# After The Flood

BY **JEFFREY L. BRUCE, FASLA, LEED, ASIC**

*Editor's note: We were working with Jeff Bruce to develop a drainage story for the magazine when Hurricane Katrina hit the Gulf Coast. This article is based on his experiences before Katrina.*

As the recovery of the Gulf Coast begins, it is timely to discuss restoration of flood damaged athletic fields and sports surfaces. It is important to understand the impacts of flooding and related issues on field operations. The severity of a flood's impact on the playing field system will be highly variable based upon the length and degree of the flood event. Flood events will have three primary adverse impacts to the playing field system. These include turf inundation, contamination of the rootzone with silt, and contamination of the rootzone with residual chemicals or biological pathogens carried by the floodwater.

Any flood event has the potential to impact the performance of an athletic surface. Catastrophic flood events tend to cause more severe problems because damage to the community is more widespread, releasing chemicals and other contaminants. Any flood event could require some field reconstruction, particularly turf replacement. The size of the drainage basins where the field resides will affect the time of inundation. In small drainage basins flood events will generally be relatively quick and unpredictable (not allowing preparations to be made) but also short-term. Small drainage basin floods should be anticipated on a more frequent basis. Small basin flooding may last only a few hours or days. Typically these types of facilities will have a history of flooding.

In large drainage basins, the flood event while much less frequent could last weeks or months like the 1993 Missouri River flood. Large drainage basin floods will slowly build for days or weeks as the capacity of the basin is filled. As the capacity of the drainage basin is exceeded, floodwater will inundate the floodplain and low-lying areas. In larger basins, the turf manager has some ability to prepare the field surface for a flood event. The flooding of New Orleans was unique because it had the magnitude of


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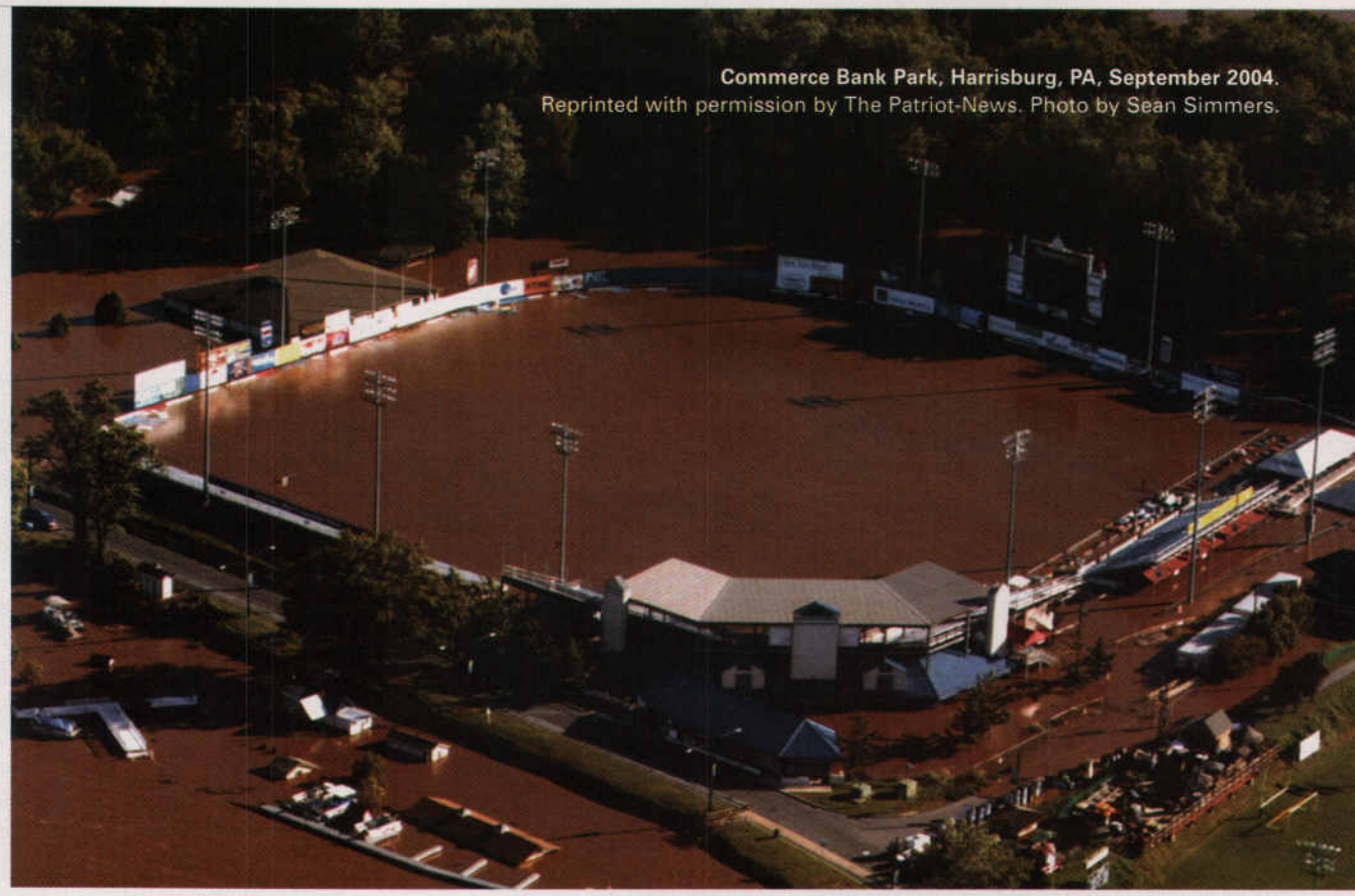

**Commerce Bank Park, Harrisburg, PA, September 2004.**
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a catastrophic large basin flood, similar to a small basin flood event; allowing no time for preparation.

The first step after a flood event of any duration is to conduct an assessment of the field surface immediately after the floodwater has receded. Photo documentation will provide valuable evidence for insurance claims. Be sure to diligently document the site, noting every detail. We have found you can never have too many photos when you need them. On a site plan, identify extent of turf damage, depth of silt deposition and any grade irregularities as a result of scouring. Check for unusual chemical or biological odors or oily sheens on the surface of the residual silt. This could be evidence of chemical contamination, which may require special remediation. Two composite soil samples should be taken on the field and sent to a lab for analysis.

The first sample should be a composite of 10 to 20 random locations of the silt deposited on the surface of the field. This sample should be sent to the testing lab for a relatively broad screening of chemical and biological contaminants. The chemical and biological screening will provide an indicator of the types of containment present and the relative concentrations. Knowing the composition of the problem will help in defining a mitigation plan for field restoration.

A second sample, with a similar frequency to the first, should be taken of the original growing media. Carefully cut and remove the turf to expose the soil surface and sample the top one to two inches. Be sure not to mix or contaminate the growing media with any silt deposited on the surface from the floodwater. This will distort the results of the test. Have the testing laboratory conduct a particle size analysis (PSA) test on the composite sample. The purpose of this test is to compare the composition of the growing media before and after the flood event to determine if the soil has been contaminated below the turf surface. Look for shifts in particle size or changes

in the infiltration rates of the growing media. Be aware that small changes in the silt and clay content of a growing media can dramatically change infiltration rates. If the test results of the deposited silt show high levels of contaminants, more extensive chemical or biological screening of the growing media may be necessary to determine to what extent the containment may have migrated into the growing media.

Inundation of the turf is the simplest problem to correct. Depending upon the species, turf can withstand inundation for approximately three to five days, after which the turf will die from a number of physiological problems. Flood events with durations of over 5 days will typically require replacement of the turf. In most cases the playing field would be ready for athletic use within six to eight weeks after sod installation. Once the turf is removed, typical field restoration activities such as grade restoration and protection of utilities occur as normal.

Contamination of the sand based growing media with silts and clay particles carried by the floodwater is a more serious problem. Deposition of silts and sediments on the playing field surface will seal the sand-based rootzone, seriously degrading the system's internal drainage. Depositions of silt as little as one quarter of one inch can contaminate the soil structure, so replacement of the sod is necessary in these situations. Silt deposition is greatest in areas of low water movement, which allow the silt to fall from suspension. Edges of the field will slow water movement and create a condition ideal for silt deposition, so it is a primary concern in this situation.

One preparatory practice that could be considered to reduce flood damage is to lightly roll the field with compaction equipment, as a potential flooding event becomes apparent. This would make the thatch layer in the turf system compress together and act as a sort of barrier to the downward movement of the silt into the rootzone. The thatch layer could then be stripped off after the floodwaters have receded, and small amounts of silt may be removed from the field using this method. Vertical mowing, power raking and verticutting are effective methods of removing silt-laden hatch. These activities should occur while the thatch still has some moisture content. If the thatch is too dry the silt and clay particles will not adhere to the thatch and fall further into the soil when agitated.

Even with small amounts of deposited silt, there is an added possibility of contaminating the rootzone during sod replacement activities. Deposition of larger amounts of silt would probably require field reconstruction. After the flood event, the silt and sediment contamination levels can be assessed through soil testing. The test results can be compared to soil tests before the flood event. In most cases the turf and thatch will act as a filter, trapping a majority of the silt particles. However the sand based growing media will also act as a filter, trapping silt and clay in the top inch or two. If testing indicates contamination of the growing media, it may be possible to remove the top inch of the growing media and capture most of the contamination. Sampling the growing media at various depths may provide a clear picture on how much growing media needs to be removed.

The most difficult and possibly most dangerous problem to address regarding a flood event is the contamination of the rootzone with residual chemicals or biological pathogens carried by floodwaters. Floodwater will often contain varying levels of nutrients, heavy metals, stable organics, phenyls, distillates, pesticides, chlorinated hydrocarbons and other chemicals that are toxic not only to the turf, but could be hazardous to individuals who might come in contact with them. While the Environmental Protection Agency (EPA) establishes safe soil and water thresholds for many of the contaminants, an athletic field constitutes a unique risk which may not be recognized by the EPA thresholds. An athlete has much more dermal contact with the field surface and because of that increased contact it is reasonable to assume they require lower thresholds. When chemical contaminants exceed recommended EPA thresholds the rules of the game change dramatically. Construction and restoration activities are subject to a number of environmental regulations in areas such as disposal of materials, disturbance of the site, protective clothing required to be on-site, and handling of contaminated materials. At this point, it is prudent to restrict access to the site and seek professional help on how to mitigate the problem.

Catastrophic flood events that result in the loss of human and animal life provide an ideal environment for the growth of dangerous biological pathogens. Severe flooding also damages sanitary systems releasing sewage into the floodwater. High nutrient loads, aqueous environments and warm temperatures contribute to an explosion in microbial and bacterial populations. Biological pathogens monitored by the EPA include total coliforms and E. *coli*. In themselves, coliforms generally do not pose a danger to people or animals, but they indicate the presence of other disease-causing bacteria, such as those that cause typhoid, dysentery, hepatitis A, and cholera. A much more detailed discussion of about chemical and biological pathogens can be found at www.epa.org.

Fortunately nature grass fields contain biological activity which will process and mitigate harmful pathogens. The natural activity can be used to restore growing media health. Under most circumstances chemical and biological contamination will be confined to the top three inches of the growing media. Removal of the field surface will go a long way in restoring the health and productivity of the growing media. Just remember handling and disposal of the material removed may be regulated.

The most efficient tool in restoring flood damaged athletic facilities is pre-planning. As a precaution, the turf manager should maintain a list of pre-qualified sod farms that meet the desired field specifications so that, in the event of a flood, approved sod could be procured quickly. As with all catastrophic events, there should be a disaster recovery plan for managing and recovering the damaged turf.

Recovery from a flood event is never fun, but with a good plan, systematic documentation, detailed testing and a lot of hard work it is possible to return the athletic facility to its intended programmed use while ensuring everyone's safety. ST

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