Flooding on Sports Fields

Flooding events caused by excessive rainfall can be extremely detrimental to sports fields. Flooding saturates a rootzone and creates an unfavorable soil environment for root growth by displacing oxygen in the soil pores with water. Without oxygen exchange in the rootzone, roots stop absorbing water and nutrients. As a result, the turfgrass plants weaken and may die depending on length of submergence.



Photo courtesy of Joe Wagner

Turfgrass Injury

Severity of turfgrass injury following a flooding event depends on water temperature, water depth, amount of time the turfgrass is submerged, and turfgrass species.

- **Water temperature** – When submersion occurs together with high temperatures, plants can die quickly due to a lack of energy production to sustain plant growth. Cool water and cloudy days increase the chances for turfgrass survival. Research shows that turfgrasses can withstand submersion up to 60 days when water temperatures are 50 degrees or less, but can be killed within 24 hours when water temperatures are 86 degrees or higher.
- **Water depth** – Saturated soils may be the only concern with light flooding while leaves remain exposed to air. Turfgrasses with leaves extending above the water surface often survives longer than fully submerged plants. Submerged plants can be severely damaged or die due to low oxygen in the rootzone and low light reaching the leaves.
- **Duration** – Turfgrass plants that are submerged for long periods of time are more likely to suffer damage or die. Stagnant water allows sediment to coat leaf blades increasing turfgrass injury when compared to moving water.
- **Turfgrass species** – Different turfgrass species vary in submersion tolerance. Creeping bentgrass and bermudagrass are the most tolerant to flooding. Research shows that bermudagrass can survive after 55 days of submersion. Kentucky bluegrass and tall fescue are fairly tolerant to flooding. Research has shown that tall fescue and Kentucky bluegrass can survive after 35 days of flooding. Kentucky bluegrass rhizomes have been shown to survive flooding events and contribute to 50% of field recovery. Annual bluegrass and perennial ryegrasses are the least flood tolerant.

Flood Recovery

After a flooding event has occurred, it is best to stay off fields until the soil can support clean-up equipment without rutting or promoting excessive compaction. This may require shutting down fields for a period of time to allow soil water to recede. Prevention of rutting and excessive compaction is better in the long run than trying to prematurely aid in water or sediment removal with heavy equipment.

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Little can be done to assess field damage from submersion until floodwaters recede. Depending on the severity of the flood, turfgrasses may be dead or only suffer minor discoloration. Initial changes in color are most likely the result of limited oxygen availability for root respiration and the resulting impact on photosynthesis and/or limited light for photosynthesis if submerged for more than a day or so. In addition, flooding leaches nutrients, especially nitrogen, from the soil. A lack of nutrient uptake by turfgrasses may also cause discoloration of the leaves.

Soil erosion and sediment deposition also presents problems for sports turf managers. Soil erosion can occur when flood waters flow rapidly in channels across fields. Silt, clay, sand, and debris can be deposited on turfgrass surfaces after flooding events. Some turfgrass areas recover from flooding with very little input. In areas suffering from extreme flood damage, sediment removal, tillage, regrading, and reseeding/sodding may need to take place.

Sediment and Debris Removal

The first priority for any flood damaged field is sediment and debris removal. Large pieces of debris deposited by floodwaters need to be removed.



Photo courtesy of Joe Wagner

Sediment should not be tilled into the top few inches of the existing rootzone. Although slow and tedious, removal of sediment deposits should occur as soon as possible to avoid immediate and long term problems. Make sure the field is dry enough to support equipment and foot traffic without causing ruts and compaction. If the turfgrass remains buried for an extended period of time, lack of light and smothering can injure the plants. Deposition of less permeable clay or silt on top of existing soil can cause long term infiltration and drainage problems. Removing sediment from sand-based rootzones is especially important to prevent the rootzone from being capped by a clay or silt layer.

Equipment that can assist with sediment and debris removal includes the following:

- Tractor with box blade
- Utility vehicles with trailers.
- Hand tools such as flat bottom shovels, brooms, and rakes
- Vacuum.
- Sweeper.
- Blower.
- High pressure hoses.
- Pumps to remove standing water

Soil Cultivation

Once sediment is removed, field injury can be evaluated. Fields that suffered from extensive damage may need to be tilled, regraded to the proper slope, then reseeded or sodded. Fields with less extensive damage can utilize soil cultivation to restore fields. Removing all traces of sediment deposition is very difficult; therefore, using various methods of cultivation to break through the remaining sediment layer can be helpful in encouraging rooting, turfgrass recovery, and water infiltration. Slicing or hollow or solid tine aerification can help dry fields, improve physical condition of the soil, and increase oxygen availability to the rootzone. Hollow tine aeration with core removal is the preferable method to aid in removal of additional sediment. When cores are not removed, the sediment is only being diluted with soil from the rootzone. Every effort should be made to avoid development of layers in the soil profile that might result from sediment remaining on the surface.

Topdressing after core cultivation can assist in leveling the turfgrass surface and further dilution of any remaining sediment. Topdressing also improves physical properties of the turfgrass rootzone. Topdressing material should match the particle size of the existing rootzone or be of a slightly coarser material.

Note: Removing sediment layers less than one inch can be very difficult. After the layer dries out, a drag mat can be used to break up the sediment layer. Aggressive hollow tine aeration and topdressing can be used to manage the sediment and prevent it from clogging the rootzone.

Fertility

Flooding will leach nutrients from the soil. Soil tests should be conducted following flooding to provide guidance for a successful fertilization plan when reestablishing turfgrasses. When submitting a soil sample for testing, be sure to indicate that the sample is for turfgrasses. Follow the recommendations given by the soil test report to determine lime, phosphorus, and potassium requirements. Apply nitrogen, using a quick release form, at a rate of ½ lb. / 1000 sq. ft. Fertilizer applications after a flooding event are important to increase turfgrass growth and recovery. Nitrogen and potassium stimulate recovery and improve stress tolerance. Phosphorus will help promote seedling growth.

Reestablishment

Depending on the degree of damage that results from a flooding event, fields may have areas of varying size that need to be replanted to facilitate recovery.

Cool-Season Turfgrasses

Fields with little damage may only need to be spot seeded or lightly over-seeded. Fields with moderate to extensive damage may require seedbed preparation and heavy over-seeding. Surface cultivation should be used to prepare fields for over-seeding. Choosing a turfgrass species for over-seeding depends on when the field must be used. Desirable species for over-seeding include:

- 100% Kentucky bluegrass if there is appropriate time for establishment. Seed can be applied at 2-3 lbs. / 1000 sq. ft.
- Perennial ryegrass used in combination with Kentucky bluegrass if field needs to be used immediately. Perennial ryegrass can be ready for play within 4 weeks with aggressive management. Seed can be applied at 4-6 lbs. / 1000 sq. ft.
- High quality turf-type tall fescue blends applied at 8 lbs. / 1000 sq. ft.

Note: Seeding amounts are only suggestions. Depending on damage, affected areas may require increased amounts of seed / 1000 sq. ft.

Warm-Season Turfgrasses

Warm-season fields may be planted with seeded-bermudagrass cultivars; however more often fields will require sprigging or sodding for re-establishment. Surface cultivation should be used to prepare fields for seeding or sprigging. Rates for seeding or vegetative propagation:

- Bermudagrass seed can be applied at 0.5-2 lbs. / 1000 sq. ft. Depending on damage, affected areas may require increased amounts of seed / 1000 sq. ft.
- Bermudagrass sprigs can be applied at 400-800 bushels / acre. Sprigging rates of 1000 – 1200 bushels / acre can provide full cover in 28 days.

Once seeding or sprigging has taken place, keep the area moist during the first month of germination and growth. It is important to remember that the area should remain moist and not wet for successful establishment. Soil that is too wet or too dry inhibits seedling germination and sprig establishment. Water should be available as installed or portable irrigation.

Areas with extensive flood damage may benefit from sod. Sod can allow for play within three months if it is properly maintained on cool season turf fields. For bermudagrass a sodded field will likely be ready to play in 3-4 weeks at most, particularly if it is installed in the summer months. If flooding occurs during the season on a game field where resodding is the only option and budget allows, thick cut sod (1.25 in – 1.75 in) should be used. Thick cut sod allows for the field to be playable within hours instead of months. However, using thick cut sod may promote greater potential for layering between the sod's soil composition and the field's rootzone composition. Aeration may help alleviate layering, but may not be possible during the season due to weekly games or other events.

Pest and Disease Control

Weeds may pose a problem after flooding events due to flood waters depositing weed seeds on fields. On fields with little damage, preemergence and/or postemergence herbicides can be used to control weeds. If the field suffered moderate to extensive damage and needs to be reestablished, weeds may compete with germinating

turfgrasses. Fall seeding of cool-season grasses should not require herbicides. Seeding of cool and warm-season grasses during spring and early summer usually require some sort of weed control. Only a few herbicides are labeled for use at time of seeding, while several others can be applied after emergence of turfgrasses or after establishment (establishment defined as having two mowings). Always read product labels to ensure proper use, timing, and rates of herbicides being used.

Depending on the time of year the flood occurs, weather conditions may contribute to disease development. Hot humid weather in conjunction with saturated soil can create a perfect environment for diseases to develop. Scouting for diseases during recovery or re-establishment can prevent further damage. Select proper fungicides after proper identification of the disease and follow label directions.

Additional Considerations

Baseball/Softball Infields

Sediment must be removed from baseball and softball skin infields to restore proper drainage. Severity of the flood will determine the amount of contaminated infield soil that needs to be removed. Some infields may require two inches to be removed while other infields may require complete renovation. Thinner layers of sediment are easier to remove when allowed to dry and flaking occurs. Sediment can be removed using rakes, flat bottom shovels, or a box blade on a tractor. Once sediment is completely removed, new infield material can be incorporated and graded to the correct slope. The pitching mound may also need to be reconstructed and restored to the correct slope. Base anchors, foul poles, and the pitching rubber may need to be reset as a result of being washed away or offset by flood waters.

Synthetic Field

Synthetic turf fields are constructed of polyethylene fibers and various polymers which are not damaged when submerged under water for long periods of time. Major concerns for synthetic fields following a flood include insurance and warranty considerations, sediment and debris removal, carpet displacement, infill displacement and/or loss, contamination, and/or complete replacement.

– **Insurance and warranty considerations** – Damage to a synthetic turf surface is typically covered by insurance and secured with an insured warranty. Before conducting any remediation efforts, the insurance provider should be consulted to approve any effort and expenditure so the vendor warranty is not violated.

– **Sediment and debris removal** – Large debris can be removed by hand while smaller debris can be removed using a sweeper. Determine the best way to remove sediment. Some sediment may be easier to remove when wet; some may be easier to remove when dry. Although slow and tedious, sediment removal should occur as soon as possible. Equipment that can assist with sediment and debris removal includes the following:

- Tractor with box blade
- Utility vehicles with trailers
- Hand tools such as flat bottom shovels, brooms, and rakes
- Vacuum
- Sweeper
- Blower
- High pressure hoses

If sediment and small debris has infiltrated into the infill, a deep cleaning can be completed using a motorized brush vacuum. Following debris and sediment removal, drainage analysis should be conducted to ensure the field is draining at an adequate rate.

– **Carpet displacement** – During extreme flooding events, water can elevate the synthetic surface and result in wrinkles after the flood waters recede. The fabric will need to be stretched and maneuvered back into position. Professionals can usually manipulate the surface back into place within a few hours.



– **Infill displacement and/or loss** – Volume of water and speed of the current will determine the amount of infill displaced from a synthetic turf system. High flow rates will result in greater loss of infill material than stagnant water. Typically loss of infill is minimal, however the depth should be checked to ensure it is in compliance with manufacturer recommendations. Once infill has been restored to the proper depth, a Gmax analysis should be performed to evaluate surface hardness and ensure the field is safe for play.
– **Contamination** – Following a flood infill material should be tested using a contamination analysis to confirm there are no harmful contaminants present. Topical sprays are available to sanitize the entire synthetic turf system including the infill. Infill can also be removed, cleaned to remove contaminants, and placed back into the synthetic turf system.
– **Complete replacement** – Severe flooding events may require complete removal of the infill material and re-infilling the synthetic turf system. In some cases, a complete synthetic field system replacement may be necessary due to extreme flooding events.

Flash Floods

A flash flood is the rapid flooding of a low-lying area as a result of heavy rain, snowmelt, or collapse of a structure such as a dam. Flash floods are different from regular floods because they occur in less than six hours. Sports fields that may be prone to flash flooding should ensure storm drains and other drainage areas are accessible and not clogged.

When flash flooding occurs, efforts to push water towards drainage areas should be utilized. Keeping the water in motion keeps sediment and debris suspended and reduces the amount of sediment deposited on the field. Once the water is cleared, vacuums and sweepers can be used to remove small debris. A fine sediment layer may still present a problem. If the layer is too thin to be manually removed, soil cultivation and topdressing can be utilized to break up the sediment layer. Light films of sediment on leaf blades can be removed with soft broom drags or light irrigation.

Conclusion

As with all weather events, it is important to be prepared. Prior to possible flooding events, ensure the field is prepared to handle large amounts of water. For example, make sure storm drains are clear to help expedite drainage of the field. Have a plan in place for field clean up and be prepared to communicate with your crew, supervisors, and users. Preparing your field and facility for the worst can often reduce flood damage and clean-up efforts.

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