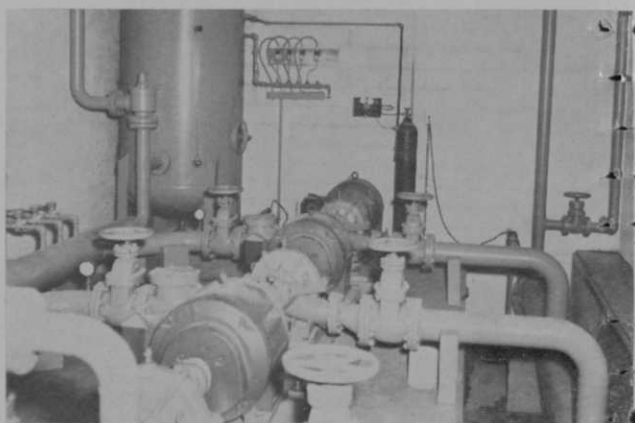




(Above) Time and sequencing controls for 99 valves in a typical course installation. Control panel is usually set to regulate watering during night hours. (Right) Up to 1,500 gpm can be pumped to many points over course area from a 16-acre water storage pond.



Cost and Design Factors in The Irrigation Installation

Engineer stresses need for careful advance study of consumption, capacity, etc. in determining what should go into the system.

By P. H. GOODELL

Hale and Kullgren, Inc.
Akron, Ohio

A high level of interest in irrigation systems for the complete watering of fairways, greens and tees was evidenced at the 1965, GCSA international convention. Some of the reasons given for this interest were increased course traffic, better playing conditions, overall savings in operating expense, reduced turf problems and better systems requiring less manual attention.

An 18-hole course, averaging 400 yards per hole and having a representative $3\frac{1}{2}$ acres of playing area per hole, requires irrigation for approximately 60 acres. Accurate determination of this area, preferably by a plot plan or survey showing the size and shape of each fairway, is essential to the design of an efficient irrigation system.

Assuming absence of natural precipitation, the minimum water requirement for sustaining turf growth on a silt-loam soil will vary from 0.7 to 1.0 gallons per square foot per week, depending on temperature and evaporation conditions. This should preferably be applied in a minimum of three applications representing 10,600 gallons per acre each, or a total of 2 million gallons per week for the entire course. Expressed in terms of reservoir capacity, this represents a peak consumption of 5.5 acre-feet of water per week.

Small, Frequent Doses

Watering is best accomplished by applications which will total one inch of precipitation per week. By allocating 16 hours for a total irrigation cycle, an 18-hole course can be watered with a supply and distribution system adequate to cover about 4 acres at one time. The schedule should be arranged for completion within a two-day period, preferably avoiding interference with normal course use. The indicated water consumption rate is 700 gallons per minute, although a somewhat larger capacity would be recommended to allow for transfer time and extra coverage for difficult growing areas.

To apply this volume of water effec-

tively, a typical irrigation system uses from 6 to 9 sprinkler heads per acre, or a total of 380 to 560 heads for the standard course. This is based on use of water pressures and sprinkler heads designed to cover a circular pattern approximately 140 feet in diameter and with a delivery capacity of up to 30 gallons per minute each. In addition, such a system may use from 80 to 250 control valves, 6 to 8 miles of water distribution line, 5 to 6 miles of feeder line and a variety of accessory items to complete the hydraulic and control systems.

Soil Studies Important

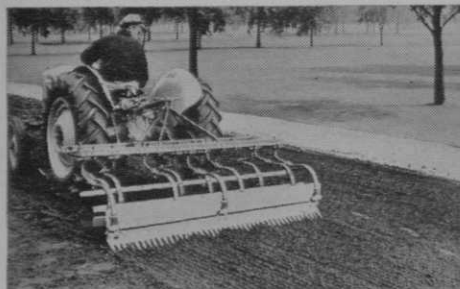
Water evaporation rate, soil conditions, mean daily temperature, drainage, type of turf, traffic volume and natural precipitation are all factors requiring consideration in planning course irrigation. Soil and hydrological studies thus become as important as physical design of the irrigation system. Where an adjacent water shed may permit impoundment of a substantial water supply, the feasibility of a water storage pond should be carefully weighed in relation to other available sources of supply.

Design of the distribution system is largely a matter of providing proper water coverage and control for independent irrigation of greens, tees, approaches and fairways. This, in turn, calls for system design and piping to provide required water pressures to serve the highest point of elevation from the water source. Simultaneously, consideration should be given to fire protection needs for service buildings and the clubhouse.

A modern system may include auxiliary provisions for automatic fertilization of turf and the application of various control chemicals. Manual or fully automatic electrical controls may be used, with corresponding flexibility in time required for supervisory attention and the advantage offered by watering during night or non-playing hours. Refinements may be provided for as "later additions" but, in any case, the extensive choice of system materials and components suggests need for careful advance study as underground construction will be accom-

(Continued on page 72)

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Irrigation Costs

(Continued from page 39)

plished at lower cost before final grading and seeding are undertaken.

With irrigation required from 12 to 20 weeks per year on many courses, a full irrigation system offering at least 25 years of useful life not only provides better playing conditions, but its overall cost will usually be substantially lower than the consequential costs of inadequate watering, with or without the aid of partial coverage systems. Lacking standards as to "quality of maintenance", individual analysis will perhaps be more convincing using published information as a guide.

Costs Vary Widely

Irrigation costs like other maintenance expense, vary widely between courses in different areas. Excluding the cost of water supply and pumping, complete, permanently installed irrigation systems are reported to cost from \$950.00 to \$1400.00 per acre. Such installation costs are highly dependent on variations in terrain, soil constituents, system design and the use or omission of automatic controls to reduce subsequent labor cost. However, these factors can be readily appraised in terms of specific investment requirements for any course to confirm the advantages offered by a complete irrigation system.

Girls' Junior Championship

Qualifying rounds on Aug. 16-17, and match play, Aug. 18-21, will be played for the USGA Girls' Junior tournament at Hiwan GC, Evergreen, Colo. July 30 is the deadline for entry applications to be filed at USGA headquarters at 40 E. 38th St. in New York City.