






Flood Mitigation Strategies and Practices Project Sheets

This appendix is a compilation of flood mitigation strategies and practices to assist local communities in their flood risk mitigation planning efforts. The appendix is divided into four sections based on the type of mitigation activity, respectively: Local Plans/Regulations, Education Awareness Programs, Natural Systems Protection, and Structure & Infrastructure. Each project page contains a description of the strategy, its applicability, step-wise approach to implementation, relative cost considerations, and references or links for additional information. The project pages are intended to serve as a menu of mitigation strategies (with supporting information) that communities can choose and incorporate directly into their mitigation planning activities.



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Category	Strategies & Practices	Undeveloped Areas 	Developed Areas 	Low Cost 	Low Maintenance 	Nature-Based 
LOCAL PLANS/ REGULATIONS	Integration of Comprehensive Flood Hazard Planning	X	X	X	X	
	Building Code Requirements		X	X		
	Stormwater Management Ordinances		X	X		
	Floodplain Ordinances	X	X	X		
	Compensatory Storage Ordinances	X	X	X		
	Low Impact Development			X	X	X
EDUCATION AWARENESS PROGRAMS	Emergency Preparedness Planning and Communication	X	X	X	X	
	Stormwater and Flood Education	X	X	X		
NATURAL SYSTEMS PROTECTION	Natural Stormwater Best Management Practices (BMPs)		X		X	X
	Maintain/Enhance Floodplain	X				X
STRUCTURE AND INFRASTRUCTURE	Floodplain Acquisition and Relocation	X	X		X	X
	Construction and Maintenance of Structural Measures		X			

Integration of Comprehensive Flood Hazard Planning



WHAT

Integrate flood hazard mitigation plan elements into overall community planning efforts to provide comprehensive flood hazard planning for communities.

WHERE

Any jurisdiction can take a comprehensive approach to planning for flood mitigation. When employing this mitigation action, communities implement comprehensive flood hazard mitigation strategies by integrating flood hazard mitigation plan elements into other community planning processes.

WHY

Community benefits of comprehensive flood hazard planning include increased coordination, heightened safety, and effective usage of resources and funds.

HOW

The comprehensive planning process will vary by community to address flood hazard and identify and integrate content from existing plan documents.

Communities are encouraged to take the following actions to proactively perform comprehensive hazard planning and incorporate flood hazard mitigation plan elements into other community planning efforts:

- If the flood hazard mitigation plan includes a mitigation action such as the establishment of a setback (a minimum distance between a stream and any development) to maintain flood flow or other floodplain functions, incorporate the setback requirements into floodplain or stormwater management ordinances.
- If the flood hazard mitigation plan includes recommended performance objectives such as target freeboard elevations or minimum structure discharges, incorporate them into design standards and processes.
- If the flood hazard mitigation plan identifies deficiencies and potential infrastructure improvements, incorporate them into the capital improvement plans of appropriate public works or engineering divisions.
- Coordinate with other communities/jurisdictions for holistic watershed approaches. Examples include developing consistent design standards and sharing flood hazard mitigation plans with surrounding communities for comment during development.
- Update plans with new information or data from government agencies such as FEMA, USGS, or NOAA as it becomes available.
- Incorporate redundancies into community plans to provide a level of safety should flood protection measures fail. For example, a plan calling for a flood protection berm could also include a deployable flood wall or sandbags as a redundant measure.

COST CONSIDERATIONS AND BENEFITS

Costs are relatively low as there are no capital improvements directly associated with the integration of planning efforts. Community staff resources should be allocated for coordination, maintenance, and updates to planning documents. The labor cost of community staff resources for integration of flood hazard planning is anticipated to be minimal.

RESOURCES

The Nebraska DNR prepared a [Resource Guide for Nebraska Communities](#), which provides information, goals, actions and policies regarding comprehensive flood hazard planning for communities.

FEMA's [Hazard Mitigation Planning Process webpage](#) describes core planning process steps.



Building Code Requirements

WHAT

Establish or enhance building code requirements to reduce flood risk to life and property. Building codes can be crafted to elevate structures further above anticipated flood levels, better maintain function of equipment during a flood event, and promote greater safety by providing evacuation routes.

Floodplain management through building code requirements may include:

- Adopting building codes and establishing a program of plan and building inspections.
- Adding or increasing the community's local freeboard requirement for mechanical and electrical equipment and structures to one (1) foot or greater.
- Require new residential development, walkways, driveways, and roadways be elevated and designed such that dryland access to evacuation routes out of the floodplain area is provided.
- Adopting standards for fill compaction, slope, materials, and armoring.
- Using check valves, sump pumps, and backflow prevention devices in homes and public facilities.
- Implement a safe room program to disincentivize use of basements in the Special Flood Hazard Area.

WHERE

Adopting or enhancing building code requirements is a mitigation action that applies to rural and urban areas and can be implemented by communities (villages, cities, and counties) of all sizes. Building code requirements apply to new development and redevelopment as well as existing development.

WHY

Building codes promote public health and safety. They are important to communities for many reasons:

1. Building codes increase protection against a wide range of hazards.
2. Up-to-date building codes reduce natural disaster damages and costs.
3. Updating building codes allows your community to benefit from the latest post-disaster research, making the community more sustainable and resilient.
4. Building codes promote improved construction quality, consistent permitting, and strong code enforcement.
5. Building codes can help a community reduce insurance premiums, lower bond ratings, and apply for federal grant funds.

Adapted from FEMA's [5 Reasons Building Codes Should Matter to You](#).

HOW

Community officials can follow the steps below to enhance building code requirements:

1. Review your community's flooding and development history to understand potential risks.
2. Review your community's existing building code requirements.
3. Develop requirements to address potential risks and/or provide enhanced safety.
4. Adopt the requirements through the community council's process.

COST CONSIDERATIONS AND BENEFITS

Costs are relatively low. Administrative resources are required to prepare, adopt, and implement the ordinance. Implementing the ordinance can be accomplished through integration with appropriate planning, zoning, and development application review processes. There are no capital improvements directly associated with building code requirements. Well-crafted building codes increase public safety and reduce disaster damages and costs.

RESOURCES

FEMA's collection of [building code documents](#) provides guidance on hazard-resistant provisions.



Stormwater Management Ordinances

WHAT

Adopt development ordinances to address community stormwater objectives and requirements.

The regulations should address requirements for both construction and post-construction periods. These ordinances do not require specific measures but may work in conjunction with others that promote natural stormwater BMPs or LID measures. These ordinances specify stormwater requirements and allow flexibility for development approaches that protect flood-prone areas.

WHERE

This mitigation action is applicable to areas of new development and redevelopment and is therefore most applicable to urban areas.

WHY

Many development activities influence stormwater runoff quantity and quality. Stormwater-related development ordinances establish controls to protect watershed and community resources from adverse effects that may accompany development.

HOW

Community officials can use the following framework to develop and adopt a stormwater ordinance:

1. Assess the existing ordinances. Some existing ordinances may not be consistent with modern stormwater management or NPDES MS4 permit requirements.
2. Review and apply model ordinances based on the community's needs.
3. Develop the ordinance to meet the community's needs and to be compatible with your stormwater program. For example, the stormwater ordinance may reference design standards that can be updated more frequently.
4. Build community and political support.
5. Adopt the ordinance through your community council's process.

COST CONSIDERATIONS AND BENEFITS

Costs are relatively low. Administrative resources are required to prepare, adopt, and implement the ordinance. Implementing the ordinance can be accomplished through integration with appropriate planning, zoning, and development application review processes. There are no capital improvements directly associated with stormwater/development ordinances.

RESOURCES

Chapter 5 of [EPA's Managing Stormwater in Your Community: A Guide for Building and Effective Post-Construction Program](#) provides helpful information on developing a post-construction stormwater ordinance.

Model ordinances to protect local aquatic resources can be found at the [Stormwater Manager's Resource Center](#).

The following Nebraska community resources include ordinances and regulations related to stormwater and development:

- City of Omaha Stormwater Program [Regulations](#)
- City of Lincoln [Regulations and Standards](#)

Stormwater ordinances generally address the following elements:

1. Regulatory structure
2. Design
3. Development review
4. Maintenance
5. Inspection and enforcement



Floodplain Ordinances

WHAT

Adopt a floodplain ordinance to require responsible development and promote resilience.

WHERE

Developing and adopting a floodplain ordinance is a mitigation action that applies to rural and urban areas and can be implemented by communities (villages, cities, and counties) of all sizes. Floodplain ordinances apply to new development and redevelopment but also affect existing development and the community's overall floodplain management efforts.

WHY

Adopting a floodplain ordinance is a sound land use strategy and controls development to promote public safety and protect property. Floodplain ordinances are a preventative tool that significantly reduces individual and community flood risks, particularly for areas of new development.

Floodplain ordinances may be adopted by any community but are required for participation in the National Flood Insurance Program (NFIP), which affects community eligibility for FEMA funding and the ability of its residents and business owners to obtain flood insurance. Floodplain ordinances promote natural and beneficial floodplain values including improved flood flow, storage, and control; groundwater recharge; water quality function; and wildlife and diversity.

HOW

Community officials can follow the steps below to prepare and adopt a floodplain ordinance:

1. Review flood sources and risks and understand the FEMA-designated special flood hazard areas in the community.
2. Obtain and review the appropriate model ordinance and higher/optional standards.
3. Refine ordinance language to meet your community's specific needs. A floodplain administrator needs to be designated to administer, implement, and enforce the provisions of the ordinances.
4. Obtain approval from the Nebraska DNR.
5. Adopt the ordinance through your community (village, city, or county) council.

COST CONSIDERATIONS AND BENEFITS

The cost of developing floodplain ordinances is relatively low and can have far-reaching effects on the community into the future. Floodplain ordinances and enforcement result in reduced flooding risks and greater community resiliency.

The cost of floodplain administration will vary based on community size and the number and nature of development activities.

RESOURCES

The Nebraska DNR has prepared [model ordinances](#) that communities can apply based on FEMA special flood hazard areas. Additionally, resources are available for [higher and optional standards](#) (including a cumulative substantial improvement policy) for greater community resilience.

Key elements of a community's floodplain ordinance approach include:

- Creating incentives that encourage developers to limit or eliminate development in flood-prone or flood storage areas.
- Adoption of practices that comply with or exceed NFIP requirements.
- Adoption of a cumulative substantial improvement policy (see Resources)



Compensatory Storage Ordinances

WHAT

Adopt compensatory storage ordinances to prevent loss of floodplain storage.

The compensatory storage ordinance requires an amendment to a community's existing floodplain ordinance or creation of a new, complementary ordinance.

WHERE

Adopting compensatory storage ordinances is a mitigation action that applies to developing areas and can be implemented by communities (villages, cities, and counties) of all sizes.

WHY

Basic floodplain ordinances restrict development from obstructing the flow of water and limit increases to flood elevations. These ordinances do not address impacts to floodplain storage that may alter flood flows in downstream areas. Compensatory storage ordinances are one way that a community can enhance their floodplain requirements and thereby mitigate flood risk.

Floodplain ordinances often focus on channel flow but neglect to address impacts to storage in overbank areas.

HOW

Community officials can follow the steps below to adopt a compensatory storage ordinance:

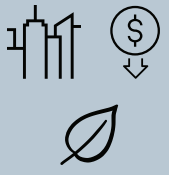
1. Review your community's Flood Insurance Study and floodplain mapping to understand potential risks.
2. Review your community's existing floodplain ordinance.
3. Develop requirements to prevent loss of floodplain storage.
4. Adopt the requirements through your community council's process by amending the existing floodplain ordinance or creating a new ordinance.

COST CONSIDERATIONS AND BENEFITS

Costs are relatively low. Administrative resources are required to prepare, adopt, and implement the ordinance. Implementing the ordinance can be accomplished through integration with appropriate planning, zoning, and development application review processes. There are no capital improvements directly associated with compensatory storage ordinances. Maintaining floodplain storage better protects communities from flooding events.

EXAMPLES AND RESOURCES

The City of Lincoln's [Codes and Regulations](#) (see Municipal Code Chapters 26 and 27) and [Drainage Criteria Manual Chapter 10 – Flood Design Criteria for New Growth Areas](#) provide an example of municipal compensatory storage requirements.



Low Impact Development

WHAT

Low impact development (LID) is a land planning and design approach to reduce stormwater runoff and pollutant loading using green infrastructure. The LID approach is supported by community plans and regulations that require appropriate stormwater measures and include design, certification, and inspection requirements.

WHERE

This mitigation action is applicable to new development and redevelopment and is therefore best suited to urban areas. While LID strategies can be implemented on an individual homeowner scale, a broad-scale community plan approach maximizes stormwater benefits. LID policies generally pertain to permanent measures rather than temporary construction measures.

WHY

LID plans and regulations promote practices and measures that provide water quality and quantity benefits in a community. Implementation of LID plans and enforcement of regulations can result in a wide range of benefits such as reduced pollutants, reduced flooding, increased water supply, reduced watering/irrigation costs, enhanced project aesthetics, and increased wildlife and natural habitat.

HOW

Communities can follow these steps:

1. Prepare or update a stormwater management plan to incorporate LID objectives and strategies.
2. Develop design guidance, standards, or requirements for acceptable LID measures.
3. Incentivize or require the use of LID techniques to manage stormwater for new development or redevelopment.
4. Incorporate review and approval procedures for site stormwater management plans within the community's platting/permitting process.
5. Specify and enforce LID measure inspection and performance requirements.

COST CONSIDERATIONS AND BENEFITS

The cost of developing adopting a LID approach into stormwater planning and regulations is relatively low and can have far-reaching effects on your community as development occurs. Administrative resources are required to prepare, adopt, and implement the plan and design guidance as well as to incorporate review, approval, and inspection procedures into your stormwater management program. LID strategies promote responsible and progressive stormwater management to control runoff and improve water quality.

RESOURCES

[The City of Omaha Stormwater Program](#) highlights projects that have implemented LID measures and has created fact sheets for many common LID measures.

Emergency Preparedness Planning and Communication



WHAT

Develop and adopt emergency communication protocols and content.

Communities can enhance flood forecasting and flood warnings to citizens by enhancing emergency communication content and collaborating with existing information outlets. Emergency communication methods can include sirens, automated phone notifications and calls, local radio and television warnings, and social media.

Key elements of emergency preparedness planning and planning include:

- Development of communication protocols related to flood threats
- Development of consistent warning content, made publicly available on city, county, or state government websites
- Collaboration with existing city, county, or state emergency management communications
- Public education on sources of flood warning information

WHERE

Emergency preparedness planning and communication is applicable to rural and urban areas and to communities (villages, cities, and counties) of all sizes.

WHY

Planning the response and communication channels to be used in an emergency flooding situation can reduce the likelihood of damages to private property, public infrastructure, and life in a community.

HOW

Steps may include one or more of the following:

1. Integrate existing emergency management systems developed by the City, County, or State into your community's Emergency Preparedness Plan.
2. Identify an effective, community-specific communication method for warnings. This method should be selected considering community size, cellular service, and broadband accessibility.
3. Develop warnings to address the source (entity issuing warning), hazard type, location, duration, and impact information which may include travel limitations, evacuation procedures, and safety recommendations.
4. Conduct periodic reviews and emergency communication drills to prevent communication gaps due to personnel changes, and to ensure prompt coordination with emergency management during flood events.

COST CONSIDERATIONS AND BENEFITS

Costs are relatively low and include up-front administrative labor costs to develop protocols, consistent content, and public education. Community staff resources should be allocated for evaluating and enhancing current community content and protocols, and for periodically reviewing and practicing notification protocols. During flood events, labor costs are required for monitoring and coordination with emergency management.

EXAMPLES

The National Oceanic and Atmospheric Administration published an [Example Warning](#) that shows a communication transcript from the National Weather Service to a community during a flash flood warning.

What should emergency warnings include?

- Source (entity issuing the warning)
- Hazard type
- Location
- Duration
- Impact information such as travel limitations, evacuation procedures, and safety recommendations



Stormwater and Flood Education

WHAT

Educate residents, business owners, and other professionals on stormwater management, flood risk, and floodplain management.

Stormwater and flood education can be applied to a number of groups including children/youth (schools), homeowners, business owners, and other professionals such as realtors. Education builds awareness of risks, encourages preparedness, and increases a community's potential for resilience.

Key elements of a stormwater and flood education program include:

- Annual distribution of flood safety pamphlets to residents in flood-prone areas. Encourage landlords to do the same.
- Teaching residents the importance of clearing storm drains of debris, and securing propane tanks, yard items, or stored objects that may be swept away or pose a hazard.
- Directing residents to GIS hazard mapping online to better understand their risks.
- Reminding realtors of State requirement to disclose in writing whether the property is in a Special Flood Hazard Area, or whether the property has incurred any damage due to flooding.

WHERE

Stormwater and flood education is applicable to rural and urban areas and to communities (villages, cities, and counties) of all sizes.

WHY

Effective stormwater and flood education programs increase stormwater and flood risk awareness, promote actions that reduce flood damages, and protect property owners.

HOW

The following steps may be helpful in building your stormwater and flood education program:

1. Inventory existing community resources, such as floodplain mapping.
2. Identify community stormwater and flood needs and risks to be addressed through education.
3. Consider coordination with NeDNR floodplain management section for materials, information, and other assistance.
4. Determine your audience(s), which may include students, homeowners, business owners, landlords, realtors, and others.
5. Gather and develop materials to meet your community's needs.
6. Collaborate with educators.
7. Promote stormwater and flood education at community events, fairs, etc.

COST CONSIDERATIONS AND BENEFITS

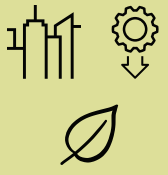
Costs are relatively low. Administrative effort is required to prepare, communicate, and disseminate educational messages and materials. There are no capital improvements associated with flood education.

EXAMPLES AND RESOURCES

[Educational materials and school lesson plans](#) are available through the City of Omaha Stormwater Program (see Residential Downloads at the left-hand side of the webpage).

The UNL Institute of Agriculture and Natural Resources provides [Stormwater Activity Sheets](#) designed for students in Grades 4-6.

The National Weather Service [Flood Safety Education and Outreach](#) website has various resources including flood related videos, public service announcements, brochures, and links to additional information.



Natural Stormwater Best Management Practices (BMPs)

WHAT

Natural stormwater best management practices (BMPs) are practices that use bioengineering and vegetative approaches to treat, prevent, or reduce stormwater runoff. Examples include rain gardens, stormwater wetlands, bioretention features/facilities, and vegetated filter strips.

WHERE

This mitigation action is applicable new development and redevelopment and is therefore more common in urban areas. Natural stormwater BMPs include temporary construction measures and permanent (post-construction) measures. A common construction BMP is a silt fence placed to control erosion of disturbed soils. An example of a permanent or post-construction BMP is a wet or dry pond that provides runoff storage and reduces downstream peak discharges.

WHY

Natural stormwater BMPs improve water quality and reduce runoff through storage, infiltration, and/or evaporation. Selection of BMPs is context-sensitive, and the advantages or benefits also vary based on application. Potential benefits include reduced pollutants, reduced flooding, increased water supply, reduced watering/irrigation costs, and infrastructure cost savings. Natural stormwater BMPs complement community parks and open spaces, enhancing recreational use. Natural stormwater BMPs also provide wildlife and other natural habitat benefits.

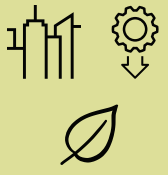
HOW

A natural stormwater BMP program includes the following actions:

- Address construction and post-construction periods
- Protect natural streams, wetlands, and adjacent property
- Design and construct natural measures that limit peak runoff and impacts to downstream channels and stormwater features as part of building permit/platting approvals
- Inspect and maintain BMPs

COST CONSIDERATIONS AND BENEFITS

Costs to construct BMPs are borne by the owner/developer. Communities should also integrate natural BMPs into public works and engineering projects where applicable. Compared to traditional stormwater management infrastructure, natural BMP construction costs are typically less costly. Maintenance of natural BMPs may be required more frequently. While they generally require less capital cost, maintenance can be more time and labor intensive due to the landscaping (weeding, mulching, replanting) required to maintain the health of natural BMPs. Responsibility for maintenance costs of the BMPs will vary based on ownership and other factors. Responsible parties might include individual property owners, developers, sanitary and improvement districts (or other similar entities), and municipalities.



Natural Stormwater Best Management Practices (BMPs)

RESOURCES



Bioswales are depressions that contain vegetation and allow for storage, infiltration, and evaporation of direct rainfall and surface runoff from adjacent areas.

Source: U.S. EPA, Different Shades of Green, October 2016.



Rainwater gardens are depressed landscape areas planted with grasses, flowers, and other plants that collect runoff from adjacent areas and allows it to infiltrate.

Source: U.S. EPA, Different Shades of Green, October 2016.



Planter boxes have vertical walls and open or closed bottoms. They are well-suited to collect and absorb runoff in dense urban areas where limited space is available.

Source: U.S. EPA, Different Shades of Green, October 2016.

AGENCY/COMMUNITY	GENERAL OR PROGRAM RESOURCES	BMP AND RELATED RESOURCES
EPA	National Pollutant Discharge Elimination System (NPDES)	<ul style="list-style-type: none"> • National Menu of Best Management Practices (BMPs) for Stormwater • Construction BMPs • Post-Construction BMPs
City of Omaha	Omaha Stormwater	Construction <ul style="list-style-type: none"> • See Construction Downloads – Stormwater BMP Field Guide – 2018 Post-Construction <ul style="list-style-type: none"> • BMP Design, Certification, and Inspection Resources
City of Lincoln	Watershed Management	<ul style="list-style-type: none"> • Requirements and Procedures • Post-Construction BMPs
City of Grand Island	Stormwater Management Plan	Post Construction Stormwater BMP Master Plan
City of Kearney	<ul style="list-style-type: none"> • Stormwater Management Overview • Post-Construction Stormwater Management Program Overview 	Acceptable Stormwater Treatment Facilities (STFs)



Maintain or Enhance Floodplains

WHAT

Maintain or enhance floodplains through intentional use of parks and open space, securing lands for drainage and floodplain purposes, and adopting setback requirements.

WHERE

This action applies to existing parks and open spaces adjacent to streams, property along streams that is developed or undeveloped, and property adjacent to streams that may potentially become open space.

WHY

Maintaining or enhancing floodplains keeps residential, commercial, and other development away from flood-prone areas and thereby reduces flood damages. Other benefits include improvements to flood flow, storage, and control; groundwater recharge; water quality; fish and wildlife habitat; and recreation.

HOW

A floodplain maintenance or enhancement program may include one or more of the following:

1. Link, manage, and expand existing parks and open space to help manage stormwater.
2. Acquire, reuse, and preserve flood hazard areas as open space.
3. Use land banking to preserve the natural and beneficial functions of wetlands and floodplains.
4. Acquire property or property easements for water retention and drainage.
5. Adopt stream and wetland buffers or setback requirements.

Stream and wetland buffers or setback requirements may be incorporated into community ordinances. For more information on adopting ordinances, see the [Stormwater Management Ordinances](#) and [Floodplain Ordinances](#) strategy pages.

COST CONSIDERATIONS AND BENEFITS

Costs are lower for maintenance and higher for enhancement through land acquisition. Significant benefits are derived by avoiding unnecessary flood damages.

Operation and maintenance costs include those typically associated with parks and open space (mowing, tree care, etc.). Administrative effort is required to prepare, adopt, and implement buffer/setback requirements. Additionally, administrative effort is required to implement easement or land acquisition. Easement or land acquisition may introduce significant costs but will vary depending on the size of the program.

EXAMPLES AND RESOURCES

The Nebraska DOT has used [wetland mitigation banks](#) to compensate for unavoidable adverse impacts to wetlands.

The [Papillion Creek Watershed Partnership Management Policies](#) include setback requirements (see Policy Group #3: Landscape Preservation, Restoration, and Conservation). Additionally, the Partnership is undertaking a [Stream Setback Policy Update](#) to better address stream degradation and protect property and infrastructure.



Floodplain Acquisition and Relocation

WHAT

Develop a program to acquire and relocate residential properties and local businesses to avoid repetitive flood losses, create open space, and restore natural floodplain values.

WHERE

This mitigation action is suited for rural or urban areas that experience repetitive flood losses and may be applied to individual structures or groups of structures.

WHY

Acquisition and relocation projects are a sustainable mitigation action that results in a broad range of economic, environmental, and social benefits. These benefits include, but are not limited to, the following:

- Eliminating future disaster assistance needs; claim administration costs; and emergency evacuation, response, and management costs.
- Reduced flood debris, increased vegetation and filtration of pollutants, increased flood storage, and reduced erosion.
- Improved life safety and reduced neighborhood blight.

HOW

Key steps to implement a floodplain acquisition and relocation program include:

1. Identify potential acquisition project sites using your Hazard Mitigation Plan, FEMA's RiskMAP program, where available, and community members familiar with historic flooding and risks. For example, high risk areas such as floodways should be evaluated for potential acquisitions.
2. Identify potential relocation sites and reuses of acquired land. Relocation approaches include using available lots, annexing adjacent developable land, modifying housing density. Acquired lands may be reused for parks, recreational areas, rain gardens, or other beneficial functions.
3. Identify potential funding sources. These may include FEMA's Hazard Mitigation Assistance (HMA) program, Increased Cost of Compliance (ICC) funding, the Community Development and Block Grant Program (CDBG), or local funding.
4. Develop, submit, and implement the project. Prepare a scope of work and a detailed cost estimate addressing appraisals, legal costs, purchase and relocation costs, and demolition and site restoration costs.

Adapted from [ASFPM's NAI How-to Guide for Mitigation](#).

COST CONSIDERATIONS AND BENEFITS

Benefit-costs analyses have shown a strong return on investment for acquisition and relocation programs. Acquired land remains undeveloped in perpetuity, so benefits continue to accumulate over time with each flood event. Removal of development reduces downstream flooding impacts. For example, runoff is reduced when impervious surfaces such as streets, driveways, and parking lots are removed and restored to vegetated open space. The restored open space may be used for recreation, wildlife habitat, flood storage, and other beneficial uses.

EXAMPLES AND RESOURCES

The Papio-Missouri River NRD provides a local example of an acquisition program from willing sellers: [Floodplain Management](#) (see Floodway Purchase). ASFPM's [NAI \[No Adverse Impact\] How-to Guide for Mitigation](#) provides guidance for anyone striving to strengthen community resilience.

What are natural floodplain values?

These include:

- Improved flood flow, storage, and control
- Groundwater recharge
- Water quality function
- Wildlife and diversity

Construction and Maintenance of Structural Measures



WHAT

Construct and maintain structural measures designed to reduce community flooding risks.

Construction and maintenance is applicable to a community's new and existing structural measures. Constructing new structural measures can bring significant flood control benefits. A maintenance program for new and existing structural measures will allow a community to receive flood control benefits for the intended lifetime of the structural measure.

WHERE

Construction and maintenance of structural measures is more common in urban areas but is also applicable to rural areas and to communities (villages, cities, and counties) of all sizes.

WHY

Structural measures can bring significant flood control benefits by reducing or diverting flood flows, increasing flood-carrying capacity, and/or limiting flood inundation extents.

HOW

A structural measures program may include the following elements:

- Routinely clean and repair stormwater drains, conduits, and other infrastructure.
- Establish a fund to maintain or rehabilitate existing flood protection infrastructure, such as flood walls, levees, and diversions.
- Increase stormwater utility drainage capacity with detention and retention basins, debris removal, and other methods.
- Implement structural best management practices for stormwater when constructing or rehabilitating facilities.
- Design roadways, bridges, or utilities with future flood conditions incorporated.
- Build levees or earthen dikes around flood-threatened critical public facilities.
- Implement program of regular maintenance of levees and dams.

Examples of structural measures include:

- levees
- flood walls
- dikes
- diversions
- dams
- detention and retention basins
- roads
- bridges
- culverts

COST CONSIDERATIONS AND BENEFITS

Capital costs of structural measures may be significant. Capital improvement costs include construction of levees, dikes, detention and retention basins, roads, bridges, and other infrastructure. Costs for construction and maintenance of structural measures will vary based on community size, as well as the age and components of the community's stormwater and flood control systems. Structural measures require routine inspection and maintenance; associated costs will vary by measure type.

RESOURCES

The Nebraska DNR website provides resources for [Dam Safety and Maintenance](#).

The [Omaha Regional Stormwater Design Manual](#) provides information on structural measures such as culverts, detention and retention facilities, and other stormwater best management practices.

The Papio-Missouri River NRD's [Flood Control](#) program includes a system of dams and reservoirs that provides significant benefits to communities in the Papillion Creek Watershed.