Follow the Water: Troubleshooting Irrigation on Athletic Fields

It's a day before the big game. Everyone expects the field to be perfect. You have your schedule full preparing the field for the big show -- mowing, grooming, painting the yard lines. All of a sudden, you notice brown spots appearing in some locations and puddles in others. This is no time to panic. Determined and focused, you begin the daunting task of troubleshooting the irrigation system on your game field. Your role to the performance and success of the team is critical.

Irrigation is critical to maintaining healthy athletic fields. It is an important tool in providing an athletic surface which is safe for the athlete. The turf manager can control surface performance by closely managing soil moisture on an athletic field. A surface which is too dry often becomes hard, increasing the risk of injury. A surface which is excessively wet will easily rut and lose stability, resulting in surface irregularities. Both conditions negatively impact the performance of an athletic surface and increase the risk associated with athletic competition. When faced with the prospect of troubleshooting an irrigation problem on an athletic field, the answer is simple. Just follow the water.

Be a Detective

Athletic fields, unlike other landscapes, are finely-tuned turf systems. They are extremely uniform in slope, solar orientation and soil consistency. The goal of a turf manager is to create a surface that is as uniform as possible in appearance and performance. As a result, high performance fields show stress sooner. An observant turf manager can use this increased sensitivity to stress as a guide to identify problems with irrigation equipment or operation. Carefully reading subtle changes in the appearance of the turf provides the turf manager a powerful diagnostic tool. Observing the location, size, distribution, pattern, and relationship to irrigation equipment provides clues on the potential irrigation problem.

In order to understand the clues, one must ask critical questions and act as detective noticing patterns in turf irregularity. Where is the problem? Does the pattern repeat on other areas of the field? What is the size of the affected area? The size of the impacted area can identify whether the problem is an entire zone or confined to a single rotor. As a general rule, smaller problem areas are usually malfunctioning heads; larger problem areas covering multiple heads are usually valves; and problems impacting the entire field are usually controllers related. Troubleshooting is most effective with a complete understanding of the design of the irrigation system. Detailed as-built drawings are essential in understanding how your system operates and where all the equipment is located.

The goal of any irrigation system is to apply the minimum amount of water required to meet the plant's needs. This requires a precise and uniform application of water over the surface. Variations in water-application uniformity usually indicate a problem. In the broadest terms, there are two types of water-related problems: insufficient water and excess water.

Insufficient Water

Dry spots and brown turf are a clear indication of insufficient water. Observe the pattern closely. Small isolated dry spots are usually related to the operation of a single rotor. If this is the case, the offending rotor can be found at the center of the dry spot. Insufficient water for a rotor is a sign that something is clogging the head or the head is not properly rotating. Check the screen at the bottom of the head for debris, and then observe the rotor in operation. Some dry areas are not centered on the individual head, but located equal distance from two heads along the edge of a field. The cause of this type of pattern is usually improper arc adjustment.

When the areas of insufficient water cover multiple heads, we need to follow the water back upstream from the head to the valve. The problem is either a control valve or a lateral pipe break when all the impacted heads are associated with the same control zone. Lateral pipe breaks that are significant enough to create large areas of insufficient water can usually be detected by the isolated area of excessive water. In sand-based athletic fields, these types of lateral pipe failures can be difficult to locate due to the permeability of the soil. A simple way to detect if a lateral pipe or a valve is the problem in sand based fields is to monitor the water meter while the zone is operating. No water flowing is an indication of a malfunctioning valve, while water flowing is usually a broken lateral pipe. There is some sound detection equipment that can detect the location of a broken pipe in a sand-based field.

A general rule when troubleshooting control valves is that if the valve fails to operate, it is an electrical problem; and when a valve fails to shut off, it is a hydraulic problem with the valve. The failure of a valve to operate can be traced to three possible components: the controller, control wire or the solenoid on the valve. Use a voltage meter to check power to the valve at the controller terminal strip with the zone operating. Problems internal to the controller typically will not power the terminal strip. Next, using the voltage meter, check power at the solenoid while the system is operating. No power or low power to the solenoid usually indicates a severed or damaged control wire. Finally, if power is verified to the solenoid and the valve will still not operate, it is time to replace the solenoid.

In situations where the entire field is impacted and shows insufficient water, follow the water upstream of the control valves to the points of connection and the control system. If the system can be manually operated by purging the master valve and control valves, the likely culprit is an electrical problem. Be sure to follow the water from the water meter, manually opening all gate, ball, and solenoid valves along the way. Often, the problem is that someone accidentally shuts off a valve without notifying the turf manager. System-wide electrical problems are a little more difficult to troubleshoot, but can be traced to four components: controller, main ground wire, rain sensor or master valve. Each of these components can disable the entire system.

To check the controller, make sure it is receiving power and that the terminal strip is being powered. Also, check the controller settings to make sure it is properly programmed and operating correctly. Both the master valve and rain sensor are designed to disable the entire irrigation system. Failure in either of these components will result in an entire system shutdown. Check the rain sensor and master valve the same as you would a control valve. Both of these components can be removed from the system by disconnecting them. The system should begin operating again; if not, the problem may be a damaged or severed common ground wire. Unlike valve control wires which run to each valve, a common ground wire is run to all the valves. Ground wire problems are among the most difficult problems to detect and repair. Typically the controller provides normal power to the terminal, but the voltage meter indicates no voltage or low voltage to all valves.

Excessive Water

Excessive water is identified by saturated soil conditions, a sour anaerobic smell, and algae cover on the surface of the soil. Clues can be gathered by the size and extent of the saturation. At times there are clear indications if the excessive water is intermittent or not by the way algae or salts have accumulated. Most excessive water problems are localized to a single equipment failure, such as leaking equipment or a broken pipe.

Saturated soil around a head is a sign of a leaking wiper seal or that the head is installed low and the nozzle is obstructed. It would also be a result of the head sticking up and the mowing decapitating the top of the riser. Observing the head in operation will help identify the problem. If the excess water appears to be bubbling out of the ground, the problem is below grade with the riser connection or the swing joint.

Other equipment problems can result in isolated wet spots. Quick coupler valves frequently leak at the seal. A control valve box filled with water is commonly a leak between the valve body and bonnet or at the threaded connections of a valve. Isolation valves are known to leak at the riser stem. A turf manager armed with the construction drawings of the irrigation system can usually follow the water to the problem.

Saturated soil not located near a head or other equipment is likely a lateral pipe break. One thing to consider is that the location of the saturated soil may not be the location of break. Excess water can travel underground through the soil and irrigation trenches and surface some distance from the break. However, it can always be assumed the saturated soil is down slope of the break. Finding the break is sometimes difficult. Running the suspected zone for a long time can sometimes force the break to surface revealing its location.

When excessive water to a large area is observed, the first place to look is at the controller settings. The system may simply be programmed to apply excess water. The next culprit is usually a valve that won't shut off. The cause of a valve remaining open can be attributed to debris stuck between the diaphragm and the valve body preventing closure of the valve or a clogged diaphragm port. If you suspect a valve problem, remove

the top bonnet of the valve and flush to remove debris. Inspect the diaphragm for damage or wear and replace if required.

When in Doubt, Follow the Water

The cause and effect relationship of problems in irrigation systems are most often direct. An observant turf manager can use the subtle changes in water distribution as a powerful diagnostic tool in troubleshooting irrigation problems on athletic fields. It requires a mental picture of how the system operates, where the equipment is located and what problem would cause the observed pattern. Armed with this knowledge, the turf manager needs to apply logic like a detective in solving a crime. Systematically considering each of the potential causes and eliminating them one by one, he follows the water back to the source of the problem.

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