing your sports fields is well under way.

An important part of maintaining good quality fields is managing your irrigation systems. We recently held our second water workshop at the Region of Halton Council Chambers. The theme was *Proactive Water Management for Sports Turf Managers* with 50+ sports turf managers and industry professionals in attendance to learn from a great slate of speakers. Thanks to the Water Workshop Committee for a job well done. Thanks also to the Region of Halton for providing a superb venue. All in all, it was a great day. Please see articles from the speakers in this issue.

It is now time to turn our focus to the fall field day. This year, the field day will be held at the Westoby Ice Surface/Olympic Sports Park in Dundas on September 13th. Last year's event showcased an impressive program with record attendance. This year's field day promises to be yet another memorable one. Mark your calendars! We want to see everyone there.

Invoices for membership fees have been sent out. Your prompt attention to these would be greatly appreciated.

This year, instead of sending out the printed membership roster, we are placing it online, readily available to our members. We are also in the process of updating our website and making it more user friendly. This will ultimately save significant time and money.

Included with this issue is the first newsletter from the Ontario Turfgrass Research Foundation. The OTRF is always looking for donations for turf research. With increased field use pressures and the movement toward reducing or eliminating the use of pesticides, the need for good research has never been more important.

Finally, with the heat of the summer upon us, please ensure that you protect yourself from the sun and that you and your staff drink plenty of water. Have a great summer! ♦

**Above:** President Gord Dol (far left) with speakers at STA's spring water workshop. Left to right: Gord Dol/President STA, Robert Edmondson/Director Watershed Management Services, Conservation Halton, Pam Charbonneau/Turfgrass Specialist, OMAFRA, Rob Witherspoon/Director, Guelph Turfgrass Institute, Gregory Snaith/President, EnviroIrrigation Engineering Inc., Wayne Galliher/Water/Wastewater Outreach Coordinator, Regional Municipality of Halton. Absent: Peter Crockett/Commissioner of Planning and Public Works, Regional Municipality of Halton, Jean Gandubert, CAO, Oakville Soccer Club.

# EVENT CALENDAR

**August 16**
12:00 noon to 8 p.m.
*Guelph Turfgrass Institute 20th Anniversary Public Open House*
A casual drop in event celebrating the 20th anniversary of the founding of the Guelph Turfgrass Institute. An opportunity to tour the research plots, ornamental grass display garden and the annual flower trial garden. Other special events and entertainment are planned. Admission is free and all are welcome.

**August 20**
*Ontario Turfgrass Research Foundation Fundraising Golf Tournament*, Georgian Bay Club
Collingwood, ON
Info: (519) 824-4120 x 56149

SPORTS STA TURF ASSOCIATION

**September 13**
*Sports Turf Association 20th Annual Field Day*
Westoby Ice Surface/Olympic Sports Park, Dundas, ON
Info: (519) 763-9431
www.sportsturfassociation.com

**November 1**
*Sports Turf Association Robert W. Sheard Scholarship Application Deadline*
Info: (519) 763-9431
www.sportsturfassociation.com

# NEW MEMBERS

**Duncan Manser**, City of Peterborough, ON
**Jeff Dobbie & Simon Hames**, Town of Oakville, ON
**Kevin Check**, City of Welland, ON
**Paul Ingham**, Town of Markham, ON
**Stephen Hewgill & Chris Nelson**, Plant Science, Inc., Barrie, ON
**Jason Inwood, Ken Pavely & Nancy Stein**,
Dol Turf Restoration Ltd., Bond Head, ON
**Jody Leis**, Grower's Choice, Kitchener, ON
**Tra Dubois & Jay Warnick**, World Class Athletic Surfaces, USA

# ODDS & ENDS

**STA Membership Plaques**
Display membership plaques are available in executive engraved walnut for $50 plus S&H. To order, contact Lee at the STA office.

**Autumn 2007 Submissions**
If you have something you'd like to submit for the next issue, please forward it to the STA office by August 24, 2007.

**Editorial Content**
Opinions expressed in articles published in *Sports Turf Manager* are those of the author and not necessarily those of the STA, unless otherwise indicated.

# UPCOMING 20TH ANNUAL FIELD DAY

## THE SPORTS TURF ASSOCIATION RETURNS TO THE CITY OF HAMILTON – HOST OF OUR 20TH ANNUAL FIELD DAY, THURSDAY, SEPTEMBER 13

1987-2007 CELEBRATING ★20 YEARS★

Overlooking the waters of Lake Ontario and extending up over the protective circle of the Niagara Escarpment lies the City of Hamilton, host of the Sports Turf Association's 20th Annual Field Day. The City welcomed us in 1995 for this annual event and we are pleased to return in this our 20th anniversary year. Since that time, the City and five surrounding municipalities, Ancaster, Dundas, Flamborough, Glanbrook and Stoney Creek, have merged to form a new amalgamated City of Hamilton. Our venue is the Westoby Ice Surface/Olympic Sports Park in Dundas.

Feature speaker is Pamela Sherratt, Sports Turf Extension Specialist at the Ohio State University, a position she has held since 1999. Her areas of research include athletic field stability and reinforcement, sand selection for athletic fields, cool season grass traits, wear tolerance, establishment speed, over-seeding options, rhizomatous tall fescues and other newer grass varieties. In extension, Pam disseminates sports turf research to the industry in a variety of ways including the development and implementation of the Buckeye Sports Turf Program to keep sports field managers abreast of current topics important in the management of athletic fields (http://buckeyeturf.osu.edu/).

We welcomed record attendance in 2006 and anticipate that we'll continue the trend in 2007. Delegates will again be provided the opportunity to meet with industry suppliers to view displays and request equipment demonstrations.

The Sports Turf Association was conceived in 1987 when, at a 'brain storming' session at the University of Guelph, a broad segment of the turf industry endorsed its need. Of particular concern at that meeting was the need to minimize and avoid injury to participants using athletic fields where they relate to sports turf. Twenty years later the STA continues to promote safe, natural sports turf through education and professional development. Stay tuned for complete event details as they become available.

Feature speaker is Pamela Sherratt, Sports Turf Extension Specialist at Ohio State University. See you this fall in Hamilton!


1998 Field Day


1988 Field Day


2006 Field Day

# EDITORIAL CONTINUED...

## PHOSPHORUS & NITROGEN WILL BE THE KEY ISSUES SCRUTINIZED

...issue. Currently the provincial government is focusing its resources on large livestock operations and manure applications. The *Nutrient Management Act* regulations are being reinforced by the *Source Water Protection Act* which brings the water quality issue from the farm to the athletic field level.

From the water standpoint, phosphorus and nitrogen will be the key issues. Movement of these two nutrients from the point of application, either internally through the drainage system or externally through runoff, will be the point where opponents will focus their energies.

Such scrutiny of phosphorus and nitrogen use is already occurring in the U.S.A. where some areas are banning phosphorus use on turf and where only phosphorus-free fertilizers are allowed. Manitoba has restrictions on the use of phosphorus adjacent to water bodies and is considering a total ban of phosphorus use on all turf. While phosphorus is generally considered to be immobile in soil there are indications that at very high levels of phosphorus in the soil there is a potential for phosphorus to remain soluble and move into the drainage system in an organic phosphorus form.

Does runoff really occur from a sports turf surface, on what slopes, at what rainfall intensity, attached to particles or in solution? Can bioherbicides keep weeds at bay?

Under agricultural conditions, the major system of phosphorus movement to water bodies is on soil particles eroding from the surface. The likelihood of such movement occurring with turf is highly improbable, although there are turf managers who will argue a field must be crowned to induce surface drainage which could result in soil particle transport.

Nitrogen may stimulate interest through two reactions in the soil. The first reaction is the leaching of nitrate nitrogen to the ground water and the potential for "blue baby syndrome" where concentrations in the water of greater than 10 ppm are recorded. The second reaction is the conversion of nitrate nitrogen to nitrous oxide gases which are evolved to the atmosphere where they have a profound effect on global warming, being 300 times more effective than carbon dioxide. Fortunately this reaction only occurs under waterlogged conditions.

What can an individual turf manager do to counteract these issue? ***Be Proactive.***

The fertilizer industry is already showing signs of being proactive. A major home fertilizer retailer is advertising an environmentally friendly, zero phosphorus lawn fertilizer.

The turf manager should lobby researchers to become active in investigating these problems. Entice them to generate information to fend off concerns. Entice them to make their information general public knowledge before the issue of fertilizer, another chemical, is raised. Does phosphorus truly move in the organic form and if so to what degree? Does runoff really occur from a sports turf surface, on what slopes, at what rainfall intensity, attached to particles or in solution? What is the level of nitrous oxide emission from a turf surface? Is irrigation water being used most efficiently? Can bioherbicides maintain a weed-free turf?

Keep a paper trail. Every sports field should have record of the particle size analysis, a once only measurement unless the field is rebuilt. A phosphorus and potassium soil test should be taken at least every third year and the application of these two nutrients be discontinued if the test so indicates. Records of the actual yearly amount of nutrients applied should be kept. When the nutrient auditor comes calling you will be in a better position to justify your operation and to prevent any restrictions or penalties.

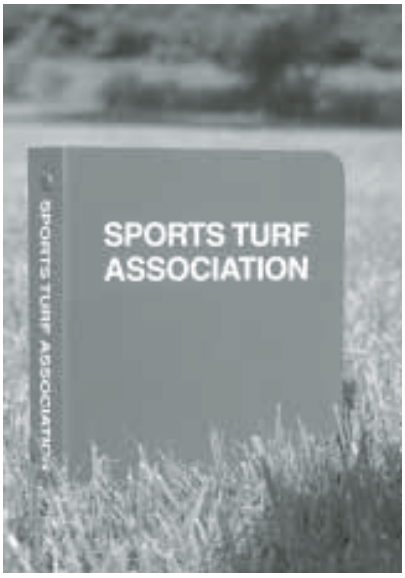
Start today, for tomorrow will soon be yesterday, and a day too late. ♦

# We're Going 21st Century in Our 20th Year!

AS PART OF OUR 20th anniversary tune-up, the STA website is being revised and updated. You won't notice much of a change in our look however; the real improvement is in the approach, not the appearance. We're moving to a Content Management System which will provide for easier design and maintenance, more frequent updates, and greater functionality.

In our first phase we've introduced a 'Members Only' section. Until this year, the STA Membership Roster has been brought up-to-to date by means of annual printed inserts. This will be replaced by a web-based version. The little green binder is now obsolete. The new adaptation will offer personal updating, instant retrieval and information that is always current. You'll also be able to search entries by name, affiliation and location. If electronic isn't your preference, the roster will still be made available in the form of a print document, upon request. Watch your inbox and mailbox for all the details!

**Below:** The little green binder was first introduced to STA members in 1995.



# NEW BOOK RELEASED ON TURF

## TURF RESOURCE CENTRE PUBLISHES *FACTS ABOUT ARTIFICIAL TURF & NATURAL GRASS*

EAST DUNDEE, IL. *Facts About Artificial Turf and Natural Grass* was published by the Turf Resource Center to help decision-makers and the general public make informed judgments regarding the installation of artificial turf or natural grass in their communities. The 30-page booklet is based upon information from some of the industry's most highly respected research scientists, sports field managers, contractors and other professionals.

Written in an easy-to-read format, *Facts About Artificial Turf and Natural Grass* provides answers to questions that key decision-makers must address when considering the possible short and long-term health, safety, fiscal and environmental consequences that artificial turf may unexpectedly present. Throughout each chapter are commonly heard "myths" about artificial turf and natural grass, followed by scientifically documented "facts" and reliable information.


The booklet's first chapter addresses what decision-makers need to know about synthetic turf and natural grass before making a selection in their communities. Subsequent chapters discuss topics such as "Financial Considerations," "Wear and Durability" and "Environmental Health Effects." Each chapter presents credible information about the differences in synthetic turf and natural grass with a comparison of advantages, benefits and disadvantages. Case studies, detailed references and in-depth scientifically-documented information by renowned scientists address true costs, environmental issues, safety and other valid considerations.

A downloadable and printable version of the book and an order form is now available at www.turfresourcecenter.org. Individuals, organizations, educators and associations can request 10 or more ***free*** hardcopies of the booklet by paying a minimal shipping & handling fee, subject to approval of the Turf Resource Center. For more information, contact the Turf Resource Center at 847-649-5555.


# STA Member Profile

## Jane Arnett-Rivers, City of Oakville, STA Past President

**1. You were president of the Sports Turf Association from 2000-2001. What was your role in the turfgrass industry at that time? Are you still involved in the industry? How?**

At that time I was Supervisor of Parks – West Area, Town of Oakville. This included sports fields, grass cutting, horticulture, trails, and sanitation for the west side of Oakville. I believe we had 7 irrigated fields. I am currently Manager of Parks Maintenance, Town of Oakville. My portfolio has a broad scope: geese, rats, turf, sports fields, boulevards, budgets – projected and current, equipment, environmental issues, design, special events and festivals, washrooms, garbage, water retention ponds, grass cutting and irrigation.

**2. What was the biggest challenge in your job at that time?**

I believe we were just entering into the unknown world of *Pesticide Free*. It was all very doom and gloom. It is amazing that we have survived and adapted to the moratorium in Oakville. The moratorium forced us, as an operation, to look at what we do and how we do it. It also pushed us into researching best practices and planning ahead to get the funding we required to carry out those best practices. Equipment changed: reel mowers were not cutting it any more (no pun intended) and mowing heights had to be raised. Topdressing and overseeding which used to be a tool to level a field suddenly became a cultural practice for healthy turf. A happy medium would have been nice – the cold turkey approach from preventative pesticide applications to nothing was very tough for a few years – but, here we are, still cutting and improving what we can, when we can.

**3. What is the most satisfying part, what makes the job worthwhile for you?**

Watching staff catch the passion for what they are doing. Of course the aesthetics of our job are what most people appreciate but anyone who works in this industry knows that aesthetics are short lived if you don't work smart and hard. Staff who truly care about what they do will find new and innovative ways to carry out their jobs so they get satisfaction. It is great to be a part of such a team and facilitate what THEY need to make us all look good.

**4. What is the biggest misconception about your job?**

The term *off season*. Can someone explain that one to me and maybe tell me when it is?

**5. What is your educational/employment background?**

Education was a long time ago: Sheridan College, Environmental Horticulture, some ODH courses, some OMD courses. Employment covers quite a scope. Many years on a weedwhipper, in the standard garden centre, with RBG as a gardener, assisting in writing a horticultural therapy manual, cemetery operations, turf leadhand, operations supervisor and currently manager of parks maintenance. 25 years and counting! Yikes!

**6. Tell us about your family.**

My husband runs the Town of Oakville Greenhouse Operation. Can you imagine our household in May? Two sons: one graduated Business from Wilfred Laurier and is living the dream in Toronto; the other is about to enter Wilfred Laurier for Honours Economics (I am sure he will be soon living the dream as well). Between lacrosse, hockey and motocross, they have kept Tim and I hopping for many years. We are looking forward to the empty nest syndrome for a while.

**7. What do you enjoy doing outside of the workplace? Hobbies, favourite past times?**

To date, hobbies and pastimes have been raising two boys. Now I would like to say kayaking and travel. Tim prefers wilderness so there will be some trade-offs, I am sure.

**8. How has the industry changed and in what direction(s) would you like to see the industry, as a whole, move towards?**

The greatest change that I have experienced is how to deal with a seasonal work force: the liability of retraining every year is high. Retaining seasonal staff is difficult. These positions are key ones that carry great responsibility with them. Of course the pesticide issue also governs so much of what we plant, how we plant, what we do and how we do it in all aspects of parks operations. Finally, and most recently, is our successful entry into the weather-based central irrigation world. This has had a similar impact to our operation as changing from reel to rotary mowers did. Forget about the rain falling, it's the moisture you are losing that counts. It rounds out the holistic approach we are taking towards our parks. Internships? I would love to see more in our industry.

**9. What do you consider to be the biggest benefit of being a STA member?**
Networking. I get to sit at a table with seasoned professionals and have answers to most of my questions in an instant. The *Sports Turf Manager*, Field Day and Ontario Turfgrass Symposium are all amazing sources for what you need to know about this ever changing industry. It's a tight group that looks out for each other and loves to share information. I can sincerely say I would not be as successful without the support of the STA.

**10. What would your advice be for current and future STA presidents?**
Every term seems to have had its issue. For me, the financial sustainability of the association was in jeopardy. My advice is to identify THE issue and go for it. You can't do everything, so pick one, get lots of help and FIX IT! ♦

**Adjacent:** Past Presidents Jane Arnett-Rivers and Chris Mark, City of Oakville. Chris was profiled in the Summer 2005 issue.

# Turf Industry Press Releases

G.C. DUKE EQUIPMENT NAMED DEALER OF THE YEAR • HUNTER'S NEW IRRIGATION ACCESSORY

### Jacobsen Names G.C. Duke Equipment, Ltd. Dealer of the Year

Jacobsen, a Textron Company, named G.C. Duke Equipment, Ltd. of Burlington, Ontario, as Dealer of the Year during the company's annual dealer meeting held in conjunction with the GCSAA show in Anaheim, California.

This annual award is presented to recognize outstanding performance in sales and customer service. G.C. Duke Equipment has been a three-time winner of this award since becoming a Jacobsen dealer in 1999.

The Burlington based head office of G.C. Duke Equipment is one of the largest Jacobsen dealers worldwide. Nolan Duke and Dick Raycroft accepted the prestigious award on behalf of G.C. Duke's 60 employees from Jacobsen President Dan Wilkinson and Vice-President Ralph Nicotera.

**Above:** From L to R: Dick Marconi (Founder of Marconi Car Museum), Nolan Duke (President, G.C. Duke Equipment), Dick Raycroft (VP/Sales – Duke), David Legg (Regional Sales Manager, Jacobsen), Dan Wilkinson (President, Jacobsen).

### Hunter ET System

Take the guesswork out of irrigation scheduling with this incredible accessory that gathers weather data on-site and continually self-adjusts to *automatically* calculate a scientific irrigation program for your particular microclimate. Easy to add on to any Hunter controller equipped with SmartPort® (models SRC, Pro-C, ICC made after 1996, and the all-new ACC), the ET System allows input of character-

istics of each valve zone's plant type, soil type, slope, shade and irrigation system and then measures key climatic conditions and uses them to adjust irrigation to suit your local evapotranspiration. By taking into account the rate at which water is consumed by weather and environmental conditions, the ET System will initiate a new schedule to replenish only the water that is actually needed for your sprinkler system, plants and soil conditions. The result: the optimum system for saving water (up to 30% over a conventional irrigation system) and creating healthier landscapes. ♦

# Nine Ways to Highlight Water Savings in July

The Irrigation Association declared July Smart Irrigation Month to draw attention to advances in irrigation efficiency and to the skilled professionals who use irrigation to make the world greener with less water. Here are nine steps you can take in recognition of Smart Irrigation Month to let your community know your facility is a good steward of water resources.

1. Write an article about the importance of water conservation and your efforts for a local newspaper, newsletter or magazine. Offer tips for the homeowner or other turf managers based on your professional training and experience.

2. Remind local newspaper, radio and television stations about Smart Irrigation Month and offer yourself as a source for information on efficient water use. If there's no immediate interest, let the reporter or editor know you're willing any time to be a source for articles on water conservation.

3. Take irrigation classes and earn an irrigation certification. Post certifications along with information about how certification demonstrates your knowledge and commitment to using resources efficiently.

4. Offer incentives for employees to take classes or earn Irrigation Association Certified Landscape Irrigation Auditor or Certified Golf Irrigation Auditor and conduct regular audits of your irrigation system.

5. Invite middle school or high school math or science students to your facility to assist with an audit. Explain how an audit helps you identify issues that could lead to water waste and let them put their math and/or data gathering skills to work on a real-world problem.

6. Offer to share your expertise with a local garden club, homeowners association or service group.

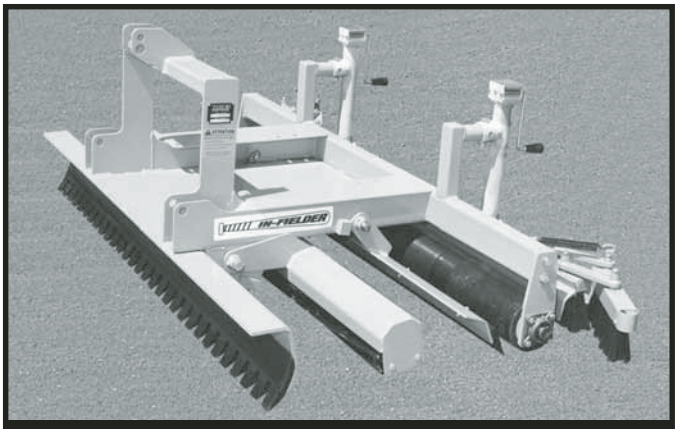
7. Use the SIM logo and consumer link, www.smartirrigationmonth.org, on correspondence, including e-mail, during July to raise awareness. The logo and other resources are at www.irrigation.org/SIM.htm.

8. Post information about irrigation efficiency on your website and in a visible location on your grounds. Include fact sheets with information about how much water it takes to keep your facility green and steps you take to ensure water is used efficiently.

9. Post photos, a slideshow or a video of an irrigation audit in progress with an explanation of how audits help you identify and correct problems to keep your irrigation running at optimum efficiency.

The Irrigation Association promotes efficient and effective water management and acts as the voice of the irrigation industry. For information on irrigation classes or certifications, visit www.irrigation.org, write news@irrigation.org or call 703-536-7080. ♦

JULY SMART IRRIGATION MONTH



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## TURF TRADES

**Employment Bulletin Board @ www.sportsturfassociation.com**

Are you advertising a position? Are you searching for a job? Target your audience or refine your search with **Turf Trades**, an online resource for all staffing levels and areas of the sports turf industry. Employment Bulletin Board ads run for 60 days with an additional 30 days available at 1/2 the price. Cost is $75 for STA members and $100 for non-members for the initial 60 day period. Payment by cheque (Canada only), MasterCard or Visa must accompany the job description.


# Proactive Water Management for *Sports Turf Managers*

Following the success of our inaugeral Spring 2006 workshop, the Sports Turf Association hosted a second *Proactive Water Management for Sports Turf Managers* full day event on March 29, 2007. This workshop addressed the implementation of water use bans and restrictions and the resulting concern for those responsible for premium field conditions for many sports such as soccer, football and baseball. It brought together those involved in managing the water supply of a municipality in the best interest of its citizens and those responsible for the management of quality sports turf surfaces for use by its citizens. Sessions were organized beginning with a more generalized view of the water management issue progressing to more specific, practical topics for use by turf managers. The following summary articles have been provided by our speakers and we extend our thanks to them for their further participation.


# WORKSHOP SUMMARY

ROB WITHERSPOON, DIRECTOR, GUELPH TURFGRASS INSTITUTE

The key issues that poured out of the water management workshop were the increasingly complex regulatory environment surrounding irrigation water use, the need for improving water use efficiencies and the development of best management practices for irrigation system management.

Not a single participant at the workshop was working in a municipality that does not have some form of water use bylaw. A challenge facing sports turf managers is making the various forms of bylaws work for a sports field environment. A system that allows professional field managers to make application timing decisions within a restricted water use situation would make best use of a limited resource. Rather than applying water based on some arbitrary calendar and/or street address criteria, water should be applied in a manner that is appropriate for turf growing conditions. Many managers feel it would be better to have a fixed allocation of water each year to be applied as needed rather than working within a day of the week and/or street address system that is effective for communicating with homeowners, but not particularly suited to the grass plant's needs.

As water restrictions increase, there appears to be a movement towards looking at alternatives to irrigating with treated municipal water. Some properties lend themselves to the construction of on-site irrigation ponds that may provide more flexibility with regards to water use. Capturing on-site runoff is one thing, but if plans call for tapping into an existing stream as a water source, extensive regulations apply including the need to develop a bypass pond and maintain a minimum stream flow. Although not discussed in detail at the workshop, waste water recycling systems that incorporate sports fields may be worthy of future investigation.

Efficiencies in water application are critical for sports turf managers to make best use of this critical resource. Regular auditing of system performance, knowing soil conditions and using some form of water budgeting all contribute to ensuring that water is being applied in an effective and logical fashion.

## What's Inside

### WORKSHOP SESSIONS

**The Protection of Our Water Resources: A Conservation Authority Perspective**
Bob Edmondson, Director, Watershed Management Services, Conservation Halton

**Water Efficiency in Halton Region**
Wayne Galliher, Water/ Wastewater Outreach Coordinator, Halton Region

**Establishing a Water Use Baseline**
Gregory Snaith, President, EnvirolIrrigation Engineering, Inc.

**Use It or Lose It: Best Management Practices for Water Management on Sports Fields**
Pam Charbonneau, Turfgrass Specialist, OMAFRA

The general consensus of workshop participants was that water restrictions are an inevitable component of managing sports turf in the 21st century. The key to success is being an efficient water user and communicating with policy makers to ensure that water use restrictions conform with best management practices for water conservation in field management. ♦

# THE PROTECTION OF OUR WATER RESOURCES

A CONSERVATION AUTHORITY PERSPECTIVE BY BOB EDMONDSON, DIRECTOR, WATERSHED MANAGEMENT SERVICES, CONSERVATION HALTON

Conservation authorities, particularly in the Greater Toronto Area, are known to most people for the conservation areas and large tracts of lands that they own and manage for outdoor recreation and education programs. In reality, the formation of conservation authorities came about with the passing of the *Conservation Authorities Act* in 1946 in response to concern expressed by agricultural, naturalist and sportsmen's groups *"that all the renewable natural resources of the province were in an unhealthy state."* The passing of the Act provided the means by which the province and municipalities could join together to form a conservation authority within a specified area – the watershed – to undertake programs for natural resource management. A conservation authority is basically a community-based agency formed on a watershed basis in partnership with its municipalities and the province to deal with resource management issues that cross municipal boundaries.

Hurricane Hazel, 1954

Many of the earlier conservation authorities were formed to deal with resource management issues such as large reforestation initiatives within their watersheds. Most, however, came into being following Hurricane Hazel which found its way into the Province of Ontario in October 1954 resulting in significant loss of life and property damage, particularly within the Humber watershed in Toronto. Approximately 81 deaths were attributed to Hurricane Hazel and some 4,000 people left homeless. The damage was put at approximately $1 billion in today's dollars. The significance of Hurricane Hazel is that it is the storm event that is used in today's standards in dealing with floodplain issues and the protection of life and property.

Hurricane Hazel served as an added initiative for municipalities to join and request the province to form a conservation authority as they were looked at as the ideal agency to deal with flood management on a watershed basis. Today there are 36 conservation authorities across Ontario.

Each conservation authority that was formed prepared a *Conservation Report* on the state of their watershed(s) that looked at flood management issues, the health of the watershed, opportunities for reforestation, recreation and land acquisition. In fact, most of the large tracts of land that are owned by conservation authorities today were originally identified from these early reports that were done in the 1950s and 1960s. These early reports also looked at opportunities to protect life and property through flood management schemes that controlled flooding and erosion. This entailed the identification of sites for reservoirs to control flood flows and channelization projects to divert flows from susceptible areas or control erosion. As a result, significant investment was made in this type of structural approach to flood management that took place throughout the 1960s and 1970s. Examples in the Conservation Halton watershed include the construction of the Kelso, Hilton Falls and Scotch Block dams and reservoirs on the Sixteen Mile Creek and the Mountsberg dam and reservoir on the Bronte Creek. Diversion channels were built in Oakville and Burlington to alleviate flooding in core areas of these centres. A channelization project in Milton was built to control the flows from the Sixteen Mile Creek and alleviate erosion through the downtown core.

### Flood Damage Reduction Program

Later in the 1970s a regulatory approach was taken to deal with development within floodplains. Regulations were enacted by conservation authorities through the *Conservation Authorities Act* dealing with construction within floodplains, alteration of watercourses and the filling of valley systems and wetlands. Regional storm events were used as the regulatory storm event, which in the case of most of Southern Ontario is the Hurricane Hazel event that occurred over the Humber Watershed in 1954. In the early 1980s the federal and provincial governments sponsored the *Flood Damage Reduction Program*, which involved the mapping and delineation of floodplains by

conservation authorities based on the regulatory storm. In effect, the intensity and duration of that storm event is transposed over a watershed to determine the extent of flooding that would occur in that watershed during that storm event. Development is prohibited or discouraged from taking place within that flood line. This approach by the province, in restricting development within the floodplain has been borne out in comparisons between significant storm events in Ontario and other jurisdictions. A well documented study comparing flooding in Ontario and Michigan found that although Michigan sustained extensive damage and suffered loss of life, Ontario had, during that same time period, higher flood yields. Even though Ontario's yields were higher the province recorded a small fraction of Michigan's damages. The difference in damages was estimated to be approximately $500,000 in Ontario compared to $310,000,000 in Michigan.

## Controlling Development

The Province of Ontario through the *Provincial Policy Statement* identifies the importance of restricting development within floodplains and hazardous lands through Part 3 of the policy statement dealing with Natural Hazards. Conservation authorities represent the provincial interest in matters of natural hazards at the local or municipal level in dealing with development applications.

A conservation authority's regulation for flood plains and fill-regulated areas (e.g. valley lands and wetlands) also deals with the control of pollution and conservation of land as they may be affected by development. Conservation of land within the context of a conservation authority regulation includes preserving the ecological integrity of, for example, a valley system.

Changes to the *Conservation Authorities Act* in 1999 resulted in the development of a *Generic Regulation* to be used by all conservation authorities to ensure more consistency among their individual regulations. In May 2004, the Province of Ontario enacted *Ontario Regulation 97/04* entitled, "Development, Interference with Wetlands & Alterations to Shorelines and Watercourses Regulation." This provides for the regulation of all watercourses, either permanent or intermittent, floodplains and meander belts (of watercourses), erosion hazards, shorelines, wetlands and associated lands and other hazardous lands (e.g. areas of karst topography). Conservation authorities had two years to bring their individual regulations into conformity with the Generic Regulation, which each conservation authority in the province has done as of May 2006.

Changes to the Act and the implementation of the *Generic Regulation* and the associated individual conservation authority regulations have essentially placed all natural hazards as identified in the *Provincial Policy Statement* under the regulations of a conservation authority. Development taking place within an area regulated by a conservation authority requires permission from that conservation authority. Violations of the regulation can result in fines of up to $10,000 or three months in prison. Further, judgments can result in significant restoration costs.

A watercourse does not have to contain fish in it to be considered fish habitat or have permanent standing water. An intermittent watercourse that does not have fish in it yet contributes a food supply to fish is considered fish habitat.

The regulations, in addition to protecting against natural hazards, also allow for the protection of watercourses, valley lands and wetlands. Coupled with this are watershed studies undertaken by conservation authorities to identify restoration initiatives and opportunities to protect and enhance watercourses, valley lands, wetlands and other natural heritage features and to look at strategies for natural heritage systems that should be protected for the long term.

## Protecting Fish Habitat

Conservation authorities have also formed partnerships with other agencies for the protection of natural features and habitats. This includes the signing of Memorandums of Understanding with municipalities to provide expert advice on development applications as they may affect natural heritage systems and the signing of agreements with the Department of Fisheries and Oceans to protect fish habitat. Conservation authorities take an active role with their municipal partners in developing subwatershed studies and implementing recommended strategies as lands are urbanized.

The *Federal Fisheries Act* has become much more prominent in the last number of years in protecting fish habitat that may be affected by development. It should be noted that the Act is not new as it was first passed in 1868. Most conservation authorities have formed partnerships through agreements with the Department of Fisheries and Oceans to screen development applications for impacts to fish habitat with the guiding principle of no net loss to fish habitat. What is important to understand is the definition for fish habitat within the *Federal Fisheries Act:*

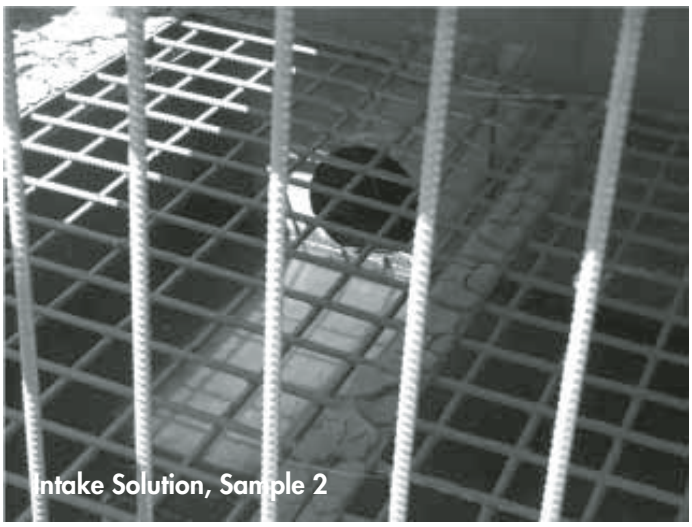
*"Spawning grounds and nursery, rearing, food supply, migration and other areas on which fish depend directly or indirectly in order to carry out their life processes."*

A watercourse does not have to contain fish in it to be considered fish habitat or have permanent standing water. An intermittent watercourse that does not have fish in it yet contributes a food supply to fish is considered fish habitat. Section 35 (1) of the *Federal Fisheries Act* prohibits the harmful alteration, disruption or destruction of fish habitat (HADD) without authorization by the Department of Fisheries and Oceans. Contravention of Section 35 (1) may result in a fine of $1,000,000 and three years in prison.

## Low Water Response Teams

Most conservation authorities have developed well-rounded programs over the years in caring for the health of their watersheds through restoration initiatives; acquisition of significant natural heritage areas; provision of open space recreational opportunities; stewardship initiatives with private landowners; providing assistance programs to landowners; establishing environmental monitoring programs; key messaging to the public on environmental




matters; advocating for environmental initiatives and implementing specific programs to address the needs of their watersheds.

An example of specific watershed programs includes the development of local *Low Water Response Teams* by most conservation authorities to deal with drought conditions within their watersheds. The programs were developed from measures undertaken by the province in the late 1990s in response to low precipitation. The programs are basically voluntary in nature to initiate actions to address low water conditions in streams or rivers and groundwater tables. The programs use indicators of precipitation and streamflow measured against normal averages. Three different levels of conditions are considered reflecting prolonged periods with little or no precipitation and corresponding reductions in streamflows. Initial actions include voluntary reductions in water use with the most extreme level (Level III) potentially resulting in regulation of water restrictions by provincial agencies. The typical *Low Water Response Teams* that are formed include representatives from municipalities, provincial agencies, the agricultural community, sportsmen associations, golf courses, aggregate operators and the water bottling industry. The teams will meet to review low water conditions; communication action plans to landowners and water conservation recommendations.

## Source Protection Initiatives

The contamination of the water supply in the Town of Walkerton in 2000 has led to the province looking at protecting drinking water supplies at its source. Conservation authorities have been identified as playing a key role in the development of source protection plans to protect municipal drinking water supplies. Technical teams have been formed in watershed regions to gather data and information in characterizing the watersheds for the preparation of source water protection plans. The information gathered from existing studies and through new studies has helped all conservation authorities gain a better understanding of the dynamics of their watersheds and the impacts of water taking on surface and groundwater supplies. Shortly, *Source Water Protection Committees* will be formed for each watershed region to prepare assessment reports for their watersheds and ultimately source water protection plans to ensure the long-term protection of drinking water supplies.

## Minimizing Sediment Loading

A continuing problem in protecting water resources has been attempting to control sediment loading to watercourses particularly from construction and de-

velopment activities. Section 36 (1) of the *Federal Fisheries Act* states that *"no person shall deposit or permit the deposit of a deleterious substance into water frequented by fish."* The release of sediment to a watercourse is considered a deleterious substance by the Department of Fisheries and Oceans and there have been well documented cases of substantial fines levied for violation of the Act relating to the release of sediment particularly resulting from construction activities.

Excess sediment can have impacts on fish through abrasion of their gill membranes and suffocating of their eggs. Sediment can also carry toxins, bacteria and excess nutrients and can result in the depletion of oxygen within a water body. Physically, excess sediment can affect flooding, fill in wetlands and influence the geomorphic stability of a watercourse channel.

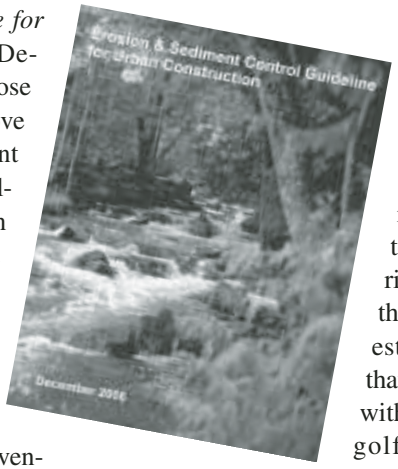
Fish are typically stressed where total suspended solids (TSS) exceed levels of 200 mg/L for prolonged periods. Studies on construction sites in Piedmont, Vermont show the benefits of having erosion and sediment control practices in place in relation to concentrations of sediment:

| | |
|---|---|
| Pre-construction (background level): | 25 mg/L |
| Post construction: | 50 mg/L |
| Erosion & Sediment Controls: | 283 mg/L |
| Erosion Controls Only: | 680 mg/L |
| No Erosion or Sediment Controls: | 4145 mg/L |

Studies undertaken more recently in the Toronto area have shown similar results.

Typical factors contributing to problems on construction sites relate to lack of phasing during clearing and grading; long lags between soil disturbance and stabilization; unnecessary clearing of sensitive areas such as riparian buffers, steep slopes and wetlands; inadequate maintenance of sediment controls; poor field inspection practices and enforcement of erosion and sediment control plans.

*Erosion and Sediment Control Plans* are typically required by conservation authorities through approvals associated with their regulations or by municipalities as conditions of development through the planning process. Recently the conservation authorities within the Greater Toronto Area have produced an *Erosion and Sediment Control Guide for Urban Construction* (December 2006). The purpose of the guide is to improve the practice of sediment control, ensure that a well-defined process is in place and ensure that Erosion and Sediment Control plans are prepared, implemented and enforced. The guide stresses the importance of erosion prevention. It is intended for contractors, consultants, developers/owners, government agencies and government inspectors. Current erosion and sediment control practices and methods are illustrated. More information on the document and up-to-date information on sediment and erosion control is at www.sustainabletechnologies.ca.




## Water Takings

*A Permit to Take Water* (PTTW) is required from the Ministry of the Environment where the taking of water from a surface or groundwater source exceeds 50,000 litres per day (10,000 gallons). In recent years, the Ministry of the Environment has initiated new water conservation requirements for permits to take water. A new classification system has been introduced that places takings in categories as to their potential for causing adverse environmental impacts. There is a greater emphasis on maintaining data on the taking of water on a daily basis and requirements for monitoring and reporting on an annual basis. Water takings in high use watersheds can be refused. Conservation authorities have always been concerned with the taking of water within their watersheds and the cumulative impacts that can affect the aquatic environment. While the Ministry of the Environment through their PTTW controls the actual taking of water, conservation authorities can influence the water takings through their regulatory control on the structures that are required to facilitate the water taking.

In some watersheds, strategies have been developed that set thresholds below which water cannot be taken. In permitting the intake structures, the conservation authority can establish the setting of the intake to ensure that water is not taken during periods of low flow where the taking would affect the established threshold for that watercourse. In dealing with developments such as golf courses, new golf courses and changes in designs to older golf courses, designers have looked at retaining more runoff from overland flow into larger irrigation reservoirs. This ensures that there is less reliance on water taking, particularly during drought or periods of low precipitation. In many cases, these reservoirs are large enough to supply other ponds scattered throughout the course that are in place for aesthetics or "water hazards" rather than for irrigation purposes. With many of these new designs or re-designs, conservation authorities will work with the Ministry of the Environment and the applicant to ensure that any water taking from a watercourse will not result in environment impacts by constructing the intakes so that water can only be harvested during high flows.

In summary, the main role and mandate of a conservation authority is to provide for programs that protect and enhance the natural resources of its watershed and to provide for the protection of property and life through regulatory control pertaining to natural hazards. Hopefully, this article has helped explain some of the history of the conservation authority movement and some of the tools, programs and partnerships that are utilized by conservation authorities to fulfill their role and mandate. ♦

# WATER EFFICIENCY IN HALTON REGION

WAYNE GALLIHER, WATER/WASTEWATER OUTREACH COORDINATOR, HALTON REGION

With the increased temperatures experienced during summer periods, water utilities across Ontario face an increase of peak in water servicing demands attributed to recreational tasks such as car washing and filling of swimming pools, seasonal irrigation of lawns and gardens, and increased personal water consumption. Should periods of peak consumption persist and recovery of water distribution system reservoirs be unachievable or overall system pumping capacities thresholds be threatened, many water service utilities are required to put in place watering bans and/or restrictions to ensure adequate levels of water are reserved for residential and business based consumption requirements and fire protection purposes.

Residential water consumption can as much as double in summer periods. It is in the best interest of water service utilities to limit the operational impacts of unnecessary treatment when looking to the added costs of additional treatment chemicals needs, energy used in treatment and distribution, and the secondary treatment of added wastewater volumes experienced under increased water peak consumption periods. As such, the introduction of numerous municipal based water efficiency programs and policies have fast become the most cost effective and environmentally friendly means in achieving reductions, and creating additional capacity, to limit the operational impacts experienced during peak summer periods.

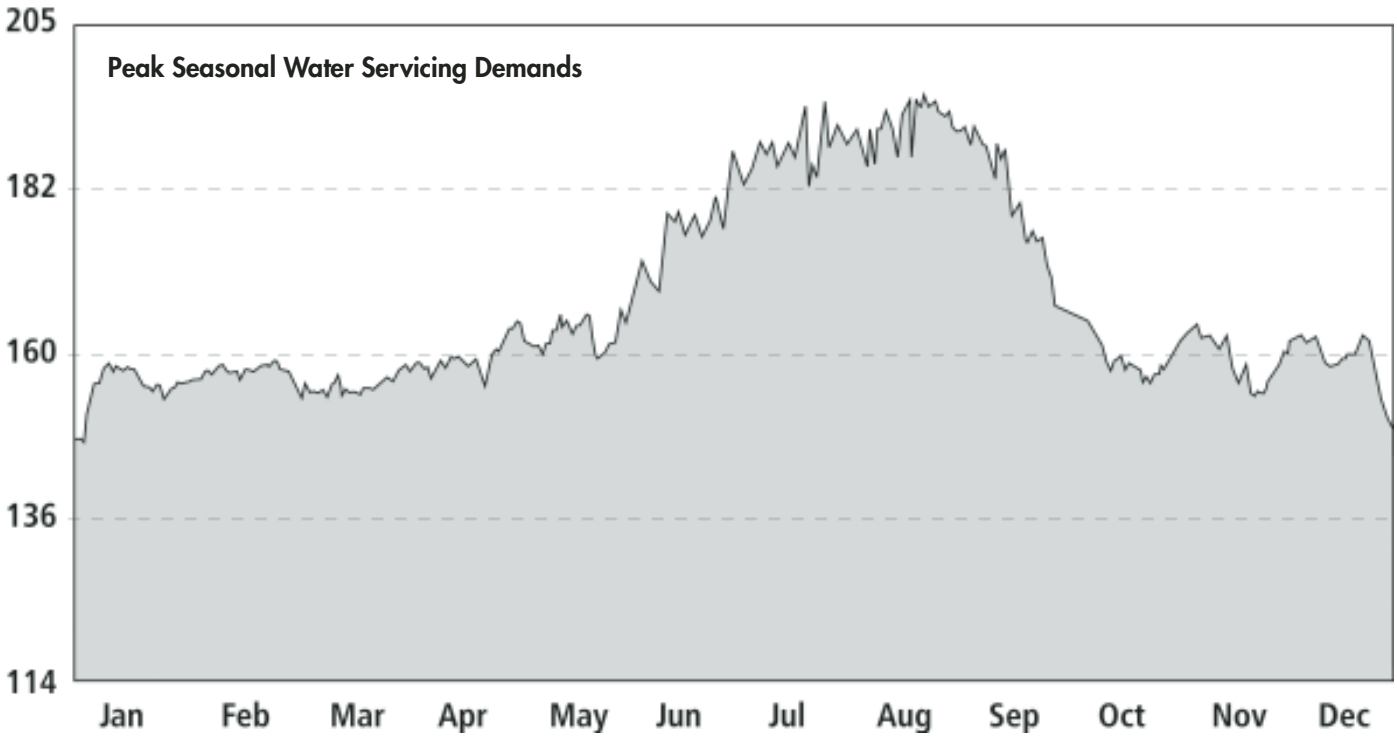
In working to reduce the impacts of peak seasonal water servicing demands and to demonstrate environmental stewardship of the region's water resources, Halton Region has employed a combination of demand side management, public education and bylaw based water conservation measures.

## Water Balance Audits

As part of Halton's demand side management initiatives, an annual *Water Balance Audit* is completed to assess the overall efficiency of each of the region's water distribution systems through a comparison of water production, billed water consumption and the calculation of water volumes attributed to non-metered tasks. In response to levels of lost water identified through the audit, Halton has employed an ongoing leak detection program to assess daily water flows into areas of suspected loss and to pinpoint water leakage in each water distribution system. Further to leak detection studies, demand side management initiatives have also transcended to include the region offering voluntary water use audits to large Industrial, Commercial and Institutional (ICI) water users within the Halton Hills groundwater based communities of Acton and Georgetown. Through this initiative, representatives of the Halton water conservation program assess how water is utilized at each site, and following a flow monitoring period at the site, provide a detailed report of possible measures which could be undertaken to limit the use of excess volumes of water observed.

## Educating the Public

To promote public knowledge of water conservation practices and programs



within the community, Halton staff has continually been involved with community based outreach events throughout Halton Region. In continuing with water conservation based public education, Halton Region and Conservation Halton partnered to provide the inaugural Halton Children's Water Festival in September of 2006 at Kelso Conservation Area in Milton, Ontario. Throughout the three-day event, over 3,000 grades 3, 4 and 5 students from across Halton Region participated in 56 interactive Ontario curriculum based activity centres focused on the main festival themes of water conservation, water health and safety, water protection, water science and technology and water stewardship. With the high success of the inaugural event, planning of the second Halton Children's Water Festival is currently underway. The 2007 event planned for September 25, 26, and 27, 2007, will again be held at Kelso Conservation Area and feature over 50 interactive activity centres for grades 2, 3, 4 and 5 Halton Catholic District School Board and Halton District School Board students.

### Implementing Bylaws

The third measure used for water efficiency is the *Halton Water Use Bylaw* (Bylaw 42-04). This bylaw distinguishes permitted usages of water, provides specification as to qualified personnel who may operate water system infrastructure, specification regarding the components of water system infrastructure, and outlines water usage violations and penalties under violation of the bylaw. In addition to the terms listed above, the *Halton Water Usage Bylaw* also provides the ability to implement water usage bans, restrictions and watering policies. With reference to this, Halton Region introduces the odd and even day watering policy each spring to limit excessive levels of irrigation as an industry best practice in water resource management and stewardship.

### Further Initiatives

In continuing to employ water efficiency measures, Halton Region is currently working towards the introduction of numerous programs including a residential toilet rebate pilot program, an ICI pre-rinse spray valve replacement program, school based water and wastewater Ontario curriculum based outreach program, and a landscape assessment program to promote outdoor water efficiency through the use of drought tolerant and native plants in home landscaping.

Furthermore, Halton Region has currently started development of the *Halton Water Efficiency Master Plan* to provide a measurable, sustainable and achievable water efficiency strategy. The plan, upon endorsement by Halton Regional Council, will see the introduction of an enhanced water conservation based program strategy and the introduction of an overall water efficiency reduction goal to be achieved over the next decade.

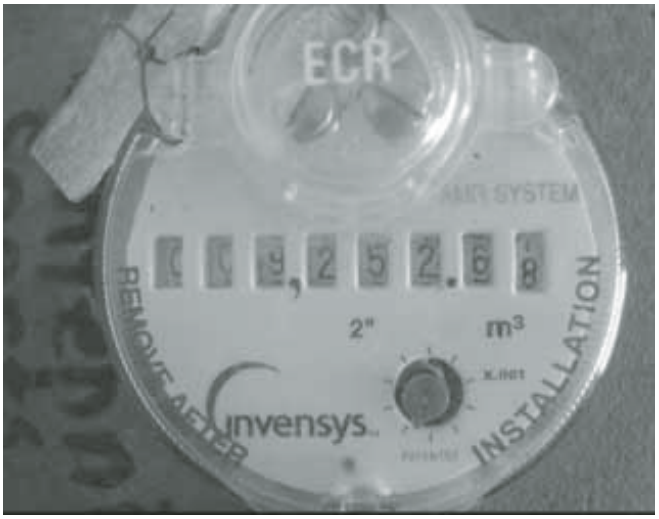
For more information on the *Halton Water Conservation Program*, please visit www.halton.ca/waterconservation. ♦

# DEVELOPING AN IRRIGATION BASELINE

ARTICLE & PHOTOGRAPHS BY GREGORY SNAITH, P.ENG., ENVIROIRRIGATION™ ENGINEERING INC.

## Using Water to Ensure Safety

A critical water use balance is essential to maintain a healthy, safe and functional turf sports field. Under irrigating a sports field may result in a playing surface that becomes dry, compacted and less safe for athletes. Sports turf managers require historical water use baselines which provide a datum to measure from while implementing higher water management technologies.




## Daily Peak Demands

During the summer months, many cities and towns across North America experience daily peak demands which approach the rated capacity of water distribution infrastructure. In critical situations, this limits available water resources for emergency response and fire protection. While outdoor water use bans and restriction programs are created to decrease daily peak demands, these water programs are often in conflict with the required water to ensure athlete safety, functional turf sustainability and Integrated Pest Management program support.

## Implementing the Water Efficiency Plan

An effective *Water Efficiency Plan* should separate the *Water Efficiency Program for Sports Fields* from the *Outdoor Landscape Water Use Program*. It only makes sense, since one is to provide a safe sports environment for the public while the other functions to achieve beautification. Since irrigation is generally considered a high water use sector, golf course superintendents and sports field managers should have strategic influence on the development of water efficiency plans. The double win opportunity would be a partnership between the city and the water purveyor (often the region) to promote water saving incentives including irrigation system performance auditing, training, technology upgrades and water use monitoring. For most cities, if water efficiency programs are not implemented, they will require major infrastructure expansion to accommodate future population growth.

## Justifying Water Usage

Justifying water use for irrigation is based on the area of playing surface multiplied by the depth of water required. To implement water efficiency, it is essential every sports turf manager understands:

- soil water holding capacity
- drainage
- infiltration rates
- compaction
- evapotranspiration rates

A recommended resource on these topics is *Understanding Turf Management* written by Dr. Robert Sheard and published by the Sports Turf Association.

## Typical Irrigation Baseline vs. ET Management

The majority of existing irrigation controllers rely on a weekly schedule of irrigation cycles that remain fixed until the sports turf manager adjusts them. Self adjusting water efficient irrigation controllers take into account both on-site rainfall and changing weather. Case studies have shown such automatic adjustments can account for seasonal water savings up to 30% or higher. Irrigation is only required to make up for the lack of timely and effective rainfall. For example, an effective rainfall of 10 mm on a 6,000 $m^2$ soccer field is worth $120 if during a dry period the same amount was added by irrigation and the water cost was $2 per $m^3$.

## Record Keeping is Essential

Measurement of the irrigation system's performance whether a golf course, sports field or a commercial site, is the critical step in identifying baseline water use. Personal auditing experience proves that no one can judge with accuracy the efficiency of any system until it is measured professionally.

## Verify Water Usage With Dedicated Flow Meters

Dedicated water meters are excellent water usage management tools and take the estimation out of volume calculations. The strategic key to implementing any water efficiency plan is to first establish and provide the historical water use baseline. This can be done by monitoring a dedicated water meter on a monthly basis and by providing a performance audit to the existing system.

## Historical Water Use Baseline (HWUB)

The HWUB for any irrigation system is affected by:

1. Original irrigation design (ideally done by Certified Irrigation Designer independent from the sale or installation of any product).
2. Original irrigation installation (ideally installed by a Certified Irrigation Contractor with same project experience and inspected by a certified designer).
3. Maintenance of system (routinely checked and repaired).

4. Management of system (ideally by implementing monitoring and seasonal changes using Smart Water Application Technologies).

Once a water use baseline has been established it can then be utilized as a datum against the following:

1. Measure baseline against seasonal ET requirements (usually measured in mm per day, week or month).
2. Measure baseline against expected water efficiency technology performance (it is realistic to expect a rotor zone to operate at an overall efficiency of 75%).
3. Measure baseline against goals and/or objectives of a *Water Efficiency Plan* (the goal may be to decrease the water use by a realistic 20-30%).

The Irrigation Association, consultant, manufacturer, contractor and the distributor are all key team members playing their appropriate roles in providing technical and educational support for all irrigation systems. No matter how simple or complicated an irrigation system is, one thing is for certain, it is very difficult to measure improved water efficiency practices without first establishing the water use baseline. Remember, you cannot effectively manage that which has not been effectively measured. ♦

# USE IT OR LOSE IT: BMPs FOR WATER MANAGEMENT

PAM CHARBONNEAU, TURFGRASS SPECIALIST, OMAFRA

*Use it wisely or lose it* should be the real slogan here. The goal is to provide turf with the right amount of water when it is needed and at the lowest cost and the least impact on the environment. There are negative consequences when turf receives too little or too much water. Not enough water can result in drought stress, thinning, localized dry spots and dormancy. Too much water, on the other hand, can result in shallow root growth, increased soil compaction, susceptibility to disease, leaching of nutrients, wet wilt and a waste of water due to runoff or drainage.

### Turf & Water Interactions

A turfgrass plant is composed of 90% water. Water is also needed in every stage of plant growth. If water levels within a plant get below a critical level the plant will die. As little as a 10% reduction in turf water content may be sufficient to cause death. Water is needed for photosynthesis, cell division, temperature control and nutrient movement. The equation for photosynthesis showing the role of water ($H_20$) is below:

$$6CO_2 + 6H_20 \xrightarrow{\text{light}} C_6H_{12}O_6 + 60_2$$

Photosynthesis and cell division account for 1% of a plant's water needs. The majority of a plant's water needs are for temperature control and nutrient movement and these account for 99% of a plant's water need. All nutrients are moved into plants through the soil solution. This nutrient rich solution is taken up by the roots and transported via the xylem in solution. This movement occurs from the roots to all parts of the plant.

IMPORTANT
TABLES/FIGURES AVAILABLE
★as an insert★

Cooling of turfgrass plants is made possible because of water loss from the plant through transpiration (as a vapour). Ninety percent of the water loss is through the stomates. In a turf system, water is also lost from the soil through evaporation. There is a combined loss of water from the soil by evaporation and by the plant through transpiration and this is called evapotranspiration (ET). ET is difficult to measure, but it can be estimated. It is influenced by sunlight, soil and air temperature, relative humidity, wind speed, turfgrass species, height of cut of turf and rainfall. It is measured in inches/day, inches/week or mm/day. Evapotranspiration is used to calculate plant water requirements. It is estimated with a device called an evaporation pan. This gives the amount of water that evaporates from a flat shiny surface. It must then be adjusted for each crop and for each microclimate. One equation that is used to estimate plant water requirements is below:

$$PRW = ET \times K_c \times K_{mc}$$

PRW = plant water requirement
ET = evapotranspiration
$K_c$ = crop coefficient
$K_{mc}$ is the microclimate factor

Crop coefficients vary with each type of grass species and the height at which they are maintained. Most crop coefficients are based on seasonal averages. Some cool season turfgrass crop coefficients are listed in Table 1 (see insert).

Microclimates may also vary from area to area and for the purpose of this article, from sports field to sports field. The microclimate factor is a correction factor that relates to things such as proximity to buildings, paved surfaces, slope, shade and wind. A microclimate factor in a full sun sports field with heat reflecting and heat generating buildings nearby that is exposed to the prevailing winds would have a high $K_{mc}$ and a microclimate with shade and no wind would have a low $K_{mc}$. In general there are three $K_{mc}$ microclimate correction factors: high = 1.4, medium = 1 and low = 0.5.

### An Alternative Method of Estimating Evapotranspiration

Some work done at the Cambridge Research Station by Dr. Robert Sheard came up with a way to estimate pan evapotranspiration based on observed weather conditions. This is an alternative method to having your own evaporation pan, which is easier, but may be a bit less accurate. Table 2 gives the estimated pan ET in millimeters based on weather observations at 1:00 pm.

A combination of the visual estimates of humidity and wind in addition to an observed temperature gives the estimate of pan evaporation. This then needs to be corrected for grass with the season correction factors found in Table 3.

ET calculation example:
Date – July
Sun – Sunny
Temperature – 27ºC
Humidity – low
Wind – low
Estimated pan evaporation from Table 2 (7.5) x seasonal correction factor from Table 3 (.75) = estimate of grass ET (5.5 mm) for that day.

### Soil and Water Interactions

The amount of water a plant needs is influenced by soil particle size, soil particle size distribution (soil classification) and root zone depth. Soils can be classified according to their particle size into sand, silt and clay. Sands can be further divided into five categories: very fine sand, fine sand, medium sand, coarse sand and very coarse sand. Table 4 shows the particle size diameter of coarse sand down to silt and clay.

For every field that you are responsible for irrigating within your municipality, it is very important to know the soil classification or particle size distribution of that field. Without this information, it is almost impossible to accurately deliver the right amount of irrigation. One way of obtaining this information is to have a

soil laboratory run a soil texture analysis of every field. This is a useful exercise and only needs to be done once in the life of a sports field. A cheaper and quicker method is to simply use the mason jar test and a soil texture triangle. Just follow the steps below. Figure 1 shows a mason jar with roughly 80% sand and 20% silt.

1) Fill a mason jar 1/3 full of a random sample of soil from one field.
2) Pack it down and mark the level with a permanent marker.
3) Add water to fill the jar 3/4 full.
4) Shake vigorously.
5) Let sit for 5 minutes.
6) Measure the sand layer (the one on the bottom of the jar) as a percent of the depth of the original soil.
7) Measure the silt layer (the one above the sand layer) as a percent of the depth of the original soil.
8) Add the percent sand and percent silt together and subtract that from 100 to get percent clay (the clay is still suspended in the water).


Figure 1: Mason Jar Test

Now that you know that you have an 80% sand and 20% silt soil you can go to the soil texture triangle (Figure 2) to determine the soil classification. Follow the percent sand arrow over to 80 and follow the % silt down to 20 and follow each of those lines to the point where they intersect. In our example, we end up in the loamy sand area of the triangle. Soil texture affects plant available water and water infiltration rates. Both of these are important factors in determining efficient irrigation scheduling.

Infiltration rate is a measure of how quickly water enters soil. It is greatest at the beginning of an irrigation event or rainfall event and again it is influenced by soil texture. Infiltration rates of each soil or each field can be measured in one of two ways. A double ring infiltrometer is the most accurate way of measuring infiltration rates. Another way is to simply put on the irrigation system and measure the time until runoff. Infiltration rates can also be estimated if you know the soil texture. Table 5 gives a list of the basic infiltration rates of six different soil classifications.

Another important aspect of a soil is its available water. This is the amount of water stored in a soil between field capacity and permanent wilt. Another way to think of it is the amount of water that the plant can extract from the soil. In fine textured soils such as a clay loam, some of the water is held so tightly onto the soil particles that it is not available to the plant. In a coarse textured soil, some of the water applied to a soil is not available to a plant because it is lost through drainage. Table 6 gives the available water in mm based on soil texture. If you are using the calculation based on soil texture, the plant available water is the available water multiplied by the active root zone depth. There are two instruments that can be used in the field to measure plant available water: a time domain reflectometry probe (TDR probe) and a frequency domain reflectometry probe (Theta probe). Both of these methods measure volumetric water content.

Plant available water is the available water which can be measured in the field or it can be calculated based on soil texture. To calculate plant available water:

Plant available water = available water (from Table 6) x root zone depth

Example:
Sandy loam soil with a 300 mm root zone
Plant Available Water (PAW) = (available water from Table 6) 0.12 mm water/mm soil x (soil root zone depth) 300 mm soil
PAW = 36 mm water

Another important concept in the field of irrigation is how much water can be depleted from a soil before there are adverse affects to the plant. This is called the maximum allowable depletion. In general, it is agreed upon that if plant available water is allowed to deplete to 50% before re-applying water that there will be no harmful effects on the turfgrass plant.

Below is an example to help put all of the pieces together. Table 7 shows an example of a water budget. The assumptions in the example are:

- A sandy loam root zone
- Rooting depth 300 m
- Plant available water is 300 mm x 0.12 mm/mm = 36 mm
- Want to irrigate when 50% of available moisture is depleted (ie. at 18 mm)
- Assume field capacity on day 1 = 36 mm plant available water

This example shows that this particular field, when ET rates are high, the field needs only to be irrigated every second or third day.

## Sprinkler Performance

Now that the plant side is taken care of, let us look at irrigation system performance. In order to irrigate efficiently, you must have an irrigation system that is performing properly. Irrigation system performance can be determined by an irrigation audit. This can be done in-house or you can hire an irrigation auditor to perform it. An irrigation audit will ensure that all sprinkler heads are level and that the pressure is relatively uniform. It will also determine the distribution uniformity (DU) of the irrigation system and this is calculated by measuring catch device volumes in the field. An irrigation audit will also determine the precipitation rate (PR). This is the rate at which water is applied per unit time (in/hour or mm/hour) and it is often referred to as the application rate. With this information you can determine your run time multiplier and finally your maximum run time cycle.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## Irrigation Scheduling

The next question should be "How long do I have to run my irrigation system to deliver 14 mm or 24 mm of irrigation?". If you have performed an irrigation audit, you can easily determine your run time. To determine this you need to know the following:

- run time multiplier (RTM)
- distribution uniformity of the lower quarter (DU) (from irrigation audit)
- precipitation rate (PR) (from irrigation audit)
- base run time( $RT_b$) $RT_b$ = plant water requirement/precipitation rate x 60.

With the above information you can then:
- calculate the adjusted run time ($RT_{adj}$). $RT_{adj} = RT_b$ x RTM
- calculate the maximum run time/cycle = infiltration rate/precipitation rate x 60

The run time multiplier is a correction factor that is used to compensate for non-uniformity of distribution of an irrigation system. Run time multipliers can be found in the Certified Golf Irrigation Auditor workbook put out by the Irrigation Association and they can also be found on the internet. The infiltration rate can either be estimated based on soil texture or you can determine it with a double ring infiltrometer as discussed earlier in the article.

Example run time calculations based on the water budget example above:
- Base run time $RT_b$ = PWR/PR (24 mm/15 mm (from irrigation audit) x 60) = 96 minutes
- Adjusted run time $RT_b$ x RTM (96 x 1.22 = 117 minutes)
- Infiltration rate – 14 mm (from Table 5)
- Maximum run time/cycle
- Infiltration rate/precipitation rate x 60 = 14 mm per hr/15 mm x 60 = 56 minutes
- The maximum time this zone should be run to avoid runoff is 56 minutes. Basically, two run cycles of roughly 56 minutes will deliver the required amount of water to recharge the root zone in this water budget example.

## Irrigation Checklist

This checklist below gives a quick overview of the information and/or equipment needed to be able to apply the right amount of water to turf.

1) Determine soil texture of each irrigated field (mason jar or lab).
2) Make note of the infiltration rate (based on soil texture, double ring infiltrometer or observation of time to runoff) and available water (based on soil texture) and root zone depth for each field.
3) Calculate plant available water = available water x root zone depth.
4) Perform an irrigation audit to determine precipitation rate and distribution uniformity.
5) Keep track of ET rates based on temperature, humidity and wind.
6) Have a method for measuring rainfall and a rain shut off feature.
7) Use the water budget to schedule irrigation.
8) Use run time calculations to determine how long to water.
9) Schedule to water only in early morning (low wind and less evaporation).
10) Ground truth by inspecting fields to make sure the turf is getting adequate water and that there are no over-watered, under-watered areas or localized dry spots.
11) Have a dedicated knowledgeable staff person in charge of irrigation.
12) Don't forget other cultural practices for maintaining healthy turf:
- Mow as high as possible and frequently enough to maintain a stress-free plant.
- Alleviate compaction (core aeration, etc.) which helps maximize infiltration rate.
- Control thatch.
- Fertilize according to the plant's needs.

## Abbreviations

| | |
|---|---|
| DU = | disribution uniformity |
| ET = | evapotranspiration |
| $K_c$ = | crop coefficient |
| $K_{mc}$ = | microclimate factor |
| PAW = | plant available water |
| PR = | precipitation rate |
| PWR = | plant water requirements |
| RTM = | run time multiplier |
| $RT_{adj}$ = | adjusted run time |
| $RT_b$ = | base run time |

## References

1) Carey, K. C., 2001. Irrigation Scheduling Principles: Tools for Dry Times. *Sports Turf Newsletter*, Vol. 14, pp. 6-7.
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