



USA: NO ADVERSE IMPACT - A NEW DIRECTION IN FLOODPLAIN MANAGEMENT STRATEGY

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Abstract. Information is provided about a new approach to flood management called the “No Adverse Impact (NAI) Floodplains Strategy” that is being proposed as an alternative to traditional federal flood management policies in the US. The new approach would require that consideration be given to the effect that proposed development activities anywhere within a given watershed could have on either increased flood stages, flood velocity, flood flows or the increased potential for erosion and sedimentation anywhere within that basin. Thus, that the action of one community does not adversely affect the flood risks for other communities unless the impact is mitigated as provided for in a community or watershed-based plan. The information is complemented with the description of three community case examples and a listing of immediate actions to implement the NAI in the US

1. Flood losses and their trend

Flood losses in the US continue to escalate. This increase in the level of damage to public and private property, amounts spent on disaster relief, disruption in lives and businesses, and loss of habitat and other water-related resources has occurred in spite of nearly a century of flood control, the implementation of floodplain management standards in about 19,000 communities nationwide, and the mapping of thousands of miles of floodplains.

The estimates of direct damage (in 1999 US dollars) due to flooding that results from rainfall and/or snowmelt highlight this increasing trend: (i) the average annual flood damage for the first half of the 20th century was \$2.2 billion, compared to \$3.9 billion for the second half of the 20th century; (ii) of the top 20 loss years, 14 occurred between 1950 and 1999; (iii) for the 1990s, average annual losses were \$5.6 billion, compared to the 1900-1909 period, when losses were \$1.4 billion annually. All this leads to the conclusion that a conservative estimate of total flood losses at present is well in excess of \$6 billion annually. This is a four-fold increase since the early 1900s, or a doubling in terms of dollars of damage per capita in the US. The general trend is for flood losses to increase every decade.

When floods hit, people are forced from their homes and businesses, and many never recover financially from the impact. Local, state, and federal officials are faced with rescue operations; there are housing needs for displaced people and immediate expense for the repair of infrastructure; dollars are diverted from other public efforts to pay for the emergency. Recent focus on, and enhanced funding for, mitigation is helping to alleviate some of the more obvious problems with existing structures being flooded, but there is need yet to come to grips with how to stop creating future flood problems caused by new development. The nation’s extensive current efforts at flood control and modern floodplain regulation were intended to control flood losses, yet data suggests that losses are not being effectively curtailed.

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2. Fundamental approaches to reducing flood losses

The current mission of federal government for flood control, flood insurance and disaster assistance all have had positive impact and will remain essential tools for the future.

Many important *flood control works* have been constructed over the years and there will be a need for flood control in the future. In addition, in the past several years a better job has been done of balancing structural flood control with non-structural projects. However, a key factor that appears to be influencing flood loss potentials are benefit-cost decisions. Managing floodplains so that they maximize benefit to society is an important objective, and an obvious element of this is economic benefit. As a matter of policy, a federal flood control project is considered justified when its benefits exceed its cost.

In accordance with the above view, once a structural project is built, there are apparent benefits to developing and intensifying land use within the protected zone. Yet to date such issues have not been adequately addressed as higher rates of runoff from developed watersheds or loss of stream storage that will lead to higher flood flows in the future. For instance, one category of induced flood damage is the extensive filling or encroachment of floodplains that translates into a more rapid movement of flood peaks or stages downstream. Properly formulated federal flood control projects do consider obvious induced damage, such as increased flood stages resulting from loss of floodplain area. Unfortunately, locally developed flood control projects (private and public) often ignore these increases, even though the projects are compliant with the minimal floodplain management criteria established by the *Federal Emergency Management Agency (FEMA)*.

In recognition of growing flood losses, the *National Flood Insurance Program (NFIP)* was established in 1968 to provide federal flood insurance for individuals that reside in a community that adopts and abides by certain floodplain management criteria. Since then, the NFIP has done a notable job of bringing floodplain management to most of the nation's communities. Furthermore FEMA, which administers the NFIP, has significantly influenced the role and acceptance of non-structural measures among other federal agencies.

Current floodplain management standards have two essential components. The first is the concept of a two-district floodplain, known as the floodway and the flood fringe. The floodway is the central portion of the floodplain, presumably the area with the greatest water velocities and highest depths, which should be left open in order to avoid increases in flood levels. Under current national standards, however, flood levels can be increased up to 1 foot. The flood fringe comprises the outer areas on both sides of the floodway, and presumably is the area of lower depths and velocities and that stores water during a flood. Current standards allow development in the flood fringe regardless of depth and velocity, and restrict development in the floodway. The second component is the establishment of the lowest floor of construction at the level of the 1% chance flood.

However, due to land use actions within and outside the floodplain, existing and future development very likely will experience flood depths of 1 foot or more above the mapped levels - which in many cases were based upon data that is 15 years old or older and could well be below today's true 1% chance flood level.

Disaster assistance to help those affected by natural disasters has become viewed as a federal responsibility, and only recently has the idea of actually mitigating some of these losses begun to seriously shape disaster recovery programs. For many years the sole focus of disaster assistance was rapid recovery with little concern for mitigation. The result was that communities were the recipients of repaired or replacement systems of infrastructure that made flood prone areas attractive locations for development. Only recently (1988 and 1994 amendments to the disaster relief acts) has mitigation become an important element of the recovery process.



3. “No Adverse Impact Floodplains” strategy

To remedy the unintended effects of several decades of flood reduction policies, it will be necessary not only to avoid creating new hazards but also to actively mitigate existing ones. The guiding principle of the proposed “*No Adverse Impact (NAI)*” floodplain management would assist in meeting this goal.

A NAI floodplain is one in which the action of one property owner or community does not adversely affect the flood risks for other properties or communities as measured by increased flood stages, increased flood velocity, increased flows, or the increased potential for erosion and sedimentation, unless the impact is mitigated as provided for in a community or watershed based plan.

The NAI impact approach was developed to support long-term, sustainable approaches to reducing flood losses now and in the future. Protection of individual property rights and the management of floodplain for the highest net social benefit must continue to be the central focus of a sustainable flood policy. Utilizing the natural and beneficial functions of floodplains and watersheds is complementary with a NAI policy. For example, adopting no-rise floodways will lead to more of the natural floodplain being available for other community needs like flood storage, recreation, and water quality filtering, thus promoting the wise use of the nations floodplains and watersheds.

The principles of the NAI floodplain would need to be applied throughout the entire watershed. In many localities, upstream development in the watershed has induced new and additional damage within the floodplains. Communities need to be encouraged to account for or mitigate flood damage locally or regionally. This can be done by promoting the use of retention and detention technologies to mitigate increased runoff from urban areas, or by planning for future-conditions flooding within the region while mitigating for induced damage.

The NAI floodplains approach is a different way of viewing flood policy. It moves away from a development standards approach while firmly placing local governments in a responsible position to manage floodplain risks. It is a “good neighbor” policy that brings focus to the issue of how existing properties within and adjacent to floodplains are being affected by the land use decisions of others. The NAI strategy is a collection of initiatives, some of which may be generic and meaningful to all communities and others that are best when tailored to fit the local situation. These can be both structural and nonstructural, and be implemented by either regulatory or programmatic means. It should lead to the production and acceptance of locally based comprehensive floodplain and watershed development and management plans. It will require federal and state acceptance of those plans as the standards in a community, as long as agreed-upon goals are met. What this means is that when no local plan exists, all federal and state programs in the floodplain would use standards that achieve NAI changes in hydrology, stream depths, velocities, and sediment transport functions.

4. Mitigating adverse impact

There are various methods of mitigation that could be utilized to offset the impact of development that exceeds local standards. Types of mitigation actions to reduce flood losses include those that modify human occupancy of the floodplain or watershed (usually a non-structural measure) or modify the flood (usually a structural measure). Examples of implementation include enforcement of regulations and master plans, as well delivery of programs and services. A NAI impact strategy most likely will contain elements of each.

There are four negative effects that are most likely to result somewhere in the watershed when development activity takes place on flood-prone land: increased flood stages, increased velocities, increased flows, and erosion and sedimentation. These are the problems that must be managed, mitigated, or prevented by the locality in order to achieve a NAI floodplain or watershed.



Increased flood stages. This is one of the primary problems of managing floodplains and watersheds subject to development. The primary existing control on future flood stages is the abovementioned NFIP floodway standard, which allows flood depths to be increased up to 1 foot above nature's floodway as a result of floodplain encroachments. The impacts of this 1-foot increase in the flood stage on existing properties and future construction are not considered under the NFIP. To address this lack, some state and local governments require new buildings to be constructed 1-3 feet above the current flood elevation. Others have adopted a modified floodway standard (called the no-rise floodway) that limits the allowed increase in the natural floodway to less than some measurable amount, say 0.1 foot. In addition, there are other tools that could be used to address this issue.

Increased velocity. Whenever the discharge in a stream is increased without an offsetting increase in cross-sectional flow area, or when the cross-sectional flow area is decreased due to fill or development in the floodplain, velocities will increase. This situation also commonly occurs when levees are installed, in some cases "pinching" the river. The impact of these actions can be erosion from increased velocity and/or increased flooding or damage downstream. Approaches that limit or result in reduced floodplain encroachment that would increase velocities will prevent this problem.

Increased flow. The management of increased flow is another area of concern. These increases are generally the result of paving of watersheds or the loss of in-stream storage due to filling or development. Communities continue to implement and evaluate retention and detention basins so that new development does not increase flow. Retention and detention can be a powerful tool, as long as it is carefully implemented.

Erosion and sedimentation. Sediment transport and sedimentation are perhaps the least-understood functions of a floodplain, yet the consequences of disrupting them can be significant. Often streams and rivers respond with accelerated erosion of other sections of the floodplain to compensate for the loss of sediment supply from the protected reach. Each stream has a certain sediment need, and if its source is cut off by armoring in one area, it will get it from another portion of the stream. Some communities are beginning to evaluate the use of erosion hazard setback zones, or they are developing sets of tools for an entire floodplain that can be used to evaluate systematic impacts of all proposed development.

Finally, the development of a *local overall management plan* is essential. It would include a technical analysis to quantify current and future conditions; incorporate mitigation techniques to minimize impacts; identify implementation measures to manage all of the hazard factors identified; include strong citizen involvement so the plan is equitable; and it would ultimately provide a vision for future use of the community's land within and outside the floodplain.

5. Community case examples

Three community case examples are included in the case study to illustrate, on the one hand, how these are striving to move toward a NAI standard and, on the other, that there are different approaches communities can use to achieve NAI. In each case the communities have recognized that development activity anywhere in the watershed can adversely affect properties elsewhere in the watershed, not just in the floodplain.

The three example communities have varied ways to address development. In one case it is comprehensive regulations, in another it is planning and management, and the third takes a strong approach to identifying the hazard area based on future developed conditions. The intent is to highlight that element which is seen as the strongest example that community can provide to other communities who may want to explore that technique to achieving NAI.



2. Main lessons learned

- Current management approaches for reducing flood losses too often allow development to occur without considering its adverse impact on other properties within the watershed or on future flooding potential. This has contributed to steadily rising flood losses and is increasing the potential for future flood damage.
- A “No Adverse Impact Floodplains Strategy” would require that consideration be given to the effect that proposed development activity anywhere within a watershed could have on flood stages, velocity, flows, and erosion or sedimentation elsewhere within that watershed. It would ensure that future development activity both in and out of the floodplain be part of a locally adopted management plan. It is an approach that will lead to reducing flood losses within the nation while promoting and rewarding strong management, planning, and mitigation actions at the local level.