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The Foundation for Safer Athletic Fields

Irrigation & Water Conservation BMPs

When rainfall is insufficient and water resources become limited, supplemental irrigation required to sustain plantings, such as turfgrass and other landscaping plants, is often the first to be placed on water use restrictions. When managing turfgrass and other landscaped areas, conserving water use to the lowest possible level protects water resources. However, it is also important that when water restrictions are threatened or imposed that sports field managers can effectively communicate that one of the most critical components of maintaining a safe field is having adequate water to maintain actively growing turfgrass and provide another tool in the management of soil surface hardness. Applying water responsibly can conserve resources and save money while still maintaining a healthy, safe turfgrass surface and aesthetically pleasing landscape.

Regulations

Always comply with local and state water use regulations and restrictions. Contact federal, state, and local water use authorities to determine annual or specific water rights, permitting guidelines, and other requirements allowed by regulators. Determine what is required to adhere to water quality standard rules regarding groundwater and surface water flows resulting from removal of water for irrigation use. Protect aquatic life and impairment of water systems by adhering to state and local water withdrawal allocations (gallons/day).

Regulations vary by state. Be aware of the following:

- Surface Water Withdrawal and Permit Regulations
- Groundwater Withdrawal and Permit Regulations
- Withdrawal Reporting Requirements
- Water Reclamation and Reuse Regulations
- Backflow Prevention and Cross Connection Regulations
- Drought Response Plan

Irrigation Timing and Amount

Plants should be watered as needed to enhance root growth and improve overall plant health. Irrigation scheduling must take plant water requirements and soil intake capacity into account to prevent excess water use that could lead to leaching and runoff.

- Water deeply and infrequently. Watering deeply and infrequently helps encourage deep rooting, gas exchange, and soil temperature moderation, while discouraging surface soil compaction. In practice, the irrigation system applies water to fill soil pores to the depth of roots and then does not irrigate again until surface soil moisture has been depleted to near the wilting point. Soil type, effective root zone depth, and estimated evapotranspiration (ET) demand determine irrigation frequency and soak cycle needs. When these factors are considered as a group, soil moisture management usually applies to the top 6 inches of a soil

profile.

- Depending on composition and levels of compaction, the infiltration rate for heavier soils such as silts and clays can range from 0.1-1 inch per hour. Infiltration rate of sandy soils can be 2-20 inches per hour. Irrigation rates should not exceed the maximum ability of the soil to absorb and hold the water applied at any one time.
- Effective rootzone depth is the depth to which 90% of the root system penetrates and must be determined with a soil probe or spade. Soil type and effective rootzone depth together are used to estimate the soil water-holding reservoir available to the root system.
- Evapotranspiration (ET) is a combination of transpirational water needs of the plant and water lost from the soil surface via evaporation. As temperatures increase and relative humidity decreases, ET demand rises. ET requirements vary based on turfgrass species, maintenance conditions, and time of year. Use computed daily ET rates to adjust run times to meet turfgrass moisture needs. Manually adjust automated ET data to properly consider wet and dry areas.

- Adjust irrigation run times based on current local meteorological data. Irrigation should not occur on a calendar-based schedule, but on actual site conditions for each head and zone. When scheduling irrigation, consider evapotranspiration rates, recent rainfall, recent temperature extremes, soil moisture, and pending field use schedules.
- Cycle irrigation so sprinklers run in shorter increments to give water time to infiltrate into the soil and minimize runoff. Excessive irrigation can transport pollutants and cause erosion which can negatively affect waterways.
- Irrigate in the early morning hours before air temperatures rise and relative humidity drops.
- Create a drought management plan for the facility that identifies steps to be taken to reduce irrigation/water use and protects critical areas.
- During a drought, closely monitor soil moisture levels. Whenever practical, irrigate at times when the least amount of evaporative loss will occur.
- Monitor and record the amount of water being applied, including system usage and rainfall. By tracking this information, areas can be identified where minor adjustments can improve performance.

Water Conservation Practices

- Select drought-tolerant varieties of turfgrasses to help maintain a safe, attractive and high-quality playing surface, while minimizing water use. Of the cool-season grasses, tall fescue and perennial ryegrass exhibit the best drought tolerance. The water use efficiency of warm-season grasses is about 50% greater than cool-season grasses. Bermudagrass exhibits the best drought tolerance for warm-season species. Websites, like the Turfgrass Water Conservation Alliance (TWCA), provide choices for turfgrass species/varieties with water conservation in mind.
- Reduce soil compaction to improve water infiltration and decrease water use and runoff. Slicing, spiking, aerating and other cultivation practices help relieve surface compaction and promote better water infiltration and penetration.
- Use mowing, verti-cutting, aeration, wetting agents, nutrition, and other cultural practices to create a healthy turfgrass environment to encourage water conservation and efficiency.
- Visually monitor for localized dry conditions or hot spots to identify areas with specific water needs. Supplement watering only for the establishment of new plantings and new sod, hand watering of critical hot spots, and watering-in of chemicals and fertilizers (if permissible).
- Reduce water use on utility turfgrass by creating landscaped areas that do not require water in addition to rainfall. Choose plants, trees, and shrubs that are drought tolerant and thrive in your climate. Indigenous plant species are adapted to the precipitation and diseases associated with the region. Work with your local cooperative extension service to determine the best native plants for your situation. Websites like Grow Native (Missouri Department of Conservation), also provide choices for native plantings for landscapes with water conservation in mind.

Irrigation & Water Conservation BMPs

Bioretention area/rain garden utilizing native plantings - Picture courtesy of Aaron Volkening, P.E.

- Design the irrigation system to target only the field and immediate surrounding areas. Create zones to address the areas that are most intensely trafficked/managed. The irrigation system should be designed and installed so that the field can be watered independently from out of bounds and landscaped areas.
- Consider having separate zones for turfgrass and landscaped areas. Use micro-irrigation and low-pressure emitters in non-play areas to supplement irrigation.
- Make sure tall grass, groundcovers, or shrubs are not blocking or deflecting the water spraying out of the sprinklers. When the water pattern is deflected by tall grass or leaves it results in uneven watering and water waste. To reduce water waste, use sprinkler heads that pop up 3 or more inches or trim plants around the sprinkler.
- Locate part-circle sprinkler heads 4-6 inches away from the edge of sidewalks, curbs, patios, etc. This will reduce the amount of spray onto the paved surface and will not create a dry area along the edge. Locate sprinkler heads 12 inches away from shrub areas.

Irrigation System Operation Efficiency and Upkeep

Irrigation systems should be properly designed and installed to improve water use efficiency. An efficient irrigation system maximizes water use, reduces operational cost, conserves supply and protects water resources.

- Design and/or maintain a system to meet the site's peak water requirements under normal conditions while being flexible enough to adapt to various water demands and local restrictions.
- Conduct irrigation audits to maximize water use efficiency. The audit should check sprinkler head operation and output as well as irrigation distribution, uniformity, and pressure. Conduct irrigation audits annually. Irrigation audits can be performed by trained technicians, however, audit kits are available for those wishing to conduct their own audits on a regular basis and/or if the facility has many fields.

Catch-can testing - Photo courtesy of Jeff Gilbert

- Check application/distribution efficiencies annually. Catch-can tests should be run to determine the uniformity of coverage and to accurately determine irrigation run times. Catch-can testing should be conducted across the facility to ensure that the system is operating at its highest efficiency.
- Inspect the irrigation system daily for proper operation by checking computer logs and visually inspecting the pump station, remote controllers, and irrigation heads. A visual inspection should be carried out for leaks, misaligned or inoperable heads, malfunctions, breaks, and chronic wet or dry spots, so that adjustments can

be made. Often, irrigation heads tend to settle or are set too low after years of topdressing. They should be set back to grade as needed for proper operation.

- Observe your irrigation system in operation at least weekly. This process detects controller or communications failures, stuck or misaligned heads and clogged or broken nozzles. Do not assume a remote system operated from a smartphone is operating properly.
- Perform frequent system checks and routine maintenance on pumps, valves, fittings, and sprinklers. Manufacturer's typically provide recommendations for timing and process for checks.
- Ensure that the irrigation system is equipped with an emergency shutdown in case of a line break and high- and low-pressure sensors that shut down the system in case of breaks and malfunctions.
- Keep records of filter changes, as this could be an early sign of system corrosion, well problems, or declining irrigation water quality.
- Check filter operations frequently. An unusual increase in the amount of debris may indicate problems with the water source. Even under routine conditions, keeping filters operating properly prolongs the life of an existing system and reduces pumping costs.
- Monitor water meters or other measuring devices for unusually high or low readings to detect possible leaks or other problems in the system. Make any needed repairs.
- Evaluate pressure and flow to determine that the correct nozzles are being used and that the sprinkler heads are performing according to the manufacturer's specifications. Pressure and flow rates should be checked at each head to determine the average application rate in an area.
- Inspect the backflow device to determine that it is in place and in good repair.
- Monitor the power consumption of pump stations for problems with the pump motors, control valves, or distribution system.
- Winterize the irrigation system to prevent damage.
- Implement a preventative maintenance program to replace worn components before they waste water. Document equipment run-time hours to ensure that all lubrication, overhauls, and other preventive maintenance are completed according to the manufacturer's schedule. Periodically review the condition of infrastructure (such as pipes, wires, and fittings). If the system requires frequent repairs, determine why these failures are occurring.
- Collecting information on the cost of maintaining the system as part of system overall evaluation allows for planning necessary upgrades and replacement. Recordkeeping can also provide comparison data after changes are made.

Alternative Freshwater Sources

Reclaimed, effluent, and other non-potable water supplies may be an option for sports fields to help conserve fresh water supplies.

- Identify and use alternative water supply sources to conserve freshwater drinking supplies.

Alternative water source – Photo courtesy of Justin Quetone Moss, Ph.D. and Charles Fontanier, Ph.D.

- Post signage in accordance with local utility and state requirements when reclaimed water is in use.
- Monitor sodium and bicarbonate buildup in the soil using salinity sensors or conduct soil tests annually.
- Routinely monitor shallow groundwater table of

freshwater for saltwater intrusion or contamination of heavy metals and nutrients.

- Monitor reclaimed water tests regularly for dissolved salt content.
- Use salt-tolerant varieties of turfgrass and plants to mitigate saline conditions resulting from an alternative water supply or source.
- Amend sodic water systems appropriately (with gypsum or an appropriate ion) to minimize sodium buildup in soil.
- Flush soil with freshwater or use amending materials regularly to move salts out of the root zone and/or pump brackish water to keep salts moving out of the root zone.
- Reclaimed, effluent, and other non-potable water supply mains must have a thorough cross-connection and backflow prevention device in place and operating correctly.
- Account for the nutrients in effluent (reuse/reclaimed) water when making fertilizer calculations.
- Where practical, use reverse-osmosis filtration systems to reduce chlorides (salts) from saline groundwater.
- Design the irrigation system so there is still access to freshwater. Salt buildup from poor-quality water sources will occasionally need to be leached from the soil.

Technology

Irrigation system planning should incorporate practices and technologies that conserve water as well as ensure the efficient and uniform distribution of water.

- Invest in an onsite weather station. Stations provide an effective method of collecting data that can be used to determine actual site ET rates. The data can be logged and interfaced with irrigation central control software to aid in determining water applications.
- ET gauges are available which allow a daily reading of evapotranspiration creating water savings that easily offset the cost of the gauge.
- Use rain gauges, rain shut-off devices, flow meters, soil moisture sensors, and/or other irrigation management devices to manage the site's irrigation schedule. Rain sensors can be programmed to shut off the system after 0.25 to 0.5 inch of rain is received. Computerized systems allow a manager to call in and cancel the program if it is determined that the field has received adequate rainfall.
- Place rain shut-off devices and rain gauges in open areas to prevent erroneous readings.
- Use soil moisture sensors to bypass preset or to create on-demand irrigation schedules. Use multiple soil moisture sensors/meters for accuracy and to reflect soil moisture levels. In-ground (wireless) sensors can be placed in representative locations of the irrigation zone. They should also be installed in the driest irrigation zone of the irrigation system. Hand-held moisture meters can also be used to enhance schedule timer-based run times. Soil sensors can be integrated with computerized irrigation systems to provide critical soil profile data in specific locations and allow for micro-climate specific water applications.
- Invest in a rain switch. A rain switch is a rain sensor that detects measurable rainfall, then turns off automatic irrigation valves.
- Measure the amount of water that is delivered through the irrigation system via a water meter or a calibrated flow-measurement device. Knowing the flow or volume will help determine how well the irrigation system and irrigation schedule are working.
- Reset irrigation controllers/timers as often as practically possible to account for plant growth requirements and local climatic conditions.
- Hand-held soil moisture meters can also be helpful to determine soil moisture for those facilities without high-tech monitors. Walking and probing fields allows the field manager to check soil moisture as well as making a visual observation of their fields.