Regaining Control:

A Tale of Two Golf Course Irrigation Systems

Low pressure heads at Canyon Country Club are l

The greens on the east nine of Atlantis Golf Club are the only greens in southern Florida that follow USGA specifications exactly.

The early morning routines of growing number of golf course superintendents have changed this past year. Like most superintendents in the U.S., they wake up before dawn, get dressed, grab a quick breakfast and head for the course. As they drive to work, they go over the work schedule for the day in their heads.

A few items weigh heaviest on their minds. In the spring, it might be the persistence of overseeded ryegrass in bermudagrass. In the summer, it may be the spread of turfgrass diseases. In the fall, it could be the condition of the overseeded ryegrass as they prepare their courses for winter golfers. But during every season superintendents start their day wondering whether or not the irrigation system malfunctioned during the night due to a break, pump problem or power failure.

Before last year, Mark Henderson at Atlantis Golf Club in Atlantis, FL, and Rick Sall, at Canyon Country Club in Palm Springs, CA, had just one way to find out if the irrigation system worked properly the night before, by jumping in a turf vehicle and inspecting the course hole-by-hole. But, that has

one to problems with drift and lower the pressure demand on the pump system.

changed. Today, Henderson and Sall can check the status of their irrigation systems from their offices with the push of a button. A quick glance at a computer screen or printout tells them everything they need to know in seconds.

If you asked Henderson a year ago if he expected to become a "computer superintendent," he would probably have said no. Ironically, for Henderson and Sall it was other improvements in their irrigation systems that led to the addition of computerized central controllers.

Atlantis Golf Club is a 27-hole private course built in the early '50s by the Kintz family as a centerpiece for its planned community development called Atlantis. Located just south of affluent West Palm Beach, the Kintz family envisoned Atlantis as a community of fine homes to serve affluent northerners during the winter. Golf course architect William F. Mitchell carefully threaded the first 18 holes through the slash pine covering the coastal flatland in the '50s and returned a decade later to add nine more holes.

It wasn't long, however, before the fine, sugar sand and four separate pump stations started to wreak havoc on the quick coupler irrigation system with its galvanized pipes. To regain control, in 1972, the course installed one of the few electric valve systems in southern Florida. Four heads were grouped on each station. Each of the 14 separate controllers had 23 stations. "On the same station, two heads would be elevated and two would be in low spots," says Henderson. "One area would be too dry while the other area was always wet." Changing the start and run times was a huge task, but it was still a major improvement over the old quick-coupler system.

Water was supplied on a piecemeal basis by four pumps spread out across the course, three from wells and one from a canal. Each well had a line shaft turbine pump with a pressure reducing valve. Only one pump had an hydropneumatic tank to protect the old lines from pressure surges. In addition, the wells were beginning to pump sand into the system. Nevertheless, the decision was made to leave the pumps and the aging water mains alone.

Southern Florida is frequently referred to as the lightning capital of the world. Lightning that strikes the ground near a valve will send a surge of current through the wires to the controller, damaging both. For this reason, an estimated 97 percent of the golf courses in southern Florida install hydraulic valves and controllers. The small, pressurized tubes of water between the valves and controllers protect the controllers from electrical damage.

By the time Henderson joined Atlantis from Mayacoo Lakes Country Club, a Nicklaus course in West Palm Beach, the irrigation system was out of control. "We had to repair five or six leaks every day as the old pipes gave out," he recalls. "The sand was also causing the rotary sprinkler heads to malfunction and we had to keep a close eye on all four pump stations. We were spending more than $30,000 every year for irrigation system maintenance." Every day was like sticking more fingers in more and more holes in the dike.

Atlantis not only had a new superintendent, it had a new greens chairman. Bob Maloney was a retired Air Force colonel and

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It was taking more than 12 hours to irrigate the course. That meant Atlantis was paying peak rates for electricity for the pumps.

The new pump station at Atlantis is concealed in an attractive pump house nestled in a grove of trees. All pump components were hot-dipped galvanized to resist corrosion.

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former vice president of RCA. The engineer, trained at West Point and Harvard, was accustomed to developing solutions for complex problems. He had chosen Henderson for his six years experience with Nicklaus and his turf management degree from Lake City Community College. The two of them started to identify all the various problems with the system.

"My main concerns were the pipes and wires on the old north and south nines and the sprinkler heads," Henderson states. Not only was high pressure from the pump system rupturing the pipes, the heads were getting stuck. It was taking more than 12 hours to irrigate the course. That meant Atlantis was paying peak hour rates for electricity for the pumps.

The Tifdwarf greens and Ormond bermudagrass fairways on the east nine were suffering from poor drainage since muck soil had been brought in when the third nine was added. "I thought some of the moisture problems could be solved with single head control, at least around the greens,"

Maloney called in golf course architect and irrigation consultant Ted McAnlis of North Palm Beach to help construct an overall renovation plan that could be presented to the private club's 380 members. The more McAnlis talked to Maloney and Henderson, the more he realized that they needed more control than a hydraulic system could provide. Engineers from Rain Bird and Toro were called in as was USGA Green Section regional agronomist John Foy about the greens on the east nine. Maloney and Henderson started visiting other courses in the area to see their irrigation systems.

"Our goal was to utilize water to its maximum capability and to get our irrigation maintenance costs down to less than $10,000 a year," said Maloney. The main focus was on the pumps, pipes, wires, and heads on all 27 holes and the greens on the east nine.

The first decision was to build one central pumping station drawing from a lake instead of wells. The old well pumps would be used for backup only. "There is a growing concern in this area about salt water intruding into the ground water," says McAnlis. Atlantis is only five miles from the Atlantic Ocean. The course has an abundance of surface water and a 23 acre lake that could serve as an irrigation reservoir.

All pipes, wires, heads and controllers would be replaced. To provide maximum control, nearly all heads would be valve-in-head. This favored staying with an electric system as opposed to an hydraulic. It also made a strong case for going to a centralized computer controller.

All the greens on the east nine would be rebuilt to "exact" USGA Green Section specifications. No course in Florida had ever followed the USGA specs to the letter, said Foy. That challenged the Atlantis team. Furthermore, drainage would be installed in problem muck soil areas on fairways and tees on the east nine. The pipes on the east nine would stay, but everything else would be replaced. Altogether the tab for the project was nearly $1 million.

"The heads are the heart of an irrigation system as far as I'm concerned," Henderson points out. "You build the system around the heads." Henderson favored the Toro gear-drive heads. That gave Chuck Watson from Hector Turf, the Toro Irrigation distributor for southern Florida, the idea that Atlantis could become the first course in Florida to install the computerized Network 8000. Henderson had seen the Rain Bird Maxi III central computer system operate and liked what it could do. Boynton Pump,

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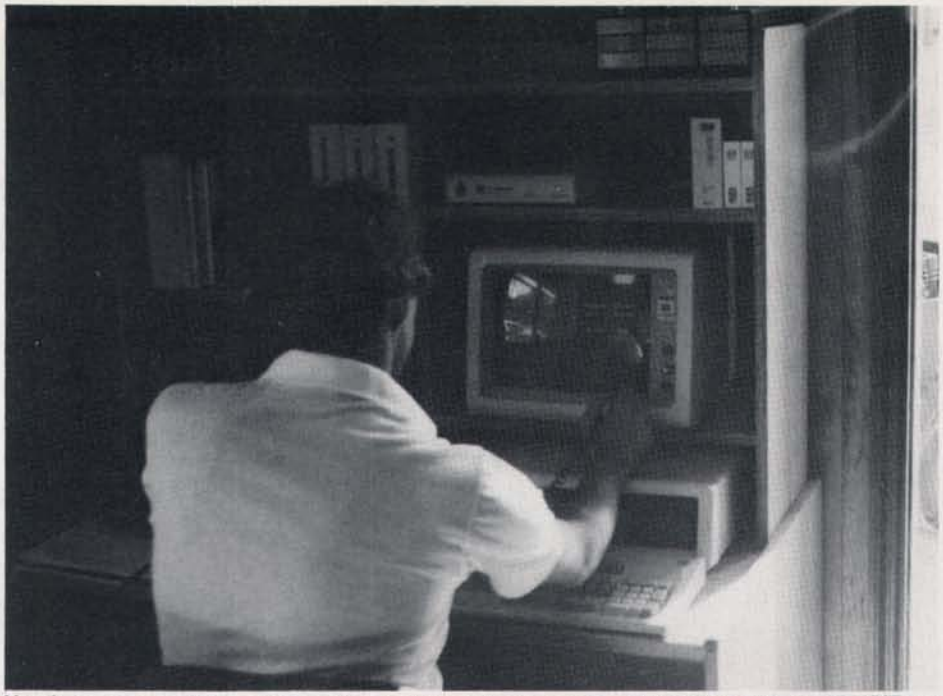
This single AquaTurf pump station replaced four separate pumps that were previously located at different locations on the 27-hole course.

McAnlis used a new method he calls "time slot design" to design a system that uses 90 percent of the capacity of the pump station at all times.



Henderson uses a light pen to make program adjustments from his office with the IBM/XT personal computer that is the central control for the Network 8000.

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a Rain Bird dealer in Boynton Beach, FL, had impressed Maloney and Henderson with its explanation of the Maxi.

After all the options were laid out on the table, McAnlis was given the job of putting together the best combination of products to fit Atlantis Golf Club. He used a new method he calls "time-slot-design" to design a system that utilizes more than 90 percent of the capacity of the pump station at all times. Rather than grouping heads in stations, he took advantage of the valve-in-head sprinklers and the capability of a central computer so that 33 to 34 heads in scattered locations would operate at all times during the schedule. By using a computer he was able to select the right combination of heads in a few hours rather than two or three days using zones and a calculator.

"We were able to knock more than four hours off the time it took to irrigate the course," boasts McAnlis. As a result, the pumps work more efficiently for a shorter length of time. Furthermore, Atlantis could take advantage of a 25 percent savings in electrical rates by operating during off-peak hours. During the day, a small jockey pump would keep the system pressurized and allow for repeat cycles and syringing.

McAnlis wanted to give Henderson the ability to make adjustments in the program from both the field and a central computer. That meant the satellites had to have much of the same programming capability as the central. That way Henderson could make changes in either location based upon conditions at each head. After adjustments were made for shade, soil, slope and wind, the schedule could be shortened or lengthened according to a calculation called evapotranspiration which determines how much water needs to be replaced each day.

McAnlis thought that if any change was made at a satellite, he wanted the change to be noted by the central computer as well. Finally, if the central computer went down, he wanted the satellites to continue to carry out the schedule as "stand-alones." He saw an advantage in downloading the commands for each satellite at once rather than having the central send the commands to the satellites as the schedule dictated. That way, if the central went down, the satellites could carry on the program without being notified by the central.

As his want list grew, McAnlis found himself leaning toward the Toro computer and satellites. "It was exciting working with what would be the first Network 8000 to be installed in southern Florida," he recalls.

Utilizing a combination of a computerized central controller and satellites with extensive stand-alone capability, the Network 8000 brings new efficiency to irrigation management. The system uses an IBM/XT personal computer, including keyboard, color monitor, matrix printer and light pen, as its operating hub. The non-dedicated central computer can be used simultaneously for business tasks and irrigation program operation. One function does not tie up the computer from other functions.

The central computer can operate up to 800 satellites with 32 stations each. By entering design, weather, geographical and agronomic information into the central, operating times for all stations are automatically computed based on the evapotranspiration rate, modified by any applicable rainfall. These calculations can be reviewed by the irrigation manager before they are downloaded to the satellites.

All relevant programming can be downloaded to the satellites at one time. From then on, the satellites can operate as standalones without further instructions from the central. Programs can be adjusted manu-

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Irrigation programs are downloaded once each day to the satellites. The temperature monitor attached to these satellites feeds data to the central computer to determine daily ET.

Determining a turf area's actual water requirements had been a stumbling block for computer irrigation control.

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ally at the satellite if desired. Each satellite can operate as many as four stations on four programs at the same time. Furthermore, each station can have eight start times and is capable of running three valve-in-head solenoids. Programs can be repeated three times.

The whole key to the system is utilizing increased control to reduce energy and water consumption. Accurately determining a turf area's actual water requirements had been a major stumbling block for computerized irrigation control. Moisture sensors measured small areas. To get accurate information for an entire course would require a multitude of sensors. A way to figure out the amount of water utilized by plants or lost to the atmosphere under changing weather conditions was needed.

Toro assigned the task of finding a practical method of determining ET to Dr. Jim Watson, its chief agronomist. Watson, assisted by five of his colleagues, Jule Meyer, Steve Cockerham and Dr. Vic Gibeault of the University of California at Riverside, and Dr. Jim Beard and Dr. Cornelius van Bavel of Texas A&M University gathered together to work out a method for determining ET for large turf areas.

There are about as many opinions about measuring ET as there are scientists," remarks Terry Mylne, designer of the electronics for the Network 8000. "We took four of the best and built a system based on them." The superintendent can choose from any of the four different ET measurement methods.

The first is based upon temperature. Each satellite has a built-in thermometer. Using this information and an equation based upon the high and low daily temperatures and the latitiude and longitude of the site, the computer calculates the ET. The second method entails a weather station to keep track of solar radiation, temperature, wind speed and humidity. The third utilizes historical weather data and the fourth relies upon agencies that collect and provide ET data on a daily basis, such as the California Irrigation Management Information System (CIMIS) headquartered at the University of California at Davis.

Once ET is determined, the amount of water to be dispersed by each station is calculated by the computer. This is possible because the superintendent has entered the type of nozzle, spacing and other conditions for each station. Values for soil type, turfgrass, soil compaction, pH, shade, wind and sun exposure are assigned to each station. The computer does the rest, although the superintendent can make adjustments to the computer's calculations if he desires.

The feature that may have cinched it for the Network 8000 was double lightning protection. Each station is isolated from the satellite in case of lightning by a surge protector. In addition, there is a back-up fuse for every five stations.

Maloney and Henderson presented McAnlis's plan to the membership. "Eighty-three percent of the members voted for the system," says Maloney. They shared his belief that there is no reason for "mature" courses to take a back seat to new ones. Private courses still have to compete for members.

AquaTurf of Jacksonville, FL, won the bid for the installation of the pump station, the irrigation system and the greens. Since the company is both a golf course construction company and a manufacturer of pump systems, it had a good grasp of fitting all the

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By inputting the ET data into the central computer, all the watering times are decreased or increased automatically.

All wires, heads and controllers on the east course at Atlantis were replaced. The pipes on the newest of the three nines was left intact.

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components together.

A single pump station with a 25 hp jockey pump, three 75 hp pumps, and a low-speed turbine pump replaced the four old pump stations. To keep tight control over pressure, a hydropneumatic tank, pressure relief valves and microprocessor controller were added. The pump controller was then connected to the Network 8000 system. This provides Henderson with important feedback and historical data so that he can adjust pump and irrigation system operation to decrease energy use.

Like any computerized irrigation system, the more you work with it the more you realize what it can do. Henderson in a few short months has discovered how easy it is to save water and to give every turf area just the water it needs. "We could see the difference between the north and south nines and the east nine in a matter of weeks," he reveals. "Applying the right amount of water to each area makes that much difference."

The Atlantis system uses a weather station for ET information. By inputing the ET data into the central computer, all the watering times are decreased or increased automatically. Henderson can override the program for specific stations if he desires, but most of the specific requirements for each station are already included in the program.

Maloney reports the course saw an immediate 25 percent reduction in energy costs. "We're saving more than we thought we would," he adds. The savings should increase further as Henderson discovers how better water management reduces fertilizer, fungicide and pesticide applications. "Each week I find another way to take advantage of the computer programs," remarks Henderson.

While Henderson is learning the ropes of the first Network 8000 in southern Florida, Rick Sall is one of five or six superintendents in the Palm Springs, CA, area who share their experiences with the system. Sall, superintendent of Canyon Country Club, talks with his computer colleagues weekly. In fact, it was his experience with computerized irrigation controllers that got him the job.

The situation looked bleak at Canyon Country Club three years ago when Dick Ameny took over as general manager. "I took one look at the budget and knew something had to be done about maintenance expenses," he recalls. Expenses were exceeding income for the private 36-hole course.

The course had one of the few remaining quick-coupler systems in the Coachella Valley, the site of more than 65 desert golf courses. Not only did it take three full-time staff to operate the system, electricity and other utilities were costing the course nearly $120,000 a year. "We would start irrigating at 2 p.m. and not finish until 6 a.m. the next morning," said Ameny. The 100 hp pumps on two wells were running 24 hours every day.

'I had to find a way to reduce our utility and manpower expenses fast," said Ameny. Since the electricity was his biggest concern, he called Tom Olson, a specialist in agricultural irrigation for Southern California Edison. The utility company was aggressively encouraging its customers to reduce or shift their electical load to off-peak hours, from 6 p.m. to noon. "He suggested finding a way to cut our energy consumption by running the system at lower pressure at off-peak hours."

A few superintendents in the area had been experimenting with a prototype low-pressure head from Toro. It operated at 50 psi, half the pressure of conventional golf course heads. Less pump horsepower was needed to meet the flow requirements of the head. The larger droplets it produced were also less prone to drifting in the desert winds.

Ameny wanted to know more about the heads and the type of automatic control system that would be needed to run them. He called Roger Gordon, a well-known local golf course irrigation specialist, for professional advice. Gordon discovered that the heads were not yet on the market and put together a state-of-the-art conventional irrigation system for Canyon Country Club that included Hunter heads, Rain Bird valves and a Motorola computerized control system.

Two years in a row the membership would not approve the new irrigation system. Ameny needed more ammunition to convince the members a new irrigation system would save money. It came when Toro finally put

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The greens on the east nine had to be rebuilt because muck soil used to construct them orgInally was causing severe drainage problems.

The bottom line is the entire course can now be watered in six hours, during off-peak hours.

The heart of the Network 8000 is an IBM/XT personal computer. A phone modem links the computer to the satellites and a printer provides "hard copy" reports.

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the 660 low pressure heads on the market. The company happened to be installing the first Network 8000 systems in the Coachella Valley at the same time. Significant water and energy savings were being reported for conventional systems utilizing the combination of satellites and central computer.

Ameny, who had learned a great deal about irrigation during his two-year search for a solution to the course's energy problem, thought there must be a way to combine the low-pressure heads with the advanced control provided by computers. No golf course had ever installed such a combination. Ameny asked Gordon if it could work. The combination excited Gordon as much as Ameny and the people at Toro and at Pacific Equipment and Irrigation, the local Toro distributor.

With the new design in hand and calculations from Olson at Edison, Ameny went before the members again. He explained the potential 20 percent savings in energy to them, as well as the shorter irrigation time and the ET adjustment for saving water. He strengthened his case with a more efficent pump station and a way to reduce the maintenance staff by three. On paper, the savings added up to nearly $180,000 per year. The system would pay for itself in five years. This time the members said yes.

"We essentially had three months to totally revamp the old quick coupler system," says Gordon. "Most of the club members leave in April or May, so the system had to installed between then and September when overseeding takes place." Another problem was finding someone who had experience with irrigation computers.

A year before, Sall had moved from Ohio to be superintendent of the Palmer Course at Mission Hills Country Club in nearby Palm Desert. Sall had quickly made a name for himself by mastering the predeccessor to the Network 800, the VT-3. Many of the programming functions were similar between the two controllers. Mission Hills also had been testing the low-pressure heads. Toro told Ameny about Sall. Not only did Canyon Country Club offer Sall a huge challenge, it would let him develop an entirely new computerized irrigation system from the ground up. He took the job.

"It took 16 manhours to input all the data the first time," Sall recalls. The computer knows where every head is located, what type of nozzle it has, the site conditions at each head and the type of turfgrass. All heads are identified to fit one of five programs, a greens program, a tee program, a rough program, a fairway program and a bank program. Sall added a sixth program to run the lake aerators.

Meanwhile, Foremost Construction Company was installing the 660 heads, valves, pipes, controllers and pump station for a new well. Previously the course had two small wells, each with a 100 hp pump. A single, larger well would now supply water for the low-pressure heads. The new pump station included a 25 hp jockey pump, one 50 hp pump and one 100 hp pump, a hydropneumatic tank, pressure valves and controller. Instead of producing 115 psi, the new pump station produces 77 psi. The two large pumps only operate at off-peak hours. The jockey pump can supply up to 20 heads during peak power hours.

It all came together in October. Right away Sall utilized the Network 8000's program capabilities to repeat programs up to eight times per day to protect the tender ryegrass seedlings from the dry, desert winds. The year before it had taken the ryegrass two months to get far enough along to allow carts on the fairways. The new system cut this time to five weeks.

ET can vary widely in the desert. Sall feeds information from local weather forecasts into the computer so it can set an ET for the day. "In simple terms, the ET is a precipitation rate measured in hundreths of an inch per day," he explains. "If the heads are putting out .6 inch of water per hour and the ET is .10 (meaning 10 hundreths of an inch of water needs to be applied that day), then the computer will tell the satellites to run for ten minutes. Sall has seen the run time vary from as short as three minutes to as long as 26 minutes.

The feature that Sall uses as much as ET is the "projected flow chart." After he has adjusted the program for whatever reason, the computer takes the start and run time data and constructs a flow chart. A smooth curve means the pumps will not have to cycle on and off to meet water demand. Before Sall downloads the schedule to the satellites at 7 p.m., he can make sure he is not wasting energy at the pump house.

Global adjust is another water-saving feature Sall uses often. If the weather forecast for the day was incorrect and the day is hotter, cloudier or windier than predicted, he can increase or decrease all the program run times by a percentage figure. "If we get a short rain or clouds move in, I'll globally adjust the programs down by 50 percent," explains Sall. "On a very hot day I'll raise it 150 percent." He can override any program if he needs to by giving an "operator selected" command.

The bottom line is that the entire course can now be watered in six hours, the money-saving off-peak hours between midnight and 6 a.m. Furthermore, for every pound of pressure saved by the heads, the energy bill drops approximately one percent. For Canyon Country Club, the two items add up to a yearly savings of more than $40,000, according to Ameny. To make the deal even sweeter, Edison gave the course a $45,000 rebate for investing in energy-saving technology. In water, savings the first year amounted to 16 percent less acre feet.

Word spreads fast in the desert and both Sall and Ameny have been getting calls from other courses. Energy savings and incentives from the electric company are catching nearly everyone's attention.

Like Henderson, Sall is getting more out of the computer programs each week. The number of Network 8000 systems in the Palm Springs area is now over five. The number of courses switching to low-pressure heads is also growing.

Unlike Henderson, Sall has superintendents nearby to discuss his experiences with the system. They talk by phone regularly and help each other out. They know they are part of a special group, the first superintendents to try this new technology. But, most importantly, by combining their knowledge of turf management with advanced technology they are are changing golf course management.

That makes them anxious to get to work in the morning, to see irrigation as a challenge instead of a chore, and to share their knowledge with other superintendents. Their morning routine may be changing, but it's for the better.