



There's not much help out there for local officials faced with questions about the placement of temporary structures in special flood hazard areas. Let's start at the beginning and then take a look at how a small community just outside Denver handled a uniquely challenging proposal to host a major temporary sporting event in its floodplain.

What is a "temporary structure"? Examples of structures that are likely to be placed for a short time could include produce stands, booths at fairs and festivals, snack bars in waterfront parks (although food trucks are more likely these days), viewing stands, and the like.

The National Flood Insurance Program doesn't define the term explicitly, but does define "development." All NFIP-participating communities should have the same definition. For the purpose of this column, I only need to look at the beginning of the definition: "any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures"

The NFIP definition refers to buildings and other structures. It doesn't specify permanent buildings or permanent structures, nor does it specify temporary buildings or temporary structures. Thus it refers to all buildings and all structures, regardless of whether they're permanent or temporary.

Next, let's check out the International Codes® (I-Codes®). While the term isn't defined, Chapter 1 of the International Building Code and International Residential Code authorize building officials to issue permits for temporary structures and temporary uses that are "limited as to time of service, but shall not be permitted for more than 180 days."

Why should we regulate temporary structures? Now that we know what they are, this is the next question to answer. If they're only in place for such a short time, surely we don't have to be worried about the very low probability of a flood occurring in such a short time period? And, given the nature of most temporary structures, surely we don't need to worry about flood damage to the structures themselves. Plus, they're not occupied, so there's no real risk to occupants, right?

While I can see the logic behind some of those questions, the wiggle room to make those decisions isn't provided in the NFIP regulations that require communities to regulate development in SFHAs. Plus, not regulating temporary buildings would ignore other possible consequences, primarily the debris that would likely be added to floodwaters. Flood-borne debris batters buildings and contributes to damage. If you've seen a local bridge or culvert jammed with debris, then you know debris contributes to scour and failure of road crossings.

Plus, a bridge or culvert blocked with debris such that floodwaters back up can increase the depth of flooding and affected area over the conditions that were likely assumed when the SFHA was delineated. That means property that, based on a FIRM, lies outside of the SFHA could be affected by increased water levels. I was told long ago that if a person or entity's actions are shown to increase damage, that person or entity may be found liable for the increase. Would that principle apply to a community that decides not to regulate temporary structures if those temporary structures – or pieces of them – block a bridge or culvert causing increased damage over free-flowing conditions?

What requirements apply? The next question is what requirements apply to temporary buildings and structure. I searched several NFIP guidance documents and didn't find anything specific. That leaves me with the general performance statements in [44 CFR 60.3\(a\)\(3\)](#).

The I-Codes specify that temporary structures and uses “shall conform to the structural strength ... requirements of this code as necessary to ensure public health, safety and general welfare.” Again, not much to go on.

While most states and communities do not adopt IBC Appendix G, it does have some specific requirements (remember, FEMA deems the flood provisions of the I-Codes to meet or exceed the NFIP requirements): “Temporary structures shall be erected for a permit of less than 180 days. Temporary structures shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the design flood. Fully enclosed temporary structures shall have flood openings *that are in accordance with ASCE 24* to allow for the automatic entry and exit of flood waters.” The italics indicate a change in 2015. The code also specifies that “temporary structures and temporary storage in floodways shall meet the requirements of [floodway encroachment].”

To summarize, I think the most effective action for temporary buildings and structures is anchoring to prevent flotation. But I've learned recently that the concept of a temporary structure or two in any given SFHA is a far cry from what officials at the city of Cherry Hills Village, CO, had to grapple with not long ago.

Told from the point of view of Troy Carmann, who was involved, what follows is the story about how Certified Floodplain Managers and other professionals with the city, local golf course, and tournament organizers worked together throughout the planning and permit process. The result was a successful event compatible with the city's floodplain management and open space objectives.

Cherry Hills Village, CO: A Case Study of Temporary Structures

Cherry Hills Village, a predominately residential community of approximately 6,000, has taken many steps to preserve its rural character despite being adjacent to an otherwise densely developed metropolitan area. The city participates in the NFIP and the Community Rating System (Class 8) and cites its floodplain regulations as helping to protect and preserve valuable open space. Enforcing a no-rise requirement in all SFHAs, not just floodways, has been particularly effective at guiding development to other areas.

In late 2012, it was announced that a major golf tournament would be held on a course located at the confluence of Little Dry Creek and Greenwood Gulch. It turns out the event would also be at the confluence of floodplain development and beneficial use.

Although the city's floodplain requirements and permit processes are clear and concise, tournament organizers engaged experienced professionals (including CFMs), to manage the process. Initially conceptualized as a few tents along the golf course, the city quickly realized the event would involve many temporary structures such as large grandstands, including some located in the floodway. Add in portable restrooms, vendor tables and tents, trash cans, spectator fencing, television podiums, security and emergency service tents, and it became clear: a different approach was needed to regulate this SFHA development.

Recent Historic Flooding. Just six months after planning started, Colorado's largest and most costly flood occurred in September 2013. Most people in Colorado expect flooding from spring snowmelt and rainfall

or summer monsoons, so the early fall prolonged torrential downpours were surprising. The CFMs on the planning team knew the statistical likelihood of that kind of event occurring again was small, but we're trained to manage low probability events. We had to acknowledge the tournament would bring a lot of temporary development, along with 20,000 spectators, into two floodplains just one year after the historic floods.

Scope of the Tournament. Most of the early planning focused on the week of the tournament: public safety, parking, transit, vendors, and an assortment of other issues that go along with any major week-long event. During an early 2014 meeting, we learned construction crews would mobilize in June. That's when we really focused on what we needed to do to regulate development that would be in place for more than three months.

Identifying and Evaluating Impacts.



Photo (above) shows one of the temporary structures built in the floodplain needed for the golf tournament. Photo courtesy of Patrick Timson of the Western Golf Association.

Our consideration of impacts on the floodplain was made easier because we had good hydraulic models prepared by the Urban Drainage and Flood Control District, a FEMA Cooperating Technical Partner. Using regionally-coordinated LiDAR mapping and updated site specific ground survey data, engineers for the tournament planner demonstrated the existing-conditions model correlated well with the model used to produce the effective FIRMs published in 2010. This is clear evidence of the city's effective floodplain management and land use regulations over the past several years.

Next, to evaluate impacts we had to decide how to classify the development given some structures would be in place for more than three months. The most significant temporary structures were the aluminum grandstands founded on drilled piers with accessible ramps and some air conditioned tent areas. Semi-rigid skirting around the bases obscured the superstructure while offering a surface for highly visible sponsor advertising.

One CFM mentioned recreational vehicles are allowed in SFHAs if placed for no more than 180 days. But RVs must be highway-ready and self-propelled or towable by light-duty trucks (the implication is RVs can be moved when flooding is anticipated). Given the nature and scope of the facilities planned for the tournament, we knew moving everything out of the way of a fast moving Colorado flood was impractical. In the end, despite the "temporary" nature of the facilities, we decide the best course of action would be to evaluate hydraulic impacts as if the structures were permanent.

The tournament planners gave us a layout that identified all of the proposed obstructions which meant we could use the hydraulic model to run scenarios to gauge impacts. One concern was the rigid skirting surrounding the base of the grandstands. The skirting and attachments are designed to withstand significant wind loading. Thus, we assumed it was likely to remain in place even under some level of hydraulic load. Consideration of requiring removal of the skirting if flooding threatened was short lived because the material would have to be moved to high ground, otherwise it would become debris. During one long planning session, we briefly considered a possible sponsor message, "This skirt-less, open frame grandstand brought to you by Colorado's Flood Safety Professionals." In the end, we decided to represent the skirted grandstands as structures that block conveyance. The hydraulic modeling, as expected,

indicated there would be BFE increases exceeding the city's no-rise criterion and the increase would extend over several cross sections along the waterways.

The CFMs convened again to examine the areas where the modeling predicted increases. The golf course property is a large swath of land, including considerable areas outside of the SFHA. We decided if the rises are confined to the the golf course, it might be acceptable to allow a temporary increase. But we didn't stop there.

Evaluating the Impact of Debris. What about all the trash cans, portable restrooms, vendor tents and tables, and many other components, all likely debris in the event of a sudden flood? If all that debris was trapped on the course's downstream perimeter fence, would it obstruct flow enough to cause additional increases in BFE that could affect adjacent property owners? To get the answer, we first had to estimate the likely quantity of debris, which we did using procurement records from past tournaments and the proposed plans for this location. We used the results to model blockage at the cross section at the downstream fence line. Luckily, although the model showed additional rise in BFE, all of the impact was still confined to the golf course property. As part of the city's final approval, the golf course owner acknowledged BFE increases were anticipated and accepted the risk of damage on the property.

Next we turned our attention to the 24-foot-wide, 12-foot-high bridge downstream of the golf course. If the total volume of potential debris we estimated actually got to the the bridge, the backwater increase would undoubtedly adversely affect adjacent private property, perhaps even some homes. However, in the 1,500-foot reach between where most of the tournament development would be located and the bridge were the perimeter fence, a heavily vegetated floodplain and the tree-lined channel, which made it difficult to extrapolate the volume of debris that might actually make it to the bridge. Detailed discussions on debris, blockage, yield strength of fence posts, and other flood dynamics were short-lived. We determined it unlikely the bridge would be significantly obstructed. In hindsight, is there liability if permitted floodplain development contributes floatable debris that may increase downstream flood impacts? Should we have required anchoring for hundreds of trash cans, vendor tables and tents, portable restrooms, and everything else? To what specifications? Given the city's small staff, would inspection have been feasible?

Safety of Spectators and Tournament Personnel. Most of what CFMs do is regulate SFHA development, checking for compliance and potential damage. But, with the previous year's historic flooding in mind, we also considered public safety. The high points of the Little Dry Creek and Greenwood Gulch watersheds are only two miles from the golf course, which means there's very little lag time between heavy rainfall and onset of high water. Tournament organizers explained that spectators quickly leave when rain begins and the site would likely be vacated completely early in a storm severe enough to cause out-of-bank flooding. Given the detailed plans for evacuation required by the state fire marshal, we decided the matter of public safety during flooding was addressed.

Conclusion. The floodplain development of temporary structures for a major event pushed the applicant, event organizers, and the city into tight corners of the NFIP regulations and city ordinances. Ultimately, the application, evaluation, and event were successful. The floodplain hosted as many as 20,000 people a day to enjoy golf with a backdrop of Colorado's best mountain views. And, granting a mulligan for one rainy evening, the hydrologic cycle cooperated perfectly.

Submit your own items or suggestions for future topics to column editor Rebecca Quinn, CFM, at rcquinn@earthlink.net. Comments welcomed!