LANDSCAPE *Guide* MANAGEMENT

CHOOSING AN IRRIGATION SYSTEM

A quality irrigation system requires a lot of work, even before the first piece of pipe is ever buried.

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Having an irrigation system designed and installed can be a rewarding experience. But you must focus on needed criteria like site surveys, water source determination, applied design principals and formulas, selection of qualified consultants and contractors and service.

An irrigation system is a mechanical system that efficiently takes water from one place and delivers it to the rootzone of plant material in another place, at the right time and in the right amount. This simple objective can often become a disaster, if the criteria set forth are not followed.

This article is divided into 16 different considerations for designing an irrigation system. Here they are, for easy reference:

1. Initial factors
2. Soil type
3. Analyzing water
4. Water sources
5. Pump system
6. System prelims
7. Water amount
8. Coverage patterns
9. Money considerations
10. Zoning
11. Valves
12. Pipe materials
13. 'Accessorizing'
14. Final design
15. Specifications
16. The contractor

1. Initial factors

Logically, the first step is to create a design. Whether the turf manager, irrigation consultant or contractor is going to do the design work, all system designs should follow several steps.

Before any actual design work can begin, the designer must fully understand where the system is to be installed and what it is expected to do. This is the purpose of the site review.

Many factors must be considered, but the first step is to create a scaled drawing of the area that accurately depicts the shape, size and location of all structures and planting areas.

Notes about elevation changes and wind direction will prove very helpful if either is present in an appreciable amount. Also, investigate utility rights-of-way and other areas that may preclude the installation of irrigation equipment.

2. Soil type

Soil type considerations must be made. Though not crucial for some systems, ignoring soil variations may be deadly on others.

Consider that a large system, such as a golf course, may encompass several soil types—each with its own rate of absorption and water retention ability. To apply water equally to each area would cause over-watering in some areas and under-watering in others. The result would be unhealthy turfgrass from too much or too little water, wasted money in water and power costs, and even erosion from run-off.

An irrigation system needs a sufficient quality and quantity of water. Lakes, rivers, wells and municipal water systems all may be used, if satisfactory and cost effective. It is advisable to have local experts make recommendations and provide data for both quality and quantity.

3. Analyzing water

Each source has individual concerns the designer must consider. Water should be analyzed for pollutants and organic matter that may harm the turf or cause problems with equipment.

Lakes tend to collect chemicals from turf via run-off and agricultural lands. Rivers and wells may have industrial or sewage contaminants; city water may contain harmful chemicals. Algae, marine plants and silt may clog pumps, valves and sprinklers, or sand may cause premature wear throughout the system.

Many solutions exist for the designer for quality problems. If, however, the quantity is insufficient, other measures must be taken.

4. Water sources

It is not uncommon to have a combination of water sources, at least as a recharge supply for the main source. For example, a large turf system may use one or more ponds as the water supply but uses wells, rivers or city water to re-charge the ponds when the natural supply is weak.

The re-charge system can normally operate within a 24-hour window, while the irrigation system has a shorter watering time frame, such as 10 hours for many situations.

As the water supply becomes more complicated, it increases the cost to purchase and operate the system. The designer must derive the proper equipment balance for performance, efficiency, reliability and cost effectiveness.

Other information to gather regarding the water source includes static water pressure, pipe size, and type of connection for city water. Can a deduct meter be installed? Where would a pump station be installed? Is there electrical power close by sufficient to power a booster pump, including three-phase?

5. Pump system

Additionally, local backflow preventer codes must be determined and implemented into the design. In some areas, backflow protection is also required for wells.

Unless an abundant supply of water, at the required pressures, can be obtained from a municipal water supply, the irrigation system will probably need a pump, or series of pumps, to supply water at the pressure and quantity required.

Whether as a pressure booster or as the supply pump, this phase of design should be left to an experienced pump station designer.

For many large turf systems the pump station may be 15 to 50 percent of the total system cost. Be sure to consider quality, performance, and service from the vendor.

While on site, many designers find it beneficial to mentally conceive the system as it would be installed. Installation problems can be foreseen and the design adjusted accordingly, instead of allowing the installer or owner to discover a problem during installation.

Though today's irrigation equipment is engineered for quality and performance, proper application of the technology is crucial for a good installation.

6. System prelims

The designer can double-check his preliminary work and form mental images of the area, which are helpful while working at the drawing table.

After creating the scaled drawing and reviewing the site, the designer can now make some preliminary decisions about the system, such as type of sprinklers, controllers, etc. Now is the time to consider the variations of plant materials and soil profiles in order to make the proper selection of equipment to be recomended.

At this time the brand and model numbers of the major components can be established as well as the overall concept concerning the system layout.

Also, some of the system operational guidelines can be established to help size the water supply and supporting equipment. For example, the designer should now know the soil conditions, the percolation rates, and the acreage to be covered.

7. Water amount

The designer now determines the amount of water to be applied on a weekly basis and the available watering window. With this information, the initial water requirements and the times of operation can be determined. From this, the designer will size the pumps, pipe, valves and sprinklers.

Armed with this data the designer can start the actual system layout, usually beginning with the sprinkler head placement. The most important criteria when laying out sprinklers is to insure an even amount of precipitation throughout the system's area of coverage. Normally this means the throw radius of one sprinkler reaching the next sprinkler, or "head-to-head" coverage.

Since the actual amount of water applied decreases toward the outer ranges of the sprinkler's throw radius, head-to-head coverage allows a more even application rate, or coefficient of uniformity (CEU), which means all areas receive about the same amount of precipitation.

8. Coverage patterns

There are two common sprinkler layout patterns, square and triangular spacing. Most systems include a combination due to the odd shapes of the irrigated areas.

Triangular spacing offers uniform coverage with fewer sprinklers. Instead of "head-to-head" coverage, or 50 percent diameter spacing (which is normally used in square spacing), triangular spacing allows 55 to 60 percent of diameter of throw spacing, therefore accomplishing the desired precipitation rate with fewer sprinklers.

Always remember, the wind factor can adjust these formulas up or down. Trying to save money by using the fewest heads should be discouraged, so always make sure the designer stays within the manufacturer's performance specifications.

9. Money considerations

A poorly designed or installed sprinkler system is extremely difficult and costly to renovate. Do not allow price to overshadow quality. If funds are not available to install a quality system, consider installing it in phases instead of skimping on the materials.

Once the sprinklers are laid out according to the design criteria and manufacturer's specifications, the next step is to divide each area into "zones" or groupings of sprinklers. This is necessary because enough water to run all the sprinklers at the same time is not normally available. Also, sprinklers with different precipitation rates can cause unequal amounts of water to be applied in an area, if operated on the same zone.

10. Zoning

Separating into zones also allows greater control over each area, which will be important because of differing soil types, exposure and plant water requirements.

Some sprinkler manufacturers provide "matched precipitation rate" (MPR) nozzles for their sprinklers. This allows the designer to put part circle heads on the same zone with full circle heads and still maintain an even precipitation rate throughout the area of coverage.

Each zone is controlled by a remote automatic control valve turned on by the controller. In the case of larger heads, such as those used on a golf course or large turf project, each head may have a valve built into it's casing, which means every head is, in effect, a separate zone.

The effects of a poorly-designed irrigation system include over-watering, pest and disease problems.

11. Valves

Control valves, all of which are hydraulic, are normally operated by electrical solenoids, or a pressurized hydraulic valve block and tubing.

Both the electrical and hydraulic control systems have merits which should be explored. The number of heads on each zone would be determined by the amount of water needed by each head compared to the amount of water available from the water source. If a sprinkler needs 10 gallons per minute (gpm) to operate properly, then a 70-gpm water supply would allow seven sprinklers to run at the same time.

After all the sprinklers are located and zoned, the designer can now design the piping system. Since the volume of water to each zone is established, the size of the pipe and valves supplying each zone can be determined according to the flow and velocity characteristics of the pipe used. Pressure loss charts provide an easy way to size pipe and stay within acceptable velocity ranges.

12. Pipe materials

Pipe materials vary according to the requirements of the system, but most systems are now installed with polyvinyl chloride (PVC) pipe. An experienced irrigation designer will make recommendations concerning the pressure ratings and strength of the pipe. These should be followed explicitly.

Allowing lower-rated or undersized pipe to be installed will cause costly problems and may cripple the entire system. The pipe design should try to minimize the amount of trenching and pipe installation to help control the system's cost.

Certain methods for using smaller pipe sizes, such as designing in "looping," can reduce friction loss and the system cost, but the designer should never undersize pipe. If anything, use larger pipe sizes, especially if the system may be expanded in the future, or if friction losses are bordering on the unacceptable.

13. 'Accessorizing'

At this point, the ancillary items are designated, such as wiring and wire sizes, valve boxes and controller accessories. The type of controller and controller location should also be decided.

Today's controllers range from the older style mechanical clocks to the newer computer-based systems.

Mechanical clocks are reliable and tend to be easier to learn how to operate, but lack the impressive array of functions provided by the computerized systems. Water management is now a reality with the computer-based controllers. Weather stations supply up-to-the-minute information about the field environmental conditions, which then alter the watering schedules to provide just the right amount of water when it is needed.

Another impressive feature is the ability to operate remote controllers via the telephone lines or radio communications, all from a central location. An irrigation computer can:

- control fountains and lighting systems;
- allow, because of "flow management," pump stations to run at their peak efficiency; and
- most importantly, water and power are saved, so the life of system components is extended.

After double-checking the hydraulic calculations, the plan is nearly completed.

14. Final design

To finish the design, a final copy is created with detail for each component of the system. Assumptions and bits of information that would be helpful to an installer should be included in the notes. The legend should include a complete list of material symbol designations. Even the hydraulic calculations can be part of the finished package.

Most designers will have completed an irrigation schedule by this time. It helps to have this prepared prior to installation as a double check of the design, and to aid in making changes in the field during installation.

Once the design is complete, the designer should develop a set of specifications for the installation of the system. This is crucial if the system is to be released for bids.

15. Specifications

Specifications assist in establishing a level of quality and expectations for bidders. Substandard contractors will be obvious since they will fail to meet the requirements of the specifications. Subjects to consider including in the specifications are who is to locate all underground utilities; who arranges for permits and inspections; and who installs backflow preventers.

Include statements binding the contractor to install according to local building codes and the equipment manufacturer's recommendations. Outline in detail how components are to be installed and the procedure for starting up the system. Cover payment terms, retainers, and clean-up expectations.

Establish how the contractor is to store materials and equipment and any other special working conditions. But, most of all, be specific about what needs to be done. Don't force the contractor to make assumptions.

16. The contractor

Several sources are available for assistance and to obtain sample specifications, including manufacturers, distributors, trade associations and some attorneys.

When a contractor is to be chosen to install the system, it pays to give careful attention to the selection process. Most contractors are honest, competent installers and are eager to provide the information you need for consideration. But, there are the bad apples.

A professional contractor is usually well prepared for meetings, knowledgeable about the product and the industry, and provides complete and accurate documentation. The poor contractor is usually ill-prepared, late for appointments and callbacks, offers vague answers and usually has the lowest price.

Ask for references, and really contact them. The questions asked will determine the quality of the information received, so ask specific questions about issues important to the job. Listen carefully about how problems were resolved and how well the contractor handled callbacks and service calls. Good contractors like to talk about their service because it is part of their success.

Inquire about their warranty and service procedures, especially if there is an emergency. Establish service costs up front; expect, and be willing, to pay a fair price for good service, because it is most definitely worth it.

A new irrigation system is a long term investment, offering the end user years of reliable performance, if proper care is applied to the planning phases. **LM**

Give a lot of thought to who you want as your irrigation contractor. Request and follow up on references and ask plenty of tough questions.

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