

WATER AUDITS  
of  
LAWN BOWLING GREENS and CROQUET COURTS

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*ABSTRACT*

*Lawn Bowling Greens and Croquet Courts are unique when it comes to designing an efficient irrigations system. The restraint of not having fixed irrigation heads on the actual playing surfaces makes it difficult to obtain good water distribution and scheduling efficiency.*

*Club members want hard, level playing surfaces, short green grass and no fixed irrigation heads on the playing surface. Water audits can be utilized to explain to club members the problems with maintaining healthy turf under these conditions and the need for extensive maintenance practices by the turf professionals.*

*Turf professionals assigned to these facilities can use the water auditing tools to offset criticism thrown their way by club members, officials and their immediate supervisors regarding the turf conditions at these facilities. Growing healthy turf under these conditions is difficult even when using the water auditing tools to demonstrate existing problems.*

**Lawn Bowling and Croquet** (not the kid's game) are two unique sports that impose somewhat severe restrictions on the design and operation of irrigation systems. These two games are played by serious adults demanding a level playing field to within  $\pm 1/8$  inch, hard almost to the point of serious compaction, a very low growing grass (typical of the region of the country or world. Tifgreen - 328 for this area of Florida) and no sprinkler heads located on the playing surface.

Good water distribution becomes very difficult under these conditions. We have experienced these problem with the three Lawn Bowling Greens and three Croquet Courts. Sarasota County, Community Service Business Center, Parks and Recreation, Athletic Division's Irrigation Unit, maintains these greens and courts for the cities of Sarasota and Venice.

We have reuse water to irrigate the lawn bowling green that is available twenty four hours per day. We do not water during the time frame between 10:00 a.m. and 3:00 p.m. We comply with existing water ban rules and regulations imposed by the Florida Water Management Districts. They have imposed limits to irrigation between these hours for those users utilizing potable, well or surface waters for their irrigation source.

We abide by this same restriction to eliminate problems with the public and law enforcement agencies and the lengthy explanation of why we are not bound by these same water restrictions.

I am only discussing the irrigation problem and the water audit conducted on the newest south Lawn Bowling Green. A very similar situation exists with the Croquet Courts. These were not audited due to current modifications to the entire court layout. These modifications may entail moving existing irrigation heads.

This audit has already shown us some modifications that need to be implemented in order to improve the distribution uniformity and water scheduling. It is eventually going to require the placing of a full circle irrigation head located in the exact center of each of these Lawn Bowling Greens. This full circle head was not provided for when this green was built nor were provision made for a solenoid valve controlled by the irrigation controller.

Recent budget cuts have limited our staffing levels for these specialty sports and we must have the assistance of members of the Sarasota Lawn Bowling Club to offset these budget restraints. This will probably require the clubs assistance in the placing and removal of the full circle heads to be located in the middle of each bowling green. These portable heads located in the center of the greens will give us better water distribution and improved scheduling efficiency.

### **HISTORY of the GREENS**

Lawn Bowling Greens are typically laid out as a 120 foot square (this is the playing surface). This green is surrounded by a ditch, which may become part of the games playing surface on occasion. The board defining the ditch that is adjacent to the playing surface (called the plinth) is actually considered part of the playing surface and its levelness to  $\pm 1/8$ " determines the levelness of the entire playing green. Irrigation heads are placed outside of this ditch and far enough away so the boards that make up the ditch can be repaired or adjusted after top-dressing of the green without damaging the irrigation system.

This south green was constructed by the City of Sarasota's Recreation & Parks Department in 1984 as a sand green generally following the construction guidelines in the book THE CONSTRUCTION OF THE LAWN BOWLING GREEN by Edgar R. Haley, Greenskeeper, Escondido, CA.

This lawn bowling green was constructed over some old shuffleboard courts that were partially removed. These courts were built on top of a well drained fine yellow sand. Large holes were jack-hammered into those courts that were not removed to "provide continuity" and "drainage" between the existing soil and the graded fine sand that makes up the new green. We have a graded 6 to 7 inch deep fine sand layer that holds more water than the typical native Florida sand.

Original irrigation system used TORO 690 series irrigation heads connected to a 3 inch mainline loop to minimize pressure loss. These were *hydraulic valve in head sprinklers* that were individually controlled by a TORO Controller.

We modified the irrigation design when we obtained reuse water from the City of Sarasota to a Rain Bird system that can eventually be connected to a Maxicom 2 Centralized Irrigation Control System. We replaced the TORO heads with Rain Bird *Eagle 750 Rotor Series*. This sprinkler head with a yellow # 36 nozzle operates at 70 psi, radius of 65 feet and flow of 20.4 gpm. All eight heads are adjusted to a "90° arc" to minimize overlap.

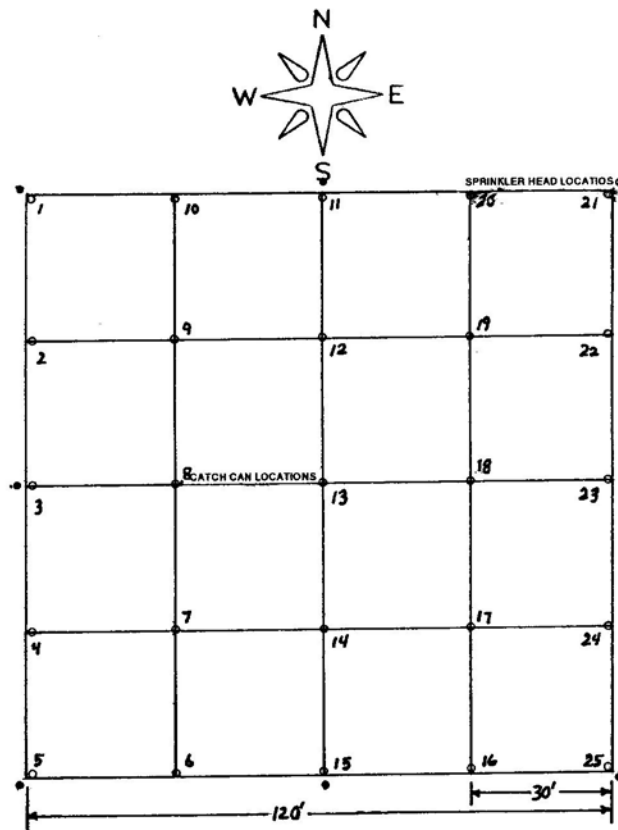
The cities reuse water main has a static pressure between 50 and 70 psi. A booster pump was installed to increase the mainline pressure to 85 psi which is high enough to provide the required 70 psi at the base of the sprinkler head.

A proper irrigation design would have utilized nine irrigation heads consisting of four ¼ circle, four ½ circle and one full circle head. The eight head design limitation has resulted in poor water

distribution. A full circle head (if currently available) would provide a more uniform watering pattern and better distribution uniformity. This (portable) full circle head would be placed in the center of the green before any schedule irrigation cycle and then removed from the green the next morning so games could be played on the green.

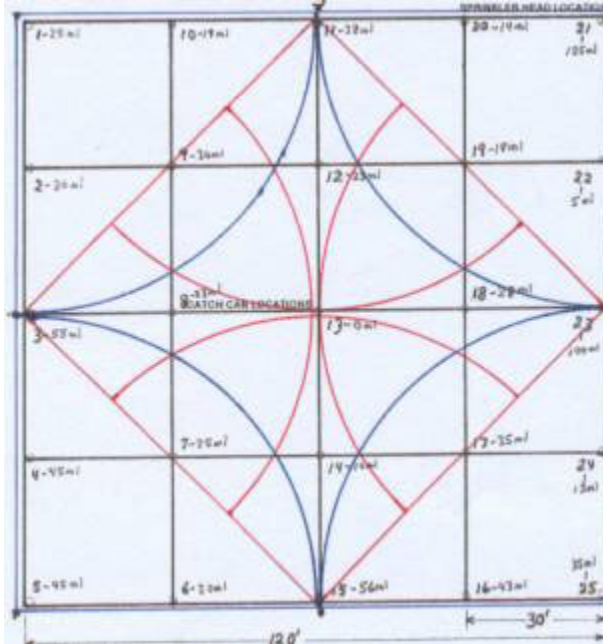
We were not permitted to add a full circle head to the middle of the green and we could not get cooperation from the Sarasota Lawn Bowling Club to move a portable head on and off of the green every time there was a scheduled irrigation cycle. The resulting poor distribution became evident when we conducted the irrigation audit.

The diagram below shows the typical layout of our south green, placement of the sprinkler heads outside of the playing surface and locations of the twenty five catch cans on a thirty foot square grid. All eight sprinkler heads cover a 90° arc to “minimize overlap” There is no full circle sprinkler head that can be placed in the center of the green.



### SOUTH LAWN BOWLING GREEN IRRIGATION PATTERNS

Corner heads are outlined with a blue arc, red arc's outline the heads located in the middles. All are set for a 90° arc with minimal overlap. Not the most desirous of designs but it works.



### IRRIGATION SCHEDULES

The irrigation chart shows the schedule for all irrigation *valve in head* sprinklers used to water the three greens, the syringe cycle used for over-seeding and the zone valve scheduling for the facility landscaping. Details are provided on the schedule. Varied run times for the south green should not exit on a bowling green constructed with a 6 to 7 inch deep fine sand over on top of an existing 15" deep sand layer.

#### FACILITY: Lawn Bowling Greens - North - Middle - South

CONTROLLER LOCATION: East side of the restroom bldg. between the north and middle greens						
CONTROLLER: Rain Bird ESP-MC - Programs Stacked						
Rain Shut Off Device	ON (X)	OFF ( )	Setting 1/4"		Date Tested	8/20/2007
Controller Programs	Descriptions		Program A	Program B	Program C	Program D
Watering Days			Daily	Daily	Daily	Daily
Start Times:	1		11:00 p.m.	11:00 p.m.	10:00 a.m.	3:00 a.m.
	2				3:00 p.m.	
	3					
Water Budget %			65%	65%	100%	100%
Station #	Description		Run Times	Run Times	Run Times	Run Times
1	North Green Middle (E) Side		6 minutes			
2	North Green Middle (S) Side		6 minutes			
3	North Green (SW) Corner		6 minutes			
4	North Green (NW) Corner		8 minutes			
5	Middle Green Middle (N) Side		8 minutes		5 minutes	
6	Middle Green Middle (E) side		8 minutes		5 minutes	
7	Middle Green (NW) Corner		4 minutes		5 minutes	
8	Middle Green (NE) Corner		6 minutes		5 minutes	
9	South Green Middle (N) Side		10 minutes		5 minutes	

10	South Green Middle (E) Side	8 minutes		5 minutes		
11	South Green (SE) Corner	8 minutes		5 minutes		
12	South Green (NE) Corner			5 minutes		
13	North Green Middle (N) Side		10 minutes			
14	North Green Middle (W) Side		8 minutes			
15	North Green (NE) Corner		8 minutes			
16	North Green (SE) Corner		4 minutes			
17	Middle Green Middle (S) Side		8 minutes	5 minutes		
18	Middle Green Middle (W) Side		6 minutes	5 minutes		
19	Middle Green (SE) Corner		6 minutes	5 minutes		
20	Middle Green (SW) Corner		6 minutes	5 minutes		
21	South Green Middle (S) Side		10 minutes	5 minutes		
22	South Green Middle (W) Side		8 minutes	5 minutes		
23	South Green (NW) Corner		6 minutes	5 minutes		
24	South Green (SW) Corner		8 minutes	5 minutes		
25	Blank					
26	Landscape Tree Bubblers				60 minutes	
27	Landscape Turf Spray Zone				15 minutes	
28	Landscape Turf Spray Zone				15 minutes	
29	Landscape Turf Spray Zone				15 minutes	
30	Landscape Turf Spray Zone				15 minutes	

**NOTES:** These three Lawn Bowling Greens are irrigated with reuse water supplied by the City of Sarasota Utility Department

Program A & B are used to irrigate the greens during the night when the prevailing west winds off of Sarasota Bay is minimal and drift is not a problem (reuse water regulation, minimum drift).

Program C is used as a syringe cycle when the greens are over seeded.

Program D provides irrigation for the landscaping trees and shrubs and the Bermudagrass turf surrounding all of the greens and common areas.

**IRRIGATION NOTES: Athletic Field Maintenance Supervisor suggests/determines station run times and water budget percentages.** Irrigation Unit's crew is responsible for setting and adjusting station run times to match weather, season and growing conditions. They test all irrigation heads for rotation, speed, arc, function and wetted pattern on a fixed schedule

## WATERING SCHEDULE for the SOUTH LAWN BOWLING GREEN

*Rain Bird Eagle 750 Adjustable 30° to 345° Sprinkler Heads* were used for all locations and “adjusted to a 90° arc for minimal overlap”. This was done to “reduce” the amount of water applied in the overlap areas.

This is not a proper design element, run times should have been adjusted for the corner sprinkler heads. They should run for ½ of the run time for the half circle heads (which have been adjusted for a 90° arc, also not a proper design element).

Station #	Description of sprinkler Head Locations	Start Time 11:00 p.m.	Start Time 11:00 p.m.	Start Times 10:00 a.m. & 3:00 p.m.
	Water Budget in Percentage	Daily @ 65%	Daily @ 65%	Daily @ 100%
	Stacked Programs	Program A Run Times	Program B Run Times	Program C Run Times
9	Middle North Side 90° Arc	10 Minutes		5 Minutes
10	Middle East Side 90° Arc	8 Minutes		5 Minutes
11	Corner Southeast Side 90° Arc	8 Minutes		5 Minutes
12	Corner Northeast Side 90° Arc		10 Minutes	5 Minutes
21	Middle South Side 90° Arc		10 Minutes	5 Minutes
22	Middle West Side 90° Arc		8 Minutes	5 Minutes
23	Corner Northwest Side 90° Arc		6 Minutes	5 Minutes
24	Corner Southwest Side 90° Arc		8 Minutes	5 Minutes

Run times for Programs “A” and “B” were determined by the Athletic Field Maintenance Unit’s Operations Supervisor I. based on “existing soil conditions, compaction, and puddling.

Program “C” was used for the water audit due to the uniform run times.

### **ACTUAL AUDITING CONDITIONS**

The first audit was run during the day utilizing the syringe cycle for the south green. Prevailing wind conditions were measured in both the north/south direction and the east/west directions. The wind at 11:00 a.m. in both directions was  $\leq$  than 4.0 mph. All heads were checked with a bubble level and any grass that interfered with the irrigation nozzles was removed prior to the audit.

The next audit was run on Friday during the 10:00 a.m. syringe cycle when the wind speed was within auditing guidelines. Wind speeds were measured with a Kestrel 3000 and indicated an average wind speed in both direction of less than five mph which is within the auditing guide lines. We have been checking the auditing conditions daily to get the best audit results possible that most closely mimics the actual operating conditions of this Lawn Bowling facility.

**SOUTH LAWN BOWLING GREEN  
AUDITING RESULTS**

Catch Can Number	Run Time in minutes	Milliliters Collected (ml), Audited at 3:00 p.m. 10/28/07	Milliliters Collected (ml), Audited at 11:45 a.m. 11/02/07
1	5	24 ml	19 ml
2	5	30 ml	25 ml
3	5	30 ml	55 ml
4	5	25 ml	30 ml
5	5	32 ml	34 ml
6	5	15 ml	23 ml
7	5	18 ml	30 ml
8	5	20 ml	33 ml
9	5	27 ml	35 ml
10	5	4 ml *	5 ml *
11	5	36 ml	24 ml
12	5	38 ml	27 ml
13	5	0 ml *	2 ml *
14	5	20 ml	13 ml *
15	5	80 ml	38 ml
16	5	15 ml	45 ml
17	5	24 ml	30 ml
18	5	15 ml	30 ml
19	5	15 ml	24 ml
20	5	4 ml *	7 ml *
21	5	8 ml *	15 ml
22	5	0 ml *	13 ml *
23	5	25 ml	54 ml
24	5	8 ml *	5 ml *
25	5	24 ml	44 ml
Total All Catch Cans Averaged		$527 \div 25 = 21.1$ ml average	$660 \text{ ml} \div 25 = 26.4$ ml average
Lowest Quarter (*) Totaled and Averaged		$24 \text{ ml} \div 6 (*) = 4.0$ ml average for the lowest quarter	$26.4 \text{ ml} \div 6 (*) = 7.5$ ml average for the lowest quarter

The first audit indicated that only minor improvements in the distribution uniformity could be obtained with some tweaks to the system. A major improvement occurred when the booster pump was repaired and back on line.

Nobody knew how long this pump had been down since it typically operates at night when no one is around to observe the irrigation patterns or check the pressure on the mainline when the system was operating.

The new pump added a significant boost to the mainline pressure from 65 psi to between 80 to 85 psi. This increase in mainline pressure had a significant impact on the distribution uniformity but not enough to overcome design flaws.

### **CALCULATIONS DISTRIBUTION UNIFORMITY:**

**Sunday, 10/28/07 @ 3:00 p.m.  
Booster Pump Off-line for Repairs**

$$DU_{LQ} = \frac{\text{Average lowest quarter}}{\text{Average of all catch cans}} \times 100 = \frac{4.0 \text{ ml}}{21.1 \text{ ml}} \times 100 = 18.9\%$$

**Friday, 11/02/07 @ 11:52 p.m.  
Booster Pump On-Line**

$$DU_{LQ} = \frac{\text{Average lowest quarter}}{\text{Average of all catch cans}} \times 100 = \frac{7.5 \text{ ml}}{26.4 \text{ ml}} \times 100 = 28.4\%$$

### **RECOMMENDATIONS**

These two audits have revealed a serious problem with the current design. It appears that with out the center irrigation head and adjustments to the existing heads that we have obtained the best possible distribution uniformity.

There may be some improvements if the corner ¼ circle heads are adjusted for a minimum rotation of six 90° arc's and are set for the lowest run time that will accomplish this criteria. The four heads located in the middle of the N, E, S and W sides of the green need to be adjusted to a 180° arc and the run times double of the ¼ circle heads in the corners.

The best solution would be to install a portable full circle *Rain Bird Eagle 700 Series* on a base that can be pegged down in the middle of the green. This portable head can be stored off of the court during play and after play ends be placed in the middle of the green for the irrigation cycle.

This proposed solution would place irrigation heads in all four corners, the four sides and the full circle head in the middle. We should be able to get good overlap of all sprinklers and each one contributing its portion to the green with out excess overlap.

I would like to be able to give a more detailed follow-up of this report at next years Irrigation Association 29th International Irrigation Show in Anaheim, CA. If we are able to make the suggested improvements and modifications I expect to see a better distribution uniformity and scheduling efficiency.

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