BLACKHAWK COUNTRY CLUB IRRIGATION SYSTEM PUMPHOUSE

Planning and Construction of a New Pump Plant

John Madison, author of "Principles of Turfgrass Culture," expresses in that book his feeling that fertilizer is the most important tool of the turf manager. Dr. Madison's reputation as a competent investigator and author notwithstanding, I disagree. I suggest there is little argument that a well designed irrigation system that provides a reliable supply of quality water leads the list of all factors responsible for maintaining quality golf course turf.

Although it has been difficult to document the exact date, I've found that Blackhawk Country Club was one of the first three Clubs in Wisconsin to have watered fairways — the system was installed in 1938. The positive aspect of this is that the Club was somewhat of a pioneer in golf course irrigation at the time. The system was designed by Scotty Stewart of Chicago and, by and large, it has been functional. The negative aspect is that few improvements have been made since 1938, only repair of existing equipment when necessary. Obviously, golf course conditions changed and improved at the same time the irrigation equipment was aging. In my ten years at Blackhawk I've seen more and more time and money spent keeping the system operational. One of any Superintendent's duties is to keep the Club Officials updated and informed of current and future needs, and in 1980 the Board approved, as the first step in replacing our irrigation system, the installation of new perimeter irrigation for the greens and tees. Years of persuasion by myself had started to pay off.

The weakest link in our irrigation system now was the pumphouse. One of the pumps was manufactured by a company that has been out of business for years; one of the pumps was outside of the small building; the pressure tank had leaks in it and was on the verge of being irrepairable. The building was in gross disrepair and was incredibly small. We were spending too much money on repairs and the system was becoming much too undependable. Beyond that, even if all the equipment was brand new it would not meet our current or future requirements. Finally, because of numberous factors, it was very energy inefficient. Something had to be done and done soon. The Board of Directors decided to proceed with rebuilding the pumphouse and replacing the equipment, and planning began in mid-1981. The construction of the new pump plant was completed in May of 1982.

I suspect there are as many different pumping stations in the state as there are golf courses, and probably for good reasons. My guess is that more variables affect the pump plant than the distribution system and there aren't the manufacturers specializing in pumping stations that there are offering materials for distribution systems (e.g., Toro, Rainbird, Royal Coach, et. al.). This lack of any standardization was a factor in our decision to contract an engineering consulting firm to design a facility that met all of the conditions peculiar to our golf course, and the result of this has been a pumping station unlike any others I've seen. I'm certainly not implying that it is any better, only that it was designed and built to exactly meet our needs and conditions. I cannot put too much emphasis on my feeling that the most important thing we did in this project was hiring an experienced, reputable and quality design engineering firm; I'd be remiss if I didn't add that this was easy for us to do because the Club President was an engineer.

The engineering not only does the obvious tasks of mechanical design, equipment specifications and drawings — he also advertises for bids and supervises the bid opening, takes care of contracts and all required signatures, handles things like permits, inspections, approval of scheduled payments, determines appropriate holdbacks, approves any changes during the constructions process, schedules the work and delivery of equipment, supervises all testing requirements, assists in the start up and shakedown procedures and insures that the work proceeds according to schedule. Simply put, he makes sure the project is completed on time, within the budget and according to plan.

The role of the Superintendent is critical to the success of this kind of project. We are the ones with the local knowledge that the designer must be aware of before the design begins. More importantly, we are the ones who must work with the facility and who will depend on it as a management tool, and it should be built with our long term goals and expections in mind. I spent a substantial amount of time with the engineer before drawings began as well as throughout the construction process, and these were hours well spent.

When a Club starts a project from "scratch," whether it be a pumphouse maintenance shop, sand trap or whatever, lots of factors are considered during the planning stages. Some of the significant considerations in designing this pumphouse were:

1. Constant pressure in the distribution system.
2. Equipment that offered the use of current technology.
3. Equipment that would give us maximum return for our energy dollars.
4. A facility that met current needs as well as projected future needs.
5. Equipment with a long term useful life and with minimum maintenance requirements.
6. Equipment that could be serviced quickly and competently by local concerns.
7. Equipment that was of the highest quality (pumps, motors, controllers, valves, heavy electrical equipment, air handling equipment, pipe and pipe fittings, pressure tanks and heating equipment).
8. Built-in safeguards to protect electrical equipment for lightning, phase failure, phase reversal and drops in incoming power; to protect the distribution system from any high pressure situations; to protect pumps from low pressure (priming) problems. Also, an alarm system to notify my office, home and/or Assistant's home of a problem and nature of the problem.
9. A building that was of ample size to house the equipment, that had enough room to work on the equipment and enough floor space for additional needs in upcoming years (e.g. sand separator).
10. A building that would last one hundred years and that would aesthetically fit the site on the Lake Mendota shoreline.
11. Neat, clean and simple plumbing layout that would allow us to isolate all segments of the pump plant (pressure tanks, all pumps, check valves, etc.). Also wanted provision for initial pump priming for spring start up, easy filling of intake line back to the lake at start up or after a shutdown for repair.
12. Adequate backup capacity in case of equipment failure and the option of manual operation of the pumps.
13. A method for drawing down large quantities of water, other than through the distribution system, for testing pumps or controllers.

The order of these considerations only roughly approximates their level of importance, but the constant pressure requirements were a must. Our old pump plant accomplished this by switching pumps on and off, but the pressure variance was too great and the results were uneven distribution of water through sprinkler nozzles, gross inefficiencies in the use of electrical power (due to increased electrical consumption at each start up) and excessive wear on pumps and switch gear. Further, because of the head conditions (approximately an elevation change of two hundred feet from pumphouse to greens and tees in clubhouse proximity) the pressure dropped very quickly when a pump(s) shutoff and rose slowly once the pump(s) came on line. So the first decision that we needed to make was the method to use to accomplish our constant pressure requirement. Obviously, switching pumps on and off wasn't even considered because of our past experience. The proximity of the pumphouse relative to the golf course and the fact that we have no ponds on the course eliminated the use of an electric valve or a hydraulic valve to bleed water (i.e. pressure) off to maintain a set system pressure. Practically speaking, this left us with two choices: 1) eddy current variable speed clutch drive on one pump, or 2) variable frequency drive for one of the pumps. Although the variable frequency drive was more efficient, the initial cost was about $13,000 greater than the variable speed clutch. Since the pumping station operates for only several hours a day and for only seven months of the year, the payback period was so long that we couldn't justify the additional cost. In addition, rainfall and cool spring and fall temperatures greatly reduced the hours of use. The variable speed drive was the obvious choice for our situation.

Once the variable speed design was selected, everything else relating to pumps fell into place. The reputation of Fairbanks Morse pumps is well established and because they were sold by L.W. Allen Company, a local distributor, we knew these were the quality pumps we needed. Our experience with a Fairbanks Morse pump in the old pumphouse was a good one and made the decision even easier. Addressing the three concerns of energy efficiency, extended life of equipment and low maintenance, we felt there was a favorable cost/benefit ratio in choosing pumps and motors that turned at 1770 rpm instead of the 3600 rpm equipment previously used. Common sense dictated the need for a jockey pump to handle low volume watering — syringing, watering of flower beds and newly planted trees, specific area watering of one to three heads, etc. — and to maintain the system pressure. The impeller for the jockey pump was trimmed to meet our hydraulic conditions, handle demand of 0-100 gpm and to maintain the system pressure at 140-160 psi at the pumphouse. The engineer had experience with several manufacturers of variable speed equipment and the Allen Co. handled both Louis Allis and Eaton variable speed units. There was no significant cost differential so we looked at delivery time and chose Eaton on this basis. One of the motors in our pumphouse was a Westinghouse and again, based on our experience, past reputation and service availability, ordered the 100 horsepower motor we needed for the constant speed pump form Westinghouse. In summary, the pumping was to be handled by the following equipment:

1. Jockey pump — 3" x 2½" horizontal two stage, constant speed, split case Fairbanks Morse pump driven by a 30 hp motor with flexible couplings and enclosed guard. Capacity of 100 gpm.
2. Variable speed pump and motor — Fairbanks Morse 6" x 5" two stage variable speed horizontal split case centrifugal pump driven by an Eaton 100 hp motor with a magnetic clutch, flexible coupling and enclosed guard. Capacity of 650 gpm.
3. Constant speed pump and motor — Fairbanks Morse 6" x 5" two stage constant speed horizontal split case pump driven by a 1000 hp Westinghouse motor with flexible coupling and enclosed guard. Capacity of 550 gpm.

Demand for water up to 100 gpm is met by the jockey pump. Demand exceeding 100 gpm drops the jockey pump out and switches the variable speed unit on. The drive unit and the clutch control the impeller speed of the pump to maintain the system pressure a preset level, regardless of the number of heads in operation on the golf course. Whent he demand for water exceeds 650 gpm, the 100 hp constant speed comes on line and the varialbe speed unit slows to the level necessary to maintain the system pressure. The capacity of the constant speed and variable speed is 1200 gpm.

The importance to the control panel is equal to the pumps and motors — it is the "brain" of the system, if you will. Our controller is not a shelf item and was built to our specifications by the Consolidated Electric Co. of St. Paul. This reads pressure from the main line out of the pumphouse and signals appropriate switches to meet and maintain conditions we have set. There are several other important features and functions of the panel:

1. RPM speed meter for variable speed pump with a manual/automatic selector and a manual speed control dial.
2. Solid state variable speed control card, solid state speed control card for jockey pump and 100 hp constant speed pump.
3. Stimulation mode card.
4. Hour meters for each pump to record running time.
5. Frictionless pressure transducer with quelling (no moving parts — nothing to wear out!).
6. Control module for each pump has dim-glow lights indicating status — required running or failed — as well as an on-off/ manual/automatic control switch.
7. Lightning arrestor.
8. Phase monitoring relay with a lockout and automatic reset (after a predetermined time lapse).
9. Jockey pump and variable pump each have a thermal flow switch to monitor water movement in pipes from the pump. These switches are an integral part of the protection of the system. The constant speed pump has a mechanical flow switch.
10. High and low pressure alarms, again with the dim-glow indicator lights (these lights are used because they make it impossible to mistake a burned bulb for a normal operating condition).

I noted earlier that we wanted an alarm system to notify staff of any problems in the pumphouse. We installed a two function alarm transmitter and receiver tied to the control panel and a telephone in the pumphouse. When there is a failure the receiver picks this up form the control panel, selects the portion of a tape that defines the problem and activates a dialer that dials my office. If no one is present to receive the call, the dialer moves to the next number, and so on. When the call is received, the dialer is deactivated by pressing a certain number on a touch tone phone. If a dial phone is receiving the call, a gadget that duplicates the numerical sound of a touch tone phone is used to shut off the dialer. Since one of the failures the alarm system is sensitive to is an electrical outage, the dialer is provided with a battery powered back up — no stones are left unturned! This feature is certainly valuable now, but I see it becoming absolutely essential when our distribution system is automated and no water man is on the property at night.

Pressure tanks are essential in a station such as this to dampen water surging to reduce the cycling of the jockey pump. We installed three 320 Well-X-Trol hydropneumatic tanks inthe system. These tanks have a rubber bladder in them so that the pressure can be pre-set and the need for a compressor to constantly replenish the air supply is eliminated. The tanks were chosen with a minimum working pressure well above the level we require.

APCO air relief valves were installed on the high point of each pump housing. These valves permit the discharge of air from the pump column to the atmosphere and close automatically when water enter them. They worked flawlessly this past summer and eliminated one more nagging problem we had with our old equipment.

Twenty or so feet out from the pumphouse and on the main line we installed a fire hydrant. Its purpose has nothing to do with fire fighting, but rather is an easy way to create demand for water when troubleshooting problems, when there is a need to run a pump to check its operation during daytime hours, when checking control sequencing, etc. It really serves our purposes. Also, on the back side of the building, a one inch copper line with a hose adaptor was installed to allow for easy filling of one of the intake lines from a sprayer tank when getting the station ready in the spring.

Details of the building itself are shown on the accompanying drawings and are pretty much self-explanatory. It is poured, reinforced concrete structure approximately 28' square. The layout of the plumbing and equipment allows easy access for repairs and plenty of room to work. Warm air form motors and the air-cooled clutch is removed fromt he building by a large exhaust fan that is thermostatically controlled. Cool air is drawn in form the west side of the building, across the equipment and exhausted on the north side. The building is heated during the winter months, for the sake of electrical equipment, by a small electric heater. Roof hatches were provided for easy removal of the equipment. All segments of the system were color coded and painted with quality industrial paint. The building and contents look good and the building is relatively easy to keep clean and sharp.

It is impossible to express how satisfied we are with the results of this pumphouse project and how rewarding it has been — I've been unable to think of a single, solitary item we wish we would have done differently. We accomplished all of the goals we set out to meet, and exceeded others. It has resulted in money savings for the Club, dramatic improvement in our control of water use, more effective use of my time and total elimination of a significant "aggravation" factor. It has secured the golf course's needs for water for years to come and set the stage for the replacement of the remainder of our distribution system.

Let me extend to all Superintendents in the stat an open invitation for the "nickel" tour — it would be my pleasure.

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