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Atlanta's Flood of Sept. 21, 2009 — Lessons Learned and NAI Discussion

by Cole Shaffer, CPCU, MIM, ARE, ASLI, AIAF

Abstract

Flood damages are increasing in frequency and severity around the world. On Sept. 21, 2009, Atlanta, Ga. experienced a catastrophic flood that went down in the history books as one of the most severe in recent U.S. history. Atlanta's CPCU members formed a research committee to study the causes, damages, aftermath and lessons learned from this tragic event. Using best practices of floodplain mangers, the article examines the seven building blocks of "No Adverse Impact," discussing shortcomings in watershed management practices and proposing some long-term solutions to the steady rise in flood damages of recent years.

Author's Note:

This article is intended for informational purposes only. It is not intended as legal, technical or financial advice.

Introduction

The amount of rainfall that fell from the sky in Northern Georgia on Sept. 21, 2009 was astronomical in scale and took Atlanta by complete surprise. It is ranked as one of the great weather events in recent history and happened in a way that few had predicted and far less had prepared for. In March 2010, hundreds of flood experts converged in Atlanta to discuss September 21 at the Georgia Association of Floodplain Management (GAFM) 5th Annual Technical Conference. Workshops and lectures were held on the seven building blocks of No Adverse Impact (NAI) — a set of managing principles developed by the Association of State Floodplain Managers (ASFM) to address shortcomings of typical local floodplain management. We will use NAI best practices as a framework to review the lessons learned in Atlanta and discuss the latest ideas and opinions of flood plain managers, engineers, attorneys and scientists to better prepare ourselves for future floods which promise to be swifter, deeper and cause greater damage and human suffering.

There is no question that flood losses are increasing in frequency and severity in the U.S. and around the world.[1] The upward trend is continuing in 2010, as witnessed by the devastating floods that have already taken place in Providence, R.I. and Nashville, Tenn. to name but a few. These floods have many common causes and characteristics, and in most cases are truly manmade disasters — both predictable and preventable. Let us begin our story of lessons learned in Atlanta by first dispelling some myths about our own big storm.

10,000-Year Storm

The western suburbs of Atlanta, Douglas and Cobb Counties received upwards of 20 inches of rain in a 24-hour period. Considering average rainfall in our area is 55 inches per year, we received close to half that amount in one day. Significant amounts of 8 to 14 inches also fell over Gwinnett, DeKalb and other metro counties. The entire region got drenched. Statistically, this amount of rainfall is off the charts. The media reported it was a 10,000-year event, yet most scientists consider this a meaningless number. The U.S. Geological Survey's (USGS) largest storm is a 500-year event. Brian McCallum of USGS explained that the confidence level of the statistical distribution is just too low to be reliable. Scientists have only been gathering rainfall data for about 120 years, and to extend estimates beyond a 500-year event is iffy at best. However we measure it, the downpour caught everyone off guard which begs the question why were the forecasts so wrong?

Weather Forecast

The midnight shift at the National Weather Service (NWS) was not forecasting 20 inches of rain for September 21, or for that matter, even half that amount. John Feldt of the NWS laid out the scenario. It had rained heavily for days leading up to the flood and the ground was completely saturated. It was early fall and the NWS was geared up for tropical weather patterns: downgraded hurricanes moving in from the Atlantic and Gulf coasts, and occasionally from the west, the remnants of a pacific storm. Preparation times are typically days if not weeks in advance. But this was an extremely rare event, one that the NWS could not predict with current computer modeling technology. It did have some tropical features. There was near record moisture in the mid and upper atmosphere due to the remnants of Tropical Storm Marty that rolled in off the California/Mexico coast, and also low level moisture from the remnants of Hurricane Fred in the Atlantic that had slowly worked its way north. At the same time a front was moving into the area. All that was missing was lift to create a storm of cataclysmic proportion. The lift came in two forms. First, large scale synoptic lift associated with a weak boundary that formed off the Jacksonville/Savannah coast moved into the higher elevations of Atlanta pushing all that moisture into a very small area. Secondly, focus lift from local topographical features enhanced and funneled the moisture into an area just west of Atlanta. The result was a sudden event that stretched forecast models to their limits. Like twisting a soaked towel, the rain poured from the sky. There was little time for preparation and nothing anyone could really do except get people and property out of harm's way as soon as possible.

We know our weather forecasts are not always spot on, but what about the river and stream forecasts? Why were they off the mark too?

Flood Forecast

According to John Feldt (NWS), major flooding was predicted for the entire area but not the flood of biblical proportion that was to come. River and stream forecasts depend heavily on weather reports and to get it right, forecasters had to know that 20 inches of rain was on the way (something they had not seen since the remnants of Hurricane Alberto in 1994) and pinpoint exactly when and where it would land. Further complicating the forecast was that two different kinds of floods were merging together. Flash floods associated with urban runoff were merging with traditional river flooding to create record high conditions. In the City of Austell, Ga., water literally poured in from all directions. The worst flooding occurred directly in the path of the heaviest rains. Fortunately for LaGrange, Columbus and other cities downstream, the floodwaters attenuated quickly. The science of river forecasting today is similar to what weather forecasting was 20 or 30 years ago. More long-term research is needed to push flood warnings and lead times out with greater accuracy. When the rain finally ended and waters receded, the amount of destruction left behind was shocking.

Damages

President Obama declared 17 counties federal disaster areas and made them eligible for Federal Emergency Management Agency (FEMA) aide. The interstate highways became rivers, railroads were underwater and even Six Flags roller coasters and the Great American Scream Machine were submerged in acres of standing water.[2] Tragically, most of the fatalities occurred in cars. There were at least 10 flash flood deaths. A baby was swept away in a mobile home park and seven were drowned in their vehicles attempting to drive through water. Two others drowned in a river and a pond.[3]

Freelance meteorologist Melisa Tuttle-Carr reported that all told, there was $500 million in damages. Forty percent of homes in the City of Austell were

Cole Shaffer, CPCU, MIM, ARE, ASLI, AIAF, *is a reinsurance claims examiner living in Cumming, Ga. He earned his MIM at the American Graduate School of International Management and has worked 25 years in the field of reinsurance claims and accounting most recently as Team Leader at AonBenfield Fac. Inc. Cole has been active in the CPCU Society South Florida and Atlanta Chapters serving on the Board of Directors.*

Other members of the Atlanta CPCU Research Committee are Chad Boatright, William Feldhouse, Deloris Lansche, Rodney Parker, Craig Stevens and Harold Weston.

significantly damaged or destroyed, 300 roads were closed (or destroyed) and hundreds of citizens were rescued by boat, many from the second story of their homes. According to data sent to us by the National Flood Insurance Program's (NFIP) "Ask the Expert," a total of 5,884 flood claims were filed by homeowners and businesses at an average cost of $17,000 per claim. FEMA's recovery efforts alone have now surpassed the $100 million mark. This compares to flood damages of only $12 million (1,650 claims) paid in the whole State of Georgia from the period 2003 to 2007! More than 27,000 families, businesses and individuals registered with FEMA. Emergency officials completed more than 23,000 substantial damage inspections and hauled away 150,000 cubic yards of debris. We asked FEMA how many substantially damaged homes were located outside of the designated flood plain. They don't keep records of that but to give you an idea of the problem, Terry Turner of GAFM pointed out that volunteers made substantial damage determinations on 720 buildings and found that more than half (392) were located outside of floodplains. These were only the substantially damaged buildings. Thousands of other buildings suffered minor flooding. This is something no one expected. The homeowners and business owners we interviewed were still in shock and disbelief even months after the storm.

There was a massive outpouring of help from the community; individuals, private and charitable organizations donated millions in cash, goods and volunteer services. Atlanta was in desperate need of assistance. Many fortunate enough to have purchased flood policies discovered their limits were inadequate or that dwellings could not technically be elevated to meet the minimum flood base elevation required for building permits. Untold numbers walked away from properties as the triple whammy of paying for temporary housing, maintaining existing mortgages and job loss from the deep recession hit home. Buildings sat rotting from the inside out waiting in vain for government grants and repurchase programs.

Businesses and public entities fared little better. We asked claims adjusters Joel Steber and Chris McCoy (Engle Martin and Associates, Inc.) about their experiences. They pointed out that the costs of mold remediation caused by the standing water, heat and humidity had become a huge problem, escalating costs way beyond commercial policy limits. There were also the familiar overcharges for labor and materials by shady contractors that seem to follow disasters everywhere.

After the initial shock had worn off and the slow process of rebuilding and putting lives back together had begun, we asked how we could objectively measure what had happened. What criteria or benchmark could we use to understand and explain the causes of so much destruction? Was this just a freak storm or the beginning of more to come? We turned to the best practices of our floodplain managers for answers, to the concepts of No Adverse Impact.

No Adverse Impact

No Adverse Impact (NAI) principles are similar to risk management processes that CPCUs are familiar with — the identification, assessment and prioritization of risks and efforts to minimize, monitor and control their impacts.[4] The goal of NAI is to ensure that the actions of any community or property owner do not adversely impact the property rights of others. This means that any adverse impact or harm caused by a project to other property owners, such as excessive run-off causing a neighbor's property to flood, must be mitigated. The seven building blocks are (1) Hazard Identification and Floodplain Mapping, (2) Education and Outreach, (3) Planning, (4) Regulations and Development Standards, (5) Mitigation, (6) Infrastructure and (7) Emergency Services. We recommend reading the Association of State Floodplain Managers (ASFM) NAI Tool Kit and Community Case Studies publications for a complete description of NAI and how it has been used to deal with flooding issues in cities around the country.[5]

Each building block has three levels of effort, starting with the lowest "BASIC" (the minimum requirements of the NFIP), progressing to "BETTER" (increased measures of protection, some mandated by law, containing elements of mitigation) and finally the highest "NAI" (reducing floods through planning and buy-in by stakeholders).

We think that Atlanta reflects the same flood problems as many big cities throughout the country, mindful that regional differences exist as to laws, local habits and geography. By examining each of the building blocks and comparing them to best practices, we can easily see the issues and why our flooding continues on the rise.

Hazard Identification and Floodplain Mapping

Everyone's first reaction to the catastrophe was to point at FEMA's Flood Insurance Rate Maps (FIRM) as the culprit. If we can't properly identify the hazards, how on earth can we prepare for them? The bewilderment was shared by our politicians and citizens alike. At an April 2010 roundtable discussion sponsored by the CPCU Society Atlanta Chapter, in which all candidates running for the office of State Insurance Commissioner were invited, each candidate harped on the need for better maps. But wait a minute! Didn't Georgia just complete an expensive statewide map modernization project in 2008? Why were the new maps so wrong? We investigated this but it didn't take long to find the answer. The federal and state governments have only limited funds and use the same standardized digital mapping techniques for nearly 20,000 communities across the nation. One size fits all mapping is not appropriate for the unique flood hazards found in every community.[6] Better maps are in the works but will be years away for many communities. In 2010, FEMA began transitioning to a new mapping project called Risk MAP. Using high resolution mapping data and other techniques, Risk MAP is intended to supplement traditional mapping efforts by identifying, assessing, communicating, planning, and mitigating flood exposures.

In spite of these federal and state government programs, it is ultimately the responsibility and we believe the moral obligation of each community to decide the level of safety provided to citizens and how much to invest in maps. Our values tell us we can no longer look the other way and ignore facts and warning signs in our development practices. Engineers knew with absolute certainty the levees would not hold in New Orleans, yet thousands were killed in Hurricane Katrina. Thousands more could perish on Miami Beach or Sacramento. In Atlanta, we know that approving projects without identifying and mitigating all the impacts will cause more flooding and human suffering. We have many options. Our communities can become more active participants with FEMA in the mapping process through the Cooperating Technical Partners Program. On the other hand, we can invest in additional studies out of our own pockets to save lives and protect the property rights of our citizens.

NAI options focus on improving map deficiencies; namely, (1) the maps are outdated, (2) they underestimate the size of the floodplain, (3) they do not prevent increase in flood damages, (4) they do not consider changes in streams, and (5) they do not show areas of coastal erosion.[7] Let's compare a few of these deficiencies with what happened during our storm.

Maps are often outdated when adopted due to the long mapping process itself. Dave Carlton (PBSJ Corp.) and Chad Berginnis (Michael Baker Corp) advise it is best to look at flood maps as snapshots in time. They show existing conditions of flow based on historic data and engineering calculations but do not take into account climate change, changes in land use and development up and down the watershed. One way to test for accuracy is to compare the stream gauge and high water marks against the maps themselves. Mapping specialist Duncan Hastie (Dewberry Corp) worked on this,

sampling the Chattahoochee, Sweetwater and Powder Springs Creeks for variances during and immediately after the storm. The Chattahoochee maps were surprisingly accurate. There were variances in either direction. In contrast, the Sweetwater and Powder Springs comparisons were far off the mark. These findings tell us we cannot view our flood hazard as a line drawn on a map. One should consider the whole map as a floodplain, not just the shaded areas. Everyone is living in a floodplain of one form or another, be it a 1-year, 5-year or 500-year flood plain. Atlanta has been home to the fastest growing counties in the nation for the past decade, and the relentless economic expansion continues up and down the I-75 and I-85 highway corridors. This exploding growth especially in Forsyth, Cherokee, Henry, Cobb and other counties makes local investment in maps a condition precedent for the protection of private property rights and safety of citizens. The flood taught us to rethink the hazard identification process. Our counties have passed some new laws and mandated studies of our floodplains but have we gone far enough? Shouldn't all of our most vulnerable communities now become Cooperating Technical Partners with FEMA? Perhaps our county commissioners should be listening more closely to the advice of legal counsel regarding community liability to make these decisions. Legal expert Ed Thomas (Michael Baker Corp.) has studied the legal consequences of maintaining the status quo or taking only minimal actions to identify hazards in our development practices. Engineering studies and computer models can now predict how much flooding will occur on a parcel of land when a given amount of rain falls from the sky. These studies are used to show proof of causation in the courtroom and are changing the way Georgia's courts see liability issues. Forensic hydrologists are chipping away at the Act of God, Government Immunity and other traditional defenses. It is no longer sufficient to say that we didn't know of the risk when the real issue being presented before the jury is that we should have known and done something about it. According to Thomas, the old saying you can pay me now, or you can pay me a lot more later may well turn out to be the greatest lesson learned.

Another deficiency is that the maps don't reflect changes in streams over time due to natural conditions and, more importantly, man made changes to the floodplain. What did we learn about stream behavior during the storm? Brian McCallum (USGS) reported on the performance of 313 real time stream gauge stations throughout the state, including a large cluster located around Atlanta. These measurements play a central role in just about every aspect of our lives — from flushing toilets and building bridges to issuing emergency flood evacuation orders. Two-thirds of these critical instruments have rain gauges attached to them, 50 have continuous water quality monitoring, and all transmit hourly and every 15 minutes when flood thresholds are exceeded for emergency warning purposes. They were calibrated to withstand a 200-year event, which was thought to be close to the worst-case scenario. The day of the flood, more than 15 gauges were underwater. Sweetwater Creek is an example of what happened. Melissa Tuttle-Car visited Sweetwater during the storm and explained that it normally runs one to two feet and is a very low creek. Flood stage is 10 feet and the forecast crest for that day was 21.21 feet. The previous record high was 21.8 feet during the remnants of Hurricane Dennis. The stream gauges went out at 18.21 feet as water was still rising. They came back on line at 30.71 feet, which was later confirmed by high water marks. In all, 65 new high water marks were established along Sweetwater Creek. Amazingly, by the following day, all stream gauges from Columbus over to Augusta and northward were setting new daily records. It rained so hard that changes to the natural landscape on the watershed were completely drowned out. Gauge data indicated that converging out toward the 500-year flood and beyond, the effects of urbanization (increased impervious surface and reduction of overbank storage) were almost nil. Pastures turned into impervious areas washing directly into streams. Rivers and tributaries such as the

Chattahoochee, Yellow, Dog and Snake rivers were recording 500-year floods and well beyond. Tom Woolsey (Georgia Safe Dams) reported that Lake Lanier, the second largest lake in the Southeast, which had recently been at all time lows due to a four-year drought, shot up more than four feet in one day. The Corps of Engineers estimated that had it not been for Lake Lanier and the Buford Dam, the Chattahoochee would have crested at the highest flood levels ever recorded. Lake Allatoona, the second largest in metro Atlanta went over full pool. The Corps estimated that but for its dam, the City of Rome would have been underwater. The lessons learned from the gauges were that extra expense and investment in upgrades to higher rate transmitters paid off but there were delays with deployment of replacement equipment and confusion at emergency management regarding how real time data was presented, especially when gauges stopped working and were underwater.

The Insurance Commissioner candidates are right, better maps are needed but this is only part of the solution. We need to recognize their limitations and supplement them with best hazard identification practices. Not unlike a good risk management program, the NAI building blocks are interconnected and must become part of our community's culture over a long period of time. Only when we correctly identify our flood risk can we begin to do a better job communicating it to the public.

Education and Outreach

Atlanta is struggling at a basic level of effort with regard to community education and outreach. How do we change widely held community attitudes such as "I don't need flood insurance because I don't live in a flood zone," and direct behavior toward a culture of mitigation? We considered our options, and believe that better training of our community professionals (insurance agents, real estate agents, floodplain managers, elected and appointed officials. ...) is the highest priority and best long-term solution.

Our education and outreach strategy needs to reach all of society. However, our professionals can spread best practices faster and more effectively than federal government agencies. Educating them is the best use of our limited funds. These are the people we count on for good advice and sound decision-making when it comes to protecting our families and property. So the question becomes how can we convince people like City Commissioners who rotate in and out of office every four years to embrace floodplain best practices? Furthermore, what can we do to ensure our professional community is working on solutions and not just becoming another part of the problem?

We can accomplish these things by raising the bar for professional licensing and mandating more continuing education. As a professional insurance association CPCUs hear the same theme over and over again from members — education and awareness are the keys to change! Many agents don't have the technical skills needed to correctly write flood coverage. Mistakes can be costly, especially in the highly technical area of the Write Your Own Flood program. How many agents do a good job explaining deficiencies of maps and base flood elevations (BFE)? Ed Thomas points out that the confidence interval used by FEMA in calculating the (BFE) estimate is only 50 percent. Half the time it will be right, the other half wrong. That may be OK, at least from an underwriting point of view. BFE calculations do not have to be 100 percent accurate all of the time; spread over many risks, the rating process will hopefully work out in the long run. In contrast, for a typical homeowner or business a good technical understanding of the risk factors could mean the difference between purchasing a policy or not.

FEMA has teamed with The Institutes to make more education available to agents, underwriters, risk managers and others involved with the flood risk. According to Connor Harrison (IIA), FEMA approached them in 2008 expressing the need for a higher level of technical training than was previously available through continuing education courses. This led to a new professional designation — the Associate in National Flood Insurance (ANFI). Beginning in 2010, insurance professionals can earn the ANFI by passing exams based on NFIP publications "Flood Insurance Manual," "Mandatory Purchase of Flood Insurance Guidelines Booklet" and an Ethical Guidelines for Insurance Professionals course. The designation recognizes a level of mastery in the highly technical area of flood insurance.

For our elected officials, how can we expect them to make informed decisions without special training? The Association of County Commissioners of Georgia (ACCG) in partnership with the University of Georgia requires mandatory training for all new commissioners when they take office. Additional training is available with elective courses in Capital Improvements, Emergency Management and Environmental Management. The advanced program has electives in Managing Growth, Negotiation and Strategic Planning.[8] These programs have been highly successful in educating more than 2,500 commissioners since inception. According to Carol Baker (ACCG) the coursework is becoming more technically oriented since the program's inception. We think it could be expanded as only the basic courses are currently mandatory. The advanced concepts and electives need to be part of every commissioner's forte.

What about outreach to the general public? We asked what people were doing as the flood waters were rising. Unbelievably, too many were driving right through three feet of water indifferent to the dangers all around them. Didn't they see the danger? Melissa Tuttle Carr is studying these behaviors. She advises that their risk tolerances are different than ours. They might have been through similar floods in the past. Perhaps some were desperately trying to pick up a child from school, grab some last minute groceries or any number of perfectly legitimate reasons at least in their own minds. Outreach must communicate risk in ways we can all understand. Our professionals can do the job best. For example, realtors working on behalf of buyers should warn that by living in the floodplain there is a 26 percent chance of experiencing a flood over the life of a 30-year mortgage. Insurance agents must warn that the odds of a flood in the Special Hazard Zone are 27 times greater than that of a fire over the same period.[9] We do not understand our risks, nor buy insurance or take other steps to mitigate them. Worse yet is we are buying only minimum coverage; only what the lender requires of us and we typically skip contents coverage.

When the public learns that they can save money by adopting best practices, there will be more pressure for change. An idea that almost sells itself is the fact that by adding a few more rows of concrete block to a foundation huge premium savings are possible year after year through the Community Rating System. Outreach can be as simple as street signage showing where the flood dangers lurk, keeping future development in those areas to a minimum. There are many options to consider. We must decide what is best for our own community.

Planning

NAI level flood planning is a function of identifying all the impacts and studying all the possible alternatives so that planners and decision makers can arrive at the best possible solutions. This multi- objective approach means coordinating watershed development plans with all parties concerned — developers, emergency managers, storm water engineers, public works, zoning officials, wildlife experts, etc. Its success is proven in communities across the country. By allowing larger constituencies into the

planning process, local buy-in and long term interests make projects much more likely to succeed.[10]

Ed Thomas points out that the population of Georgia is projected to increase 40 percent over the next 20 years with 580,000 to 1,000,000 new housing units yet to be built. Much of that new construction, as well as replacement of existing units will be in the Atlanta metro area. The average life of new homes built today is 170 years. The life of businesses structures such as strip malls is much less, typically 20 years. We believe investment in a future condition hydrology study is critical in planning for all those new housing units already loaded in the pipeline. Where is all that development going to go? Where are people going to work? How will they get there? Our economic competitiveness and survival depend on answers to these questions. Was Cobb County's disaster an economic boom to that area? We think not. Chad Berginnis (Michael Baker) and Dave Carlton (PBSJ) point out several studies, which show 25 percent to 50 percent of small businesses never, reopen after a 100-year flood. Safe places for folks to live and work are the foundation of a growing and sustainable economy. The expense of a future condition study is well worth it. Planning ahead is more cost effective in the long run than going back and fixing problems for the next 170 years after build out is completed.

For the already built environment, NAI strategies concentrate on slowing down run off and increasing absorption through use of non impervious surfaces, more urban gardens, green roofs, stream restoration projects and retrofitting with larger pipes, wider ditches, setbacks and buffer zones. Needless to say, our courts are already making a lot of these decisions for us. Our development plans must embrace the Endangered Species Act (ESA). Who can forget the outcry on both sides of the table over saving the freshwater mussels during our long four-year drought? Litigation over drinking water rights to the Chattahoochee between Georgia, Alabama and Florida shows no end in sight. Ed Thomas points out that huge amounts of NFIP litigation is going on around the nation under the banner of the ESA. The Chattahoochee is now classified as one of the 20 most endangered rivers in America. Wood storks, mussels, shiners, turtles and 19 species of plants are on its list. A future condition study is perhaps the only defensible way that impacts on these "Threatened," "Endangered" and "Special Concern" creatures can be mitigated to ensure their survival and also provide for our future development needs.[11]

If we look into a crystal ball, what might future impacts look like if we maintain the status quo? A glimpse is not too hard to imagine. During the storm, millions of gallons of untreated human sewage, oil, gasoline, trash, pesticides and other debris ran off directly into rivers and streams, including massive releases from Fulton, Cobb and Gwinnett's sewage treatment plants. The result was an environmental nightmare that took engineers days and weeks to get back under control.[12] Maintaining the status quo is not a viable option; our planning decisions must consider all the impacts and possible alternatives to reduce flooding and ensure growth and prosperity for our future generations.

Regulations and Development Standards

NAI approaches to regulations and development standards emphasize preserving and enhancing the ability of floodplains to naturally carry and store floodwaters. They preserve important natural areas such as wetlands and create buffer zones and open spaces to protect water quality and wildlife habitat. They work with all impacted parties in a planned development approach.[13]

Land use rights are hot button issues almost everywhere and perhaps the most complicated in law. Ed Thomas points out that the days when people could stand up in front of county commissioners and shout "By God it's my property and I can do anything

I please with it" are going away. Property owners don't have the right to be a nuisance, trespass or be negligent. No one has the right to put water on someone else's land, and courts are awarding huge settlements for negligence to successful plaintiffs in cases across the nation.

The question becomes, do our regulations and development ordinances truly reduce flood damage and property damage to others and preserve the natural functions of our watersheds? What about our subdivision regulations? Manicured lawns are sloughing all kinds of pollutants into our lakes and riverbeds. De-forested areas are sloughing sediment. Are we leaving enough trees behind on parcels to reduce run off? Dave Carlton (PBSJ Corp.) argues that some studies show measurable impacts begin after clearing just 10-15 percent of vegetation. We think the answer to these questions is a resounding no. Let's look at more examples of rules and regulations that are contributing to the problem.

In 2008, Georgia adopted a statewide water management plan consisting of 11 regional water-planning councils. The Metropolitan North Georgia Water Planning District has been very successful in implementing best practice rules and regulations in the 15 counties under its control. However, one must ask if these measures go far enough to reduce our flooding problems. Do our watershed rules and regulations specifically mention the words No Adverse Impact? After all, isn't code enforcement and granting of variances really just a matter of interpretation of our laws? Dave Carlton and Chad Berginnis discussed NFIP rules regarding fill in floodplains as an example of how following these rules is actually making our flood problems worse. Under minimum NFIP rules we are allowed to put as much fill in a floodplain as we wish, as long as it isn't in the floodway (the most dangerous part of the floodplain). We can even put fill in the floodway if we have an engineer's study signing off on it. These practices are guaranteed to cause harm to other property owners yet are perfectly legal in some communities. We need to revisit our rules for building outside the floodplain too. Impervious surfaces outside the floodplain can cause an increase in runoff, peaks, frequencies and velocities to those folks living inside the especially hazardous areas.

Our rules need to be signed off by critical infrastructure and facilities authorities such as police, fire, hospitals, jails and emergency management during the permitting process. How deep does the water have to get for emergency vehicles and school buses to safely drive through? Cobb County rescue personnel made hundreds of swift water rescues by boat. Was that part of the master plan? Furthermore, are all our counties regulating to common 10-, 25-, or even 100-year standards in construction of roads, bridges, storm drains and other infrastructure? 100-year standards are extremely rare, but a few communities around the nation are adopting them. Is it really going too far to ask for common ordinances that say you cannot permit any new structures in subdivisions located in a flood plain without mitigating?

Working with developers needs to be done with balanced rules and regulations to help correct the economic imbalances built up over the years in our development practices. Our community shifts many of the costs of poor development practices (flood rescue, disaster relief, rebuilding of infrastructure, etc.) onto taxpayers. The winners are the developers, mortgage companies and real estate agents; the losers are the taxpayers left to clean up the mess after the party is over. Best practice rules and regulations shift some of those costs back onto the developers who, in turn, pass them onto consumers in the form of higher prices. Ed Thomas points out that NAI is equitable, moral, legally defensible and the right thing to do. Tighter rules also correct economic imbalances that our communities and nation can no longer afford.

Mitigation

Mitigation deals with reducing damage caused by floods using structural means such as building dams, levees and channels, and non-structural approaches such as changing human behavior, enhancing flood control construction techniques and purchasing flood insurance. Best practices identify all the impacts and then decide how each will be mitigated in a comprehensive and coordinated manner.[14]

Brad Loar (FEMA — Mitigation Division) took a look at the question of mitigation after the storm and directed efforts to the following priorities: (a) contacting non participating communities (those that haven't adopted the flood maps and ordinances) to set up visits and workshops, (b) assisting floodplain managers in the impacted areas (evaluating how well they were responding and reviewing permitting processes, ordinances and training), and (c) working with insurance agents (visiting and training them while things were still fresh in everyone's minds). In addition, FEMA added more Call Centers, updated Community Information Systems and distributed flyers and pamphlets on retrofitting old structures, Section 406 Stafford Act grants, building code issues, strengthening of roads, bridges and drainage systems.

There are still communities in Georgia that are not part of NFIP or are participating at minimum levels. FEMA added two new communities to the NFIP following the storm but our local officials must take responsibility and do a lot more on their own. We have to ask ourselves, in rebuilding hundreds of washed out bridges and roads, are we really mitigating the best we can? Rebuilding with higher standards takes more time and money than just putting things back the way they used to be. The grant process is slow. Are we rushing too fast at the cost of making the same mistakes all over again? Are we encouraging future growth in the same risky areas, or forcing people to drive through them to get to work? There are no easy answers, but things to think long and hard about.

FEMA's next mitigation priority, assisting the floodplain managers was very successful. According to Brad Loar, our storm was only a medium sized disaster due to its localized nature. Instead of initiating "full scale" activities, FEMA called in its Disaster Assistance Workforce to supplement a core of FEMA staff. These folks work on call, can get off regular paid jobs or are self employed — retired engineers, floodplain managers, community organizers and ex-FEMA employees. Incredibly, they inspected every single repetitive loss structure in the whole State of Georgia — 1,200 buildings, taking pictures and confirming data was correct!

We are continuing our mitigation efforts following the flood, elevating our homes, waterproofing them and relocating some to higher grounds. There is talk of buying up properties and turning them into natural areas and open space. These are expensive and long-term projects. Unfortunately, for our hardest hit areas this will probably have to wait for better economic times.

Infrastructure

How well did the roads, dams, utilities and other infrastructure hold up? Best practices tell us we need to go beyond simply doing the minimum to maintain, repair and replace them following the storm. NAI takes into account the impacts of this activity on surrounding properties and our natural environment.[15] Tom Woolsey (Georgia Safe Dams) explained what happened to the 480 Category 1 (High Hazard) dams that his office regulates throughout the state. Fortunately, none of them failed but four overtopped and 46 others had their emergency spillways activated. The Water Conservation Commission, Dog River, and Yellow River dams as well as scores of other flood control structures engaged their emergency spillways. Reservoirs filled up quickly and decisions to release water had to be made with fear that entire cities downstream

might be flooded. Surface sloughs and cracks formed in several critical structures with imminent danger to subdivisions, schools and malls. Safe Dams sent up an emergency inspection team to survey the damage by helicopter. What they found was astonishing. Engineers inspected 96 Category 1 dams during and immediately following the flood. In regulated and unregulated structures, massive erosion with enormous debris fields had carved breathtaking canyons and valleys in the emergency spillways. Some dams had breached entirely and were washed away. Overwhelmingly, the cause of spillway failure was identical in case after case. We had done everything imaginable to obstruct the flow in the spillway; filling them in with our driveways, mobile homes, fishing piers, gazebos, horse riding stables, and unbelievably even our public sewer lines and utilities — all out of convenience and with total disregard to public safety. In extreme cases, erosion was only a few feet away from causing catastrophic breaches with unthinkable consequences. The lesson learned is obvious; we need a program of regular inspections for our dams and flood control structures. We also need consistent enforcement of our laws to prevent a real tragedy from occurring. Our situation is not unique. Aging dams are becoming real dangers to communities all across the country. The following is a success story of what Gwinnett County did about its aging dams.

The Natural Resources Conservation Service (NRCS) in Georgia built 307 flood control dams from the 1950s through the 1990s. According to Gregg Hudock (Golder Associates) all were exempt from rules for dam safety (until 2000) because their intent was to dam the headwaters of floodplains principally for agricultural development downstream. They were low to medium hazard dams, meaning no danger to loss of life if one were to fail. That changed when our sprawling subdivisions and strip malls reached the suburban floodplains and turned low hazard dams into high hazard structures. The Safe Dams Program identified 29 in need of rehabilitation, with 14 located in Gwinnett County. Though rehabilitation was not yet complete, none of the dams failed in spite of record conditions. Forensic hydrologists are studying what would have happened without the rehabilitation program — it's not a pretty picture.

The lessons learned are that emergency staff and resources need to be in place at a moment's notice to watch the dams and flood control structures as they perform during the storm. Lines of communication between local and state agencies need to be planned in advance. Contractors and engineering experts working on the projects provided critical resources for decision makers during the crisis. In addition, they helped set up lights at night and controlled access by the public as people with inner tubes and kayaks became a public safety issue.

Emergency Services

Emergency services get our highest rating for effort of the seven building blocks. Getting people out of harm's way as quickly as possible was the lesson learned during our storm. Best practices focus on pre and post-disaster preparedness. We created the potential for killer floods but emergency response was exemplary and saved many lives.

In Cobb, the 911 emergency call center received 5,667 calls for assistance, the normal daily volume averages only about 275. Lanita Lloyd (Cobb EMS) said there were 313 emergency requests for swift water rescue and 70 for animal pet rescues. Hundreds of roads and bridges were closed. Rescuers struggled to reach stranded victims due to the high waters and were overwhelmed by looting, mosquitoes, non-English speaking residents and their own problems — moving families and property to safety. Cobb schools were in full session that morning with nearly 100,000 students in attendance. As early closings were announced school officials discovered students, particularly the youngest ones, had no place to go — their parents were still at work. Early closing meant no lunch for thousands on the subsidized lunch program, which, for many, is their

only square meal of the day. Clarksdale Elementary was totally destroyed. The students were still evacuating as rising waters filled hallways and eventually made it over the school's rooftop.

Cobb's volunteer program was another success story in part thanks to a monitoring group that matched volunteer organizations to the areas of most need. They sounded the call for help through the local TV news and web sites, ultimately mobilizing 7,000 workers in five days. Saturday morning teams were given maps, told what to bring, where to go and what to do. Groups reported back at the end of the day with status reports of what had been accomplished and made preparations for new groups to go out the following day. These groups were a success because of planned pre and post disaster drills and exercises, which focused on the recovery and rebuilding effort in addition to emergency evacuation.

Conclusions

The lessons learned from Atlanta's big flood have uncovered opportunities for improvement in risk identification, planning, education, regulation, mitigation, infrastructure and emergency response. The flood taught us that there is no such thing as sustainability when community hazards have not been mitigated. We are struggling at a basic level of effort and barely maintaining the status quo. Our flood problems are getting worse, yet no sweeping reforms are being proposed to deal with the coming floods, which promise to be swifter, deeper and cause more fatalities. Our sense of urgency of is slowly fading away.

Let's not forget the lessons we have learned!

- We cannot continue to view our flood hazard as a line drawn on a map. Flood maps are snapshots in time with inherent flaws. We are all living at some level of flood risk. We must recognize the limitations of flood maps and supplement them with best hazard identification practices. Our society has a moral obligation to protect property rights and the safety of our citizens.

- We have a legal obligation, too. The way our legal system views flood liability issues is changing rapidly. We must improve and expand our successful floodplain management practices to meet the new legal challenges.

- Our weather and stream forecasts are subject to wide margins of error and include many unknowns such as the impact of climate change. We must better educate and prepare our communities for potential worse case scenarios.

- We do not understand our flood risk nor are we taking steps to mitigate it. Education and awareness are the keys to changing this behavior. The new ANFI designation is a step in the right direction. Raising the education bar for our community professionals and politicians should be our highest priority.

- Our long-term development and planning must include comprehensive future condition hydrology studies to ensure survival of our endangered species and our own economic sustainability.

- Our aging dams and flood control structures as well as those in other regions across the U.S. need urgent rehabilitation, regular inspections, maintenance and enforcement of laws.

- Our current regulations and development standards are making our flood problems worse. The cost shifting in our economic development practices is inequitable and financially unsustainable.

- Upgrades and investment in stream and river gauges were critical to emergency response. However, emergency management personnel must clearly understand the limits of this technology, especially when gauges stop functioning and are underwater.
- Pre- and post-disaster preparedness are the keys to effective emergency management. Training must include community recovery and rebuilding in addition to emergency evacuation.

At the time of this writing, we find ourselves facing one of the greatest environmental disasters in our history with the oil spill in the Gulf of Mexico. Are we seeing some of Atlanta's lessons being repeated in the Gulf? Green movement talk needs to embrace all seven NAI building blocks, especially risk hazard identification, mitigation and sustainability on the ground. There is too much emphasis on electric cars, solar panels and wind turbines. What good are these things when they are flooded and underwater? We have created too many death traps, places like Sacramento, New Orleans, and Miami Beach that are watery time bombs waiting for the right conditions to blow. Economic growth and sustainability, indeed our own survival, requires us to change the way we are mitigating. Atlanta's flood was a wakeup call, the culmination of a record storm and decades of industrial development. On the national level, Congress continues postponing the issue of our $19 billion NFIP debt and reform into the future. We believe that NAI solutions will be a central part of that reform, and the majority held approach to watershed planning in the coming decades. We don't need a crystal ball for a glimpse of the future; Atlanta's lessons learned are fine starting points.

Endnotes

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