

The NAI
Approach to
Floodplain
Management

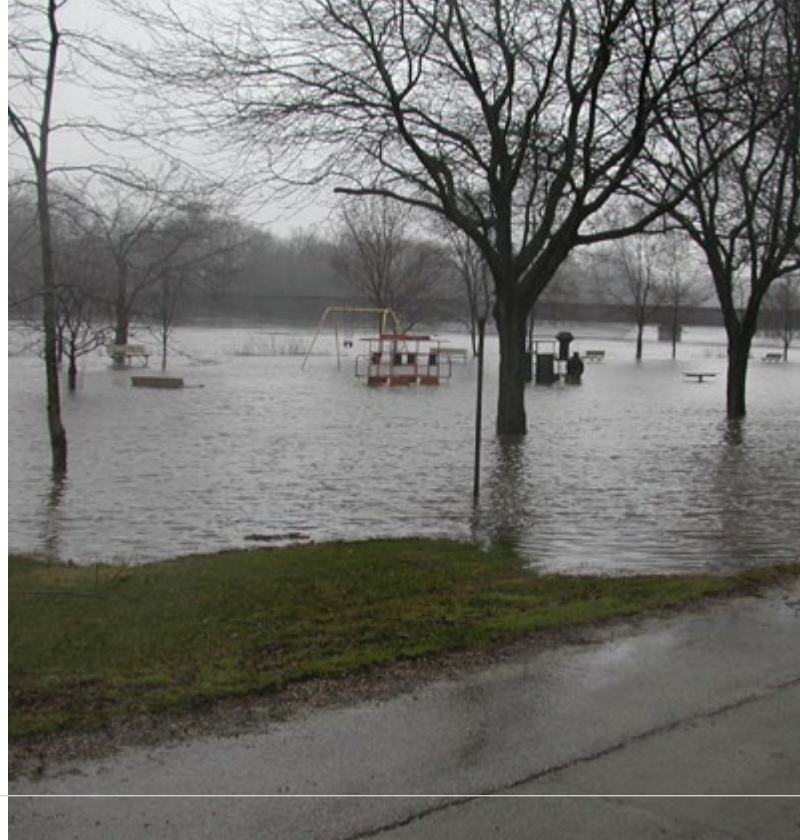
Regulations
& Floodplain
Management

Regulations
Tools

Case Studies

NAI How-to Guide for Regulations and Development Standards





Regulations

This park in Aroma Park, IL, illustrates the NAI approach. Waterfront properties serve the community with open, green space, but damage is limited during a flood. Photo credits: “Dry” photo by French & Associates, “Wet” photo by Kankakee County Planning Department.

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ON THE COVER:

Aerial view of a flooded Iowa River near Marengo, Iowa October 2016. Photo by Eric Johnson.



This playground equipment was built using natural materials while providing fun features for kids to explore. Cedar River at the Charles City Riverfront Park, IA. Photo courtesy of the city of Charles City, IA.

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Introduction

As a nation, we continue to build at-risk structures in or near floodplains, yet we don't spend as much time or effort considering the adverse impacts of these developments on adjacent properties or elsewhere in the watershed. The minimum standards we follow today – if, indeed, there are standards being utilized at all – are resulting in increasingly difficult flood issues and higher flood risk to our nation's communities and its citizens.

Some of these persistent flood risk issues are historical. Towns and cities were settled near watercourses for transportation, while others, especially in the arid west, were settled where precious water was available as a resource. However, today, poorly designed and

constructed development and redevelopment, and a changing climate, are increasing flood risk to these communities. Many communities are dealing with

persistent flood problems. Some of those same communities have residents and business owners attending board meetings after a heavy rain, complaining of flooding and demanding that the flood problems be fixed.

Communities can get ahead of these flooding issues, avoid causing problems for themselves and others, and ultimately lessen their flood risk, by embracing a new approach to managing their flood problems – the No Adverse Impact approach. In essence, NAI floodplain management takes place when the actions of one property owner are not allowed to adversely affect the rights of other property owners.



Who Should Use this Guide?



After a flood, damage assessments should be conducted to identify where changes can be made during repairs and reconstruction. Damage assessments are vital for a post-disaster plan, such as the ones discussed in Section 3, Tool 3, Estes Park, CO. Photo by Patsy Lynch/FEMA.

Anyone who wants a more resilient community that can withstand a major flood event should use this guide. That could mean anyone, from local officials, to elected officers, decision makers, floodplain managers, coastal managers, stormwater managers, emergency managers, planners, hazard mitigation specialists, public works and engineering

staff, design professionals, concerned citizens, and various other groups in the community.

This Guide is one of a series of how-to guides that expand on the knowledge base within the [No Adverse Impact Toolkit](#), a 108-page document prepared by the Association of State Floodplain Managers. The *Toolkit* is ASFPM's

reference on implementing the NAI approach. It identifies tools for incorporating NAI floodplain management into local regulations, policies and programs; while the *How-to Guides* break down, by subject matter, that information into compact, usable information communities can apply.

This *Guide* reviews only five tools, but there are many more NAI tools for regulations, and for each of the other building blocks found in the *NAI Toolkit*. The Toolkit, additional references, and more information can be found by clicking on the NAI icon at the bottom of ASFPM's homepage: www.floods.org

When the *How-to Guides* series is completed, there will be one guide for each of the seven building blocks found in the *NAI Toolkit* (hazard identification and floodplain mapping; education and outreach; planning; regulations and development standards; mitigation; regulations; and emergency services ([links below](#))).

The *How-to Guides*' ultimate goals are to have communities take a different approach to managing development that prevents increasing flood risk, and to incorporate NAI concepts into other community activities. This *Guide* identifies just a few ways a community can incorporate the concepts into its regulations activities.

Users should view NAI as a continuum – every community is somewhere on the path between not addressing minimum flood standards at all, addressing only the minimum standards of the National Flood Insurance Program, and being 100 percent resilient and sustainable in the face of a flood threat. The more NAI steps a community takes, the better prepared it is for the next flood.

THIS HOW-TO GUIDE IS DIVIDED INTO FIVE SECTIONS:

SECTION ONE: The NAI Approach to Floodplain Management

SECTION TWO: Regulations and Floodplain Management

SECTION THREE: Regulations Tools

SECTION FOUR: Case Studies

SECTION FIVE: Resources & Fact Sheet

After reading this *Guide*, it is recommended that a community conduct an assessment of its regulations activities. A gap analysis would identify what is being done and what is not being done from an NAI perspective. It would lead to strengthening existing programs and implementation of new ones that can help reduce the community's flood risk. Similar assessments should be conducted after reviewing the other *Guides* in this series.

Common Terminology used throughout this Guide



This is an example of following the NAI floodplain management approach, letting nature follow its course with no threat to life or property. The waterfront is a community asset, of open green space and parks, where people can relax and enjoy the view. Photo from the CRS Coordinator's Manual.

NFIP: National Flood Insurance Program. Most community floodplain maps and floodplain management standards have been adopted to meet the NFIP's criteria. Learn more at www.fema.gov.

Community: The NFIP definition of a community is a political subdivision that has authority to adopt and enforce floodplain management regulations for the areas within its jurisdiction. The

term usually means cities, counties, and Indian tribal governments. For the purposes of this *Guide*, a "community" also includes a neighborhood, unincorporated settlement, or other non-governmental subdivision where people live or work together.

CRS: NFIP's Community Rating System is a program that provides reduced flood insurance premiums for policyholders in communities

that go above and beyond the NFIP criteria. For more information see www.FloodSmart.gov/crs or www.CRSResources.org. This *Guide* identifies how communities can receive CRS credits for implementing NAI tools and standards.

Floodplain: Nature's floodplain, which includes the Special Flood Hazard Area (defined on next page), and other areas subject to flooding, includes:

- Areas subject to greater than the 1 percent annual chance flood, often referred to as the 100-year flood;
- Areas subject to smaller, more frequent, or repetitive flooding;
- Areas subject to shallow flooding, stormwater flooding, or drainage problems that do not meet the NFIP mapping criteria (but where 20 percent of flood insurance claims occur);
- Areas affected by flood-related hazards, such as coastal and riverine erosion or subsidence; and
- Areas that will be flooded when future conditions are accounted for, such as sea level rise and upstream watershed development.

For these reasons, “floodplain” is the term that best reflects a community’s true flood risk, and is used in this *Guide* instead of “SFHA.”

Natural floodplain functions:

The functions associated with the natural or relatively undisturbed floodplain that moderate flooding, maintain water quality, recharge groundwater, reduce erosion, redistribute sand and sediment, and provide fish and wildlife habitat. One goal of NAI floodplain management is to preserve and protect these functions, in addition to protecting human development.

Resilient: “Able to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies,” as defined in [FEMA’s National Disaster Recovery Framework](#).

SFHA: A Special Flood Hazard Area mapped on an NFIP Flood Insurance Rate Map that shows the area subject to the 1 percent annual chance flood caused by rivers, lakes, oceans, and other larger sources of flooding.

Sustainable: “Able to meet the needs of the present without compromising the ability of future generations to meet their own needs,” as defined in FEMA’s National Disaster Recovery Framework.

The *Toolkit*, additional references, and more information can be found by clicking on the NAI icon at the bottom of ASFP’s homepage: www.floods.org

SECTION ONE

The NAI Approach to Floodplain Management



Cleaning up a flooded home can be a long and expensive process. Cedar Rapids, Iowa, June 2008. Photo from FEMA library. www.fema.gov/media-library/assets/images/52962

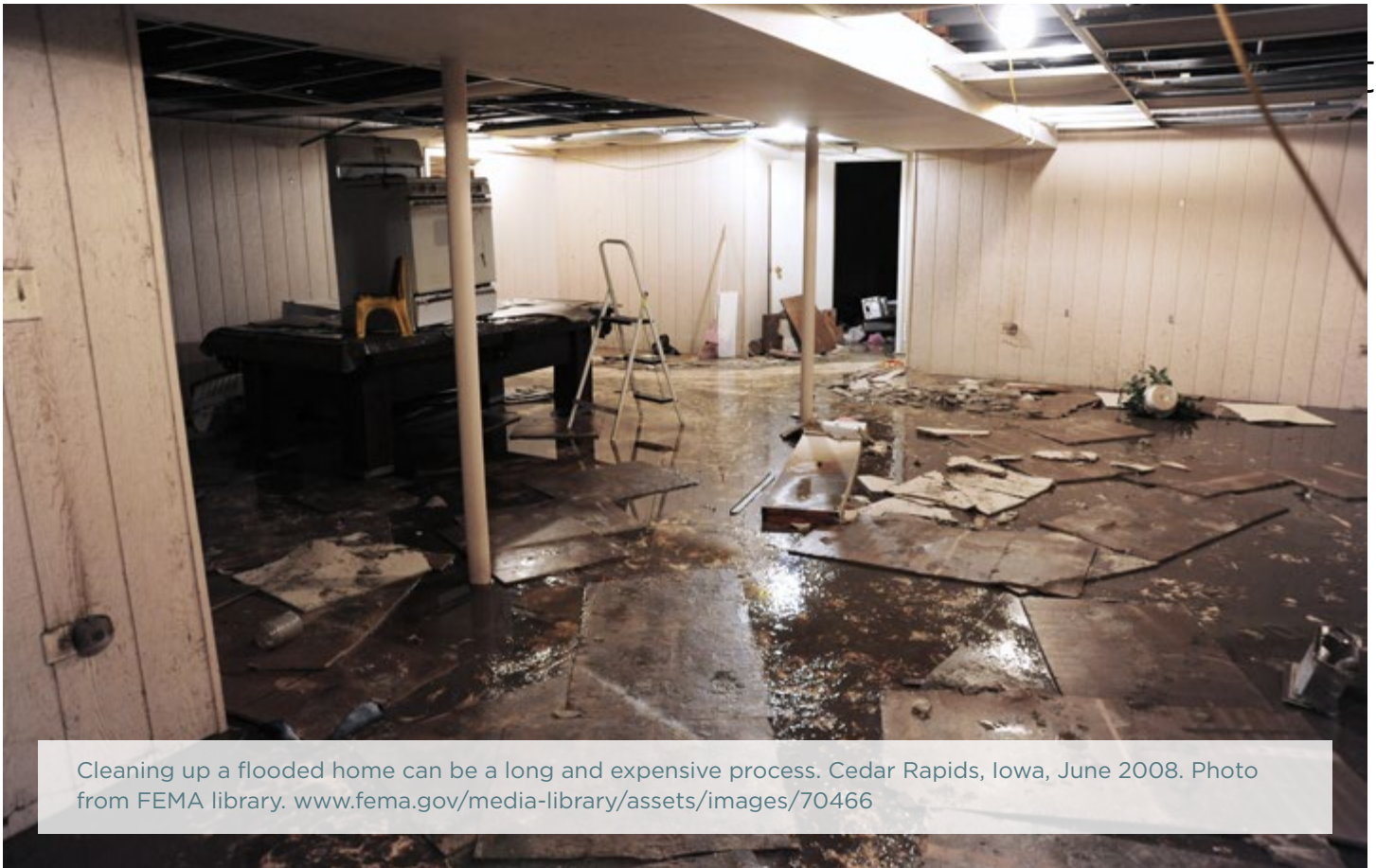
The NAI Approach to Floodplain Management

FLOOD LOSSES AT THE LOCAL LEVEL

Local flooding can have a much greater impact than is commonly thought. Consider that for every federally-declared flood disaster, numerous other floods never get declared – and little to no federal assistance is available. Studies show that communities experiencing a major flood take years, if not decades, to recover. For example, 50 percent of small businesses never reopen after a major flood, and those that do, fail at a higher rate within a few years.

For many communities that have not experienced a flood in recent years, it is only a matter of time until a major event occurs. When there is a flood in a developed area, any and all of the following impacts on communities and their residents and businesses can be expected:

- Decreased revenue due to loss of income, sales, tourism, and property taxes;
- Costs incurred due to post-flood clean up and repair of buildings and Regulations;
- Loss of jobs due to businesses closing or cutting back on operating hours;
- Risk of injury or loss of life, including first responders rescuing those who did not evacuate or are stranded;
- Mental health and family impacts, including increased occurrence of suicides and divorce;
- Loss of historical or unique artifacts;
- Loss of programs or services that are cut to pay for flood recovery; and
- Deterioration of homes and neighborhoods as floods recur.



Cleaning up a flooded home can be a long and expensive process. Cedar Rapids, Iowa, June 2008. Photo from FEMA library. www.fema.gov/media-library/assets/images/70466

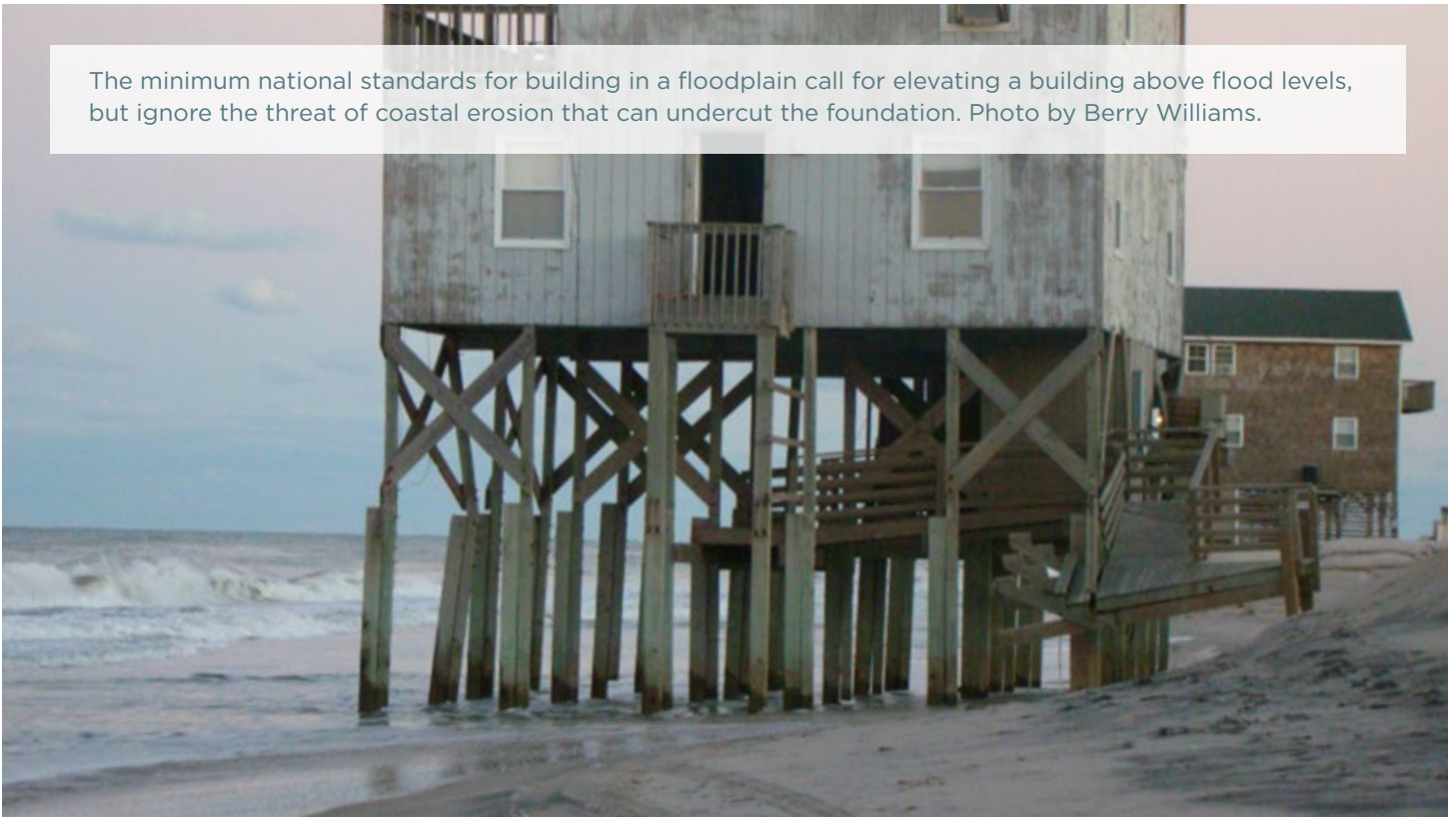
NATIONAL STANDARDS

The NFIP's *minimum* standards have been accepted by many as the default standards for communities' floodplain management programs. However, they were designed for the purposes of an insurance program and not to control our escalating flood losses. The NFIP sets minimum construction standards for communities' regulations in the mapped SFHA. These minimum standards are

inadequate to stop and reverse the long-term trend toward increasing flood damage because:

- They do not address the entire floodplain. In other words, they neglect the potential for larger floods, other unmapped local flood hazards, or the effects of urbanization and a changing climate on future flood levels.
- They focus on how to build in a floodplain rather than how to avoid unsafe locations.
- They allow floodwater conveyance areas to be reduced, essential valley storage to be filled, and/or velocities to be increased – all of which can adversely affect others.
- The standards are flood-oriented and some construction techniques may increase exposure to damage from other hazards, such as wind and earthquakes.

The minimum national standards for building in a floodplain call for elevating a building above flood levels, but ignore the threat of coastal erosion that can undercut the foundation. Photo by Berry Williams.



- They assume the ground is stable, and that if a building is high enough, it will be protected from damage. This is not the case in areas subject to erosion or mudslides.
- There are no accepted national flood loss reduction standards for levees.
- While standards for dam safety are good as they relate to the protection level of the dam from failure or overtopping, there is a continued problem of increasing development downstream, necessitating a dam to be retrofitted to a higher protection standard.
- There are no commonly-applied flood loss reduction standards for Regulations and critical facilities, such as wastewater treatment plants and emergency operations centers.
- Sedimentation, erosion, channel migration, ice jams in rivers, and coastal erosion, often cause flood hazards that are not adequately reflected in the NFIP's Flood Insurance Rate Maps.
- In areas subject to subsidence, floodplain maps lose their accuracy when the ground settles over the years.
- NFIP regulatory standards may not work adjacent to lakes where water levels may remain high for months or years.

For these reasons, relying on minimum national standards will not reduce flood losses or even stop the increases in flood losses.

The NAI Approach to Floodplain Management, cont.

FLOOD LOSSES IN THE NATION

Local flood losses add up to very large numbers at the national level, and those numbers are getting bigger. Since the early 1900s, the nation's flood losses have increased five-fold. Since 2000, that figure has averaged \$10 billion annually. Hurricanes Katrina and Sandy occurred within seven years of each other. They were the two largest flood-related disasters in U.S. history and together caused more than \$200 billion in direct losses (see the graph on page 12).

This continued pattern of destruction has persisted despite the investment of billions of dollars in structural flood control projects during the last 100 years, as well as the development of many other flood protection measures. Yet, even in the face of increasing flood losses, development continues in high risk locations. For example, it is predicted that the U.S. population near the water will increase by 50 million more people by 2050 – putting more people

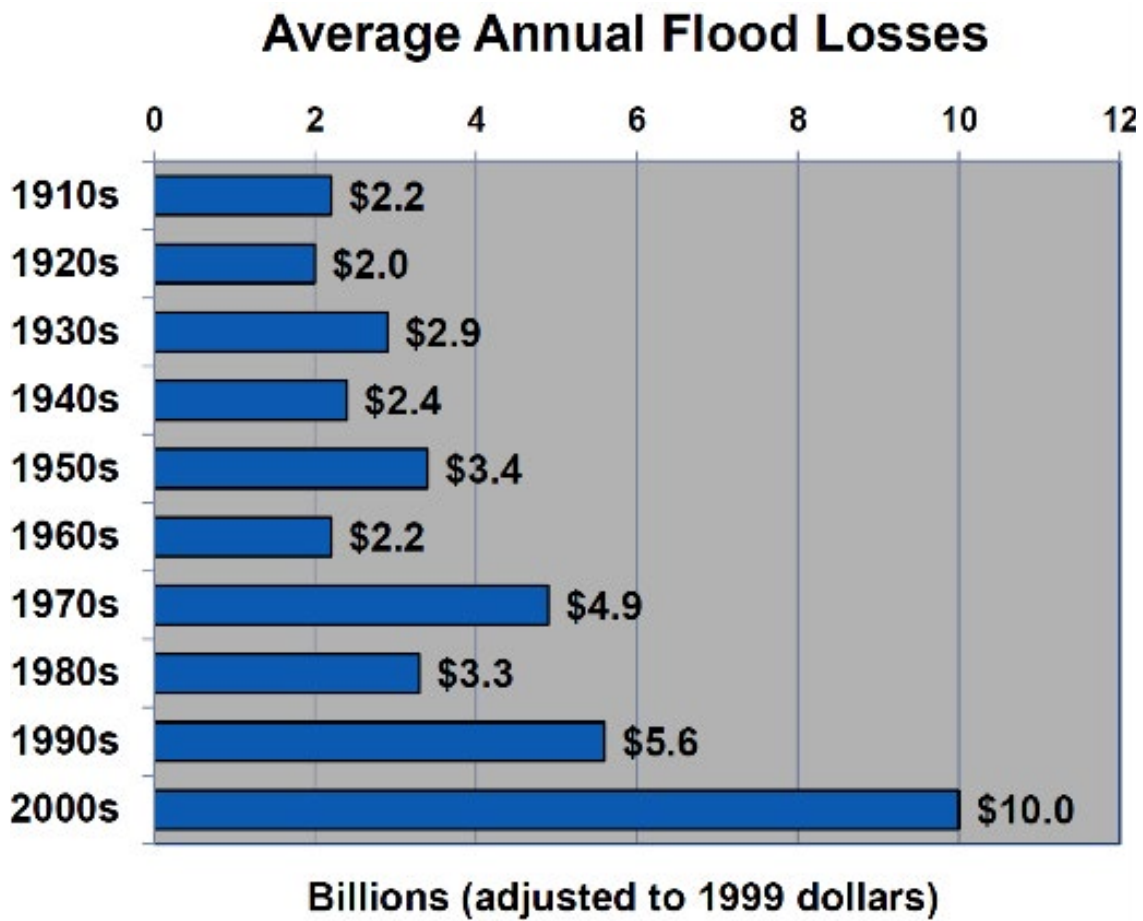
and property in harm's way. The federal government's programs are not curbing the increases in flood losses as floodprone areas keep developing at what many believe to be an alarming rate. Consider the following:

- Funding for flood protection programs, especially structural flood control projects, has declined over recent years.
- Tax incentives and funding for disaster assistance have encouraged, and often subsidized, floodplain occupancy and development and reduced local and individual accountability for flood losses.
- The NFIP's national standards for managing floodplain development have not changed in more than 20 years and are assumed by many communities to be adequate for their floodplain management program, without regard to implementing other or higher standards that would address the hazard(s) they face.



Comic created by Rob Pudim, and appeared in Natural Hazards Observer, May 2014.

The NAI Approach to Floodplain Management, cont.



Jeff Stone with ASFPM's Science Services Dept. created the graph above. Source: Flood Loss Data, National Weather Service, Hydrologic Information Center (www.nws.noaa.gov/hic/).

Further Information: Flood Damage in the United States 1926-2003 A Reanalysis of National Weather Service Estimates (www.flooddamagedata.org/).

The No Adverse Impact Approach



NAI floodplain management is a principle that is easy to communicate and, from legal and policy perspectives, tough to challenge. In essence, *No Adverse*

Impact floodplain management takes place when the actions of one property owner are not allowed to adversely affect the rights of other property owners. The adverse effects or impacts of unwise community development decisions can be measured by increased flood peaks, increased flood stages, increased flood volumes, higher flood velocities, increased erosion and sedimentation, deterioration of natural floodplain functions, or other impacts to a community's well-being.

NAI philosophy can shape a community's floodplain management approach if the community:

- Identifies acceptable levels of impact;
- Specifies appropriate measures to mitigate adverse impacts; and
- Establishes a plan for implementation of multiple tools to reduce or eliminate those impacts.

“

“...insisting that landowners internalize the negative externalities of their conduct is a hallmark of responsible land-use policy...” – Justice Samuel A. Alito Jr., in the majority opinion for the Supreme Court's ruling in *Koontz v. St. Johns River Water Management*, 133 S. Ct. 2586 (2013). The *Koontz* case is very important to floodplain management. For more information on it, see www.americanbar.org/content/dam/aba/administrative/state_local_government/land_use.authcheckdam.pdf

”

The No Adverse Impact Approach, cont.

THE COMMUNITY'S ROLE

NAI principles give communities a way to promote *responsible* development measures through community-based decision making. Under NAI floodplain management, communities identify potential impacts of new development proposals, and implement actions to mitigate those adverse impacts before they occur.

A community's approach could be specific to flood damage or encompass related objectives, such as water quality protection, groundwater recharge, and protection of wetlands and riparian zones. NAI criteria can be extended to entire watersheds to support regional stormwater management methods to mitigate the adverse impacts caused by increased runoff from urban areas. At the community level, the NAI floodplain management approach and implementation plan should be comprehensive and address all the NAI building blocks:

- Hazard identification and floodplain mapping
- Education and outreach
- Planning
- Regulations and development standards
- Mitigation
- Emergency services

NAI ADVANTAGES:

Local empowerment: The NAI approach removes the impression that floodplain management is something imposed by federal or state government. Communities become accountable and accept responsibility for what happens. It also encourages development of a better informed public and a constituency for wise development.

More effective programs and projects: Floodplain management programs and flood mitigation projects are better tailored to local needs and conditions with the NAI approach. Communities are able to better utilize federal and state programs to support their own local initiatives.

Lower long-term costs: Over time, the NAI approach will reduce local government expenditures. For example: a mitigation project that relocates buildings out of a floodprone area not only can result in a community open space amenity, but in less maintenance of roads and public utilities, less risk to first responders who must conduct search and rescue operations when it floods, and lower disaster recovery costs.

Improved partnerships: Informed local officials can make the right decisions about protecting their community. Economic development organizations, transportation and public works departments, and local utilities do better when they work with planners and floodplain managers to implement an NAI based approach. This is especially true when everyone realizes that they have a role and a responsibility to address their own flood problems. Once people agree that flooding is a local problem and their department is affected, they are more willing to work together and share the workload.

continued on page 15

The No Adverse Impact Approach, cont.



Source: Natural Hazards Informer, July 1999, Natural Hazards Center, University of Colorado.

Reduced liability: NAI doesn't take away property rights – it protects them by preventing one person from harming another's property. One of the most important options a government typically has for reducing liability for flood losses is the prevention of increasing flood levels and erosion hazards due to government actions (or inaction). To do this, governments can adopt NAI standards for private development (through its regulations) and public Regulations (through its design standards).

Meet community needs. NAI floodplain management is about communities being proactive toward understanding potential impacts and implementing preventive measures and mitigation activities. The NAI concept offers communities a framework to design programs and standards that meet their true needs, not just the minimum requirements of a federal or state governmental agency.

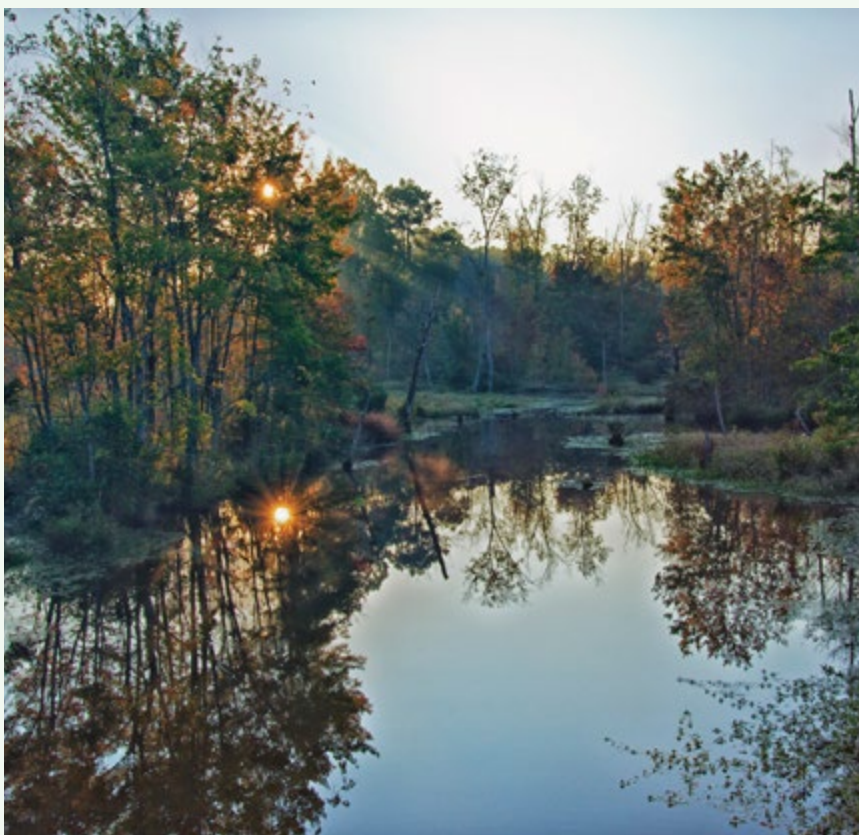
Greener floodplain: Flooding is a natural phenomenon and one goal of NAI floodplain management is to preserve and protect natural floodplain functions in addition to protecting buildings and Regulations. An NAI emphasis will result in protection of natural buffers and environmentally sensitive areas, improvement in the biological, ecological and geomorphologic functions of riverine and coastal areas, improved water quality, more open spaces, protected

The No Adverse Impact Approach, cont.

fish and wildlife habitat, and similar benefits that come with maintaining an environmentally sustainable ecosystem.

CRS credits: By continually seeking to meet local needs, a community will implement programs and projects that are above and beyond the minimum requirements of the NFIP. Such activities are encouraged by the NFIP because they do a more effective job of preventing and reducing flood losses. This encouragement is accomplished through the CRS, which provides reduced flood insurance premiums in communities that implement NAI floodplain management activities.

On the whole, the NAI approach has many benefits at the local and national levels. With these benefits in mind, the remainder of this *Guide* explores how to take advantage of the NAI approach in a community's regulations and development standards programs.



A wetland in Franklin County, NC. Photo by Jim Liestman via Flickr



SECTION TWO

Regulations & Floodplain Management



Great Sippewissett Marsh in Massachusetts. Photo by Edgar Kleindinst, NMFS Woods Hole Laboratory.

Regulations and Floodplain Management

The cornerstone of a floodplain management program is to manage human development in order to prevent or reduce flood hazards to people, flood damage to property, and loss of natural floodplain functions. Managing human development is done through regulations that govern land use, ground alterations and construction of buildings and other structures. This work is usually the floodplain manager's responsibility.

This *Guide* provides tools to help the floodplain manager do a better job. It explains how to raise the bar to make a basic program more effective. This *Guide* assumes the reader has some experience with floodplain management and is familiar with the regulatory concepts explained in Units 5-8 in Floodplain Management Requirements Desk Reference, FEMA 480.

Regulations and Floodplain Management, cont.

The Context: People often want to build on or develop their land. When land subject to a natural hazard or supports natural functions is developed, there can be adverse impacts, including:

- Exposure of property to damage;
- Increase of the flood hazard on innocent third parties;
- Exposure of future occupants to safety and health risks;
- Damage to sensitive areas and natural functions; and
- Transferring costs of occupying a hazardous area to future residents and the local, state and national taxpayers.

Floodplain managers are officers of a governmental agency and assume their government's responsibility to protect public health, public safety, taxpayer's money and natural resources. When people get permits to develop floodplain property, they trust that their floodplain managers have done due diligence and it is safe to build.

Floodplain managers ensure that it is safe to build and that adverse impacts on and off the site do not occur or are minimized before the development starts. Preventing adverse impacts on others should be a central point of reference for a floodplain management program.



National Flood Insurance Program (NFIP)

Floodplain Management Requirements

A Study Guide and Desk Reference for Local Officials

FEMA 480

February 2005



FEMA

FEMA 480 is the basic guide on floodplain management regulations and is recommended reading before a community tackles NAI level activities.

NFIP Regulations

To provide for public health, safety, general welfare and reduce property damage, and because of the need for flood insurance, more than 22,000 communities in the country participate in the National Flood Insurance Program. As a condition of making flood insurance available for their residents, these communities have agreed to regulate development in accordance with the NFIP's minimum criteria. The requirements for community regulations are in the [Code of Federal Regulations, 44 CFR Parts 59 and 60](#).

The NFIP requirements are keyed to the mapping information provided on the Flood Insurance Rate Map. Here are the basic regulatory criteria for development in the Special Flood Hazard Area:

RFIP Regulations, cont.

1. The 100-year (1 percent annual chance) flood level and the 100-year floodplain are the bases for the flood protection level (base flood elevation or BFE) and the area subject to the regulations (the SFHA).
2. All development in the SFHA must have a permit from the community. “Development” is defined as any manmade change to improved or unimproved real estate.
3. Development along a river or other channel cannot obstruct flows so as to cause an increase in the base flood of more than 1 foot on other properties within the community.
4. New buildings may be built in the SFHA, but they must be protected from damage by the base flood.
5. New buildings in a coastal high-hazard area must also be protected from damage by wave action during the base flood and constructed to avoid deflecting waves to adjacent properties.
6. Substantially improved or substantially damaged buildings must be brought into compliance with the requirements for new buildings.

44 CFR Part 60.3 has more details on these basic regulatory criteria and some requirements for additional situations, such as subdivision of land and protection of utilities. There are also FEMA technical bulletins and other documents that offer guidance on the NFIP criteria.

The NFIP’s criteria are considered the base for a regulatory program. These criteria are the “start” to a complete and effective program, and are minimum national standards that provide some protection to new buildings. However, they have not been shown to provide protection to new development from all known flood hazards and can result in increased flood losses to existing development.

There are two ways the NFIP recognizes that communities can and should adopt locally-appropriate standards that are higher or more restrictive than the national minimums:

1. Higher standards are specifically encouraged in the regulations. 44 CFR §60.1(d) states, “**The criteria set forth in this subpart are minimum standards** for the adoption of floodplain management regulations by flood-prone, mudslide (i.e., mudflow)-prone and flood-related

erosion-prone communities.

Any community may exceed the minimum criteria under this Part by adopting more comprehensive floodplain management regulations utilizing the standards such as contained in Subpart C of this part. In some instances, community officials may have access to information or knowledge of conditions that require, particularly for human safety, higher standards than the minimum criteria set forth in Subpart A of this part. **Therefore, any floodplain management regulations adopted by a state or a community which are more restrictive than the criteria set forth in this part are encouraged and shall take precedence** (bold text added for emphasis).”

2. Higher standards are rewarded by lowering flood insurance premiums in communities that adopt them and participate in the



[Community Rating System.](#)

Incentives for an NAI Program



Hurricane Matthew via PixabayPix

If a community meets the NFIP criteria and is in good standing with the program, it will be managing new development to flood protection standards and its residents will be eligible for flood insurance. Why should a community do anything more than the basic level? Here are four reasons to start with the NFIP and then build a better program:

1. **The basic NFIP criteria have some shortcomings,** which include:
 - In riverine floodplains, encroachments can be allowed that result in up to a 1 foot increase in the BFE. This conflicts with NAI standard that prevents increases in flood hazards and flood damage.
 - The criteria in 44 CFR §60.3 do not explicitly implement one of the goals of the National Flood Insurance Act, which was

to “guide the development of proposed future construction, where practicable, away from locations, which are threatened by flood hazards...” By setting minimum building protection standards, there is a sense that it’s acceptable to build in the floodplain. While increased costs of building in a floodplain may discourage some developments, it is often assumed it’s acceptable to build in a hazardous area if the NFIP

Incentives for an NAI Program, cont.

- construction criteria are met.
 - As part of a program to insure and protect buildings from flood damage, 44 CFR focuses on standards to protect insurable buildings. There are little or no criteria for protecting other types of development, such as driveways, culverts, landscaping, utility lines and personal property such as vehicles.
 - The NFIP requirements say little about protecting public safety and health. In fact, by allowing buildings in the floodplain, occupants and emergency management staff are put at risk.
 - While the consequences of critical facilities being flooded are much more severe than other types of property, NFIP standards do not require any special protection measures for them.
 - 44 CFR §60 does not address protection of natural floodplain functions. One result of this has been lawsuits over violations of the Endangered Species Act. In response FEMA has added new guidance, but it is limited to the issues raised by the specific suits in specific geographic areas.
 - Protection is only to the BFE as depicted on what is often an outdated FIRM. Shortcomings with the studies used to prepare FIRMs are discussed in the *NAI How-to Guide for Mapping*.
 - There are no development standards related to some of the special flood-related hazards, such as streambank and coastline erosion and subsidence.
 - Construction standards for buildings in V Zones are intended to protect buildings from breaking waves of 3 feet or greater. However, breaking waves of 1.5 feet or more can cause damage to buildings. As a result, areas outside the V Zone are not adequately protected from damage by waves.
 - 44 CFR §60.3 has not been updated since 1986.
2. **The NFIP criteria do not prevent adverse impacts:**
- The criteria in 44 CFR allow new development to increase the base flood up to 1 foot over time without requiring notification or compensation to owners of existing development that will be impacted.
 - The NFIP criteria allow buildings to be protected to a protection level set by a flood study that does not reflect the anticipated increase due to watershed development, climate change or land subsidence.

A community could be liable for the damage if it permitted a project that caused an adverse impact on other properties, even when the project meets the NFIP's minimum standards. There are several such court cases described in the [NAI legal issues studies](#).

Incentives for an NAI Program, cont.

3. **Locally-pertinent standards do a better job of addressing local conditions:**

- Communities that have experienced flooding higher than shown on the FIRM (or in areas not mapped on the FIRM) often document the higher flooding and extend their programs to protect their citizens from the known hazard(s).
- Local regulations often protect development from other local flood-related hazards, such as streambank or coastline erosion, not addressed by the NFIP criteria.
- Communities have programs to protect water quality, wetlands, habitat and other natural floodplain functions not covered in the NFIP rules.

4. **Residents and businesses**

will save money. Here are some ways setting regulatory standards higher than the basic level can pay off:

- Better flood protection means less flood damage. Even if a property owner is insured, an NFIP policy does not cover uninsured items such as landscaping, vehicles, losses less than the amount of the deductible, loss of revenue and temporary housing. Some items such as family photographs or heirlooms are irreplaceable.
- Preventing floodplain encroachments and managing watershed development will help ensure flooding will not get worse. As a result, the current FIRM will less likely need to be revised with a higher BFE, and flood insurance policies will not have to be rereated to higher premiums to account for a higher flood threat.
- Building to a higher protection level means lower flood insurance premiums.

- Guiding development away from the floodplain; adopting and enforcing higher standards; and implementing better administrative procedures are credited under the CRS.



The NAI Approach



Photo via PixabayPix.

There is a five step NAI process for mitigating the impacts of individual development proposals:

1. Identify all the impacts of the proposed development;
2. Identify all property owners affected by those impacts;
3. Notify all those property owners of what may happen;
4. Conduct a public meeting to allow the developer and impacted property owners to review and discuss the impacts; and

5. Do not allow the development to proceed until the adverse impacts are mitigated or legal arrangements have been reached with all owners of adversely affected properties.

This process works, but can be cumbersome, time-consuming and expensive. This *Guide* provides regulatory language and procedures to prevent the expected adverse impacts. If the adverse impacts are not allowed in the first place,

there would be no need for the notifications and meetings listed above. If an applicant wants a variance from the requirements, the community could follow the NAI process for that particular situation.

This *Guide* reviews the three major types of adverse impacts caused by floodplain development: damage to property, threat to safety and health and loss of natural floodplain functions.

The NAI Approach, cont.

These adverse impacts can be addressed through NAI regulations tools described in Section Three:

- Tool 1. Prevent Adverse Impacts to Other Properties
- Tool 2. Prevent Adverse Impacts to Safety and Health
- Tool 3. Prevent Adverse Impacts to Natural Floodplain Functions

Tool 4 covers ways to preserve undeveloped floodplains, the ultimate way to prevent adverse impacts to all three types of adverse impacts.

FACTORS FOR EFFECTIVE REGULATIONS

If you're interested in making your regulatory program more effective and useful, consider the following factors as you develop and administer an NAI program. The case studies later in this *Guide* demonstrate how local officials succeeded by taking advantage of these factors.

1. TAKE RESPONSIBILITY FOR YOUR REGULATIONS

Your community likely had a flood problem long before it joined the NFIP and your officials probably felt some responsibility to address flooding. Your regulatory program should be one of several ways your community is tackling its flood problem. The objective of your regulations should be to protect your community, not just to make flood insurance and disaster aid available. Once community leaders and citizens recognize the primary purpose of your floodplain management regulations is to protect your citizens, everyone should feel responsible for improving them.

2. USE THE BEST AVAILABLE DATA

Your regulations are designed to

protect people and property from a certain flood level. That protection level is based on records and studies that are less than perfect predictors of the hazard. Better data can be developed through more accurate ground elevations, longer streamgage records, newer study techniques, data from recent floods, and study assumptions that better reflect current and future conditions. Obtaining and using better data are covered in NAI How-to Guide for Mapping. In some communities, there is a tendency to want the lowest protection level possible in order to save money on construction costs. This simply passes flood costs on to others. You are not doing your residents or businesses any favors by setting protection levels lower than the known hazard and expected future hazard. The best way to save money over the long run is to keep your regulatory standards up-to-date and use the best available data.

3. HAVE A SOUND BASIS FOR THE STANDARDS

Regulations designed to prevent adverse impacts may face unpopular, political and even legal opposition. It's important to show the nexus between standards and what they are intended to do, and that rules and procedures are not arbitrary. Property owners, builders and developers

The NAI Approach, cont.

need to view them as necessary to protect people, property and/or natural floodplain functions.

This is especially important for legal challenges. Regulations and the process followed to review and adopt them need to describe the problem and how the standards address it. A court ruling (right) supported a very restrictive regulation because of safety hazards and potential adverse impacts on state and local finances.

4. COORDINATE WITH OTHER PROGRAMS

Coordinated regulatory programs are more effective and appreciated by permit applicants. Things will go smoother. You may also find that other programs have, in effect, higher flood protection standards. A zoning ordinance, shoreline protection setback or critical areas regulations may well prohibit or limit buildings or other types of development in some or all of the floodplain.

5. EXPLAIN THE RULES AND RATIONALE

Ordinance language can be difficult to understand. It helps to have a lay person's summary of the requirements, which can also head off misunderstandings.

People are more likely to accept regulatory requirements when they

ILLINOIS SUPREME COURT RULING

Regulatory standards that are reasonable, tied to the hazard and support public objectives usually withstand legal challenges. In upholding the state's prohibition of new buildings in northeastern Illinois floodways, the Illinois Supreme Court noted that while buildings could be designed to be protected from flood damage, there were still adverse impacts of building in the floodway: residents would be surrounded by moving water during floods, preventing access by emergency vehicles.

“The prohibition takes into consideration not only the concern about preventing further flooding, but also the concern about the need to provide disaster relief services and the need for the expenditure of state funds on shelters and rescue services for victims of flooding.” (Beverly Bank v. Illinois Department of Transportation, Sept. 19, 1991, 579 N.E.2d 815 (Ill. 1991)).

know the benefits. Show the costs of inaction (e.g., threat to safety and health, property damage, lost tax revenue, etc.) and the benefits of NAI.

Telling a permit applicant “FEMA makes us do this” is not as effective as explaining the risks (preferably with examples of past damage), and how the requirements protect people and property. A handout on the rationale should be part of a permit application package.

6. BUILD A CONSENSUS FOR BETTER RULES

If the affected stakeholders are involved in developing a new rule, it will more likely be understood, accepted and followed. Stakeholders include floodplain residents, property owners, businesses, contractors, developers, elected officials and organizations interested in developing or protecting floodplains.

The NAI Approach, cont.

It pays to have residents involved because they usually are the ones adversely impacted by new development in the floodplain. Once they see the basis for the rules is to protect them from flood damage, they often come to accept and support NAI approaches.

Involving contractors and developers provides a forum to educate them on the potential impacts of their work. It also gives them a chance to help with the regulatory language to make it better understood and enforceable. Conscientious developers do their best to build developments that are not floodprone and take pride in the reputation they have established. NAI regulations help ensure there is a level playing field so less conscientious and uninformed developers do not have a financial advantage.



As noted in the Pierce County, WA case study in the NAI How-to Guide for Mapping, staff can show people a TV news video of a flood that necessitated a helicopter rescue of a family. The family lived in a new house that was built to the NFIP criteria, but was isolated by a deep and fast moving flood (above). Screenshot from KOMO TV video.

7. TAKE ADVANTAGE OF OPPORTUNITIES

If your community or a nearby community is flooded, act quickly to record the experience. It is likely that some losses could have been prevented with NAI standards. Meet with decision makers, builders and developers while the memory is fresh and talk about more effective standards.

If your zoning, shoreline, or subdivision ordinance is up for revision, there may be ways to incorporate flood protection criteria in them. Get involved when the building inspection process is being reviewed and see if the procedures can be changed to do a better job of checking that the floodplain management standards are met.



SECTION THREE

NAI Regulations Tools

Photo credit: PixabayPix

Introduction

There are many tools in the NAI Toolkit, and this *Guide* does not cover them all. Instead, four tools are described to illustrate the broad range of possible tools communities can utilize. They show how factors for effective regulations can help communities prevent and reduce flood problems and protect natural floodplain functions.



The table on the next page shows which case studies and community examples illustrate the tools. It also identifies which “factors for effective regulations” are illustrated in each example.

Paragraphs with the Community Rating System logo (left) describe how using these tools can receive credit under the CRS.

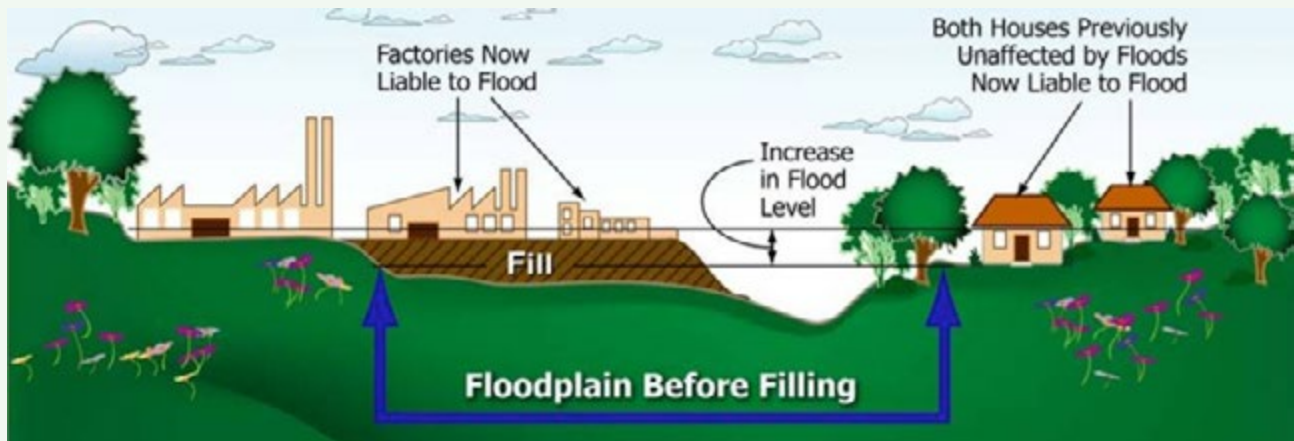
NAI Regulations Tools

NAI Case Studies	Delaware DNREC	Grays Harbor County, WA	Lee County, FL	Marana, AZ	Mecklenburg County, NC	Norman, OK	Puget Sound, WA	St. Joseph, MI	Upper Township, NJ	Weaver Creek, CO
Page number	98	75	63	86	92	110	103	57	81	80
Regulations Tools										
Tool 1. Prevent Adverse Impacts to Other Properties	•			•	•	•	•		•	•
Tool 2. Prevent Adverse Impacts to Safety and Health			•	•		•	•			
Tool 3. Prevent Adverse Impacts to Natural Functions	•	•		•	•	•	•	•	•	•
Tool 4. Preserve Undeveloped Floodplains	•	•		•	•	•	•	•	•	•
Factors for Effective Regulations										
Take responsibility for your regulations	•	•	•	•	•	•		•	•	
Use the best available data		•	•					•		
Have a sound basis for the standards	•	•	•	•		•	•	•	•	•
Coordinate with other programs	•	•			•	•	•			•
Explain the rules and rationale	•			•	•	•	•	•		•
Build a consensus for better rules				•	•	•	•	•		
Take advantage of opportunities				•	•			•		•

Tool 1: Prevent Adverse Impacts to Other Properties

It is a basic tenet of floodplain management and the foundation of the No Adverse Impact approach that new development should not be allowed to increase flooding on other properties. This is a pretty simple concept that makes sense to everyone.

While this rule applies to all floodplains, it is most often an issue along rivers and streams where an obstruction to flows can increase problems elsewhere. The NAI illustration below provides a graphic explanation of what happens when the floodplain is filled.



Tool 1: Prevent Adverse Impacts to Other Properties, cont.

To prevent development from increasing floods on others, a permit applicant needs to demonstrate the proposed project will not obstruct flows. This requires an engineering study in riverine areas. Under the minimum requirements of the NFIP, there are two types of studies:

STUDY 1.

A study conducted by the permit applicant that looks at the proposed project's impact on flood heights. If the FIRM includes BFEs, but not a floodway, 44 CFR §60.3(c)(10) must be followed. The community must:

Require until a regulatory floodway is designated, that no new construction, substantial improvements or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's FIRM, unless it is **demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than 1 foot at any point within the community.**

STUDY 2.

A study that delineates a regulatory floodway for the community.

The NFIP regulations define the floodway as “the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.” Under the minimum NFIP mapping standards, the “designated height” is 1 foot (in some states, a smaller encroachment is used). Delineating the floodway boundary is shown in the graphic on the next page.

Where the FIRM includes BFEs and a floodway, 44 CFR §60.3(d)(3) governs. The community must:

Prohibit encroachments, including fill, new construction, substantial improvements and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that **the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge.**

continued on page 34

Tool 1: Prevent Adverse Impacts to Other Properties, cont.

The floodway map approach is usually preferred as it eliminates the requirement for a case-by-case analysis for every project that is not in the floodway.

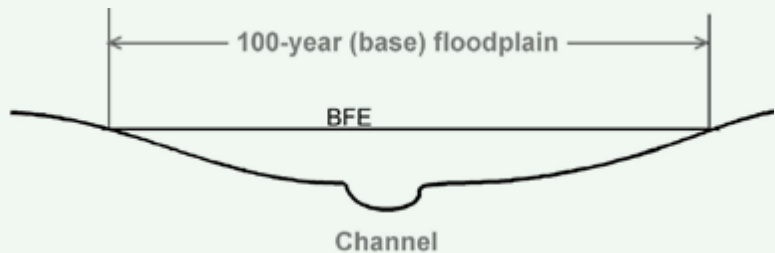
In both types, the NFIP allows flood heights to increase up to 1 foot (see graphic right) and there are no criteria that address other adverse impacts, such as increases in velocities, loss of flood storage or damage to habitat. Some background on how the NFIP criteria were developed can be found in *NAI How-to Guide to Mapping*.

THE PROBLEM

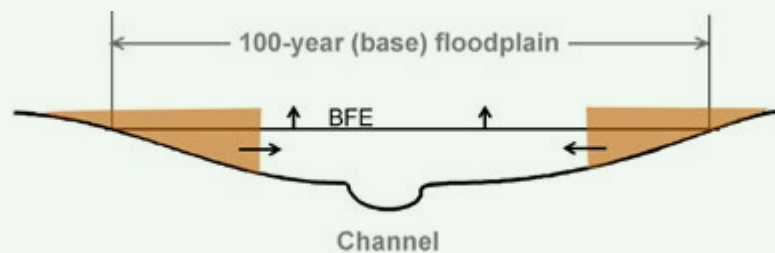
The studies required by 44 CFR §§ 60.3(c)(10) and 60.3(d)(3) are called encroachment analyses. The problem is that the standards used for encroachment analyses do not prevent adverse impacts on other properties or to public health and safety or natural floodplain functions.

Here are the top 10 reasons why the FEMA encroachment study requirements and NFIP floodway map regulations are not NAI approaches to floodplain management:

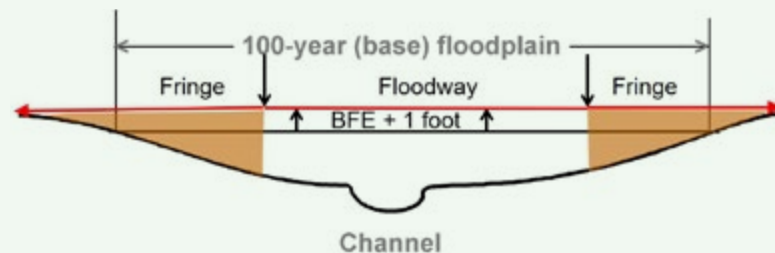
HOW FLOODWAY BOUNDARIES ARE DETERMINED



At each cross section, the hydraulic study determines the BFE.



The computer model inserts a virtual obstruction at each edge of the floodplain. This is brought closer to the channel (horizontal arrows). As this happens, the flood level increases (vertical arrows) because there is less area to carry the flow of the base flood.



The points where the increase reaches one foot above the BFE determines the boundary of the floodway (in some states, a smaller encroachment is used). The area outside the floodway is the flood fringe.

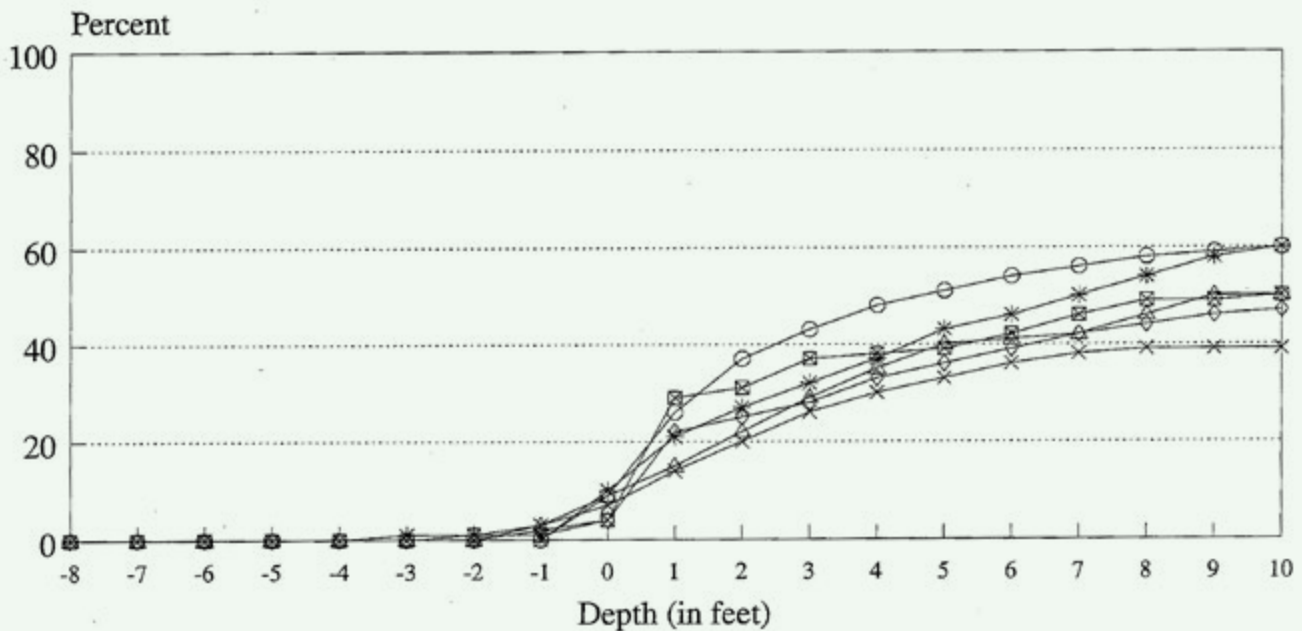
Tool 1: Prevent Adverse Impacts to Other Properties, cont.

1. Allows a significant portion of the natural floodway to be developed: A 2013 ASFPM floodway study (see box next page) showed that allowing encroachments that would result in a 1 foot rise in the base flood reduces the width of the floodway available to convey floodwaters by an average of 50 percent.

2. Increased flood damage to homes and businesses: As seen in the graph below, allowing a flood to increase by a foot can cause damage up to 30 percent of a building's value. Buildings properly elevated are now at risk. Building presently at risk face greater flood damage.

3. More properties flooded: Allowing a 1 foot increase in flood heights extends the area impacted by the base flood outward to properties outside the SFHA shown on the current FIRM. See the red line in the graphic on the previous page. In flat areas, an increase of 1 foot can expand the boundaries of the 100-year floodplain by hundreds of feet.

DAMAGE
(PERCENT OF BUILDING VALUE)



This graph was developed by the U.S. Army Corps of Engineers from data supplied by six districts around the country (hence the six lines). It shows that a flood 1 foot over the first floor causes damage between 15-30 percent of the value of a single family home (one story, no basement). While the percent of damage caused by an additional foot of floodwater decreases as the flooding gets deeper, damage is still increasing. "Catalog of Residential Depth Damage Functions Used by the Army Corps of Engineers in Flood Damage Estimation," IWR Report 92-R-3, May 1992, Figure 2.

Tool 1: Prevent Adverse Impacts to Other Properties, cont.

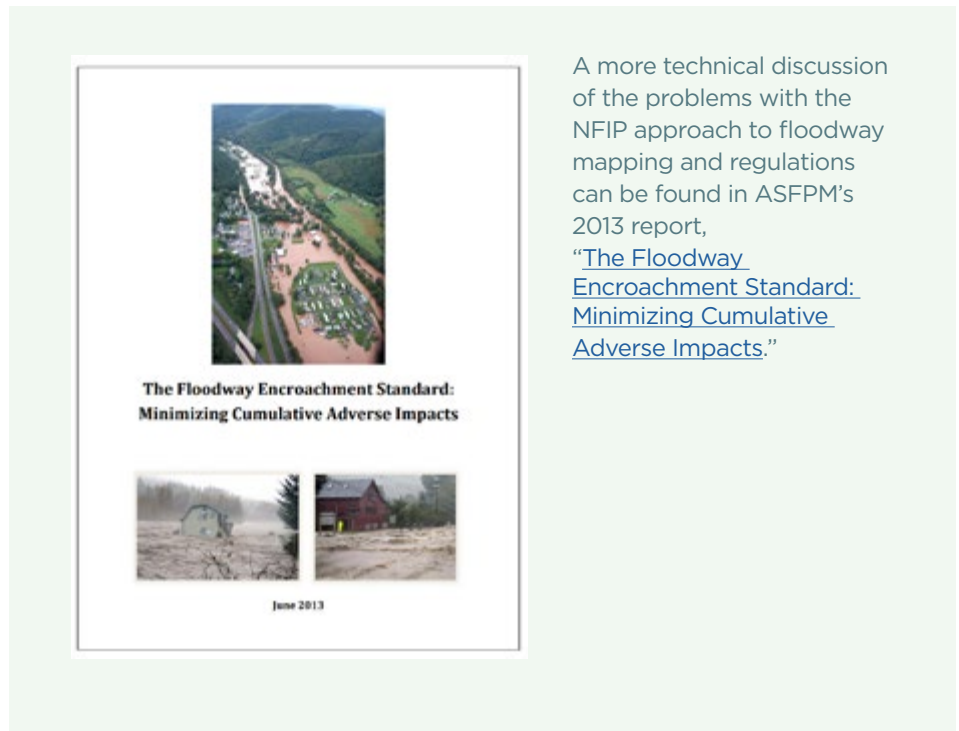
4. Increased velocities: A 2013 ASFPM floodway study (right) showed that allowing encroachments that would result in a 1 foot rise in the base flood can reduce the width of the floodway available to convey floodwaters by an average of 50 percent and increase velocities by an average of 33 percent.

“By increasing the velocity of water moving in the channel, the flowing water can scour the stream bed and deepen the channel. This means the banks are higher and often more unstable resulting in increased streambank erosion and more sediment entering the stream. Increased sedimentation makes it difficult for some fish to feed and spawn...” The Floodway Encroachment Standard, pg. 8.

5. Loss of flood storage:

The report also notes:

FEMA’s Guidelines and Specifications [for Flood hazard Mapping Partners] include guidance on how to develop a 1-foot rise floodway based on loss of storage. However, when mapping regulatory floodways,



evaluating the flood storage loss is not standard practice (pg. 19).

A loss of flood storage can have a significant impact on flood heights in wide floodplains with slow moving floodwaters. In undeveloped areas, much of the flooding is attenuated by storing the higher flows in the fringe. Storage loss due to filling up to the mapped floodway line is not reflected in a standard encroachment model that only looks at conveyance at the cross sections.

6. Damage to natural floodplain functions: The NFIP standard focuses on increased flood heights upstream of the development or fill. This is measured at the cross section as an obstruction to conveyance. An encroachment analysis could conclude there will be no increase in flood heights because the project will remove trees and pave the area, allowing more flow through a smaller cross section. However, this increases velocity and reduces flood storage, causing increased flooding downstream in addition to adversely impacting floodplain habitat.

continued on page 37

Tool 1: Prevent Adverse Impacts to Other Properties, cont.

7. Some areas are exempt from any analysis: An encroachment analysis is only required by the NFIP where the FIRM includes a BFE (i.e., there is an AE Zone). There are many streams in the country that are only mapped as approximate A Zones. In these areas, there is no NFIP requirement for analyzing the impact of the development on flood heights.

8. The flood protection level becomes obsolete: The FIRM's BFE reflects the pre-encroachment level, even though the floodway rules allow development to increase flood heights up to a foot. As a flood protection level, the BFE will be outdated as soon as any development is allowed in the fringe that obstructs flow. The next restudy will take past development into account and produce a map with higher BFEs, resulting in higher construction costs for new buildings. Because of the increased exposure, buildings built to the old BFE are subject to higher flood insurance premiums if their NFIP policies lapse.

ADVERSE IMPACTS OF FILLING

Filling is often viewed as a way to elevate land above the flood level. While there may be some flood protection benefits to the property owner, filling can have adverse impacts on other properties and natural floodplain functions, including:

- Loss of flood storage;
- Removal of trees;
- Smothering riparian vegetation;
- Destroying wetlands; and
- Constricting channels so they cannot follow their natural, meandering course.

9. Filling is encouraged: Congressional directive requires FEMA to revise FIRMs to reflect natural and manmade changes to the floodplain. As a result, allowing Letters of Map Revision based on Fill, or LOMR-Fs, to remove a building constructed on fill from the flood insurance purchase requirement and from jurisdiction under most communities' floodplain management regulations, encourages filling in the SFHA. While a property owner may only want a building protected from flood damage, the LOMR-F criteria encourage a larger amount

of fill and greater loss of flood storage in the fringe—adding to the problem.

10. Shortcomings in encroachment studies: There are also problems with the typical encroachment study and implementation of the NFIP criteria. For example, encroachment studies are supposed to look at “the cumulative effect of the proposed development, when combined with all other existing and anticipated development” (44 CFR §60.3(c)(10)). However, there is no specific definition of “anticipated development.”

Tool 1: Prevent Adverse Impacts to Other Properties, cont.

While communities may indicate that no plans for development have been received, they must recognize the legal difficulty they would have denying similar proposals after they allow the first development project. Without assuming that the entire area between the proposed development and the edge of the SFHA will also be developed, an encroachment study will not account for “the cumulative effect of the proposed development.”

FEMA developed guidance in the 1970s on how to do a cumulative impact analysis (pg. 26). However this guidance is not readily available and often neglected.

HOW TO PREVENT ADVERSE IMPACTS TO OTHER PROPERTIES

There are four types of approaches to better manage floodplain encroachments and avoid the problems previously discussed: mapping, technical review, stronger riverine regulatory provisions, and stronger coastal regulatory provisions. These are discussed under Steps 1-4. A community should use all relevant approaches simultaneously, so they are not listed in order of steps to take.

1. MAPPING APPROACHES

Mapping approaches are discussed under Tool 3 in the *NAI How-to Guide for Mapping*. That tool should be reviewed with the community’s engineer. Preparing a new floodway map may take a lot of time, so the other approaches should be pursued while waiting for a new floodway map.

If a community has a 1-foot rise floodway, it can elect to apply NAI encroachment standards to the entire floodplain instead of following the usual floodway permit process. Developers would be required to follow the five NAI steps described in Section Two. The first step in that process would be to conduct a cumulative impacts analysis. Any proposed encroachments should also be required to address other issues, such as no increase in velocity, no loss of flood storage, and the issues discussed under Tools 2, 3 and 4 in this *Guide*.

2. TECHNICAL REVIEW PROCESS

It’s often easier to tighten up technical review procedures than to enact new regulatory standards. Therefore, review procedures are discussed first. However, a complete NAI program needs to tackle both approaches.

For communities participating in the NFIP, an engineer’s certification is required for any project in a riverine floodplain. If the project is in a mapped floodway, a no-rise certification is needed. If a floodway has not been mapped, 1-foot rise certification is needed. The specific NFIP requirements are delineated in Unit 5.D of the FEMA 480 Desk Reference.

If the engineer’s analysis concludes the project will cause an increase in base flood levels in a floodway, a request for a Conditional Letter of Map Revision, or CLOMR, must be submitted to FEMA. The requirements for a CLOMR, including notifying affected property owners, are found with the instructions for [FEMA Form MT-2](#).

There is some guidance on this process in Unit 5.D, but that

continued on page 39

Tool 1: Prevent Adverse Impacts to Other Properties, cont.

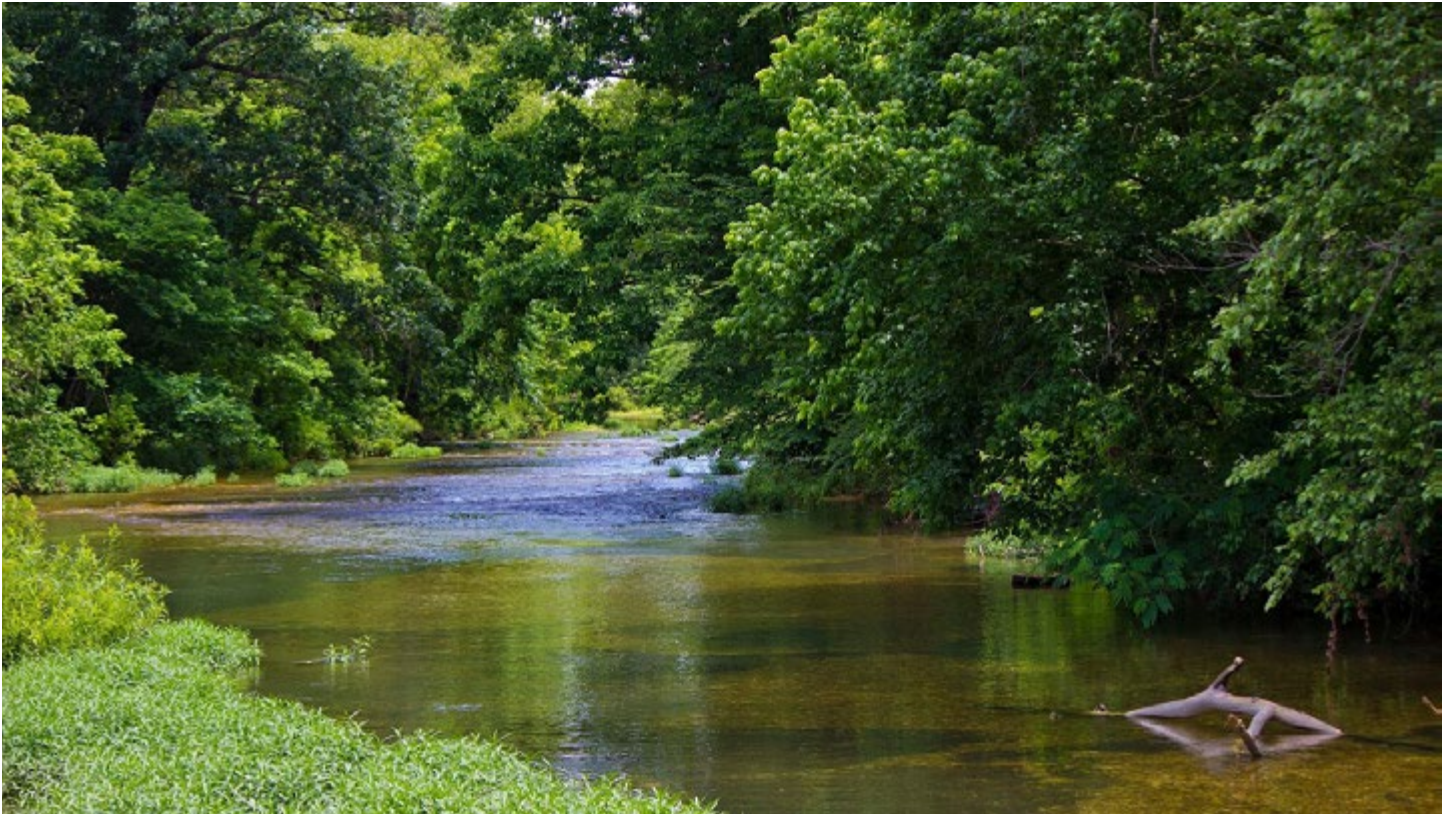


Photo via PixabayPix.

guidance is on how to meet the minimum NFIP requirement. Here are some recommendations that will make the certification more effective:

1. Require a certification for all streams. The NFIP only requires the engineer's certification where there is a floodway or a BFE on the FIRM (44 CFR §60.3(c)(10)). **While the NFIP regulations do not require a certification on streams in approximate A Zones, your community should still require them to protect all your residents from the adverse impacts of floodplain encroachments.**

Talk to your attorney about whether you would need an ordinance amendment. It is likely that your ordinance has purpose language and/or performance standards that can provide legal grounds to require a review of all permits to determine BFEs and whether proposed projects will adversely impact others (see box on next page for one example).

If your attorney does not think your ordinance has sufficient authority to require an encroachment analysis on every stream, pursue an ordinance amendment that

gives you clear authority. A good example of ordinance language is in the Norman, OK case study.

2. Require a cumulative impact analysis. While this is considered a minimum requirement of the NFIP, it is often overlooked because specific language is not in 44 CFR. An equal degree of encroachment analysis helps ensure cumulative impacts are analyzed. For example, if one structure is proposed 100 feet into the floodway, the engineer should assume future structures in the area will also be allowed to encroach into

continued on page 41

EXAMPLE ORDINANCE



CHECK YOUR ORDINANCE

The Mississippi model flood damage prevention ordinance has the following provisions. Those that could provide authority to require an engineer's encroachment certification everywhere are bold. Any question on regulatory authority should be reviewed by the community's attorney.

ARTICLE 1. STATUTORY AUTHORIZATION, FINDINGS OF FACT, PURPOSE, AND OBJECTIVES.

SECTION C. STATEMENT OF PURPOSE.

It is the purpose of this ordinance to promote the public health, safety and general welfare and to **minimize public and private losses due to flood conditions** in specific areas by provisions designed to:

1. **Restrict or prohibit uses** that are dangerous to health, safety and property due to water or erosion hazards, which result in damaging increases in erosion or in flood heights or velocities;
2. Require that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
3. **Control the alteration of natural floodplains**, stream channels and natural protective barriers in-volved in the accommodation of flood waters;
4. **Control filling, grading, dredging and other development that may increase erosion or flood damage**; and
5. **Prevent or regulate the construction of flood barriers that will unnaturally divert floodwaters or may increase flood hazards to other lands.**

...

ARTICLE 5. PROVISIONS FOR FLOOD HAZARD REDUCTION.

SECTION A. GENERAL STANDARDS FOR ALL ZONES.

4. New construction or substantial improvements shall be constructed by methods and **practices that minimize flood damage.**



Tool 1: Prevent Adverse Impacts to Other Properties, cont.

the floodway to the same degree (since future development needs to be treated fairly under the law). The proper analysis will look at the expected impact over time, not just the impact of the immediate project. See more details in box at right.

3. Specify the analysis model.

One thing to look out for is an encroachment analysis that uses a different study technique than used in the original floodway determination. An analysis based on different assumptions and/or using different techniques could easily get different results than the original basis for the floodway delineation.

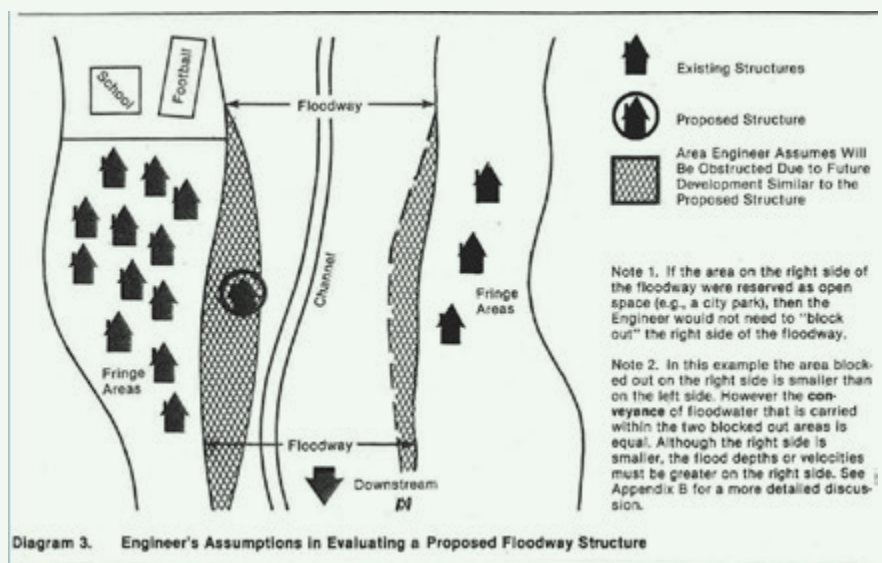
EQUAL DEGREE OF ENCROACHMENT ANALYSIS

The permit official should initially review the development plans to determine the extent of the development. In some cases, the permit official can readily determine that the proposed development will cause no change in the existing topography (for example, a play or residential lawn area). In most cases, the permit official will not be able to determine that the development will cause no rise in base flood elevations. The permit official's first assumption will be that any new obstruction in the floodway will cause some rise in base flood elevations.

When the permit official is uncertain, the developer must prove that the proposed development, along with similar future development assumed by the equal degree of encroachment rule discussed below, will not cause **any** increase in base flood elevations. The developer provides this proof by hiring a registered professional engineer to analyze the development plans and **certify** how the base flood elevations will be affected. The developer will need to utilize an engineering firm experienced in the hydrologic and hydraulic procedures specified for a Flood Insurance Study.

The FEMA Regional Office should be contacted for guidance to assure that the same or similar methodology and constants as those used in the original Study are used for the new calculations.

Normally, the professional engineer will analyze a proposal based on the equal degree of encroachment rule. For example, if one structure is proposed 100 feet into the floodway, the engineer will assume that future structures in the area will also be allowed to encroach on the floodway to this degree. So the engineer will block out this area in making his analysis. Diagram 3 shows the engineer assumes more obstruction than is created by the one proposed structure. This assumption is based on the legal difficulty a community would have denying similar proposals, if it allowed the first proposal. The equal degree of encroachment rule provides a uniform legal basis for granting or denying a proposed development and all similar future developments.



Excerpted from [The Floodway: A Guide for Permit Officials](#), Community Assistance Series No. 4. FEMA, 1979, pps. 9-10. Note: this is no longer in print.

Tool 1: Prevent Adverse Impacts to Other Properties, cont.

The NFIP requires the current effective model be used as the starting point. The community should be able to tell the applicant how to obtain the right model. If the model is unavailable the engineer should make every reasonable effort to duplicate the results on the FIRM before evaluating the proposed encroachment.

4. Specify the certification

language. You can incorporate the above approaches by giving the engineer the certification language you want. For example, specify projects demonstrate no increase in velocity and no loss of flood storage in addition to no increase in flood heights. Check with your attorney to see if you would need regulatory language to do this (see the language used by Brevard, NC on page 43).

5. Require the analysis to show the rise. Once the floodway has been defined, any additional obstruction in the floodway will result in an increase in the BFE. Requiring an analysis that demonstrates “no rise” can lead to manipulation of the floodway boundary and other problems described earlier. Instead, require an analysis that calculates the actual increase and identify which properties will be affected. If the results are not zero, this would trigger the five NAI steps explained in Section Two.

6. Review the analysis. Don't assume that if a proposal is stamped by a registered professional engineer that the project will not have adverse impacts. If your community does not have an engineer on staff with the technical expertise to review submittals, it may be necessary to seek outside technical support. The cost may be small compared to dealing with adverse impacts after the fact or the legal costs faced if the community is deemed liable for the resulting adverse impacts. The cost can also be included in the permit fee.

EXAMPLE ORDINANCE



BREVARD'S CERTIFICATION OF NO ADVERSE IMPACT

Section 34-22 specifies the floodplain development application, permit and certification requirements in the Flood Damage Prevention Ordinance of the city of Brevard, North Carolina. It lists certifications needed, such as an Elevation Certificate, Floodproofing Certificate and Certification of NAI. Here is the ordinance language:

(c) Certification requirements

(2) **Certification of no adverse impact.** When deemed appropriate by the administrator and as per section 34-33 of this chapter, development endeavors within the city of Brevard's Special Flood Hazard Areas shall be required to certify, utilizing a professional engineer licensed in the state of North Carolina, that the development endeavors of one property owner or community do not adversely affect flood risks for other properties or communities as measured by increased flood stages, increased flood velocity, increased flows, increased potential for erosion and sedimentation, or any other impact deemed important or as specified by the city of Brevard, unless the impact is mitigated as provided for in a community or watershed-based plan. This certification shall employ industry standards for hydraulic and hydrological analysis to determine no adverse impact and all data shall be provided in hard copy and digitally for review and corroboration by the city's engineer or any governmental review agency acceptable to the city of Brevard. See section 34-33 of this chapter.



Tool 1: Prevent Adverse Impacts to Other Properties, cont.



Photo via PixabayPix.

3. RIVERINE REGULATORY PROVISIONS

New regulatory standards will likely require an amendment to your ordinance. You may also need to amend your ordinance to include improvements to your technical review process that your attorney says require new regulatory authority.

1. REGULATORY PROVISIONS FOR PUBLIC SAFETY AND HABITAT PROTECTION THAT DISCOURAGE FLOODPLAIN ENCROACHMENTS.

Here are some standards for protecting public health, safety and natural floodplain functions. A side benefit is that meeting these standards often results in projects that do not cause adverse impacts to other properties.

- Require on-site waste disposal sites to be out of the floodplain for public health reasons and to reduce adverse impacts on natural floodplain functions (see the box on pg. 46 for Kenosha County's ordinance language).

- Set higher water quality protection standards where a public water supply may be adversely impacted. This was done in Mecklenburg County, NC (page 92) and Norman, OK (page 110).
- Prohibit all or some buildings in all or parts of the floodplain. The number one reason for filling and encroaching is to build buildings or infrastructure that serves buildings. Indiana, Illinois, Michigan, Montana, Washington and Wisconsin all have state requirements that prohibit most residential structures in the floodway. Marana, AZ prohibits

Tool 1: Prevent Adverse Impacts to Other Properties, cont.

buildings in areas subject to deep and fast moving floodwaters (pg. 86). Kenosha County, WI prohibits them in the floodplain overlay district (pg. 46).

- Require critical facilities or hazardous materials storage to be located out of the floodplain. Kenosha County, WI and Norman, OK restrict the latter and Marana, AZ sets standards for both.
- Require dry land access for new subdivisions and other development. This allows evacuation during high water and tends to keep development along the edge of the floodplain out of the deeper areas. Wisconsin requires dry land access, although waivers are possible where the developer can demonstrate that flood depths are shallow enough to allow emergency vehicles to access the site during a flood (see also the Marana, AZ case study).
- Coordinate flood protection regulations with protection standards for other hazards. The Brandon example to the right, which has been edited for grammar, shows how streambank erosion regulations effectively limit development in the more hazardous parts of the floodplain.
- Prohibit or restrict filling, the major contributor to encroachments and damage to natural floodplain functions. Some options:

BRANDON, VERMONT'S REGULATIONS

Brandon, VT regulates a Fluvial Erosion Hazard Zone to protect property from damage by streambank erosion. Where the FEH overlaps with the SFHA, the more restrictive requirements apply. Below is an excerpt from Article VIII Flood Hazard Regulations in the Town's Land Use Ordinance. Prohibiting new structures, storage and filling goes a long way to preventing floodplain encroachments. More information on Brandon's program can be found in NAI How-to Guide for Mapping.

Section 804. Summary Table: Development Review in Hazard Areas

The hazard areas are not appropriate sites for new structures or for development that increases the elevation of the base flood or obstructs the ability of streams to establish and maintain geomorphic equilibrium.

#	Activity	Hazard Zone		
		Special Flood Hazard Area	Floodway	FEH Zone
	P Permitted C Conditional Use Review X Prohibited A Exempted			
1	New Structures	X	X	X
2	Storage	X	X	X
3	Improvements to Existing Structures	P, C	C	C
4	Small Accessory Structures	P	X	C
5	At Grade Parking	P	C	C
6	Replacement water supply or septic systems	C	C	C
8	Fill as needed to elevate existing structures	C	C	C
9	Fill	X	X	X

- Prohibit buildings on fill (e.g., they must be constructed on piers, pilings or flow-through crawlspaces); or
- Prohibit all fill; or
- Require removal of fill to compensate for the loss of floodplain storage.



The CRS provides credit for all of the above criteria under different elements in Activity 430 (Higher Regulatory Standards).

continued on page 47

EXAMPLE ORDINANCE



KENOSHA COUNTY, WISCONSIN'S FLOODPLAIN OVERLAY DISTRICT

Section 12.26-1 of the Municipal Code of Kenosha County, WI creates a Floodplain Overlay District with several provisions that help prohibit adverse encroachments.

(g) Dumping, Filling, Excavation and Obstructions Prohibited

Lands lying within the FPO Floodplain Overlay District shall not be obstructed in any manner, nor shall such lands be used for dumping of any material or substance (including manure) or be filled, except as authorized to permit the establishment of approved bulkhead lines or to accommodate bridge approaches. **Excavation in the Floodplain area shall be prohibited**, except that normal earth grading activities as defined in this ordinance to permit utilization of the lands for open space, outdoor recreation, yard, parking and similar uses are permitted.

(h) **Storage of Materials Prohibited**

Lands lying within the FPO Floodplain Overlay District shall not be used for the storage of materials that are buoyant, flammable, explosive, or injurious to human, animal, plant, fish or other aquatic life.

(i) Incompatible Uses Prohibited

Lands lying within the FPO Floodplain Overlay District **shall not be used for any solid waste disposal** site, on-site soil absorption sanitary sewage system site, holding tank, or the construction of any wells used to obtain water for ultimate human consumption. The restricted confinement or permanent sheltering of animals shall be prohibited.

(j) Structures Prohibited

Except for navigational structures, public water measuring and control facilities, bridges and utilities, **No structures**, dwellings, mobile homes or shelters shall be located, moved or placed on lands in the FPO Floodplain Overlay District. This section shall be strictly construed and shall not be subject to variances.

...

(m) Removal of Trees and Shrubs

The **removal of trees, shrubs and foliage from the Floodplain Overlay District shall be prohibited** unless conducted in accordance with section 12.18-2 and with the further provision that such activity is conducted in a manner so as to be consistent with sound floodplain management.



Tool 1: Prevent Adverse Impacts to Other Properties, cont.

2. REGULATORY PROVISIONS THAT EFFECTIVELY LIMIT FLOODPLAIN ENCROACHMENTS.

The following regulatory provisions do not outright prohibit encroachments, but require that any potential adverse impacts are properly evaluated. The end result is that adverse impacts on existing development and natural floodplain functions are often avoided or mitigated.

- Require applicants to show projects will cause no rise in flood elevations, no increase in velocity and no loss of flood storage. As highlighted earlier, most model ordinances only address the NFIP minimum standard that focuses on increased flood heights upstream of the development or fill. This is measured at the cross section as an obstruction to conveyance. An encroachment analysis could conclude there will be no increase in flood heights because the project will remove trees and pave the area, allowing more flow through a smaller cross section.

Increasing the velocity and reducing flood storage can cause increased erosion and flooding downstream

in addition to adversely impacting floodplain habitat. Therefore, requiring no increase in velocity and no loss of flood storage closes this loophole and more fully analyses potential adverse impacts. The Brevard ordinance on page 49 is an example of this approach.

- Require a public hearing before issuing any permit in the floodway or for filling. This will allow those potentially impacted to be notified and have a venue in which to state their concerns (see pg. 110 on Norman's Floodplain Permit Committee procedures).
- Require applicants for projects that will result in any increase in flood levels to obtain a written agreement from all affected property owners, or purchase a flowage easement on the impacted properties (see next page). This would require developers to compensate for the impact of the increased flood risk.
- Do not recognize physical map revisions or LOMR-Fs, which are issued by FEMA to remove a filled property from the SFHA. They are usually requested to remove a property from the flood insurance purchase requirement and local floodplain regulation requirements.

A community may decide the mapped floodplain is the regulated floodplain, even if it is filled above the BFE. The community's ordinance will need to clarify that its jurisdiction is the SFHA on the FIRM as of a certain date, not "as later amended or revised."

The important thing is to advise the public that map revisions based on fill will only impact insurance rating and the mandatory purchase requirement, not the community's regulatory requirements.

By not recognizing a LOMR-F, the site would still be subject to all floodplain management requirements, but is treated differently for a flood insurance policy. The lowest floor must be protected to the freeboard level (meaning no basement). The end result is that filling would be discouraged as a way to avoid floodplain management requirements. Pensacola Beach stated this explicitly in its ordinance by basing the regulations on its corporate limits rather than a FEMA map and in the ordinance's definition of "Letter of Map Change" (see page 51). Minnesota does not allow areas filled above the BFE to be removed from the SFHA.

continued on page 50

EXAMPLE EASEMENT



FLOODING EASEMENT

WHEREAS, the undersigned _____
is (are) the owner (s) of certain land located near _____,
a waterway, where the same flows through part of the _____ Section (s) _____,
Township _____, Range _____, County of _____; and

WHEREAS, the State of Wisconsin, Department of Natural Resources, has determined that the
regional flood elevation at the grantor's property will be _____ feet and that the
backwater resulting from the proposed construction of _____
will constitute an increase in the regional flood elevation of approximately _____ feet
at that same location, which is _____ feet in excess of the acceptable maximum
permitted in the absence of appropriate legal arrangements under Chapter NR 116 of the
Wisconsin Administrative Code; and

WHEREAS, the Department of Natural Resources has indicated that if affected landowners
will grant to _____ flooding easements, that the plans for the
placement of the proposed _____ would be approved.

NOW, THEREFORE, in consideration of \$ _____ (_____) dollars and
other valuable consideration, the undersigned landowner (s) does (do) hereby grant to
_____ flooding rights to permit surface water from
_____ to go upon the land herein described should the same become
necessary to accommodate any backwater resulting from the construction of
_____ on the waterway herein referred to. This flowage easement is granted
as a covenant running with the land and shall be binding upon the grantor's heirs, successors
and assigns. Said increase in backwater shall be included on the official floodplain maps for
_____ as part of the regional floodplain when the existing floodplain
zoning ordinance is amended or, if no ordinance exists, or if the stream in question is not
mapped, when mapping is prepared for the stream.

Dated this _____ day of _____, 200__

Grantor _____

Grantor _____

ACKNOWLEDGEMENTS

State of Wisconsin) ss.
County of _____)

Personally came before me this _____ day of _____, 200__, the above-named to me
known to be the person (s) who executed the foregoing instrument and acknowledge the same.

Notary Public, State of Wisconsin
My commission (is) (expires) _____



EXAMPLE ORDINANCE

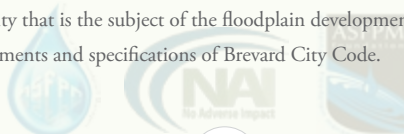


BREVARD, NORTH CAROLINA'S NO ADVERSE IMPACT CRITERIA

Brevard, NC debated an ordinance that would prohibit all floodplain development. Upon advice of its attorney, the following provisions were adopted in 2009. Key parts are in bold.

Sec. 34-33. - No adverse impact determination.

- (a) After examination of the National Flood Insurance Program standards for floodplain development, the City Council of the city of Brevard has made the judgment that due to its geographic location, topography and the extensive riverine floodplain systems within its jurisdiction that **the minimum standards of the National Flood Insurance Program are not wholly sufficient to protect its citizens and their properties from the effects of flooding**, especially in situations where flooding possibly could be exacerbated by development that would otherwise be allowable under the minimum standards of the National Flood Insurance Program, and that additional protections must be employed to protect the lives and property within the jurisdiction of the city of Brevard.
- (b) No structure or land shall be located, extended, converted, altered or developed in any way within the special flood hazard area, nor shall any floodplain development permit be issued except as otherwise provided in this chapter, until the administrator makes a determination that **the project would not increase danger to life or property and would have no adverse impact** based upon the affirmative findings that:
 1. The granting of the floodplain development permit will not create a danger that fill, construction materials or other debris or construction spoils may be swept onto properties upstream from, downstream from, or adjacent to the project area, or increase erosion and sedimentation; and
 2. **The granting of the floodplain development permit will result in no rise in the base flood elevation** as defined by this chapter; and
 3. The granting of the floodplain development permit **will not result in increased flood peaks, increased flood stages, or increased flood velocities** during the base flood discharge; and
 4. The granting of the floodplain development permit **will not increase or alter the width or extent of the floodway or special flood hazard** area except within the property or properties upon which the floodplain development is located or the property of a consenting owner, where such property is protected from future development by means of a conservation easement or other, similar restriction that is acceptable to the administrator; and
 5. The granting of the floodplain development permit **will not increase the susceptibility of any property to flooding during the base flood except the property or properties upon which the floodplain development is located or the property of a consenting owner**, where such property is protected from future development by means of a conservation easement or other, similar restriction that is acceptable to the administrator; and
 6. The granting of the floodplain development **permit will not increase the susceptibility of existing or proposed structure to flooding** during the base flood; and
 7. The granting of the floodplain development permit **will not detrimentally impact the functionality or level of service of any street, bridge or culvert, or public utility** during the base flood; and
 8. The granting of the floodplain development permit will not reduce the effective base flood storage volume of the floodplain; [and]
 9. The granting of the floodplain development permit **will not increase the susceptibility of any critical facility to flooding**, nor detrimentally impact access thereto during the base flood; and
 10. The granting of the floodplain development permit will not otherwise increase the probability of flooding or property damage and thereby create a danger to life and property, or otherwise create conditions that are injurious to the public health, safety, and welfare, or detrimental to the value of adjoining property and associated uses; and
 11. The use, structure, or other activity that is the subject of the floodplain development permit will comply with all other requirements and specifications of Brevard City Code.



Tool 1: Prevent Adverse Impacts to Other Properties, cont.



Floodplain in the city of Brevard. Image courtesy of Daniel Cobb, Director of planning and zoning, City of Brevard, N.C.

- Prohibit revisions to the floodway boundary. Frequently developers propose moving the floodway boundary and then applying for a CLOMR or LOMR to make it official. In effect, an area becomes more buildable by moving the restrictions to other properties. This is counter to the equal degree of encroachment approach and adversely impacts other properties unless the other impacted properties are either owned by the developer or easements are obtained. The regulations would define the floodway as delineated on a map and not subject to revision to accommodate a permit application.
- Prohibit any floodplain storage loss or require compensatory storage to offset storage loss caused by filling. This rule should also be enforced in the floodplain fringe, not just in the floodway. Note that requiring compensatory storage does not offset the damage cutting and filling does to natural floodplain functions.

continued on page 52

EXAMPLE ORDINANCE



PENSACOLA BEACH, FLORIDA AND LETTERS OF MAP CHANGE

Following severe damage from Hurricane Ivan, Pensacola Beach-Santa Rosa Island Authority, FL decided to treat the entire community as a coastal high hazard area and require all new construction to meet the higher V Zone standards plus 3 feet of freeboard.

The regulations are enforced everywhere, regardless of the FIRM zone. The ordinance language is simple. Instead of defining the floodplain map, A Zone or V Zone, the ordinance applies community wide:

4-3.3 APPLICABILITY.

- (a) **General.** Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable.
- (b) **Areas to which these regulations apply. These regulations shall apply to all land within the jurisdiction of the Santa Rosa Island Authority.**

To inform the public that changes to the FIRM do not remove properties from the community's regulatory requirements, the underlined statement was added in the definitions section of the ordinance:

Letter of Map Change (LOMC). An official determination issued by FEMA that amends or revises an effective Flood Insurance Rate Map or Flood Insurance Study. **Such amendments or revisions generally only affect the insurance aspects of the National Flood Insurance Program and do not alter the fact that the entire jurisdictional area of the Santa Rosa Island Authority is considered a coastal high hazard area and subject to this ordinance and the *Florida Building Code*.**



Tool 1: Prevent Adverse Impacts to Other Properties, cont.



Photo via Pixabay Pix

- Prohibit alterations to the ground or vegetation. Sometimes, developers propose compensating for an increase in flood heights by re-grading the land or removing vegetation (which reduces the roughness in the hydraulic model). They apply for a LOMR to revise the floodway boundary because these changes allow the 100-year flood to flow through a smaller area.

While the hydraulic model may show that flood levels do not increase, there are adverse impacts to this approach:

- Rivers go where they need to. Manmade alterations to the ground need continual maintenance or the channel will meander back to its natural course.
- There is usually an increase in velocities, which can increase bank erosion.
- There is usually damage to native vegetation and habitat.

- Unless maintained in perpetuity, the vegetation will grow back, increase floodway roughness, and contribute to flood flow obstructions.

An alternative to prohibiting alterations to the ground or vegetation is to require the encroachment analysis to account for increases in velocities, as noted above. This treats part of the problem, but not the damage to vegetation or habitat.

Tool 1: Prevent Adverse Impacts to Other Properties, cont.

- Two other options are to not allow removal of native vegetation (see Section m in Kenosha County's ordinance, p. 46) or require a natural floodplain functions impact assessment (see Grays Harbor County, WA box (p. 75) and Puget Sound Model Ordinance (p. 103)).

The CRS provides credit for



almost all of the above criteria under different elements in Activity 430 (Higher Regulatory Standards).

3. LAND USE REGULATIONS.

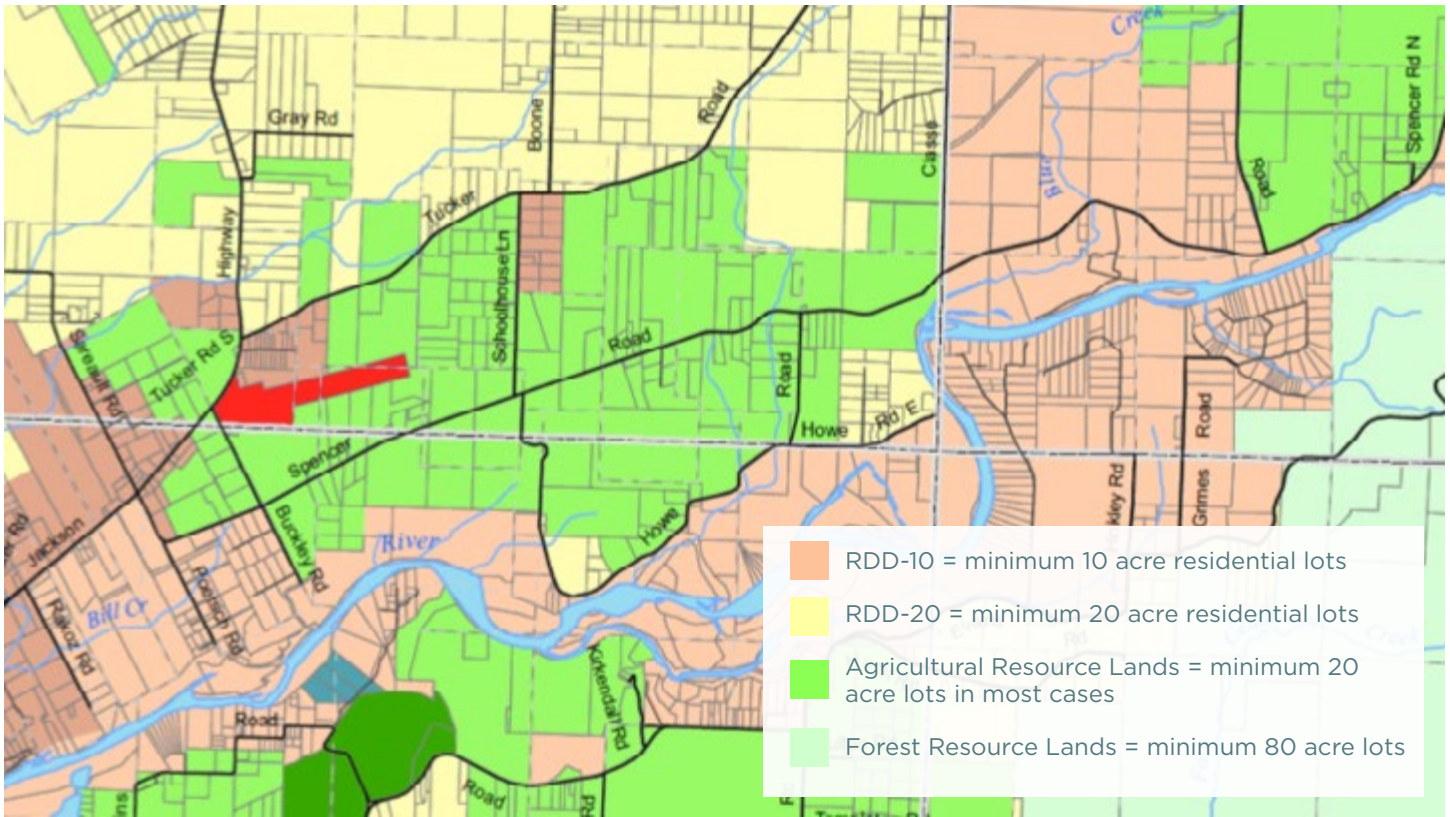
Floodway and encroachment requirements are based on preventing a project from increasing the flood hazard. These are construction standards and do not differentiate between different types of development. The shortcoming is that if developers can show the flood hazard will not be worsened, their projects can proceed, even if they adversely impact natural floodplain functions, or the development is inappropriate for a flood hazard area, such as school or nursing home.

Under local zoning authorities, communities can determine future land use, i.e., what is allowed to be built in different zoning districts. Two approaches have been used:

1. Designate zoning districts in the floodplain that minimize development or filling. These could include conservation, agriculture, forestry and very low density use, such as 10-acre-lot, single family residential. These districts allow owners an economic return on their land, but prohibit the more common problematic developments, such as high-density residential development or commercial and industrial activities.

An example of such zoning along the Cowlitz River is on the next page.

Tool 1: Prevent Adverse Impacts to ther Properties, cont.



Lewis County, WA zoned the areas along the Cowlitz River for low density land uses.

2. Create a zoning overlay district. This approach does not change the underlying land use designation, but restricts certain uses because of the flood hazard. For example, residential buildings could be prohibited in the floodway, even in a residential zoning district.

Examples of this approach to regulations can be seen for Kenosha County, WI, (p. 46, Section j) and Lawrence and Overland Park, KS (next page).



The CRS provides credit for low density zoning districts in Activity 420 (Open Space Preservation). The prohibition of buildings in an area, such as the floodway, is credited under Activity 430 (Higher Regulatory Standards).

EXAMPLE ORDINANCE



KANSAS COMMUNITIES' FLOODWAY RULES

The cities of Lawrence and Overland Park, KS have a simple approach to limiting development in the floodway. In addition to requiring a demonstration that there will be no increase in the BFE, their ordinances specify land uses in the floodway, similar to a zoning ordinance. The uses do not include buildings, many kinds of structures, and similar activities that encourage more encroachments.

Lawrence

Section 20-1204 of Lawrence's Land Development Code restricts what can be constructed in the floodway. These restrictions mean most development projects that would need an encroachment analysis are not allowed.

(b) Floodway Restrictions

Any encroachment, including fill, new construction, substantial improvements or cumulative improvements or other development is prohibited within the regulatory floodway, except for the following structures:

1. Flood control and stormwater management structures;
2. Road improvements and repair;
3. Utility Easements/Rights-of-way; and
4. Public improvements or public structures for bridging the floodway.

Overland Park

Overland Park's floodplain manager said the biggest challenge was prohibiting reconstruction of a substantially damaged building in the floodway. To date, they've only had two buildings where that came into play (both were owned by banks). The owners opted to tear down the buildings and not fight the regulation or try to get a variance.

18.360.460 Permitted uses; prohibited uses

A. Floodway

Only uses having a low flood-damage potential and not obstructing flood flows shall be permitted within the floodway to the extent they are not prohibited by any applicable law, ordinance or regulation. No use shall create ANY increase in the Base Flood Elevation. The following uses are permitted in accordance with standards established in this chapter:

1. Agricultural uses such as general farming, pastures, nurseries, forestry.
2. Residential uses such as lawns, gardens and yard areas, however, residential parking areas shall not be permitted.
3. Boat ramps.
4. Public and private recreational uses such as golf courses, archery ranges, picnic grounds, parks, wildlife and nature preserves.
5. Utilities.

Any use not enumerated above is prohibited within the floodway.



Tool 1: Prevent Adverse Impacts to ther Properties, cont.



Photo via PixabayPix

4. COASTAL REGULATORY PROVISIONS

While most of Tool 4 focuses on adverse impacts caused by encroachments in riverine floodplains, coastal properties can also be damaged by development projects. This happens when the floodplain is altered and coastal flooding is increased or diverted to other properties. Here are two measures to consider.

- The NFIP minimum requirements already have two provisions in V Zone coastal high hazard areas to protect neighboring properties.

- 44 CFR §60.3(e)(4) and (5) require buildings to be on pilings or columns so there will be minimum debris during a flood and to prevent deflecting waves onto adjacent properties.
- 44 CFR §60.3(e)(7) prohibits alterations of sand dunes and mangrove stands, which have proven effective in dissipating waves during coastal storms.

Development projects that alter the shoreline have been shown to cause problems on other properties. Seawalls, jetties and groins impact the transfer of sediment, starving some areas of

the natural beach replenishment that protects inland structures. The St. Joseph, MI example on the next page describes the process followed by one community to prohibit such structures.

Tool 1: Prevent Adverse Impacts to Other Properties, cont.

ST JOSEPH, MICHIGAN ENACTS A COASTAL SETBACK OVERLAY DISTRICT

St. Joseph, MI is on the southeastern shore of Lake Michigan where storms have caused significant beach erosion over the years. In January 2012, the city received an application for a permit to build a large seawall to protect the applicant's property. Adjacent property owners and the surrounding community raised objections based on concerns that the proposed seawall would likely aggravate erosion on neighboring properties and limit public access to the shoreline.

The application was withdrawn, but there still were concerns about what could be built on the lakeshore and who might suffer consequences. Private donors, with support from the City Commission, funded an engineering study to evaluate potential impacts of construction near the lakeshore. The study looked at historic Lake Michigan water levels and extreme weather events and recommended a fixed setback line, beyond which property owners could not build permanent structures along the beach. The line was based on historic high water levels, anticipated storm surge and waves from storm events.

The study became the focal point for discussion at meetings that included the City Commission, general public and the study's engineers. On one side there was concern about taking people's right to use and protect their land and the scientific basis for the line. On the other side were those who did not want adverse impacts from neighbors' projects.

The open discussion proved very valuable. In fall 2012, the St. Joseph City Commission passed a "no-build" zoning ordinance that, in accordance with the consulting engineers' recommendations, prohibits construction of permanent structures at a fixed elevation above sea level, which intersects with the shoreline approximately 200 feet from the water's edge. The recommended elevation was determined by adding a 2-foot storm surge and a 50-year wave run up to Lake Michigan's record high water level.

A consensus was reached partly because of key conditions: the line would be reviewed periodically and zoning restrictions in the Edgewater Beach Overlay District did not prohibit every use. Even though it says "No structure shall be installed or constructed" in the district, stairways, free standing signs and short temporary fences to accumulate sand are allowed.

An example of the benefits of a process that allows for review and discussion of technical issues is this quote from resident Herald Palladium, Sept. 7, 2012, "Commissioner Phil Maki said he had been against having a fixed line for setbacks, but in reading the study he came to favor its simplicity and predictability." A balance was found between private property rights and preventing adverse impacts from floodplain development.

Since then, the original permit applicants have moved their house landward, outside the overlay district.



Photograph from Section 9.7.2.1 Area of Edgewater Beach Overlay District, St. Joseph, MI Zoning Ordinance.

Tool 2: Prevent Adverse Impacts to Safety and Health

Floods bring a variety of safety and health hazards. There should be no greater community objective than to protect the lives and welfare of citizens. While it appears many floodplain management programs are concerned about buildings and property, protecting people from safety and health hazards should be just as, or more, important to your community.

There have been several cases of deadly floods motivating elected officials and communities to seriously address their communities' flood problems, even though they'd had many floods that just caused property damage. For example, after Tulsa,

OK lost 17 residents in a 1984 flood, city leaders, "[...responded to the shock of this killer flash flood with community-wide commitment to end our recurring disasters. Determined leaders crafted a unified program to curb flood losses.](#)"

That work paid off with a comprehensive program. According to the city flood control and drainage web page, since the city adopted comprehensive drainage regulations, it's had no record of flooding in any structure built in accord with those regulations. Tulsa was the first CRS Class 5 community in the country and is now a CRS Class 2.

Tool 2: Prevent Adverse Impacts to Safety and Health, cont.

However, it should not take deaths to prod your leaders to act. Instead, the NAI approach is to move proactively with good regulations that will prevent these adverse impacts on people's lives and health. This Tool reviews a variety of regulatory provisions to do this.

You should have a multi-pronged approach. Measures to protect safety and health rely heavily on people to protect themselves, such as evacuating after warnings are issued. Therefore, your program should include education, outreach and emergency management tools, which are discussed in other *NAI How-to Guides*.

HOW TO PREVENT ADVERSE IMPACTS TO SAFETY AND HEALTH

STEP 1. DETERMINE THE SAFETY AND HEALTH HAZARDS

Your community's program should address your community's needs. The first step in designing a program to protect people from safety and health hazards is to identify those hazards. Review your flood history, current and future flooding conditions, and existing and expected floodplain development to prepare a list of the types of problems your floodplain management program should address.

1. Common safety hazards.

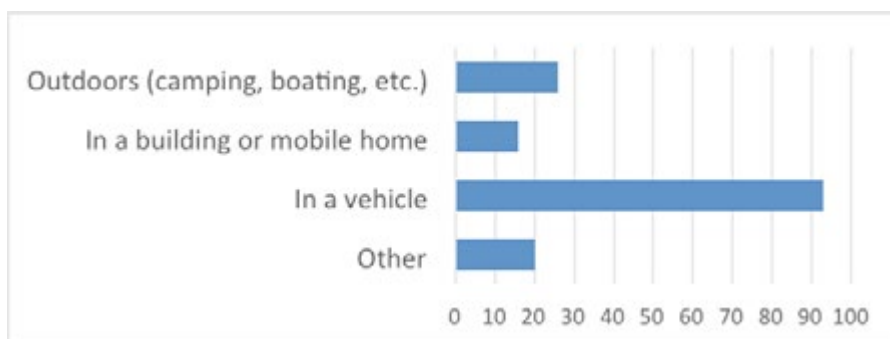
The National Weather Service keeps track of fatalities by weather event.



"A woman waits to be rescued by the Tucson Fire Department" July 23, 2007. Photo by: Aaron J. Latham with Arizona Daily Star in FEMA photo library.

Between 2006-2015, flash flood and riverine flood deaths averaged 82 per year and hurricane deaths (which don't differentiate between wind and flood) averaged 43 per year.

2015 had the highest number of people killed by flash floods and riverine floods since 2005. There were 176 and they occurred in the locations shown in the graph to the left. Note the graph indicates deaths due to riverine flooding and does not include the more than 1,000 people killed in Louisiana and Mississippi during the flooding caused by Hurricane Katrina in 2005.



Location of the 176 flood deaths in 2015.

Tool 2: Prevent Adverse Impacts to Safety and Health, cont.



A flood on the St. Mary's River severed an arterial highway, US 301. - Nassau County, FL, 2012, Keith Gaston.

The distribution of flood deaths by location in 2015 was typical of the recent decades: more people are killed in their cars or other vehicles than anywhere else. There is reason to believe that many drivers ignored warning signs and drove into flooded areas. That is the motivator for the NWS's "Turn Around, Don't Drown" campaign.

It may appear that development regulations would not impact flood deaths if so few people are killed in buildings. However, people in their vehicles were likely going to or from a flood-prone building and were driving

on a road that went underwater during a flood or tried to cross a bridge that may have washed away (see photo above). The NFIP has no standards for road construction.

Other sources of flood deaths or injuries include:

- Electrocutation from downed power lines or when a person enters a flooded building without turning off the power;
- Injury from falling ceilings, broken flooring, etc., when a damaged building is re-entered; and/or
- Injuries and strains from heavy cleanup work.

There is a special risk to first responders and rescue personnel. After the 1973 Rapid City, SD flood killed 220 people, the mayor estimated 10 percent were people trying to rescue others caught in the flood.

Flooding can also shut down or prevent access to critical facilities like hospitals, nursing homes and schools. This exposes citizens to safety hazards caused or aggravated by floods. Sadly, a number of the deaths associated with Hurricane Katrina were nursing home patients incapable of evacuating on their own.

Tool 2: Prevent Adverse Impacts to Safety and Health, cont.

2. Common health hazards.

Health hazards are not as obvious or newsworthy as safety hazards. But they can be just as dangerous and affect many more people. The Centers for Disease Control and Prevention lists the following concerns:

- Eating or drinking anything contaminated by floodwater can cause diarrheal disease;
- Open wounds and rashes exposed to floodwaters can become infected;
- Trench foot, also known as immersion foot, occurs when feet are wet too long;
- Hazardous materials in floodwaters when chemical containers move, float and leak; and
- Animals, insects and reptiles displaced from flooded areas.

Other health concerns that come after a flood include:

- Contamination of public or private water supplies that are used for drinking, cleaning and bathing;
- Mold and mildew in damp areas that are not adequately dried out. They can cause nasal stuffiness, eye irritation, wheezing and skin irritation. People with allergies to molds may have more severe



This car was washed off the highway and its occupants had to be rescued when Tropical Storm Erin flooded Kingfisher, OK in 2007. - FEMA photo.

- reactions, including fever, shortness of breath and lung problems;
- Heart and back problems caused by the stress and strain of cleaning up;
- Loss of vital medicine or having insufficient supplies after evacuating; and
- Anxiety, stress and fatigue when residents are faced with the extent of damage, cost of cleanup and repairs, and uncertainties about whether their homes can be reoccupied or whether they will get a grant to mitigate or relocate.

clinic or doctor's office is closed or inaccessible. When facilities like cell phone towers, power stations, water treatment plants and natural gas lines are flooded or knocked out, it impacts properties well beyond the flooded areas. Homes without heat or potable water are not considered safe and sanitary housing.

As with safety hazards, health hazards can affect many people when critical facilities are impacted. People may forego regular health care if a hospital,

Tool 2: Prevent Adverse Impacts to Safety and Health, cont.



Professional and volunteer rescue personnel are exposed to safety and health hazards, including polluted floodwaters. Sometimes the people being rescued live in buildings that meet the floodplain management regulatory standards, but they are isolated during a flood. - Kingfisher, OK, 2007, FEMA/Marvin Nauman.

STEP 2. REVIEW AND ADOPT PROVISIONS FOR LARGER DEVELOPMENTS

Step 2 addresses safety and health provisions that are appropriate for larger subdivisions, commercial complexes, planned unit developments and similar projects.

Obviously, the safest way to manage a floodplain is to keep it as open space. This is discussed under Tool 4 and shows there is more flexibility for a larger development to incorporate NAI standards.

- **Dry land access:** This means ensuring new streets are at or above a flood protection elevation. This would allow vehicular access during high water.

Dry land access is required for all communities in Wisconsin. The Wisconsin regulations use this definition: *A vehicular access route that is above the regional flood elevation and connects land located in the floodplain to land outside the floodplain, such as a road with its surface above regional flood elevation*

and wide enough for wheeled rescue and relief vehicles.

Some communities require access roads to be no more than 1 foot below the BFE, which at least allows reasonably safe access by emergency vehicles and trucks during the base flood (but not during higher floods).

As noted before, meeting this requirement often requires filling. The adverse impacts of filling are discussed in the box on page 37.

Tool 2: Prevent Adverse Impacts to Safety and Health, cont.

Therefore, if there is no natural high ground and filling is required, it is only recommended in areas already built up (i.e., areas with few or no natural floodplain functions), subject to coastal flooding (where floodwater storage is not an issue), and/or shallow flooding (to minimize the amount of filling).

- **Evacuation plans:** In areas with several hours of flood warning time, evacuation is an option. Some communities require developers of certain sized subdivisions to provide evacuation plans. Lee County, FL has gone one step farther by requiring developers to address the impact of more people living in a floodplain when there are limited evacuation and shelter facilities.
- **High hazard areas:** Some parts of the floodplain may be so hazardous that all buildings or other types of development should be prohibited because of the threat to lives. For example, Minnesota, Montana, Washington and Wisconsin prohibit residential development in the floodway. The Illinois Supreme Court case (p. 27) shows how life safety concerns upheld the state's prohibition of all buildings in the floodway.

LEE COUNTY, FLORIDA'S REGULATIONS FOR HURRICANE PREPAREDNESS

Lee County, FL is along the southwest coast. The county is vulnerable to significant storm surge flooding from hurricanes. Limited shelter space, high evacuation clearance times and large coastal populations require emergency management staff to carefully plan how to best evacuate and shelter residents and visitors in advance of storms. For this reason, the Lee County Land Development Code includes provisions that require new developments to take these issues into consideration. The regulation begins with:

The purpose of this article is to address the impacts created by residential development on hurricane shelter availability and evacuation capability in Lee County. These regulations are intended to mitigate the growing hurricane shelter deficit, along with related effects on evacuation times and infrastructure, caused by permitting residential development without addressing the incremental impact on the county hurricane preparedness program. –Lee County Development Code, Chapter 2, Article XI, Hurricane Preparedness, Section 2-481.

The regulation includes formulas for determining impacts from hotels, healthcare facilities, houses, mobile home parks, etc. The formulas help determine shelter seeking rates, shelter square footage requirements and other key data related to evacuation and sheltering impacts.

Developers have several options to mitigate these shelter and evacuation impacts, including providing land for shelters, use of private structures as shelters and funds that assist in hurricane shelter and evacuation planning.

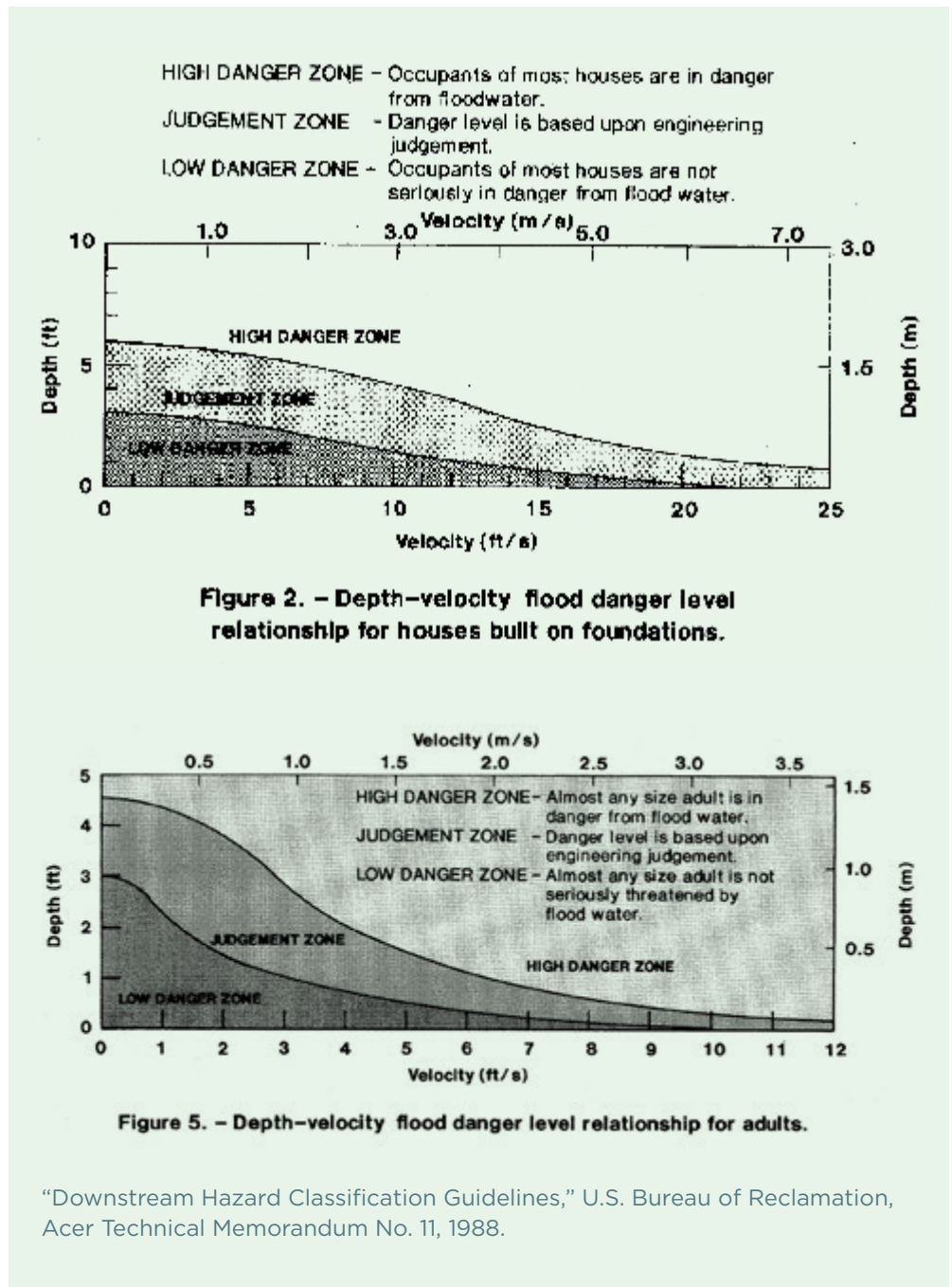
Tool 2: Prevent Adverse Impacts to Safety and Health, cont.

Some communities prohibit residential buildings in areas of deep or fast moving floodwaters because of the safety threat (see Marana, AZ p. 86 and the Pierce County, Washington case study in the NAI Mapping How-to Guide). The graphs at right are from a U.S. Bureau of Reclamation report prepared for guidance in areas downstream of dams. They relate flood depth and velocity hazards for houses (Figure 2) and for people (Figure 5). The graphs could be used by a community, coupled with average floodway velocities (from the Flood Insurance Study) and base flood depths, to prepare a map of areas unsafe for residential developments.



Regulations that prohibit

buildings from all or parts of the floodplain are credited under the Development Limitations (DL2) element in Activity 430 (Higher Regulatory Standards). The other provisions listed would be credited under 430, (Other Higher Standards).



“Downstream Hazard Classification Guidelines,” U.S. Bureau of Reclamation, Acer Technical Memorandum No. 11, 1988.

Tool 2: Prevent Adverse Impacts to Safety and Health, cont.

STEP 3. REVIEW AND ADOPT PROVISIONS FOR INDIVIDUAL SITES

This step covers safety and health regulations for individual sites that will be developed or re-developed. These can be applied to individual buildings and single parcel projects.

- **Dry land construction:** Dry land access requirements (discussed on page 62) could result in streets higher than the adjacent buildings. Dry land construction requires buildings to be on fill (or preferably, natural high ground), so a person can walk out the front door and be on dry land, which facilitates rescue operations. The best approach is access on dry land all the way to high ground.

The downside to this provision is that filling adversely impacts floodplain storage and natural floodplain functions (see box p. 37). Therefore, if there is no natural high ground and filling is required, it's only recommended in areas already built up (i.e., areas with few or no natural floodplain functions), subject to coastal flooding (where floodwater storage is not an issue), and/or shallow flooding (to minimize the amount of fill).

- **Public health regulations:** Most communities have public health regulations that govern the location and placement of private wells, septic systems and sanitary sewer lines constructed by developers. The NFIP requirements are general performance standards. For example, on-site waste disposal systems must “be located to avoid impairment to them or contamination from them during flooding.”

Some communities and states have adopted more specific and restrictive standards, such as prohibiting private wells and septic systems from the 10-year or 100-year floodplains.

The Minnesota Pollution Control Agency regulations state that individual subsurface sewage treatment systems “...must not be located in a floodway and, whenever possible, placement within any part of the floodplain should be avoided. If no alternative exists, a system is allowed to be placed within the flood fringe if the requirements in subparts 4 to 11 are met.” –Minnesota Administrative Rules, 7080.2270 Floodplain Areas.

- Subparts 4-11 include specific requirements for openings, backflow prevention and similar precautions to prevent flowage or seepage from the system into floodwaters.
- **Hazardous materials:** Oil and gas wells, gasoline, farm chemicals, storage tanks, explosives and similar hazardous materials should be prohibited from the floodplain or subject to higher standards of care, such as being elevated above the 500-year flood level in properly anchored containers.

Storage tanks may look benign, but during a flood they can float, crack, leak hazardous materials and hit buildings or plug bridge openings. If they cannot be elevated above flood levels, underground and above ground storage tanks should be designed and installed to account for flood loads assuming at least 1.5 times the potential buoyant and other flood forces acting on empty tanks. Tank inlets, fill openings, outlets and vents should be located above the 500-year flood elevation and they should have barriers to protect them from impact by large debris. Maryland recommends that oil tanks are anchored (see p. 68).

Tool 2: Prevent Adverse Impacts to Safety and Health, cont.



A hazmat team checks damage and oil contamination from flooded propane tanks.
- Franklin, VA, 1999, Liz Roll/FEMA.



An oil spill caused by Hurricane Katrina covers the streets of Chalmette.
- Chalmette, LA, 2005 Bob McMillan/FEMA.

- **Critical facilities protection:** The dangers posed by critical facilities being flooded or isolated by floods are discussed under Step 1. Where possible, these facilities should be kept out of the 500-year floodplain. This may not be possible in very large floodplains that need fire stations, schools and other public facilities to serve the residents of the area. In such cases, a more specific definition is needed for what is allowed and prohibited.

- Where new critical facilities or expansions to existing facilities are allowed, there should at least be a requirement to protect them to the 500-year level and have dry land access during the 500-year flood (but note the problems of dry land access requiring fill discussed on p. 65).

The following model ordinance language was developed by Washington's Chehalis River Basin Flood Authority:

Definition of affected critical facilities:

“Critical Facility: a facility necessary to protect the public health, safety and welfare during a flood. Critical facilities include, but are not limited to, schools, nursing homes, hospitals, police, fire and emergency operations installations, water and wastewater treatment plants, electric power stations and installations which produce, use or store hazardous materials or hazardous waste (other than consumer products containing

Tool 2: Prevent Adverse Impacts to Safety and Health, cont.

hazardous substances or hazardous waste intended for household use).”

- Prohibition language:

“Construction of new critical facilities shall be located outside the 500-year floodplain or the area inundated by [the highest recorded flood], whichever is larger (see also Marana’s ordinance, p. 86).”

- Protection language:

“a) Construction of new critical facilities shall be, to the extent possible, located outside the 500-year floodplain or the area inundated by [the highest recorded flood], whichever is larger.

b) Construction of new critical facilities in the area of special flood hazard shall be permissible if no feasible alternative site is available, provided:

1) Critical facilities shall have the lowest floor elevated 3 feet above the BFE or 1 foot above the 500-year flood elevation, whichever is higher. If there is no available data on the 500-year flood, the permit applicants shall develop the needed data in accordance with FEMA mapping guidelines.



This fire station was constructed above the 500-year flood level. Only minimal clean up was needed after Hurricane Sandy. - Sea Bright, NJ, 2012, Patsy Lynch/FEMA.

2) Access to and from the critical facility shall be protected to 1 foot above the 500-year flood elevation or 1 foot above [the highest recorded flood elevation], whichever is higher.”



Prohibition of hazardous materials and standards for storage of them are credited under the Development Limitations element in Activity 430 (Higher Regulatory Standards). There is a separate element for Protection of Critical Facilities in 430. The other provisions listed would be credited under 430 (Other Higher Standards).

EXAMPLE ORDINANCE



MARYLAND MODEL ORDINANCE LANGUAGE

4.11 Gas or Liquid Storage Tanks

- (A) Underground tanks in flood hazard areas shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the base flood.
- (B) Above-ground tanks in flood hazard areas shall be anchored to a supporting structure and elevated to or above the base flood elevation, or shall be anchored or otherwise designed and constructed to prevent flotation, collapse, or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, during conditions of the base flood.
- (C) In flood hazard areas, tank inlets, fill openings, outlets and vents shall be:
 - (1) At or above the base flood elevation or fitted with covers designed to prevent the inflow of floodwater or outflow of the contents of the tanks during conditions of the base flood; and
 - (2) Anchored to prevent lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, during conditions of the base flood.



Tool 3: Prevent Adverse Impacts to Natural Floodplain

Too often floodplain managers focus their efforts only on protecting people and property from flooding. The profession is also about protecting natural floodplain functions from development by filling the floodplain, draining wetlands, diverting water and making other changes to the land that have adverse impacts on natural functions. The benefits of protecting natural functions, include:

- Protecting wildlife habitat;
- Preserving flood storage (which helps prevent increased flood heights and velocities);

- Improving water quality;
- Providing compatible recreational opportunities; and
- Increasing neighboring property values.

There are many existing programs that regulate development, inform the public and/or fund actions that protect natural functions, even though they may not explicitly be floodplain management programs. The biggest challenge in Tool 3 is learning about these programs and coordinating your floodplain management activities with them.

Tool 3: Prevent Adverse Impacts to Natural Floodplain, cont.



A seagull gives new meaning to reserved parking at Rogue Bluffs State Park, Maine.
Photo by Capt. Albert E. Theberge (NOAA).



Just one of the many recreational opportunities available when protecting natural flood functions.
Photo by Mike Bach.

HOW TO PROTECT NATURAL FLOODPLAIN FUNCTIONS

STEP 1. IDENTIFY AREAS AND FUNCTIONS WARRANTING PROTECTION

Start with determining what natural floodplain functions in your community need protection. Here's a checklist of things to look for in your floodplain:

- Parks, conservation areas, refuges or undeveloped public open spaces
- Undeveloped privately-owned land
- Sand dunes
- Mangrove stands
- Wetlands (There may be a regional or state inventory. If not, check the [National Wetland Inventory](#))
- Threatened or endangered species habitat (Start with the [US Fish & Wildlife Service maps](#))
- Wildlife migration routes
- Designated shoreline protection areas
- Critical or sensitive areas designated by a state or federal program
- Important water quality designations for the waterway
- Other programs and sources discussed in Step 1 of Tool 2, Integrate Your Maps, in NAI How-to Guide for Mapping

Don't assume that every place in your floodplain with functions worth protecting has been designated on a public map. Prepare your own map showing which areas support natural floodplain functions. To do this, talk to those who work with natural functions, including

Tool 3: Prevent Adverse Impacts to Natural Floodplain, cont.

- Parks and recreation department staff
- Environmental program staff
- Stormwater management staff, such as the MS4 office
- Staff of state and federal wildlife or natural resources programs
- Environmental groups, land trusts, neighborhood groups, etc.

There could be many areas and functions, so you may have to prioritize them. Areas that should be a high priority for attention include:

- Properties prime for development or with known developer interest
- Habitat for flora or fauna that have been designated as threatened or endangered by a state or federal program
- Critical wildlife migration routes
- Areas or functions not protected by an existing program



The element Additional Map Data in Activity

440 (Flood Data Maintenance) credits having GIS layers showing different features, such as soils unsuitable for septic fields and areas with natural floodplain functions.

The credit is dependent upon the communities using the information in its regulatory program.

STEP 2. DETERMINE THE PROTECTION NEEDS

What do you need to protect your natural functions priority areas? See if there is already a habitat conservation, land acquisition or species protection plan that has reviewed what should be done and listed action items.

For those areas and functions that are not covered by an existing plan:

- Review your list with agency staff and knowledgeable groups to identify relevant regulatory programs;
- Review their rules and permit procedures;
- Identify where their regulations support or complement protecting your community's natural floodplain functions and how your programs support their goals; and
- Identify where natural floodplain functions are not adequately protected by either other programs or your community's programs. These should be your next priorities for attention.



Activity 510 (Floodplain Management Planning)

has two elements that recognize plans that address natural floodplain functions: Floodplain Management Planning and Natural Floodplain functions Plan. The latter can be prepared by any local or regional agency. Your NAI research may find another agency's plan that deserves credit or may help provide the data needed for preparing a creditable community plan.

Tool 3: Prevent Adverse Impacts to Natural Floodplain, cont.



Birch Island beach showing gradation of sediment from coarse pebbles to sand as one moves up from the shoreline. Sea-weed is evident along “rack” line showing furthest extent of normal high tide. Wildflower seeds float in on algae and take root helping preserve sediment. Photo by: David Sinson, NOAA.

STEP 3. COORDINATE WITH ENVIRONMENTAL PROTECTION PROGRAMS

Once you know what areas and natural floodplain functions need protection (Step 1) and what programs are in effect (Step 2), develop procedures to coordinate these programs with your floodplain management activities.

A good place to start is to have a smooth process to review each

other’s permit applications. A memorandum of understanding or similar agreement might help ensure an office will not issue a permit without coordination or a sign-off from the other related offices.

While you may already have developed such procedures, here’s a checklist of state programs to coordinate with:

- Is there a state office that issues floodplain or floodway development permits?

- Is part of your floodplain in a coastal zone subject to state rules on construction, alteration of dunes or protection of habitat? This question should be answered by [your state coastal zone management office](#).
- Are there state coastal or riverine erosion regulations? Do they prohibit or limit new buildings in a certain area? Do they place restrictions on seawalls or other erosion protection measures? Talk to the department of natural resources or the equivalent.

Tool 3: Prevent Adverse Impacts to Natural Floodplain, cont.

- Is there a state shoreline protection program?
- Is there a state program to protect sensitive or critical areas (see the Grays Harbor County, WA example, p. 75)?
- Are there any watershed plans in place?
- Is there a state growth management act or regulations on developing rural areas?

Here's a checklist of possible federal programs to look into:

- Is part of your floodplain on a navigable river, lake or the Intracoastal Waterway? If so, see what the Corps requires under Section 10 or other authorities. [Find your Corps district office.](#)
- Are there any water bodies or wetlands subject to the Corps' 404 wetlands permits and/or state delegated fill permits?
- Check with the [U.S. Fish & Wildlife Service](#) to see if your community has any designated habitat for threatened or endangered inland species.
- Check with the [National Marine Fisheries Service](#) to see if your community has any designated habitat for threatened or endangered marine species.

- The US Environmental Protection Agency has water quality programs, but most states have been delegated the authority to administer some of them. Most medium to large communities have their own office responsible for programs like National Pollutant Discharge Elimination System and Municipal Separate Storm Sewer Systems.
- Does your community have federal facilities where future construction would be subject to Executive Orders 11988, 11990 and 13690? These orders set standards for federal agency activities in floodplains and wetlands.

STEP 4. REVIEW AND ADOPT REGULATORY PROVISIONS

What can your community's floodplain management program do to protect natural floodplain functions not already protected by another program? Consider the following:

- Adopt regulatory language that prohibits filling, building or other types of development in all or parts of your floodplain. Generally, the best way to protect natural floodplain functions is to not fill or develop an area at all.

Approaches to prevent development in undeveloped natural areas are reviewed in Tool 4's "Preserve Undeveloped Floodplains."

- Short of a full prohibition of all development, prohibit the most damaging actions. Examples would be hazardous materials storage, septic systems and filling. Only water dependent development could be allowed, such as marinas and boat houses.
- In lieu of prohibiting development throughout the floodplain, a regulation could prohibit development or land disturbance in areas most sensitive to natural floodplain functions, such as within 100 feet of the shoreline. Many states have shoreline setback or riparian buffer requirements to provide natural filters for runoff into streams (see Mecklenburg County, NC case study, p. 92).

Washington local critical areas ordinances have restrictive requirements for sensitive areas such as wetlands and fish and wildlife habitat. One county's use of these rules is described on page 75.

Other states have shoreline setbacks that help floodplain management and dune or mangrove protection

Tool 3: Prevent Adverse Impacts to Natural Floodplain, cont.

benefits. Delaware's coastal building line is a good example of this (see pps. 98-102).

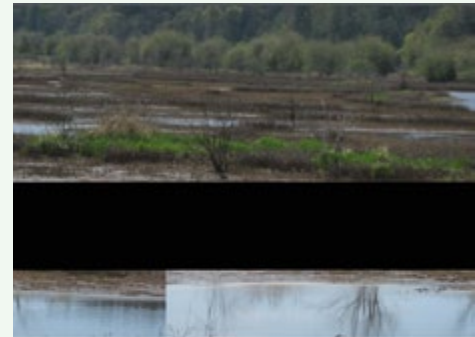
- Require best management practices for stormwater runoff, including
 - Erosion and sedimentation controls
 - Water quality provisions in stormwater management facilities
 - Low impact development/green infrastructure techniques
- It's likely the local and regional offices responsible for point source and non-point source pollution (NPDES or MS4 program office) have such regulations and knowledge about how they should be worded and enforced.
- An alternative to prohibiting certain types of development projects is to require permit applicants to assess the impact of their projects on natural floodplain functions. This is done by designating areas or conditions where a natural functions impact assessment would be required. Such an assessment would need to have:
 - An inventory of the natural floodplain functions at the site
 - A review of the proposed project
 - An assessment of the project's impact on the natural functions

- A review of alternative ways to prevent or minimize adverse impacts
- A plan to implement the best alternative(s)
- This approach is used by Grays Harbor County, WA (next page) and the Puget Sound Model Ordinance (p. 103).



Activity 430 (Higher Regulatory Standards) credits prohibiting certain types of development such as filling or buildings. Activity 420 (Open Space Preservation) credits different ways to preserve open areas including buffer zones.

Water quality regulatory standards for stormwater management are credited under several elements of Activity 450 (Stormwater Management).



National Flood Insurance Program
Community Rating System

**CRS Credit for
Habitat Protection**

2010



[CRS Credit for Habitat Protection](#)

provides an introductory level discussion on the benefits of protecting habitat and different ways to do it. It is one of the products of the effort to prepare the Puget Sound Model Ordinance and related guidance documents.

EXAMPLE ORDINANCE

GRAYS HARBOR COUNTY, WASHINGTON'S CRITICAL AREAS PROTECTION ORDINANCE

Critical areas ordinances are required by the Washington State Growth Management Act (Chapter 36.70 RCW). Grays Harbor County's ordinance (Title 18 Environment, Chapter 18.06) applies to "geologically hazardous areas, frequently flooded areas, wetland areas, fish and wildlife habitat conservation areas and critical aquifer recharge areas."

The ordinance's definition of "frequently flooded areas" is "the land in the floodplain or floodway within the county that is subject to a 1 percent or greater chance of flooding in any given year." In fact, the county's floodplain management rules are subsections of Chapter 18.06. These include the minimum NFIP requirements and a few higher standards, such as a 1-foot freeboard and the state required prohibition of certain residential structures in the floodway.

Other rules apply in wetlands, habitat conservation areas or other areas considered "critical areas." Where these areas are also in the regulated floodplain, the more restrictive rules apply.

For example, depending on the wetland category, wetland buffer widths range from 40-225 feet with mitigation and 50-300 feet without mitigation. Categories range from Category 1 that "represents a unique or rare wetland type, or is more sensitive to disturbance than most wetlands, or that is relatively undisturbed and contains ecological attributes that are impossible to replace within a human lifetime..." to Category 4 that "has the lowest levels of function and is often heavily disturbed." The table below shows the buffer requirements for these areas.

"The county may require increased buffer widths as necessary to protect wetland areas. The additional buffer width and other issues shall be determined by an examination of the wetland area's relationship to critical drainage areas, location of hazardous materials, critical fish and wildlife habitat, the presence of landslide hazard areas or erosion hazard areas adjacent to wetlands, groundwater recharge and discharge areas, and the location of a trail or utility corridor." (Section 18.06.135(6)(b))

Buffer widths for streams vary from 60-150 feet. There are no specific buffers for wildlife habitat areas. Instead, the ordinance refers to guidance documents from the Washington Department of Fish and Wildlife.

No new buildings are allowed in the buffers. Utility lines and hazardous materials may be limited.

Another key provision is the requirement for a special study "to adequately evaluate the proposal and all probable adverse impacts." (Section 18.06.020). These are required whenever the project varies from the specific standards of Chapter 18.06. Studies "shall be prepared by a professional possessing the appropriate state or similar accreditation or license that demonstrates their understanding and skill in examining the scope of work." The contents of the studies are prescribed in 15 subsections.

Wetland Category	Standard Buffer Width	Additional buffer width if wetland scores 20 - 28 habitat points	Additional buffer width if wetland scores 29 - 36 habitat points
Category I	75 feet	Add 75 feet	Add 150 feet
Bogs	190 feet	N/A	N/A
Estuarine	150 feet	N/A	N/A
Coastal Lagoons	150 feet	N/A	N/A
Natural Heritage	190 feet	N/A	N/A
Wetlands	190 feet	N/A	N/A
Category II	75 feet	Add 75 feet	Add 150 feet
Interdunal Wetlands	110 feet	N/A	N/A
Category III	60 feet	Add 50 feet	N/A
Category IV	40 feet	N/A	N/A

Tool 4: Preserve Undeveloped Floodplains

Floodplains are developed, partially developed or undeveloped. Floodplain management measures for areas already developed generally focus on protecting properties or mitigating flood impacts on properties through acquisition, retrofitting, structural flood control projects, redevelopment plans and substantial

damage regulations. These approaches can be expensive and disruptive.

There are more options in undeveloped and sparsely developed areas, where problems can be prevented before development is allowed. The best approach is to keep these floodplains vacant.



Figure 3-1: Conventional development (left) vs. conservation design (right). A conservation subdivision groups homes on smaller lots than otherwise allowed by the property's zoning in order to maximize and permanently protect greenspace on the project site. Images, which appeared in [Best Practices: Greenspace and Flood Protection Guidebook](#), are credited to LandChoices and Randall Arendt.

Tool 4: Preserve Undeveloped Floodplains, cont.



Cook County Forest Preserve District website.

Preserving undeveloped floodplain areas from development that will have an adverse impact on other properties, safety, health and natural floodplain functions is easier where there are large parcels of land. In these cases, developers have more freedom to concentrate and locate structures and facilities outside of the floodplain (or in less hazardous locations in the floodplain). Buildings can be allowed on the high ground portion of a property, leaving the flood hazard area as an open space amenity. This has an added benefit of increasing the value of lots for sale, as noted in the Weaver Creek, CO and Marana, AZ examples (pp. 80 and 86, respectively).

This section reviews the various approaches to keep vacant, flood-prone areas free of developments that would otherwise be prone to flood damage and/or cause adverse impacts.

HOW TO PRESERVE UNDEVELOPED FLOODPLAINS

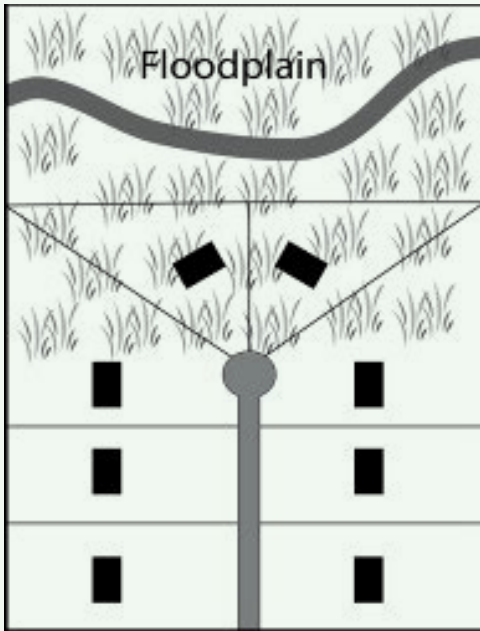
For this tool, you may not need regulatory changes if you can convince developers how NAI developments help them save and even make money (see Step 1). Before or during your work on ordinance

revisions, meet with developers or speak at their organizational meetings. Even if they are not 100 percent in support of your proposals, they will give you valuable feedback on the regulatory language being considered. Be sure to work closely with the planning office, which normally is the primary reviewer for a larger development or a subdivision. The objective is to use regulatory tools to allow or encourage an alternative to the traditional approach. The traditional approach and three alternatives are illustrated on the next page.

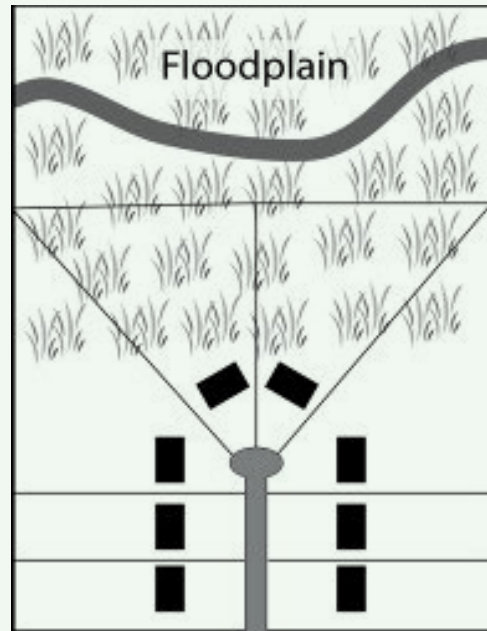
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Tool 4: Preserve Undeveloped Floodplains, cont.

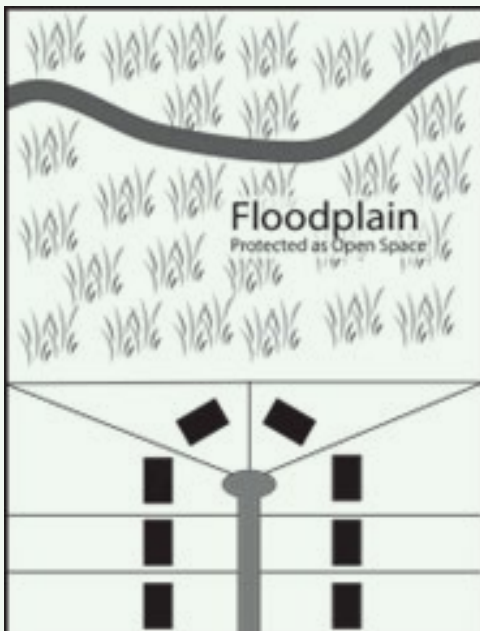
APPROACHES TO UNDEVELOPED FLOODPLAINS



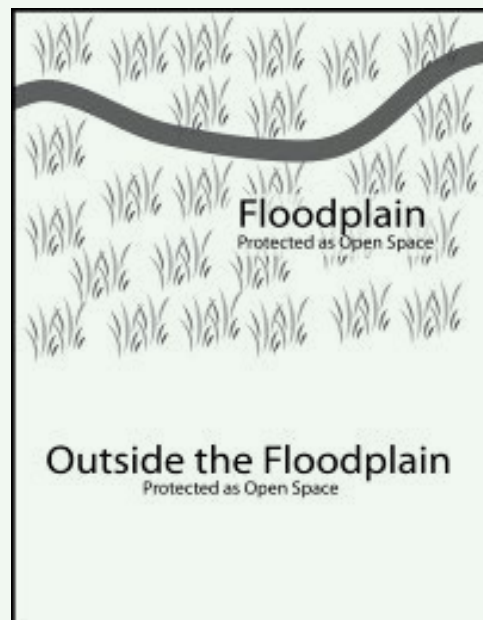
Traditional approach: Platting standard size lots results in some parcels and house sites within the regulatory floodplain.



Building protection: All buildings are on high ground, outside of the regulatory floodplain. Portions of some lots are within the floodplain and therefore still may be subject to development, filling and grading that reduce natural floodplain functions and increase flood risk.



Clustering: All buildings and lots are clustered outside the regulatory floodplain. The development has the same density as the first two graphics, but with smaller lot sizes. All of the land in the regulatory floodplain is preserved as open space.



Transfer of development rights: The community provides the developer an incentive to dedicate the entire parcel for open space, such as allowing a higher density development at another location, well away from the flood hazard area. - CRS Coordinator's Manual, pp. 420-21.

Tool 4: Preserve Undeveloped Floodplains, cont.

STEP 1. START WITH PERSUASION

If you have large undeveloped parcels in your floodplain, take the opportunity to sit down with the owner or developer before they apply for subdivision approval or other permits or in the early stages of permit review, such as at a pre-application meeting. Here are some topics to discuss:

- Review problems caused by developing in the floodplain, even when meeting all of the community's regulatory requirements, such as:
 - Exposure to damage from a flood above the flood protection level
 - Lack of ambulance, fire and police access to the new development during floods
 - Damage to natural floodplain functions
 - Increased maintenance costs due to water damage
 - Loss of business and use of the properties during floods and subsequent recovery
- Review the requirements in your floodplain and related regulations, such as shoreline and stormwater management rules and zoning. It may be that they will consider the cost of meeting all the public safety

and health requirements are greater than the benefits of developing the floodplain portion of the parcel.

- Review potential liability for creating adverse impacts on other properties and injuries or problems that occur during a flood evacuation. Provide the developer with copies of [NAI Legal Issues articles](#).
- Show how the developer can **save money** by avoiding developing in the floodplain (see Tool 3 “Educating Developers” in [NAI How-to Guide for Education and Outreach](#)).
- The message to developers is that they can **make money** by using NAI approaches. If they do not build in floodplains and wetlands, they will have:
 - Lower construction costs;
 - Faster permitting procedures because fewer permits are needed;
 - Lower operation and maintenance costs for the buyer;
 - Areas that can be used for open space requirements or tax credits;
 - A positive response to house hunters inquiring about the flood hazard;
 - Waterfront and open space locations people will pay more for;
- A unique character that improves the marketability of their development; and
- A reputation as a land steward and community supporter.
- Show how the developer can make money by using the floodplain as an asset:
 - Floodplains can be incorporated into parks, greenways, nature trails, etc., increasing the development's value;
 - People will pay extra to live and work amid green spaces with trails and other recreational amenities; and
 - It might be feasible to use preserved floodplains as a mitigation site for a development that must meet the Corps' 404 permit requirements. The owner may be paid to preserve or restore wetland areas.
- The Preserve at Weaver Creek, CO illustrates these financial benefits (on the next page).



Informational materials and/or speaking to developers or contractors can be credited under Activity 330 (Outreach Projects).

continued on page 80

Tool 4: Preserve Undeveloped Floodplains, cont.

STEP 2.

PROVIDE THE FLEXIBILITY TO STAY OUT OF UNDEVELOPED FLOODPLAINS

Sometimes existing regulations do not permit a developer to try alternatives to the standard subdivision requirements for lot sizes and setbacks. See if there are already regulations that allow flexibility in development designs. The more common allowances are:

- Zoning rules that allow clustering of buildings in certain parts of a development, such as on the high ground. See the box on the next page.
- Zoning ordinances that have planned development districts, planned development or planned unit development options in a regular district.
- Some state statutory authorizations allow communities to vary from some requirements when negotiating an annexation agreement.

THE PRESERVE AT WEAVER CREEK IN COLORADO



This floodplain preservation project is described in a case study on pages 63-64 in the [NAI How-to Guide for Education and Outreach](#). The developer had a 15-acre site in the Denver suburbs. The floodplain of Weaver Creek took up 20-25 percent of the site.

At an early coordination meeting, staff explained there would be two immediate monetary benefits to the developer if nothing was put in the floodplain and wetland:

1. The developer would not need certain permits that would take significant time and resources to obtain.
2. The developer's stormwater facility would not have to meet the district's depth and velocity criteria because the natural floodplain and wetland already attenuated flood flows. This would save significant construction costs.

The developer estimated the direct dollar benefits of staying out of the floodplain would come close to the income lost by not building more housing units in the floodplain. So he agreed to reserve the floodplain for trails, maintenance access and one stream crossing with low flow culverts and a pond. Otherwise the riparian and wetland habitat was preserved.

The developer charged additional sums of \$5,000, \$7,000 and \$10,000 for the units on the first, second and third floors of the creek-side units. The premiums offset the cost of floodplain improvements (walls, trails, stream crossing, pond, stream stabilization and extra land given over to habitat preservation). The developer gained in two ways: the increased price per unit and all the units were presold.

For more information on The Preserve, see the [Denver Urban Drainage and Flood Control District's Floodplain Preservation brochure](#).

EXAMPLE ORDINANCE



UPPER TOWNSHIP, NEW JERSEY'S CLUSTER DEVELOPMENT AUTHORIZATION

Upper Township NJ has a coastal floodplain and extensive inland floodplains. Approximately 60 percent of the community is wetlands. The zoning ordinance sets minimum lot sizes in different districts. Section 20-6.2 allows developers to have the same number of parcels on a smaller area if they preserve floodplains and other sensitive lands as open space.

20-6.2 Conservation Residential Cluster Development.

- a. The purpose of this subsection is to provide a method of developing single-family detached dwellings which will preserve desirable open spaces, conservation areas, floodplains, school sites, recreation and park areas and lands for other public purposes by permitting the reduction of lot sizes (and certain other regulations hereinafter stated) without increasing the number of lots in the total area to be developed. Cluster, single-family, residential developments are permitted in the "AR" and "C" Districts and the "RD," "F3," "F10" and "F25" Districts in the Pinelands Area.
- b. All conservation residential cluster developments shall meet the following requirements:
 1. Total lots permitted shall be calculated by preparing a conventional subdivision concept plan for lots which conform to the area standards for the underlying zone district. The portion of the lot constrained by environmental restrictions shall be excluded from the concept plan.
...
 6. All lands not included in or assigned to individual lots and not utilized for street rights-of-way must be permanently dedicated through recordation of a restriction on the deed to the parcel as open space with no further development permitted. All lands not accepted by the township shall be owned and maintained by a homeowners association...
...
 10. A homeowners association, established for the purpose of owning and maintaining common lands and facilities, including conservation, open space, floodplain, recreation and park areas and other lands which would otherwise be dedicated to the township, shall be in accordance with the following provisions:
...
 - (b) Executed deeds with restrictions stating that the prescribed use(s) of the lands in the common ownership shall be absolute and not subject to reversion for possible future development shall be tendered to the township simultaneously with the granting of final subdivision approval.



Tool 4: Preserve Undeveloped Floodplains, cont.

STEP 3.

PROVIDE INCENTIVES TO STAY OUT OF UNDEVELOPED FLOODPLAINS

If persuasion and authorizing flexible development are not enough, look into ways your regulatory program can offer financial incentives to avoid adverse floodplain development.

- Provide a faster permit review process. Time is money for developers. The justification for a speedier review is that less work and analyses are needed if there are no alterations proposed in the floodplain.
- Provide bonuses if required open spaces are located in the floodplain. Often subdivision regulations require larger developments to reserve a certain percentage of the land for park, recreation or stormwater storage purposes. One option would be to allow each acre set aside in the floodplain to count as 1.5 or 2 acres toward the open space requirement.
- Provide density bonuses or credits for maintaining floodplain areas as open space. If a 20-acre parcel can have 60 single-family homes and five acres are in the floodplain, the community could allow the developer to plat 60 lots in the 15



Stowe, Vermont Planning Commission proposed a new “Meadowland Overlay District” that placed additional restrictions on what could be developed on these open meadows. To soften the potential financial impact on owners of land within the overlay district, a Transfer of Development Rights program was created. [Visit this link.](#)

acres of high ground. This would also likely save the developer money because shorter streets and less infrastructure would be needed to serve the smaller area.

- Offer transfers of development rights (TDR). Under the TDR approach, the community allows the developer higher densities on flood free land in exchange for not developing the floodplain. The preferred approach is for the floodplain parcel(s) to be dedicated to the community, neighborhood association or a nonprofit organization.



Ordinances that authorize clustering and planned unit developments are credited under the element Open Space Incentives in Activity 420 (Open Space Preservation). More credit is provided under OSI for density bonuses, TDRs and other measures that encourage preserving a development’s floodplain as open space.

Tool 4: Preserve Undeveloped Floodplains, cont.



FEMA photo library.

STEP 4. PROHIBIT DEVELOPMENT IN UNDEVELOPED FLOODPLAINS

Many kinds of developments can be prohibited from hazardous areas. Because buildings can be engineered to be protected from many kinds of hazards, communities are more often successful if the prohibitions are related to protecting public health, safety and natural floodplain functions. For example, prohibiting new buildings will be easiest in areas subject to deep, fast moving or flash

flood-prone areas because of the safety hazard. This approach is supported by the Illinois Supreme Court ruling on page 27.

It is easier to prohibit development on portions of a property if the owner can still use or get an economic return on the rest of the land. Therefore, some of the more restrictive language can be found in subdivision ordinances and similar regulations that govern larger developments.

Here are some ways to prohibit some activities in all or part of a floodplain:

- Setbacks and buffer zones are used across the country for water quality, natural corridors, shoreline protection and/or stream channel and beach erosion. These may only affect 10, 50 or 100 feet from the shore or bank, but the result is protection of the most sensitive part of the floodplain. These rules may only restrict buildings or they may cover any alteration to the land surface. The case studies for Marana, AZ (p. 86), St. Joseph, MI (p. 57), Grays Harbor County, WA (p. 75), and Mecklenburg County, NC (p. 92) describe setbacks

Tool 4: Preserve Undeveloped Floodplains, cont.

for channel erosion, building protection, wetlands protection and water quality purposes.

- Regulatory provisions that discourage encroachments are discussed in Tool 1, Step 3, such as prohibiting fill because it displaces floodwater storage and increases flooding on others.
- Zone the floodplain for conservation, agriculture, forestry or other low density uses. This is discussed at the end of Tool 1. This approach is also likely to be supported by farmers and others interested in preserving the agricultural base or rural character of the area.
- Require all parcels in a new subdivision have building sites out of the floodplain. This is illustrated in the “building protection” example on page 78. There is ordinance language for this in the case studies for Marana, AZ (p. 86), Norman, OK (p. 110) and Puget Sound (p. 103).

- Keep buildings or residences out of especially high-hazard areas, as discussed in Tool 1, pages 32 – 57, and Tool 2, pages 58 – 68.
- Require new subdivision plats to show the floodplain area as separate lots to be dedicated as open space. Upper Township’s ordinance does this (p. 81).



Activity 420 (Open Space Preservation) credits different ways to preserve open areas using buffer zones, incentives for developers, subdivision requirements and zoning. Activity 430 (Higher Regulatory Standards) credits prohibiting certain types of development, such as filling or buildings.



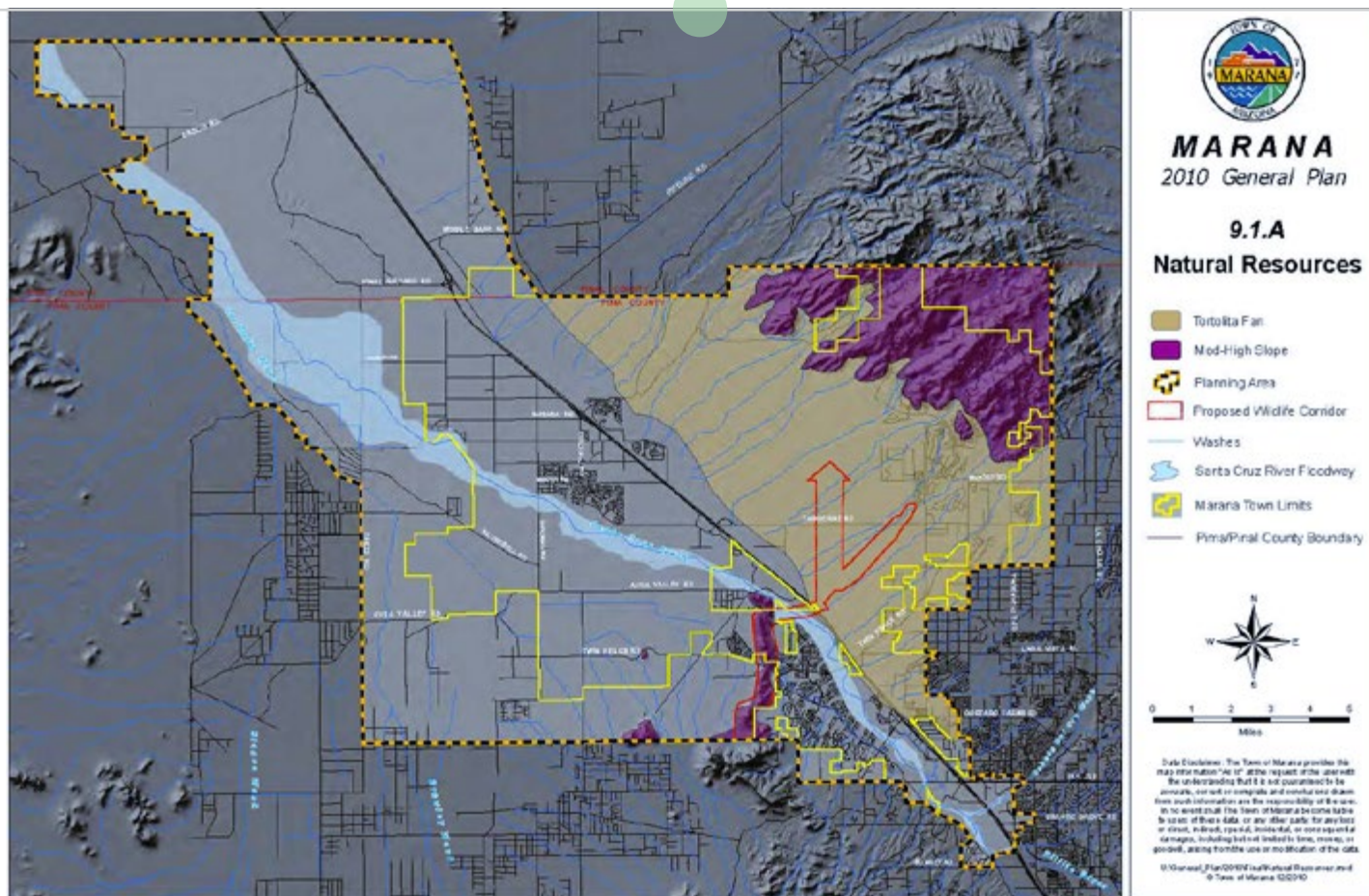
SECTION FOUR

Case Studies



Marana, Arizona

— Keeping Hazardous Areas Open



Marana is a town of 40,000 located northwest of Tucson. While relatively small in population, the town covers 121 square miles of desert and farmland. It is subject to development pressures from the Tucson area, but it has lots of land to allow avoidance of flood hazard areas.

The region gets 11-12” of rain each year. This is not enough rain for ground cover to grow, resulting in very erodible soils.

The largest flood event in recent history was in 1983. It caused fatalities and substantial damage to structures and infrastructure. Subsequent flood events occurred in 1996, 2006 and 2011. While

subsequent floods were not as destructive, local officials and residents viewed them as reminders of floods destructive and life threatening nature.

In 2004 FEMA met with town staff to discuss the new FIRM changes underway. FEMA said that when the FIRM was complete, Marana would have to amend its

Case Study: Marana, Arizona — Keeping Hazardous Areas Open, cont.

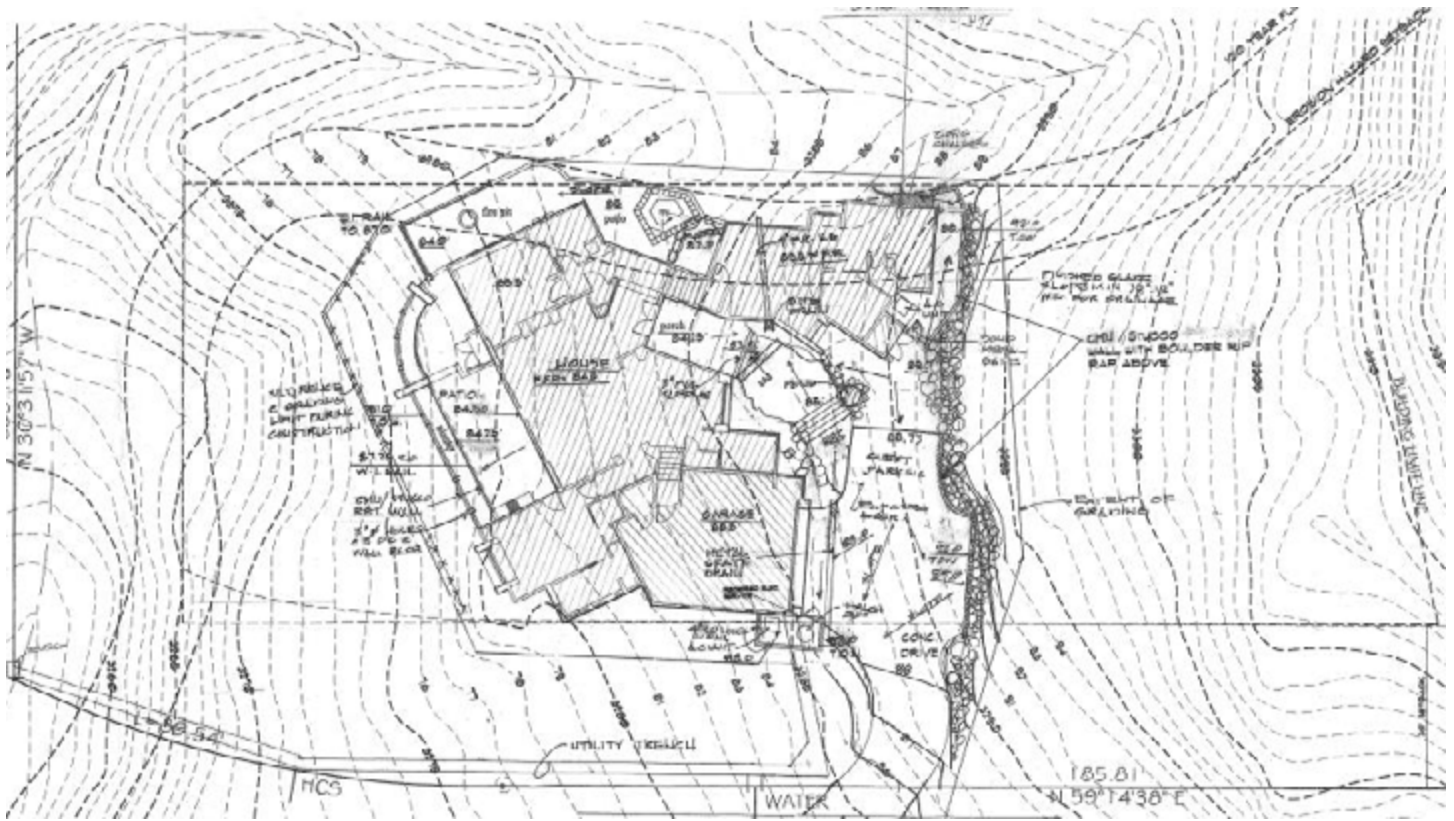


Image from a 2003 site plan that shows the potential for damage to a new building that met the minimum NFIP criteria. The building could still be impacted by channel erosion and local drainage.

ordinance to adopt the new map. Staff wondered if the entire ordinance could use an “overhaul.” They started with the state’s model ordinance template and asked “what have been our problems?” Based on the recent flood history, two concerns stood out:

- The mapping standard would not include smaller watersheds. Land in the floodplains and even dry channels (washes) of smaller watersheds were being built on with no flood protection measures because they were not included on a regulatory map.

- The mapping and regulatory standards did not address channel erosion and scour. During a flood, the channel could shift and undercut building foundations, even if the buildings were built to flood protection standards.

Staff took these concerns and recommendations to the Town Council. They built their case with actual photographs of authorized houses built in a wash. Their homework and preparations paid off and their recommendations were accepted, even by those council

members who were also developers. It did help that the proposals came at a time of a building recession and soon after a 2006 flood. Marana’s 2008 Floodplain and Erosion Hazard Management Code has four general approaches that curtail floodplain development and produce a No Adverse Impact result:

1. Mapping the floodplain and erosion hazard area for smaller watersheds,
2. Incorporating channel erosion criteria in floodplain regulations,
3. Prohibiting hazardous materials

Case Study: Marana, Arizona — Keeping Hazardous Areas Open, cont.

and critical facilities from the 100-year floodplain, and

- Setting high standards that effectively discourage development in the washes, 100-year floodplain and erosion hazard setback limits.

FLOODPLAIN AND EROSION HAZARD MAPPING

Subdivision developers must map the floodplain and erosion hazard setbacks. Together they are considered one area subject to the ordinance.

Each channel must be studied. The table below is from the ordinance. It shows the setback to be used based on the 100-year discharge. (Section 17.15.10.K.5)

The setback is measured from a primary channel bank. If there is no defined channel that contains the majority of the 100-year flood, it is measured from the floodplain boundary.

Staff was advised to not recommend complete prohibition. There should always be room for special situations. Accordingly, the size

of the standard erosion hazard setback may be reduced by an engineering study performed by an Arizona registered professional civil engineer and accepted by the floodplain administrator. The reduced setbacks shall not fall below minimum allowable erosion hazard setbacks unless the study also includes an analysis performed by an Arizona registered professional geological engineer.

Base Flood flow rate (cfs)	Standard Erosion Hazard Setback (feet)	Minimum allowable Erosion Hazard Setback (feet)
< 500	25	15
500 - 1999	50	25
2000 - 4999	75	45
5000 - 999	100	70
10,000 and greater	250	175
Santa Cruz River	500	350

Case Study: Marana, Arizona — Keeping Hazardous Areas Open, cont.

DEVELOPMENT PROHIBITIONS.

Subdivisions with small lots shall not be platted in the FEMA or locally-mapped floodplain/erosion hazard setback:

“All subdivisions with a minimum lot size of 16,000-square-feet or less shall be platted such that FEMA SFHA, locally-regulated floodplains and erosion hazard setback areas are not located on individual lots. Such areas shall be contained within common areas.” (Section 17.15.10.E.7)

Marana requires the establishment of a homeowners association to maintain and manage the common areas. Residential buildings are prohibited in high hazard areas:

“Structures designed or utilized for human habitation, whether full or part time, shall only be permitted where the product of the flow depth d , in feet, times the square of the flow velocity v , in feet per second, of the surrounding floodwaters of the base flood does not exceed the numerical value of 18 ($dv^2 \leq 18$) for a period greater than 30 minutes in duration as determined by an Arizona registered professional civil engineer and accepted by the floodplain administrator and the surrounding floodwaters of the base flood do not exceed 3 feet in depth.” (Section 17.15.10.B.2.E)

Hazardous materials are prohibited:

“The storage or processing of materials that are, in time of flooding, buoyant, flammable, explosive or could be injurious to human, animal or plant life is prohibited.” (Section 17.15.10.C.I)

Certain critical facilities are prohibited:

“Public and private utility facilities that are vital to maintaining or restoring normal services to flooded

areas” and public safety and health facilities must be located outside of the FEMA and locally-mapped, 100-year floodplain or have their safety certified. Certain very hazardous facilities, such as sewer pump stations and landfills, must be located outside both the FEMA and locally-mapped, 500-year floodplain. (Section 17.15.10.H.2)

Higher Standards. The remaining regulatory standards do not prohibit development, but one effect of the following requirements is that avoiding the floodplain and erosion hazard areas is more cost effective than meeting all the flood and erosion protection requirements.

- Buildings in a floodplain or erosion hazard setback area must be protected from scour and lateral erosion: “In all cases scour protection shall be designed to be a minimum of 3 feet below the lowest point of the adjacent channel or thalweg.” (Section 17.15.10.B.2.F)
- There are erosion and scour standards for utility lines:
- “Utilities shall be buried at least 2 feet below the calculated scour depth as determined in a study/

Case Study: Marana, Arizona — Keeping Hazardous Areas Open, cont.

analysis prepared by an Arizona registered professional civil engineer.” (Section 17.15.10.D.4)

- Development in the 500-year floodplain as it pertains to the alluvial fan area is regulated: “New construction and substantial improvement of any residential structure in Zone X-500 alluvial fan shall have the lowest floor, including basement, elevated at least 18 inches higher than the highest existing adjacent grade.” (Section 17.15.10.B.3.D)
- Subdivisions that meet certain criteria must provide all-weather access, but: “The floodplain administrator may allow certain exemptions to all-weather access as stated in the preceding section. A condition of allowing this exemption is that the owner shall execute and record a covenant running with the land enforceable by the town which contains the following:

- a. An acknowledgement that the vehicular access may be impassable to conventional motor vehicles and emergency vehicles in times of flooding;
 - b. A hold harmless provision, holding the town, its agents, the floodplain management board harmless from and against all injuries and damages resulting from the traversing or attempting to traverse the vehicle access during times of flooding; and
 - c. The covenant, successors and assigns shall erect and maintain a sign(s) in a location(s) and size(s) acceptable to the town stating ‘DO NOT ENTER WHEN FLOODED.’” (Section 17.15.10.M.2.C)
- The hazards must be disclosed: “All final subdivision plats shall delineate the FEMA SFHA, floodway if applicable, locally-regulated floodplain and erosion hazard setbacks in a surveyable manner and sealed by an Arizona registered land surveyor.” (Section 17.15.10.E.2)

Advising the Public. In 2011 staff notified all property owners who were affected by the new FIRMs. They provided on-site outreach, met with homeowner associations and provided individualized written materials to local residences directly affected by the change in FEMA mapping. Marana also produced a handout for individuals that explained the rules of building in the floodplain in lay terms. An excerpt is on the next page. Note the key message, “The most important step in the process of building your home is to ensure it is outside the flood-hazard area.”

The handout tells how to obtain flood data, explains the rules for manufactured homes and substantial improvements and encourages flood insurance.

Case Study: Marana, Arizona — Keeping Hazardous Areas Open, cont.

Results. Town officials consider themselves “friendly to responsible developments.” As they said, “open space sells.” One result of Marana’s approach is that some developers have gotten as much as \$100,000 premiums for lots adjacent to (but outside) regulatory and non-regulatory washes.

In 2014, winter storms closed some roads and caused some scour. The high water lines matched 100-year flood levels in many places. However, newly constructed subdivisions survived fine.



BUILDING IN THE FLOODPLAIN

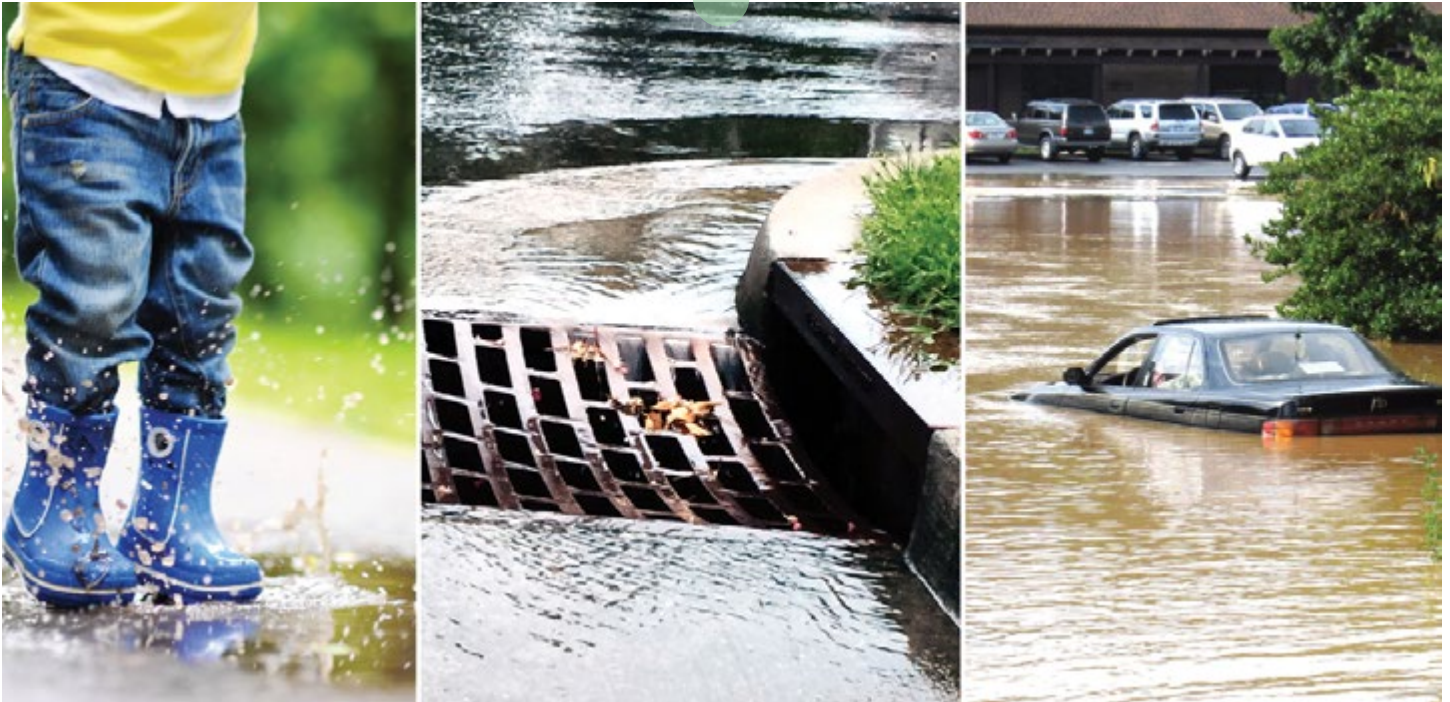
A Floodplain Use Permit is required by the Town for any proposed development in the floodplain. Development may consist of site-built homes, manufactured homes, commercial structures, or substantial improvements. Construction in the Floodplain is regulated under Chapter 17-15 of the Marana Land Development Code.

PLANNING FOR BUILDING IN THE FLOODPLAIN

Flooding is a natural occurrence within floodplains. Be aware that Town regulations often forbid you from impacting water courses and redirecting floodwaters. Consult with our Development Engineering Division office for assistance.

The most important step in the process of building your home is to ensure it is outside the flood-hazard area. If this is not possible, then there are requirements to follow in order to receive a building permit from the Town of Marana.

Mecklenburg County, North Carolina — Buffers Protect the Floodplain



Mecklenburg County, NC is home to Charlotte and several smaller towns, and is one of the fastest growing metropolitan areas in the country. With growth came problems, but county officials tackled them in a careful and coordinated way.

In the 1990s, the County's Storm Water Services office was charged with improving the quality of the county's streams. They made their case before the Board of County Commissioners, stressing that most residents of Mecklenburg County did not realize their streams were so polluted they were not swimmable.

In 1996, the board got the message and adopted the "Creek Use Policy," an overall guide based on the need to make streams and lakes "suitable for prolonged human contact." The policy was intentionally broad, and came with a directive for SWS staff to develop a program with the details.

continued on page 94

EXAMPLE ORDINANCE



MECKLENBURG COUNTY CREEK USE POLICY

The following policy was adopted unanimously by the Mecklenburg County Board of County Commissioners Oct. 15, 1996:

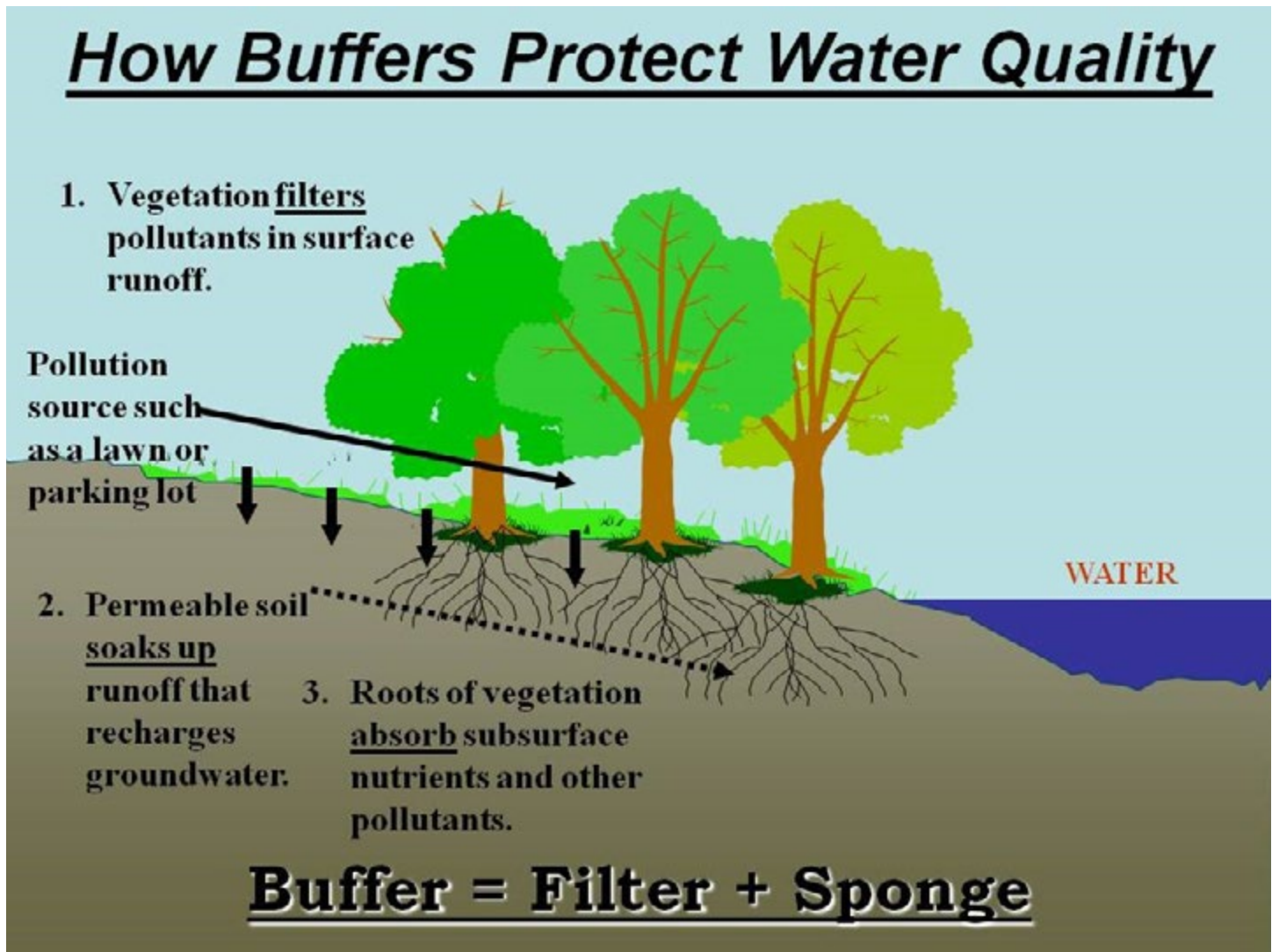
“The county commission herein finds that the public policy of Mecklenburg County is that our surface waters—creeks, tributaries, ponds and lakes—are a natural resource to be protected as a source of natural beauty and recreation.

Further, that the use of our creeks, tributaries, ponds and lakes as a stormwater disposal method shall be secondary to the preservation of creeks, tributaries, ponds and lakes. It is the intent of the commission that all Mecklenburg waters shall be suitable for prolonged human contact, recreational opportunities and shall be suitable to support varied species of aquatic vegetation and aquatic life.

That staff is directed to bring to the commission within 90 days a list of alternatives and potential costs to restore our waterways and lakes to natural beauty and recreational use, whether through public and/or private ventures.”



Case Study: Mecklenburg County, North Carolina — Buffers Protect the Floodplain, cont.



The program developed was called the Surface Water Improvement and Management initiative or “SWIM.” It was developed over two years with lots of stakeholder input, including developers and SWS staff involved in floodplain management and flood protection.

Buffers. It was concluded that streamside buffers were needed to filter stormwater runoff going into the streams. As explained in the SWS graphic (above), buffers filter runoff and soak it up.

The questions facing the team were how big should the buffers be and what rules would apply. This is where

stakeholder involvement really paid off because those most affected helped write the rules. As staff said, “There was no basis in science, but it works.”

The resulting approach bases the size of buffers on the size of the stream. Here’s a summary of the program.

Case Study: Mecklenburg County, North Carolina

— Buffers Protect the Floodplain, cont.

SWIM Buffers			
Characteristics	Stream Side Zone	Managed Use Zone	Upland Zone
Function	Protect the integrity of the ecosystems	Provide distance between upland development and the stream side zone	Prevent encroachment and filter runoff
Vegetative Targets	Undisturbed (no cutting or clearing allowed)	Limited clearing—Existing tree density must be retained	Grass or other herbaceous ground cover allowed—Forest is encouraged
Permitted Uses	Flood control structures, bank stabilization, utilities and road crossings	All uses allowed in the Stream Side Zone, stormwater best management practices, bike paths and greenway trails	All uses allowed in the Managed Use Zones, lawns, gardens and gazebos, and non-commercial storage buildings < 150 sq. ft.

- Two sets of rules were adopted. All streams that drain watersheds greater than 100 acres are covered by the SWIM standards. Lakes and streams that drain into the area’s water supply reservoirs have higher standards.
 - The SWIM standards have three zones: streamside, managed use and upland. The different rules in these zones are summarized in the table above
 - The buffer widths for Mecklenburg County are shown in the table below. Note that in watersheds large enough to be mapped as SFHA, the area of the fringe is included as part of the dimensions.
 - Buffer dimensions of cities within the county vary, but all of them are at least as large as the county’s. For example, some set buffers in watersheds as small as 50 acres.
- Buffers in three communities are the entire SFHA or 100 feet wide, whichever is larger.
- Some grandfathering is allowed. Some rules do not apply in areas already subdivided, where lots are smaller. Existing buildings can remain, but they cannot be enlarged in the buffer.
 - The SWS website has a page for property owners that explains the

Total Buffer Widths—Mecklenburg County			
> 640 acres	> 300 acres	> 100 acres	> 50 acres
total = 100 ft. + 50% of area of flood fringe beyond 100 ft. stream side=30 ft. managed use=45 ft. upland=25 ft. +50% of area of flood fringe beyond 100 ft.	total = 50 ft. stream side=20 ft. managed use =20 ft. upland=10 ft.	total = 35 ft. stream side=20 ft. managed use =none upland=15 ft.	No buffer requirements

Case Study: Mecklenburg County, North Carolina — Buffers Protect the Floodplain, cont.

Voting Location
Park Locator
Google Directions
Quality of Life Dashboard
Zoning Designations PDF

Environmental Information

Inside Water Quality Buffer	Yes
Inside FEMA Flood Zone	No
Inside Community Flood Zone	No
FEMA Panel No	3710453800J
FEMA Panel Date	03/02/2009
Post Construction District	Western Catawba
Stream Watershed Name	Long
Regulated Drinking Watershed Name	Lake Wylie

The map shows an aerial view of a residential area with a green buffer zone overlaid on a stream. A purple dashed line indicates the stream's location. A red address marker '100-4155' is visible on the map. Navigation controls (+/-) are in the top left of the map area.

Screenshot from SWS web page “[Find out if your property has mandatory water quality buffers.](#)”

program, in print and with a video. Users can enter an address or search a GIS map to find out if their property is in a floodplain and/or buffer. An example is above.

The Result. Developers know they can't build in the buffer or in portions of the floodplain, so they avoid these areas. The impact is that practically nothing has been built along the streams and lakes of Mecklenburg County in the last 15 years.

Water quality has improved. In 1998, SWS started tracking the level of fecal coliform in 340 miles of streams. In 1998, 25.1 percent of the streams were suitable for swimming. In 2015, the number had risen to 76.1 percent. This wasn't entirely due to the buffers, but they played their part in the overall program.

The buffer rules have been enforced for more than 15 years. They have not been challenged in court and no elected official has threatened to repeal them. They are an integral part of the county's surface water management program and have strengthened the floodplain management program. Buffers have been successful and are expected to stay that way because:

- Key stakeholders helped develop the rules;
- They are easy to explain and information on them is readily available (see website screenshot on the next page);

Tool 4: Preserve Undeveloped Floodplains, cont.

- They do not adversely impact existing development;
- With a strong economy, developers build larger projects that can afford to stay out of the floodplain;
- Staying out of the buffers and floodplain helps meet other development requirements, such as preserving trees; and
- Some developers donate their floodplain to be public greenways, thereby saving owner maintenance costs.

OVERVIEW OF CHARLOTTE-MECKLENBURG'S WATER QUALITY BUFFERS

How to determine if water quality buffer requirements apply to a specific parcel

1. Determine if the stream channel is piped in which case water quality buffers do not apply. [Details](#)
2. Identify the type of buffer that might apply and the jurisdiction. [Details](#)
3. Confirm whether the buffer requirements apply by reviewing the applicability requirements for the corresponding ordinance. [Details](#)
4. Delineate the stream or lake shoreline on the property. [Details](#)
5. Delineate the water quality buffer area on the property. [Details](#)

Sometimes, buffer disturbances are allowed under the law

1. Categories of buffer disturbances. [Details](#)
2. Water Supply Watershed buffer disturbances. [Details](#)
3. S.W.I.M. and Post-Construction buffer disturbances. [Details](#)
4. Goose and Six Mile Creek buffer disturbances. [Details](#)

Sometimes, a buffer can be disturbed if it is properly mitigated

1. General information applicable to obtaining approval for all types of buffer disturbances. [Details](#)
2. Water Supply Watershed buffer disturbances. [Details](#)
3. S.W.I.M. and Post-Construction buffer disturbances. [Details](#)
4. Goose and Six Mile Creek buffer disturbances. [Details](#)

Violations

A buffer disturbance is considered to be in violation if that disturbance is not allowed by the governing ordinance and if there is no approved mitigation plan. The following actions are required to achieve compliance and avoid penalties:

1. Mitigating illegal buffer disturbances. [Details](#)
2. Seeking a Variance from Water Quality Buffer requirements. [Details](#)
3. Seeking an Appeal for Water Quality Buffer requirements. [Details](#)

SWS website's "[Quick Reference Guide for Determining the Water Quality Buffer Requirements for a Specific Parcel.](#)"

Delaware DNREC — Protecting New Homes from Coastal Erosion



Bethany Beach after the 1962 storm - Delaware DNREC.

Since the 1800s, Delaware's shore communities relied on hard structures to combat coastal erosion. At the state level, the program was administered by the Highway Commission. This approach seemed to work until the 1960s, when a series of coastal storms caused extensive damage to homes and businesses.

In 1972, the state Legislature adopted the Beach Preservation Act. The Delaware Department of Natural Resources and Environmental Control administer the Act.

DNREC conducts a three-part program to address beach erosion:

1. Protect through regulations
2. Enhance through beach nourishment
3. Preserve through dune maintenance

This case study focuses on the first part—the regulatory approach.

Case Study: Delaware DNREC — Protecting New Homes from Coastal Erosion, cont.

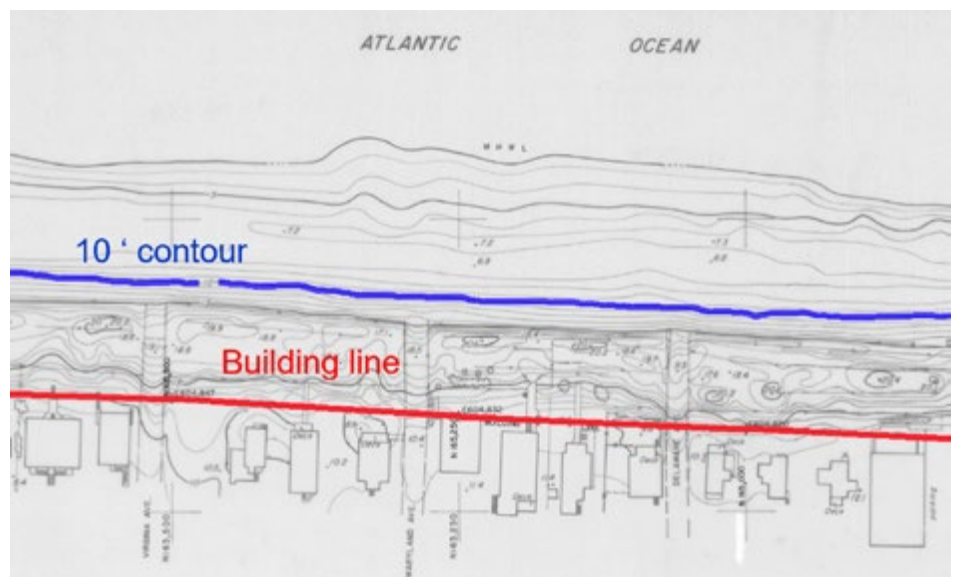


Site plan for building back of construction line - Delaware DNREC.

While revised over the years (and undergoing review at this time), the basic concept is to establish a building line that sets construction back from the beach. The line is intended to represent the landward toe of the primary dune.

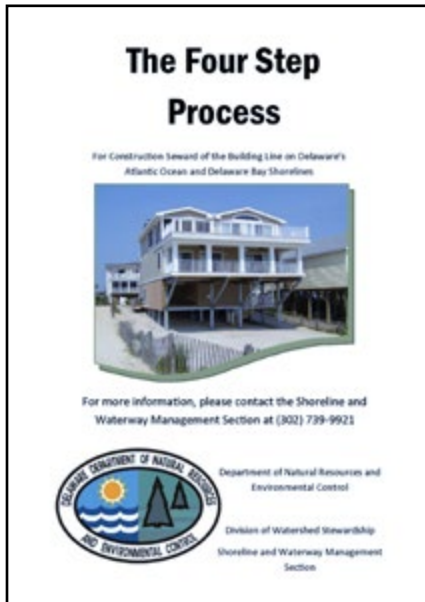
Initially, the building line was determined by DNREC staff at a site visit. However, because dunes move, site visits to neighboring properties at different times would result in different lines. Starting in 1981, the line was drawn on a map and new buildings were prohibited seaward of that line.

The problem is that the building line can run through existing parcels and even through or behind pre-existing buildings that were built legally in the past. Criteria were needed to handle non-conforming properties and improvements to existing buildings.



The building line was drawn 100 feet landward of the 10-foot elevation contour line. The concept provides space for a 100-foot-wide protective dune. - Delaware DNREC.

Case Study: Delaware DNREC — Protecting New Homes from Coastal Erosion, cont.



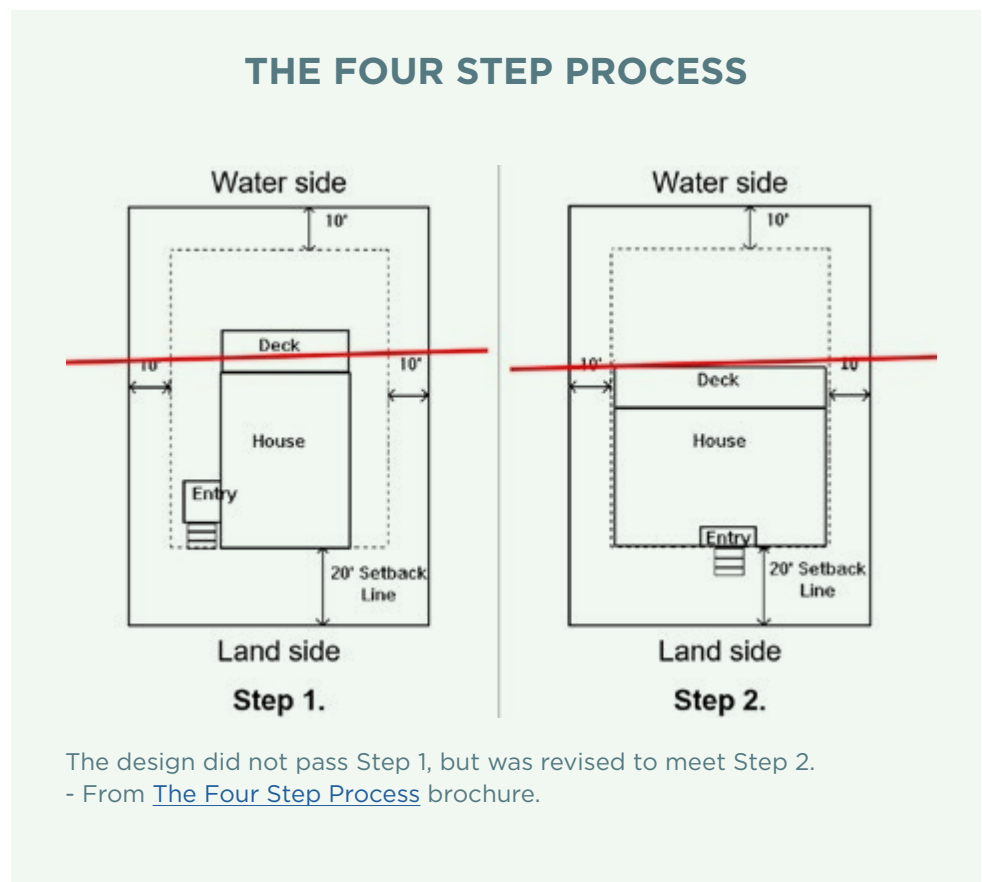
In 1996 the Legislature passed an amendment to the Beach Preservation Act that told DNREC to minimize any encroachment such construction would make seaward of the building line. The DNREC rules have [a four step process](#) to prevent a building or reduce the size of a building in an area that is already developed seaward of the building line.

STEP 1.

Locate the structure as far landward as possible. The exterior wall of the living space must be on the land side setback line. Porches, decks and entranceways are not allowed along that wall of the building unless recessed into the exterior wall or alongside the structure.

STEP 2.

If Step 1 fails to bring the structure entirely landward of the line, then the structure must be redesigned to use all of the buildable area landward of the line. The building design must utilize all the area up to the side yard setbacks.



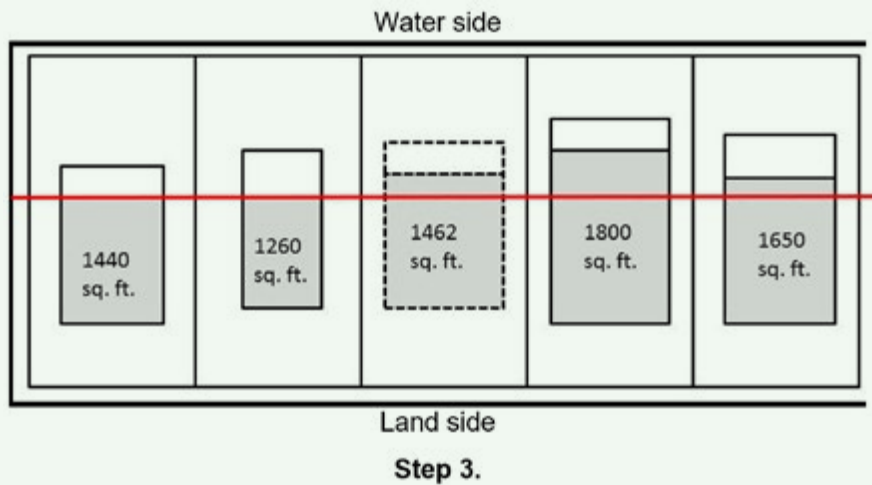
The design did not pass Step 1, but was revised to meet Step 2.
- From [The Four Step Process](#) brochure.

Case Study: Delaware DNREC — Protecting New Homes from Coastal Erosion, cont.

STEP 3.

If Steps 1 and 2 do not eliminate encroachment over the building line, then the square footage of the structure will need to be reduced. This is done by averaging the square footage that exists among the adjacent structures within the smallest subset of lots. The “smallest subset of lots” means the “smallest identifiable group of lawfully subdivided, contiguous lots that exist within a subdivision, development or community separated by either dedicated public walkways, roads or subdivision boundaries.” The proposed structure must not exceed the average square footage found in those lots.

THE FOUR STEP PROCESS, CONT.



Step 3. from [The Four Step Process](#) brochure.

Case Study: Delaware DNREC — Protecting New Homes from Coastal Erosion, cont.

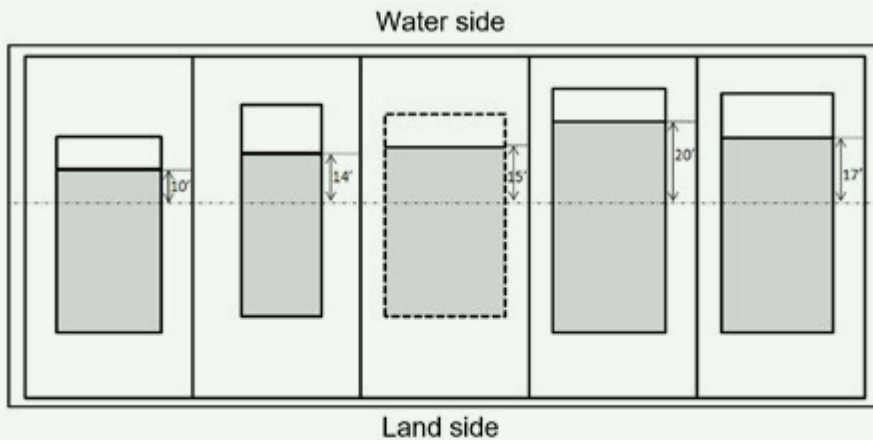
STEP 4.

If steps 1, 2 and 3 still leave the building seaward of the building line, step 4 caps the encroachment beyond the building line at the average encroachment of adjacent structures within the smallest subset of lots is determined.

The [regulatory requirements](#) are explained to the public on DNREC's website and in a simple straightforward brochure that uses the same graphics as this case study.

The end result of this regulatory approach is to prohibit new structures seaward of the building line in undeveloped areas. Where an area has already been developed, the four step process uses objective criteria to minimize the amount of construction seaward of the line. In both situations, the natural flood damage protection provided by existing sand dunes is preserved.

THE FOUR STEP PROCESS, CONT.



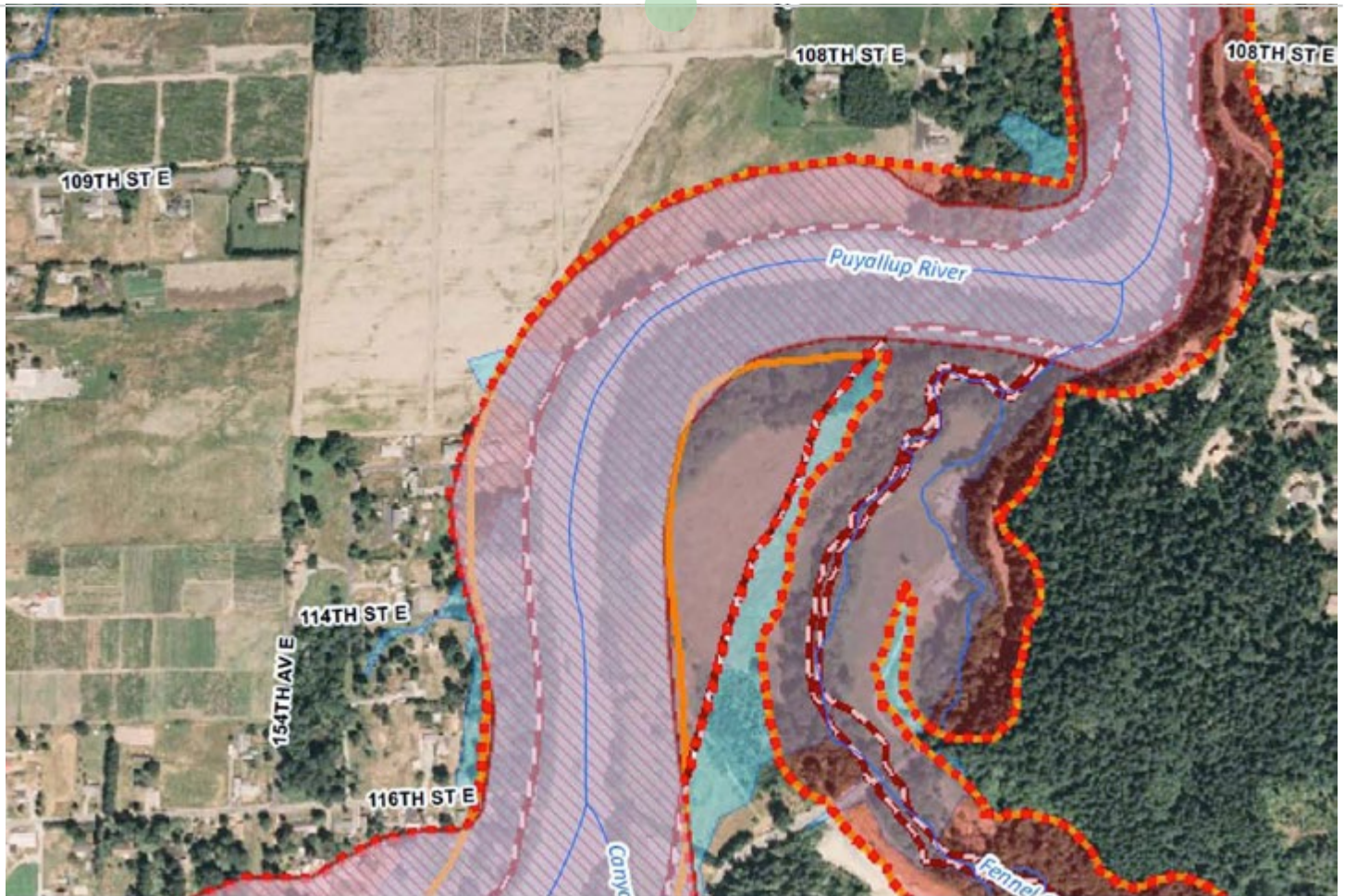
Step 4. The average encroachment of the four existing structures is 15 feet

Step 4. The average encroachment of the four existing structures is 15 feet. From [The Four Step Process](#) brochure.



This house was designed and constructed using the four step process.

Puget Sound Model Ordinance — Protecting Endangered Species



Following a lawsuit initiated by the National Wildlife Federation, a federal court ruled that FEMA had not consulted on the implementation of the NFIP in Washington, as required by the Endangered Species Act. The court directed FEMA to consult with the National Marine Fisheries Service.

In September 2008, NMFS issued a Biological Opinion that implementation of the NFIP in the Puget Sound watershed adversely affected the habitat of Puget Sound salmon, a threatened and endangered species under the ESA. By allowing floodplain development, including the placement of fill, salmon habitat

had degraded, threatening future populations. Since Puget Sound salmon are the primary food source for the Puget Sound killer whale pod, the NFIP, by extension, also threatened the existence of that endangered species too.

Case Study: Puget Sound Model Ordinance — Protecting Endangered Species, cont.

The BiOp included criteria NMFS believed, if fully implemented, would prevent all future development in the floodplain, thereby preserving both Puget Sound salmon and killer whales. FEMA had three years to make the modifications in the administration of the NFIP to comply with NFMS' BiOp.

FEMA developed three alternative approaches to help communities meet their NFIP obligations and Endangered Species Act requirements:

- Option No. 1: Adopt a model ordinance issued by FEMA Region X that incorporated all the provisions of the BiOp;
- Option No. 2: Provide Region X a copy of the ordinances, policies and regulations that meet the performance standards of the BiOp; or
- Option No. 3: Require permit applicants to assess the impact of the proposed development on salmon habitat on a permit by permit basis.

The ruling affected 122 NFIP communities in the Puget Sound Watershed. Some communities

adopted the entire model ordinance, but more chose Option No. 2 and used the model ordinance language to fill gaps in their programs. A number of communities are using Option No. 3 until documentation of Option No. 2 is submitted and approved. Others are following Option No. 3 because they have little potential for floodplain development.

Model Ordinance

The model ordinance was prepared with an advisory group of state, local and tribal floodplain managers. In addition to the provisions of the BiOp, it includes many higher regulatory standards recommended by ASFPM, FEMA and CRS. In the introduction, it is noted that:

“This model ordinance does not prohibit development. It requires new development projects be reviewed to ensure that they do not adversely affect safety, public health, other properties, water quality and aquatic and riparian habitat.”

The model ordinance has seven sections:

1. The legal provisions needed for any regulatory program,

such as the penalties clause.

2. Definitions of the technical terms used in the ordinance.
3. Establishment of the maps and data needed for the flood and habitat protection requirements. The ordinance regulates development in the SFHA. The “protected area” determines where special habitat protection requirements must be met. It includes the floodway as well as any riparian habitat areas and channel migration areas.
4. Procedures for permits and record keeping.
5. General development standards that apply to all new development and redevelopment in the SFHA, such as rules for hazardous materials and alterations of sand dunes. The rules for subdivisions are expanded on the next page.
6. Standards for projects that involve construction, repairs or improvements to buildings.
7. The habitat protection criteria, including floodway rules, a compensatory storage requirement and habitat assessments. The habitat assessment procedures are discussed below.

Case Study: Puget Sound Model Ordinance — Protecting Endangered Species, cont.

The model ordinance is presented in two columns, with ordinance language on the left and commentary on the right. The commentary notes the NFIP requirements in 44 CFR, where a higher standard would receive CRS credit, and provisions that are required by the ESA and NMFS' BiOp. See the example on the next page.

Subdivision Language

The subdivisions section in the model ordinance has language that requires the floodplain portion of the development to be preserved as open space (Section 5.1.B). Properties with portions on high ground cannot have a lot split or other action that would create a parcel wholly in the SFHA (Section 5.1.C).

The subdivision language in the Puget Sound model ordinance appears on the next page.

Habitat Impact Assessments

Here's the model ordinance language that requires a habitat impact assessment for projects that are not exempt under Sections 7.1 (which describes non-development activities, such as building

maintenance and landscaping) and 7.2 (which lists projects, such as non-substantial improvements to an existing building).

7.7. Habitat Impact Assessment

Unless allowed under Sections 7.1-7.2, a permit application to develop in the SFHA shall include an assessment of the impact of the project on federal, state or locally protected species and habitat, water quality and aquatic and riparian habitat. The assessment shall be:

- A. A biological evaluation or biological assessment developed per 50 C.F.R. § 402.12 to initiate federal Inter-agency consultation under ESA section 7(a)(2); or
- B. Documentation that the activity fits within Section 4(d) of the ESA; or
- C. Documentation that the activity fits within a Habitat Conservation Plan approved pursuant to Section 10 of the ESA, where any such assessment has been prepared or is otherwise made available; or
- D. An assessment prepared in accordance with *Regional Guidance for Floodplain Habitat Assessment and Mitigation*, FEMA

Region X, 2013. The assessment shall determine if the project would adversely affect:

1. Species that are federal, state or locally listed as threatened or endangered.
2. The primary constituent elements for critical habitat, when designated, including but not limited to water quality, water quantity, flood volumes, flood velocities, spawning substrate and/or floodplain refugia for listed salmonids

Section 7.7 requires applications for projects that might adversely affect habitat for threatened or endangered species to conduct an assessment to determine the impact. If the assessment concludes that the project will adversely affect habitat, then either the permit must be denied or the project must be revised so that there is no adverse effect (Section 7.8). Revisions would be in the form of a mitigation plan that must be implemented in order for the project to receive a certificate of occupancy.

This process is shown in the flow chart on page 108, which is from page 6 of the model ordinance.

Case Study: Puget Sound Model Ordinance — Protecting Endangered Species, cont.

Ordinance Language	Commentary
<p>Section 5. General Development Standards</p>	
<p>The provisions of this Section 5 shall apply in the Special Flood Hazard Area:</p>	<p>There may be locations where part of a protected area lies outside the SFHA.</p>
<p>5.1. Subdivisions This section applies to all subdivision proposals, short subdivisions, short plats, planned developments and new and expansions to manufactured housing parks.</p>	<p>The community needs to make sure this section is consistent with its subdivision regulations. If not, the community may want to incorporate these provisions into its subdivision ordinance.</p>
<p>A. All proposals shall be consistent with the need to minimize flood damage.</p>	<p>44 C.F.R. § 60.3(a)(4)</p>
<p>B. The proposed subdivision must have one or more new lots in the SFHA set aside for open space use through deed restriction, easement, subdivision covenant or donation to a public agency.</p> <ol style="list-style-type: none"> 1. In the SFHA outside the protected area, zoning must maintain a low density of floodplain development. 2. In the SFHA outside the protected area in which the current zoning is less than 5 acres must maintain the current zoning. 3. The density of the development in the portion of the development outside the SFHA may be increased to compensate for the amount of land in the SFHA preserved as open space in accordance with _____ (section of the community’s zoning or other development ordinance that allows PUDs and/or transfers of development rights). <p>C. If a parcel has a buildable site outside the SFHA, it shall not be subdivided to create a new lot, tract or parcel within a binding site plan that does not have a buildable site outside the SFHA. This provision does not apply to lots set aside from development and preserved as open space.</p>	<p>ESA Requirement: RPA 4.B and Appendix 4, Section 3.11 require preserving floodplain open space via cluster development, planned unit developments and other methods, wherever possible. Communities should put this language in their zoning or subdivision ordinance.</p> <p>ESA Requirement: RPA 4, Section 3.2  CRS credit for preserving open space is provided under Sections 421.a and 431LD.a.2(a). The credit under 421.a is based on the amount of floodplain area set aside. More points are provided if the preserved area is habitat for threatened or endangered species.</p>
<p>D. All proposals shall have utilities and facilities, such as sewer, gas, electrical and water systems located and constructed to minimize or eliminate flood damage.</p>	
<p>E. All proposals shall ensure that all subdivisions have at least one access road connected to land outside the SFHA with the surface of the road at or above the FPE [flood protection elevation] wherever possible.</p>	<p>This section is optional, but recommended by FEMA. CRS credit is provided under Section 431.i.</p>
<p>F. All proposals shall have adequate drainage provided to avoid exposure to water damage.</p>	
<p>G. The final recorded subdivision plat shall include a notice that part of the property is in the SFHA, riparian habitat zone and/or channel migration area, as appropriate.</p>	<p>ESA requirement (Biological Opinion Appendix 4, Section 3.9)  Five points of CRS credit is provided for requiring such a notice to be filed with the subdivision plat, under Section 341.c.</p>

Case Study: Puget Sound Model Ordinance — Protecting Endangered Species, cont.



View of Puget Sound by Chris Balance via Flickr.

Section 7.7 references Regional Guidance for Floodplain Habitat Assessment and Mitigation, which is now called Floodplain Habitat Assessment and Mitigation—Regional Guidance for the Puget Sound Basin.

This *Guide* lists six steps required of developers for projects that are not exempt:

- Step 1. Describe the Project Area
- Step 2. Describe the Project Area's Habitat
- Step 3. Describe the Project
- Step 4. Assess the Impact
- Step 5. Review Mitigation Alternatives
- Step 6. Prepare the Mitigation Plan

Steps 4 and 5 are key. This *Guide* offers examples of impact types that would come from direct, indirect and cumulative effects induced by the project. Step 5 requires review of four alternatives that prevent or rectify an adverse impact on salmon habitat. They are listed in order of preference and effectiveness:

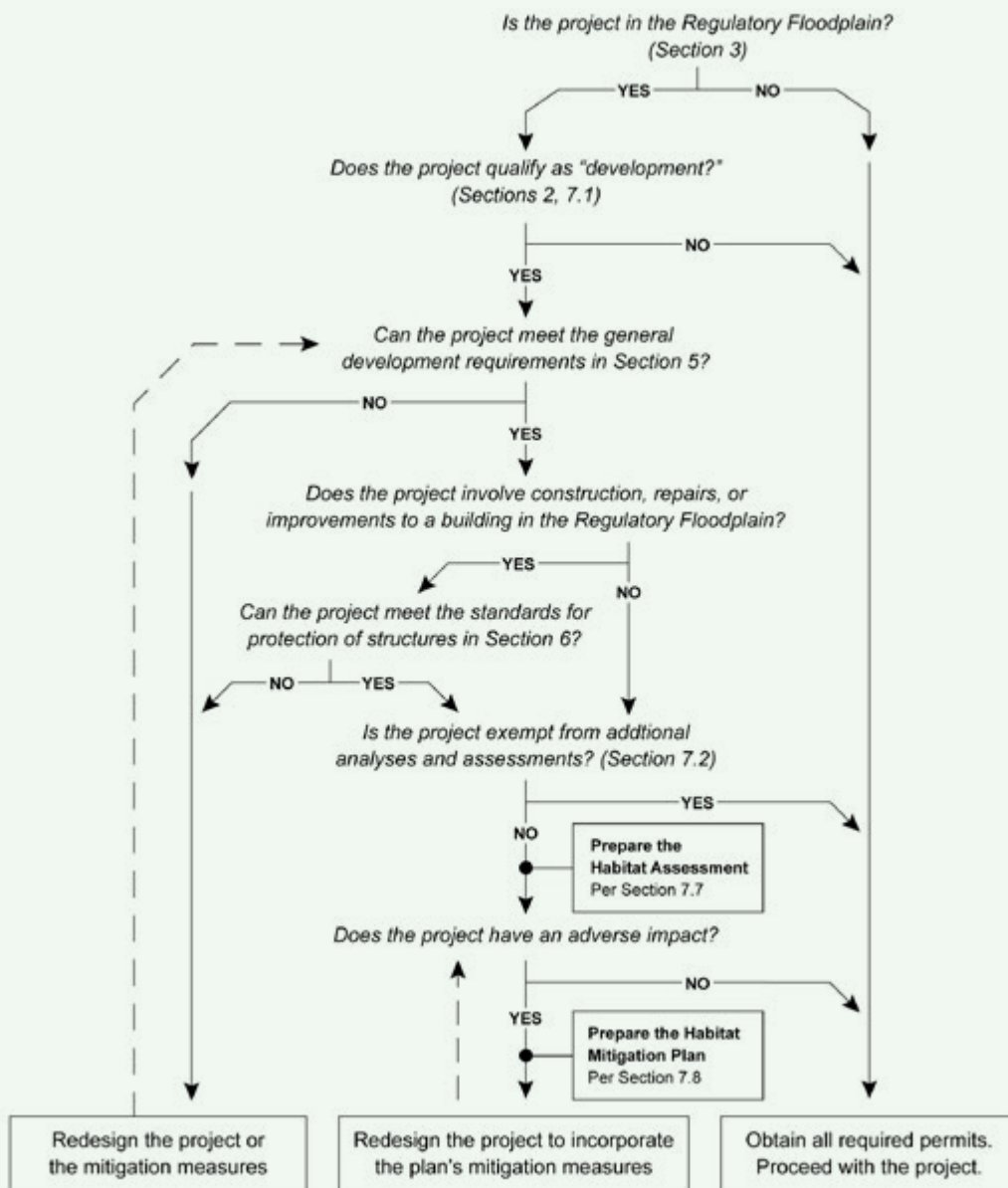
- **Avoidance:** Keep the project outside the regulatory floodplain using one or more of the incentives discussed in Tool 4 “Preserve Undeveloped Floodplains.”

- **Minimization:** Reduce impact by preventing development in identified high value habitat areas and/or by changing the construction design.
- **Restoration:** If the project only causes problems during construction, the sensitive area can be restored when finished.
- **Compensation:** Varies from in-kind, on-site compensatory actions, to off-site, out-of-kind actions. An example of off-site compensation is discussed in the box on Auburn Narrows (p. 109).

Case Study: Puget Sound Model Ordinance — Protecting Endangered Species, cont.

These alternatives may work independently or in combination. The final objective is to provide sufficient and appropriate mitigation to compensate for habitat impacts, in terms of features, area and/or function.

MODEL ORDINANCE PERMIT REVIEW FLOW CHART



Case Study: Puget Sound Model Ordinance — Protecting Endangered Species, cont.

Reviewing Assessments

An understandable concern for communities is knowing whether they have a good assessment or mitigation plan. The habitat assessment guide indicates one of the most important things is who coordinates the assessment. The guide offers these suggestions:

- Establish a list of qualified consultants who have experience in the area and provide it to permit applicants.
- Clarify the qualifications for authors of habitat assessments and mitigation plans. It offers this language: “Reports and plans shall be prepared by persons who have a minimum of a bachelor’s degree in wildlife or fisheries habitat biology, or a related degree in a biological field from an accredited college or university with a minimum of four years experience as a practicing fish or wildlife habitat biologist.”
- Provide a public comment period to ensure that interested third parties would have ample opportunity to review and comment on proposed projects. They may identify issues or impacts not adequately addressed.
- Establish a system of third party review(s) by qualified consultants or agencies. The cost could be passed on to the applicant.



The Auburn Narrows floodplain restoration project along Green River in King County, Washington was funded by a developer. The developer wanted to build on a nearby site with a designated habitat. As a condition of the permit, the developer compensated for the adverse impact of the development with this project that included creation of side-channel habitat, off-channel habitat and riparian habitat. — Photo courtesy of ESA Adolfson.

In addition to the model ordinance and habitat assessment guide, other helpful materials in the series include:

- *Regional Guidance for Hydrologic and Hydraulic Studies In support of the Model Ordinance for Floodplain Management and the Endangered Species Act, 2010*
- CRS Credit for Habitat Protection, 2010
- Engineering With Nature—Alternative Techniques to Riprap Bank Stabilization

These and other FAQs related to the Puget Sound Biological Opinion can be found at www.fema.gov/national-flood-insurance-program-endangered-species-act.

Norman, Oklahoma — Floodplain Rules Protect the City's Water Supply



Norman gets its water supply from Lake Thunderbird, created by dam construction on Little River. While the lake is publicly-owned and the shoreline is protected, water flowing into the lake has gotten dirtier. Over the years, agricultural practices and development in the floodplain and watershed have increased the amount of pollutants in the runoff that flows to the river and eventually into Lake Thunderbird. At times it was called Lake Dirtybird.

The Little River basin needed special attention and was declared a Water Quality Protection Zone. In 2008, Norman adopted special rules for the Little River watershed to prevent new buildings in new subdivisions from being constructed in the floodplain. Section 429.1 of the zoning ordinance is the Flood Hazard District.

Section 429.1.4(h) has subsections with different ways to minimize the likelihood of buildings being located in the floodplain.

- Subsection (3) requires buildings on parcels partly in the floodplain to be located on high ground.
- Subsection (4) allows a density transfer from 10 acre minimum lot size to 2 acres if needed to meet subsection (3).
- Subsection (5) requires building envelopes to be outside the floodplain. If a building envelop is in the floodplain, the permit must be approved by the Floodplain Permit Committee.
- Subsection (7) specifies how the floodplain portion of the lots shall be preserved.



The ordinance language is on pp. 112-113, and qualifies for CRS credit as open space incentives under Activity 420 (Open Space Preservation).

Floodplain Permit Committee.

The Floodplain Permit Committee is established in Section 429.1.5. Floodplain Permit Administration. Permit approval requires a vote of five or more members of the seven-member committee. The members include the directors of Planning and Community Development and Public Works departments, city engineer, development coordinator, manager of the current planning division and two citizens appointed by the mayor.

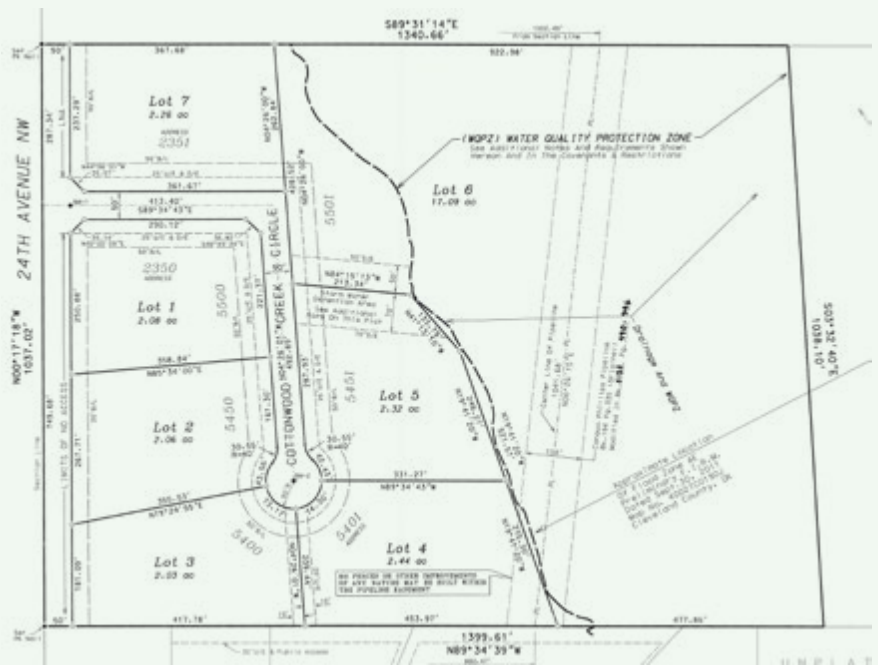
Case Study: Norman, Oklahoma — Floodplain Rules Protect the City’s Water Supply, cont.

“The citizen members of the Floodplain Permit Committee shall serve staggered three year terms. All members shall have successfully completed the basic floodplain training offered by the Oklahoma Water Resource Board or equivalent training or education, and at least one member shall be a Certified Floodplain Manager.”

The committee meets twice a month at an open public meeting. Because the Flood Hazard District is part of the zoning ordinance, zoning rules apply. All property owners of record within 350 feet of the proposed development are sent notices of the meeting.

EXAMPLE LITTLE RIVER FLOODPLAIN SUBDIVISION

The small subdivision of Cottonwood Creek was approved in 2013. Below is the final plat, showing the large floodplain area preserved and a 2015 Google Earth® aerial photo showing construction in the areas.



EXAMPLE ORDINANCE



LITTLE RIVER FLOODPLAIN RULES

Section 429.1.4(h) Special Floodplain and Building Construction Regulations
Applicable to Little River and Its Mapped Tributaries.

...

- (3) **Parcels and Lots Located Partially Within The Floodplain-Transfer of Permitted Development Density**—Any development resulting in the construction of buildings or other structures on a parcel partially located in the floodplain, shall be located wholly in upland areas of the parcel outside the floodplain. This procedure will not result in a change to the density permitted in underlying zoning district.

...

- (4) **Reduction in Minimum Lot Size**—To accommodate transfers of permissible residential density as provided above, the minimum lot size in land zoned A-2, Rural Agricultural District, subject to this Section 429.1.4(h) may be reduced from 10 acres to a minimum of 2 acres. The process that allows this transfer is through the Norman Rural Certificate of Survey to ensure that proper restrictions are put in place at the time of development.
- (5) **Lot Configuration and Building Envelopes**—To the maximum extent feasible, lots subject to this section 429.1.4(h) shall be configured so that they lie entirely out of the floodplain with any remainder parcel being preserved as provided in section 429.1.4(h)(7) below. As an alternative, lots may be configured so that portions are located within the floodplain. However, building envelopes of such lots shall be delineated to lie to the maximum extent feasible outside the floodplain. All building permits with building envelopes partially within the floodplain shall be subject to approval of the Floodplain Permit Committee in keeping with the purpose of this section 429.1.4(h). If no other option for access is practicable, driveways may be located within the floodplain.

...

- (7) **Floodplain Land Conservation**—Any portion of a parcel or lot located in a floodplain and not part of an approved building envelope shall be permanently protected from development as private or public open space through a mechanism acceptable to and approved by the city of Norman. Such mechanism may include, but is not limited to, a conservation easement, permanent deed restriction or transfer to a non-profit conservation organization or government entity.



EXAMPLE ORDINANCE



LITTLE RIVER FLOODPLAIN RULES, CONT.

Section 5 of Norman's Flood Hazard District ordinance covers floodplain permit administration. Section 5(h) has language that explains the above provisions

- (1) Parcels and Lots Located Partially Within the Floodplain—
Transfer of Permitted Development Density.

Example A: Smith owns a 10-acre lot adjacent to the Little River. The underlying A-2, Rural Agricultural zoning allows 1 unit/10 acres. Seven acres of the parcel lie in the floodplain, and 3 acres on an upland portion outside the mapped floodplain. Smith would still be allowed to build on the lot, but it would have to be sited on the 3 acres outside the floodplain. Any septic system would also be located outside the floodplain to the maximum extent feasible.

Example B: Farmer Brown owns a 40-acre parcel that could be divided into four 10-acre building sites under the applicable A-2 zoning. Thirty acres of the parcel are located in the floodplain, and 10 acres are outside. To subdivide the parcel, Brown would be required to cluster the building site (to a maximum of four lots) on the 10 acres outside the floodplain. Each of the lots could be reduced in size to 2 acres as provided below. As an alternative, up to four 10-acre lots could be created, all having some portion in the floodplain. However, Brown would work with staff to identify building envelopes located outside the floodplain within each lot.



EXAMPLE ORDINANCE



OTHER REGULATORY STANDARDS

While floodplain development is minimized in undeveloped areas, Norman has several higher regulatory standards for what is allowed. For example, 2 feet of freeboard is required. Here are some more, with the interesting provisions in bold.

SECTION 429.14. FLOOD HAZARD DISTRICT LAND USES

- (b) (3) Any new construction or substantial improvement that would individually or when combined with all other existing and anticipated development **expose additional** upstream, downstream or adjacent **properties to adverse flood effects** that would otherwise not be exposed to such effects due to the regulatory flood **shall not be permitted**;
- (4) Any new construction or substantial improvement that would **increase velocities or volumes of floodwaters** to the extent that significant erosion of floodplain soils would occur either on the subject property or on some other property either upstream or downstream **shall not be permitted**;
- (5) **Compensatory storage** must be provided within the general location of any storage that is displaced by fill or other development activity and must serve the equivalent hydrologic function as the portion that is displaced with respect to the area and elevation of the floodplain;
- (14) **The storage or processing of materials that are in time of flooding buoyant, flammable, explosive or could be injurious to human, animal or plant life is prohibited** except as provided in section 4(d) herein.
- (17) **The following floodplain modifications require approval by the City Council:**
- (i) A modification of the floodplain that results in a change of 10 percent or more in the width of the floodplain.
 - (ii) The construction of a pond with a water surface area of 5 acres or more.
 - (iii) Any modifications of the stream banks or flow line within the area that would be regulatory floodway whether that channel has a regulatory floodplain, unless the work is being done by the city of Norman staff as part of a routine maintenance activity.
- (c) (10) **All new fences or replacement of existing fences in the SFHA require a floodplain permit.** Approved fences shall be designed and installed to be breakaway (see def.) or in some other manner so that flows will not be impeded.



EXAMPLE ORDINANCE



SECTION 429.14. FLOOD HAZARD DISTRICT LAND USES, CONT

Section 429.1.5. Floodplain Permit Administration.

- (b) (5) When a regulatory **floodway has not been designated**, the Floodplain Permit Committee shall not permit any new construction, substantial improvements or other development (including fill) within Zones A, A1-30 and AE on the community's FIRM, unless it is demonstrated by the applicant that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, **will not increase the water surface elevation of the base flood more than five hundredths of a foot (0.05') on any adjacent property.**
- (c) **Approval or Denial of a Floodplain Permit request**, as required by subsection 5(a) and (b) above, by the Floodplain Permit Committee **shall be based on all of the provisions of this ordinance and the following relevant factors:**
- (1) The danger to life and property due to flooding or erosion damage;
 - (2) The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;
 - (3) The **danger** that materials may be swept onto other lands to the **injury of others**;
 - (4) The compatibility of the proposed use with existing and anticipated development;
 - (5) The **safety of access to the property in times of flood** for ordinary and emergency vehicles;
 - (6) The **costs of providing governmental services** during and after flood conditions including maintenance and repair of streets and bridges, and public utilities and facilities such as sewer, gas, electrical and water systems;
 - (7) **The expected heights, velocity, duration, rate of rise and sediment transport of the flood waters** and the effects of wave action, if applicable, expected at the site;
 - (8) The necessity to the facility of a waterfront location, where applicable;
 - (9) **The availability of alternative locations, not subject to flooding or erosion damage**, for the proposed use;
 - (10) The relationship of the proposed use to the city of Norman's adopted LAND USE PLAN for that area.



SECTION

FIVE

Resources &
Fact Sheet



Resources

General

[Floodplain Management Requirements Desk Reference](#), FEMA 480, 2005.

[National Flood Insurance Program Regulations.](#)

[No Adverse Impact Toolkit and other NAI](#)

[How-to Guides.](#)

[Reducing Flood Losses through the International Codes: Coordinating Building Codes and Floodplain Management Regulations](#), FEMA and the International Code Council 2014.

[Community Rating System introductory information.](#)

Community Rating System, [more detailed references](#).

Tool 1. Prevent Adverse Impacts to Other Properties

[The Floodway Encroachment Standard Minimizing Cumulative Adverse Impacts](#), ASFPM, 2013.

Tool 2. Prevent Adverse Impacts to Safety and Health

[Downstream Hazard Classification Guidelines](#), 1988,

US Bureau of Reclamation, Acer Technical Memorandum No. 11.

[Critical Facilities and Higher Standards](#), FEMA Fact Sheet, 2015.

Tool 3. Prevent Adverse Impacts to Natural Floodplain Functions

See Tool 3, Steps 1 and 3, for links to programs that protect natural floodplain functions.

[Protecting Floodplain Resources—A Guidebook for Communities](#), FEMA, 1996.

[Floodplain Habitat Assessment and Mitigation Regional Guidance for the Puget Sound Basin](#), FEMA Region 10, 2013.

[CRS Credit for Habitat Protection](#), FEMA, 2010.

Tool 4. Preserve Undeveloped Floodplains

[Best Practices: Greenspace and Flood Protection Guidebook](#), Georgia Environmental Protection Division, 2014.

Fact sheet: How-to Guide for No Adverse Impact Regulations and Development Standards

“If we continue to encourage at-risk development and ignore the impact to others, can we accept the consequences, and are you willing to pay for it?”

-Larry Larson, ASFPM

“No adverse impact is an approach that ensures the action of any community or property owner, public or private, does not adversely impact the property and rights of others.”

-NAI Toolkit, 2003

For case studies and specific examples of NAI success, visit <http://bit.ly/1H5SeXL>.

To speak to a No Adverse Impact expert, contact ASFPM at ASFPM@Floods.org or (608) 828-3000.

THE CONCEPT

The foundation of a No Adverse Impact floodplain management program is to manage human development in order to prevent or reduce flood hazards to people, flood damage to property, and loss of natural floodplain functions. Managing human development is done through regulations that govern the use of land, alterations of the ground and the construction of buildings and other structures.

Most communities base their development regulations on the requirements for participation in the National Flood Insurance Program. This approach can be helpful but also has shortcomings that allows lives to be threatened, property damage to increase and natural floodplain functions to be destroyed. They also leave the community open to liability for allowing such adverse impacts.

The NFIP criteria should be viewed as a start point to an NAI program. This Guide describes how a community's program can be augmented and improved in order to become an NAI program. Here are seven factors a community can follow to improve its floodplain management regulations:

1. Take responsibility for your regulations
2. Use the best available data
3. Have a sound basis for the standards
4. Coordinate with other programs
5. Explain the rules and rationale
6. Build a consensus for better rules
7. Take advantage of opportunities

While there are many ways to improve a local regulatory program, this Guide describes four basic tools a community can use:

Fact Sheet, cont.

TOOL 1: PREVENT ADVERSE IMPACTS TO OTHER PROPERTIES

Current NFIP regulations allow a developer to increase flood heights on other properties by up to 1 foot. They also allow storage loss and velocity increases. These legally allowed impacts can severely increase flood damage to buildings and their contents.

Tool 1 identifies three ways to prevent these adverse impacts. Mapping approaches are referred to the NAI How-to Guide for Mapping. Second, an improved permit application review process can identify problems that the applicant would have to address. The third way is through adoption of higher regulatory standards that prevent or limit development impacts. Both riverine and coastal regulations are addressed.

TOOL 2: PREVENT ADVERSE IMPACTS TO SAFETY AND HEALTH

Most national regulatory standards focus on protecting insurable property. While buildings may be protected from damage, people are often exposed to hazards that range from infections from dirty floodwater to stress from dealing with the aftermath of a flood to a

drowning death. Tool 2 provides numerous regulatory standards to protect safety and health when designing larger developments, such as requiring dry land access, and standards for individual sites, such as restrictions on hazardous materials.

TOOL 3. PREVENT ADVERSE IMPACTS TO NATURAL FLOODPLAIN FUNCTIONS:

There are many existing regulations that protect natural functions, such as Corps of Engineers 404 wetlands permits and critical areas ordinances. The biggest challenge is learning about these programs and coordinating floodplain management activities with them. Tool 3 provides a step-by-step process to identify natural functions that are important to your community and find existing programs or new floodplain management regulatory language that can protect those functions.

TOOL 4. PRESERVE UNDEVELOPED FLOODPLAINS:

There are more options to protect property, people and natural floodplain functions in undeveloped and sparsely developed areas. In such areas problems can be prevented before development is

allowed. The best NAI approach is to keep vacant floodplains vacant. Tool 4 identifies informative, persuasive and prohibitive regulatory approaches to keeping undeveloped floodplains open.

IN SUMMARY

Relying solely on NFIP's minimum regulatory criteria leaves a community open to increased threats to property, safety, health and natural floodplain functions. This Guide reviews four tools that can counter these shortcomings and help your community implement an NAI regulatory program.

RESOURCES

For more information refer to [ASFPM's NAI Resource Center](#).