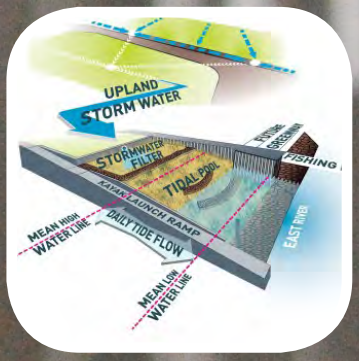
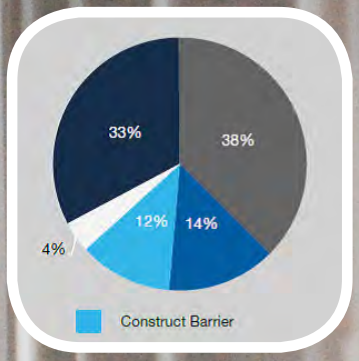
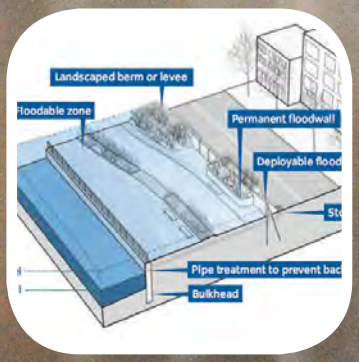
BROWNFIELD REVITALIZATION IN CLIMATE-VULNERABLE AREAS







COMMUNITY-BASED EXAMPLES FOR IMPROVING ORDINANCE REGULATIONS, DEVELOPMENT INCENTIVES, PROGRAMS, AND PROJECTS

CONTENTS

INTRODUCTION

BACKGROUND

> ***Brownfield:*** *a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant*

Former industrial areas along riverbanks and other water features are often home to brownfields. While some communities have limited market demand to redevelop property, revitalizing brownfields remains a priority. The revitalization process can improve local health and the quality of the environment, spur area-wide investment, increase the local tax base, and provide new jobs. Revitalizing waterfront brownfield areas can provide people with access to greenspace and recreation opportunities. These areas can play an important role in bolstering local resilience to increased flooding, storm surge, or temperatures from a changing climate. However, incorporating climate resilient features into redevelopment of these "climate vulnerable" properties can be resource intensive and may increase development costs. Therefore, careful consideration of long-term goals, best practices, and financing opportunities to meet both a community's revitalization plans and its resiliency requirements is necessary.

PURPOSE

The U.S. Environmental Protection Agency's (EPA's) Office of Land and Emergency Management (OLEM) Land Revitalization Program helps restore land and other natural resources into sustainable community assets that maximize beneficial economic, ecological and social uses, and ensure protection of human health and the environment.

The Land Revitalization Program developed this tool to provide communities with practical, real-world examples of regulations, incentives, projects, and programs that local governments may consider to balance economic development goals with climate resiliency needs. The tool focuses on examples of regulations, incentives, projects, and programs that:

- Support revitalization of brownfields.
- Mitigate stormwater and flooding impacts.
- Could work in areas with low to moderate demand for development.
- Can be implemented by individual communities (as compared with approaches that require multi-community or regional collaboration).

The examples provided in this tool are representative approaches that communities can review and consider for use in their own communities.[1]

The tool organizes the examples into three sections.

Section 1: Ordinance Regulations and Development Incentives	Provides examples of incentives and ordinance regulations that can be implemented without public or foundation money
Section 2: Program and Project Approaches to Resiliency	Summarizes relevant examples of projects, programs or approaches not directly applicable to land use regulations
Section 3: EPA Climate Adaptation Planning Resources	Provides several additional resources for communities to explore in climate adaptation planning that have been developed by EPA

[1] This tool was originally developed for use in EPA Region 3, and included examples of land revitalization regulations, incentives, projects, and programs that are not well-known or widely-used in Pennsylvania, Delaware, and New Jersey. However, the examples compiled in this tool can be used as a reference by communities anywhere.

SECTION 1
ORDINANCE REGULATIONS AND DEVELOPMENT INCENTIVES

Increasingly, local zoning codes are written to specifically identify types of buildings and site features that are permitted without special approval, a permit, exception or variance. This tool identifies examples of incentives and ordinance regulations that use this technique to enhance climate resilience without requiring additional public or foundation money.

This section of the tool summarizes examples of such regulatory and development incentives, organized as follows:

Stormwater Management Incentives and Tools

Land Use and Building Codes and Regulations

Best Practices, Guidance, Recommendations

Communities interested in developing regulations and incentives similar to these examples should consider whether the approaches overlap with existing regulations or incentives, would make the zoning code more difficult to understand or administer, or inadvertently create barriers to redevelopment.

STORMWATER MANAGEMENT INCENTIVES AND TOOLS

Stormwater Management Incentives and Tools *Example 1-1*

Green Roof Tax Credits/Rebates (Philadelphia, PA)

Source: *http://www.phillywatersheds.org/whats_in_it_for_you/residents/green-roofs*

- Incentivizes construction or retrofitting of roofs that have been covered with living vegetation to provide stormwater management and other benefits.
- Businesses apply for a Green Roof Tax Credit that reduces its Business Privilege Tax by 25% of the costs of constructing the green roof, up to $100,000.
- Green roof costs range from $10 (extensive – i.e., shallow) to $25 (intensive – i.e., deeper) per square foot, and tend to extend lifetime of roof by 10-200%.
    - Extensive green roofs contain up six inches of soil, are lightweight, accommodate shallow rooted plants, and provide baseline stormwater management, insulation, and ecological benefits.
    - Intensive green roofs contain more than six inches of soil, accommodate a variety of plants, require greater roof loads, and provide greater stormwater management, insulation, and ecological benefits.
- According to Greenroofs.org, “in summer, depending on the plants and depth of growing medium, green roofs retain 70-90% of the precipitation that falls on them; in winter they retain between 25-40%. For example, a grass roof with a 4-20 cm (1.6”-7.9”) layer of growing medium can hold 10-15 cm (3.9”-5.9”) of water.”

Stormwater Management Incentives and Tools *Example 1-2*

Green Roof Rebate (Nashville, TN)

Source: *http://www.nashville.gov/Water-Services/Developers/Low-Impact-Development/Green-Roof-Rebate.aspx*

- Incentivizes green roof construction by offering a credit of $10 per sq. ft. of green roof construction cost against monthly sewer charges for the property for up to 60 months.
- Required a partnership between the city and provider Metro Water Services.

RainScape Rewards Program (Montgomery County, MD)

Sources: *http://www.montgomerycountymd.gov/DEP/water/rainscapes-rebates.html*

http://www.montgomerycountymd.gov/DEP/water/wqpc-rates.html

www.greenroofs.org

- County offers technical and financial assistance and "Rainscape Rewards Rebates" or up to $2,500 to residential properties and up to $10,000 for commercial, multifamily, and homeowner association projects, for work that reduces stormwater runoff volume and improves water quality on properties.
- Project types include the planting of canopy trees, removal of impervious pavement, or installation of conservation landscaping, dry wells, green roofs, permeable pavement, rain gardens, rain barrels, or cisterns.
- Rebate issued after project passes final inspection.
- Funding source is a county Water Quality Protection charge, which appears as part of the Montgomery County property tax bill.
    - Raises funds to support clean water initiatives to improve stream and water quality and prevent stormwater pollution.
    - Charge applies to all residential and commercial property owners and is calculated based on the potential for a property to contribute to stormwater runoff. Larger, more developed property produces more runoff.
    - Calculated based off of ERU (Equivalent Residential Unit) statistical median of the total horizontal impervious area of developed single family detached residences in the County serving as a base unit of assessment.
    - In 2014, one ERU equals 2,406 square feet, which equals a charge of $88.40.

Green Infrastructure Tools (Nashville, TN)

Sources: *www.nashville.gov/Portals/0/SiteContent/WaterServices/Stormwater/docs/reports/GreenInfrastructureRpt101120.pdf*

www.nashville.gov/Water-Services/Developers/Low-Impact-Development.aspx

Although Nashville implemented the following solutions as part of its Green Infrastructure Master Plan—which coincides with its combined sewer overflow area—many of the green infrastructure tools identified could be implemented through a local landscape or site design ordinance. Green Infrastructure tools included in the plan focused on retrofits for existing developments and designs for future development.

- Tools to be implemented, and approximate costs for those tools, included:
  - Downspout Disconnection: <$ 100 per disconnection.
  - Filter Strip: < $1 per square foot.
  - Infiltration Practices: $5 per cubic foot of stormwater treated.
  - Pocket Wetlands: $1.50 per cubic foot stormwater treated.
  - Permeable Pavement: $5-$15 per square foot.
  - Rain Barrels/Cisterns: $1 per gallon of stormwater stored.
  - Rain Gardens/Bioretention: $3-$4 per square foot for simple residential designs; $10-$40 per square foot for more complex commercial designs.
  - Soil Amendments: < $1 per square foot.
  - Street Trees and Afforestation: Seedlings range from $6 to $25 depending on size.
  - Tree Box Filters: $12,000-$15,000 per 6'x6' unit.
  - Vegetated Roofs: $5-$25 per square foot.
  - Vegetated Swales: $0.50 per square foot.
- Role of Metro Water Services (which is a part of the city government):
  - Developed a Green Infrastructure Master Plan.
  - Published a Stormwater Management Manual, training videos, and training presentations.

Potential Funding Sources for Nashville, Tennessee, Green Infrastructure Tools:

- Loans and grants through HUD, FEMA, EPA
- Tennessee State Revolving Loan Fund (development and maintenance of drinking water and wastewater infrastructure)
- Tennessee Clean Water State Revolving Fund Loan Program (planning, design, and construction of wastewater facilities)
- Tennessee Department of Environmental Conservation Green Development Grant (green infrastructure and low impact development)
- Clean Water Infrastructure Program (improvements/upgrades to Metro's stormwater management systems)
- Land Trust for Tennessee (nonprofit)
- Metro Greenways Commission (nonprofit)
- Tax Increment Financing
- Community Development Block Grants

  - LID (Low Impact Development) Site Design Tool: An online tool that aids engineers in designing the water quality treatment for a project in accordance with the methodology in the LID manual and to see if the design meets Metro's water quality requirements.
  - Funding through stormwater fees, loans, and grants.
  - Maintains a list of recommended contractors for maintaining stormwater best management practices (BMPs).

- One key lesson learned was the that city must take responsibility for maintenance of the low impact development features after installation—both to ensure that they continue to function as designed, and to avoid property owner reluctance to install features that they will then have to maintain. Clarion's experience confirms this lesson.
- Example projects:

Bioswale at the Hill Center Belle Meade.

Pervious concrete parking at Tennessee Association of Realtors.

Bioretention area along Deaderick Street.

Stormwater Management Incentives and Tools *Example 1-5*

Innovative Stormwater Fee Calculation (Philadelphia, PA)

Sources: *https://louisville.edu/cepm/GI%20Strategies%20-%20Case%20Studies.pdf*

http://archives.huduser.org/scrc/sustainability/newsletter_040113_1.html

- Philadelphia revised its calculation of stormwater fees to encourage implementation of green infrastructure features lowering stormwater runoff.
- 80% of stormwater fee is based upon a property's impervious area and 20% on property's gross area.
- Discount created for customers who reduce impervious cover using green infrastructure practices including rain gardens, infiltration trenches, porous pavement, vegetated swales, and green roofs.
- Residential and other small-meter customers do not require detailed analysis, because of the administrative difficulty and cost required for detailed analysis of 450,000 residential properties. So all residential properties are combined and treated as a single land parcel, with total costs of the 80/20 calculation divided equally among all households.
- Stormwater costs spread out and shared over larger customer base; calculations show majority of customers will see a reduction or otherwise minor impact to bill.
- According to a HUD article, the program has successfully created greenspace. The program is "well on its way to achieving its 5-year goal of approximately 750 greened acres (1.2 square miles) within the combined sewer system (CSS) area largely due to commercial, industrial, and institutional property owners trying to reduce stormwater fees on their properties."

Stormwater Management Incentives and Tools *Example 1-6*

Stormwater Fee Discount for Non-residential Property Owners (Toledo, OH)

Source: *https://louisville.edu/cepm/projects/sustainable-community-capacity-building/gi-strategies*

- Program identifies several different practices that property owners can install to reduce stormwater runoff and establishes different discount percentages for each:
  - 10% discount for brownfield reuse;
  - 30% discount for installing forested buffer or swale.
- Maximum discount is 50% of stormwater fee, is applicable only to the impervious area controlled by the practice, and is awarded only for fully constructed/functional practices.

LAND USE AND BUILDING CODES AND REGULATIONS

Compensatory Floodplain Storage Model Regulatory Text (Nashville, TN)

Source: http://www.floods.org/ace-files/documentlibrary/committees/Higher_Stds_Ref_Guide_07-12-11.pdf

- Text included requiring development to compensate for the loss of floodplain storage caused by filling in the floodplain, which can result in raising flood elevations.
- Model text reads:

  (1) Add to language for the Assurance of Flood Carrying Capacity:

  - Compensatory Storage Required for Fill

    "Fill within the special flood hazard area shall result in no net loss of natural floodplain storage. The volume of the loss of floodwater storage due to filling in the special flood hazard area shall be offset by providing an equal volume of flood storage by excavation or other compensatory measures at or adjacent to the development site."

  (2) If regulations explain the minimum application items, add:

  - "Volumetric calculations demonstrating compensatory storage."

Compensatory Storage Regulations (Dallas, TX)

Source: *http://www.floods.org/ace-files/documentlibrary/committees/Higher_Stds_Ref_Guide_07-12-11.pdf*

- Detailed floodplain development regulations added to mitigate loss of valley stormwater storage, reading:

  "Section 51A-5.105 Filling in the Floodplain

  Subsection (e)(4)(g)(4) Filling to Remove a Floodplain Designation

  The Floodplain area may be altered only to the extent permitted by equal conveyance reduction on both sides of the natural channel. The following valley storage requirements apply to all Floodplain areas except those governed by a city council-adopted management plan that contains valley storage regulations, in which event the valley storage regulations contained in the plan apply:

  (A) Except as otherwise provided in Subparagraph (B):

  (i) no loss of valley storage is permitted along a stream with a drainage area of three square miles or more;

  (ii) valley storage losses along streams with a drainage area between 130 acres and three square miles may not exceed 15 percent, as calculated on a site by site basis; and

  (iii) valley storage losses along streams with a drainage area of less than 130 acres are not limited.

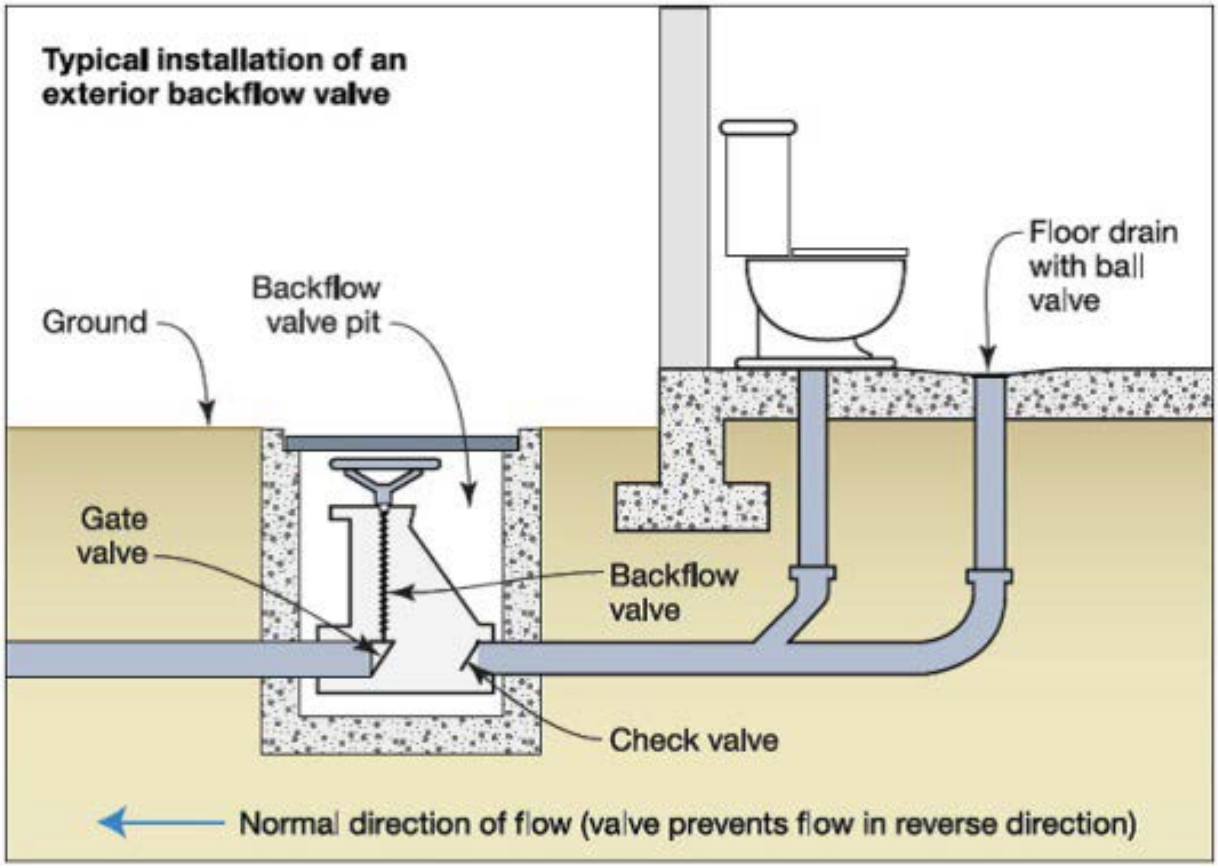
  (B) Hydrologic computations may be performed to evaluate basin-wide valley storage loss impacts on the design flood discharge. If the computations demonstrate that valley storage losses do not result in increases in the design flood discharge at any point downstream of the project, valley storage losses are permitted even though they exceed the limits provided in Subparagraph (A)."

2013 Building/Plumbing Code Changes (New York, NY)

Source: http://www1.nyc.gov/site/buildings/homeowner/resiliency-legislation.page

New and substantially improved buildings in the 100 year floodplain are required to install backflow preventers for sewer connections, to seal points of entry from floodwater, and will be required to safeguard toxic materials.

- Fiber optic cables that carry telecommunications service into buildings may now exceed 50 feet to allow these cables to reach elevations above the design flood elevation (DFE).
- Current limits on fuel tanks located above grade revised to allow for larger storage capacity.
    - Maximum fuel oil storage capacity is increased to 3,000 gallons on lowest story above the DFE.
    - Each tank is limited to a 24 hour supply for emergency generator operation or 1,500 gallons.
    - Tank must be enclosed in a 3 hour fire-rated vault.
    - Vault must be located in a room separated from other areas by 2 hour fire-rated construction and protected by an automatic fire-extinguishing system.



Typical installation of an exterior backflow valve.

Floodplain Management Regulations to Help the City Earn Community Rating System (CRS) Status (Des Moines, IA)

Source: http://www.fema.gov/media-library-data/20130726-1722-25045-0903/fema_p_765.pdf

- New construction requires 1-foot freeboard.
- Substantial improvement regulations do not allow any additions that will increase the total square footage of a structure in the floodplain by 25 percent or more.
- Sanitary sewer systems must be watertight or located on higher ground than the base flood elevation (BFE).
- All new construction to have dry land access during the 1-percent-annual-chance flood event.
    - Dry land access language: "New development proposals will be designed, to the maximum extent practicable, so residential building sites, walkways, driveways, and roadways are located on land with a natural grade with elevation not less than the base flood elevation and with dry land access."
- Open space credits for any open spaces in the Storm Flood Hazard Area (such as parks, natural preserves, etc.) that prohibit construction of structures.

BEST PRACTICES, GUIDANCE, RECOMMENDATIONS

Best Practices, Guidance, Recommendations *Example 1-11*

Building Performance Technical Guidance, Disseminated Following 2008 Floods in Iowa and Wisconsin (Des Moines, IA)

Source: http://www.fema.gov/media-library-data/20130726-1722-25045-0903/fema_p_765.pdf

- FEMA Recommendations from the Mitigation Assessment Team include:
    - Fill or remove basements that are below BFE or basement must be certified by a design professional to resist flood loads.
    - Foundation walls constructed of unreinforced concrete masonry units should be reinforced during repairs.
    - Consider open foundations requirements for buildings constructed in potential high-velocity areas.
    - All new construction, substantial improvements, and repair of substantially damaged properties should follow flood damage-resistant criteria and be elevated above the BFE as specified by ASCE 24.

Comprehensive Plan Resilient Land Use Element (Scott, LA)

Source: http://www.cityofscott.org/uploads/ComprehensivePlanDraft.pdf

- Detention BMPs include gathering runoff in wet ponds, dry basins, or multi-chamber catch basins and slowly releasing it to receiving channels.
- Infiltration BMPs include site design that facilitates the percolation of runoff through the soil to ground water. Ordinances should require a minimum of 15 percent greenspace, with incentives for additional greenspace and preserving existing trees. Examples include infiltration islands/trenches, green roundabouts, dry wells, and porous pavements.
- Vegetative BMPs include landscaping features that remove pollutants and facilitate percolation. Examples include grass swales, filter strips, artificial wetlands, and rain gardens.
- Other BMPs such as the use of cisterns and rain barrels store rainfall, which in turn reduce runoff, and can be used for activities such as lawn care and washing vehicles.
- Examples of BMPs below:

Bioretention Cell

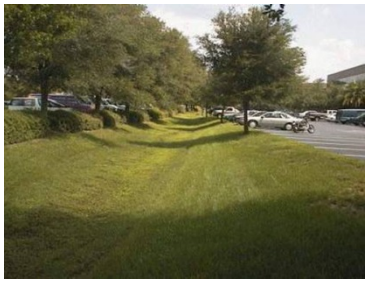
Cisterns

Porous Pavers

Porous Asphalt

Vegetated Swales

Rain Barrels



Bioswales

Port of New Orleans (PONO) Resiliency Manual 2013 (New Orleans, LA)

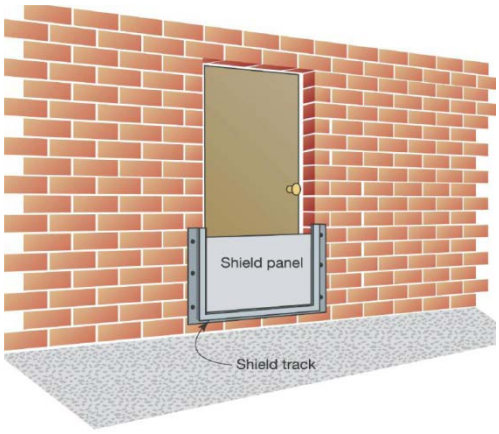
Source: http://resiliency.lsu.edu/wp-content/uploads/2014/01/Port-of-New-Orleans-Design-Resiliency-Guidelines-Manual.-2013.pdf

- The manual serves as a "guidebook intended to be a parting point for designers, architects, engineers, and contractors who are familiar with the design and construction of PONO facilities."
- Elevation is preferred over flood proofing for new construction.
    - For slab-on-grade foundation on structural fill, the fill must be designed to minimize adverse impacts such as increasing flood elevation on adjacent properties, increasing erosive velocities, and causing local drainage problems.
    - For solid foundation walls, open foundations, piles, piers, columns, or posts are recommended if velocities are high or debris load is anticipated.
    - When practical, Design Flood Elevation (DFE) should be at or above the BFE.
- Dry Floodproofing measures include:
    - Installing watertight shields for doors and windows and using membranes and sealants to reduce seepage of floodwaters (walls must be design checked to resist the additional water loads).
    - Reinforcing walls to withstand floodwater pressures and impact forces generated by floating debris.
    - Installing drainage collection systems, sump pumps, and check valves to control water levels and prevent floodwater backflows.
- Requirements for use of use of flood damage resistant materials include:
    - Only FEMA Technical Bulletin 2, *Flood Damage-Resistant Materials Requirements* (FEMA 2008a) class 4 and 5 materials are acceptable for use below the DFE.
- Steps to protect electrical and mechanical systems from flood hazard events include:
    - Elevation of equipment and under-floor utilities and ductwork to a height above the DFE.
    - Electrical and other conduits below the DFE should be located and anchored to resist the effects of flooding.
    - Utilities and equipment located outside of the building must be elevated on platforms that are attached to the primary structure—these platforms should be designed to resist all flood loads.
- Steps to protect potable water and wastewater systems from flood hazard events include:
    - Onsite water supplies should be located on land elevated above the surrounding landscape to allow contaminated surface water and runoff to drain away from the site.
    - Sewer collection lines should be located and designed to avoid filtration and backup due to rising floodwaters. Secondary backup devices should be used as redundant measures of protection.

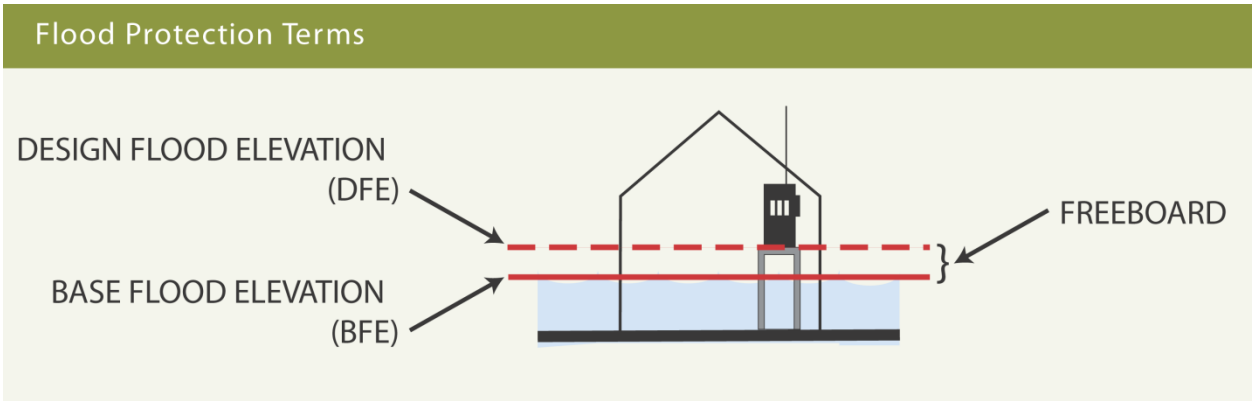
Stronger, More Resilient New York Recommendations (New York, NY)

Source: http://www.nyc.gov/html/sirr/html/report/report.shtml

- 98% of buildings destroyed and 94% of buildings severely structurally damaged during Superstorm Sandy were built before 1983. Newer building codes have had an immense effect on reducing flood related losses.
- Core Flood Resiliency Measures include elevation or flood protection for:
  - Fire protection equipment (including alarms and pumps).
  - Electrical equipment (including panels, switch gear, and transformers).
  - Heating, ventilation, and air conditioning (HVAC) equipment (including boilers, furnaces, and burners).
  - Plumbing equipment (including domestic water equipment and sump pump power feeds).
  - Telecommunications equipment.
  - Elevator equipment.
  - Emergency generators and associated fuel tanks and pumps (subject to the approval of the Code amendments described above).
- Elevation or flood-proofing of this equipment will be required to meet the higher of (a) the BFE, as set forth in the preliminary work maps, plus 1 to 2 feet of freeboard, or (b) the FIRMs in effect as of the writing of the report plus 1 to 2 feet of freeboard.
- Temporary flood shields can help prevent low-level flooding from entering through an opening such as a door or window.

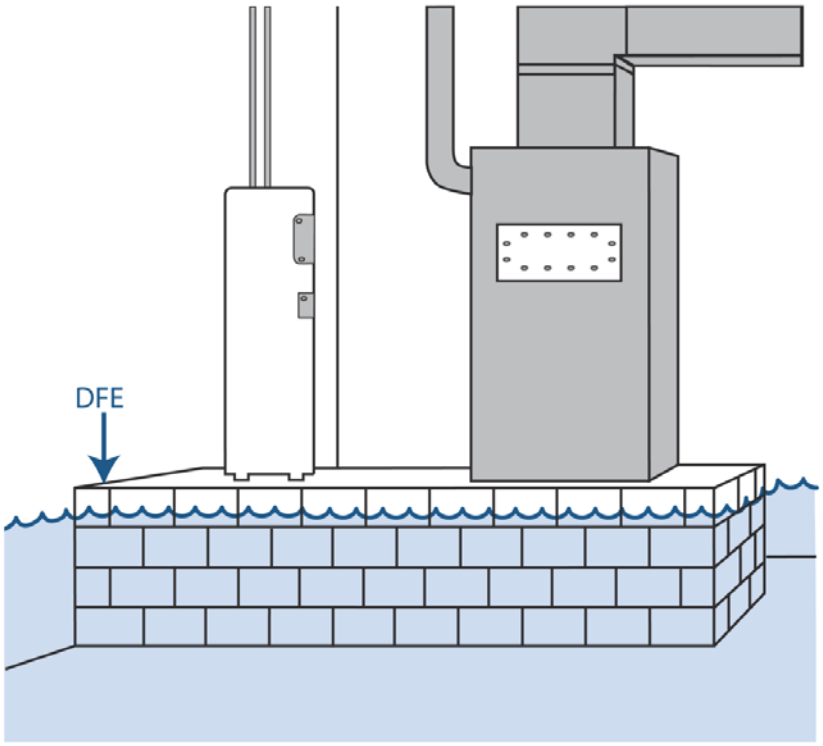


One method of dry flood-proofing is a temporary flood shield.



Flood Protection Terms

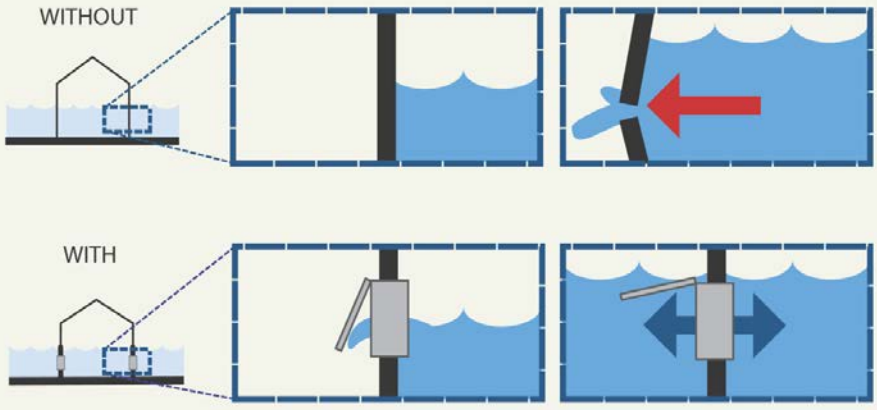
Flood Protection of Building Systems



Example of a building hot water heater and furnace elevated above the minimum flood protection level via a platform.

Flood Protection of Building Systems

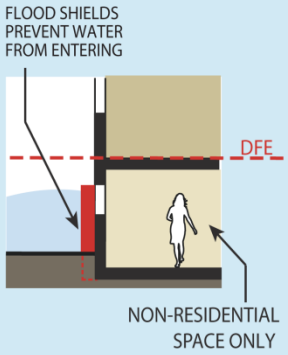
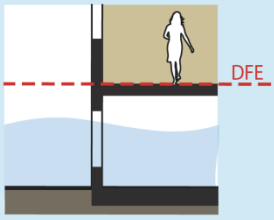
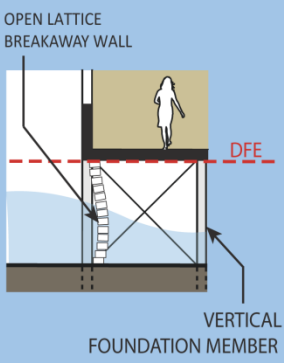
Wet Flood-Proofing Method



Without wet flood-proofing, pressure from floodwaters builds up on one side of a building's walls, often causing structural damage. With wet flood-proofing, openings or vents permit floodwaters to enter an enclosed area, allowing this pressure to equalize on both sides of the building's walls thereby preventing the structural damage.

Wet Flood-Proofing Method

Overview of Appendix G: Flood-Resistant Construction

	A ZONE		V ZONE
FLOOD PROTECTION STRATEGY	DRY FLOOD-PROOFING WATERTIGHT STRUCTURE e.g., FLOOD SHIELDS	WET FLOOD-PROOFING WATER TO RUN-IN / RUN-OUT e.g., FLOOD VENTS	ELEVATED STRUCTURE VIRTUALLY OPEN STRUCTURE e.g., OPEN LATTICE BREAKAWAY WALLS
GROUND FLOOR CONFIGURATION	 LOWEST OCCUPIED FLOOR ALLOWED TO BE EXCAVATED BELOW GRADE NOT PERMITTED FOR ENTIRELY RESIDENTIAL BUILDINGS	 LOWEST OCCUPIED FLOOR TO BE AT OR ABOVE DESIGN FLOOD ELEVATION	 BOTTOM OF LOWEST STRUCTURAL MEMBER TO BE AT OR ABOVE DESIGN FLOOD ELEVATION
PERMITTED USE BELOW DFE	✓ PARKING ✓ ACCESS ✓ STORAGE ✓ NON-RESIDENTIAL ✗ RESIDENTIAL	✓ PARKING ✓ ACCESS ✓ STORAGE ✗ NON-RESIDENTIAL ✗ RESIDENTIAL	✓ PARKING ✓ ACCESS ✓ STORAGE ✗ NON-RESIDENTIAL ✗ RESIDENTIAL

Source: DCP

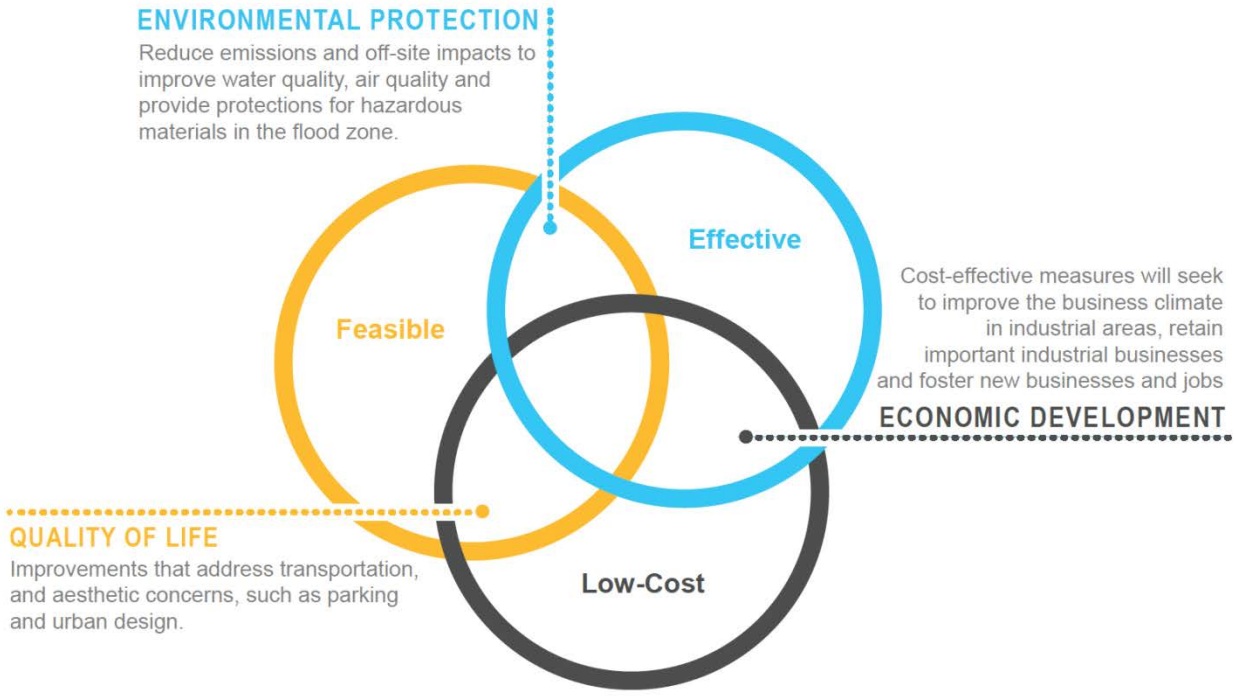
Overview of Flood-Resistant Construction

Open Industrial Uses Study and Proposed Ordinances (New York, NY)

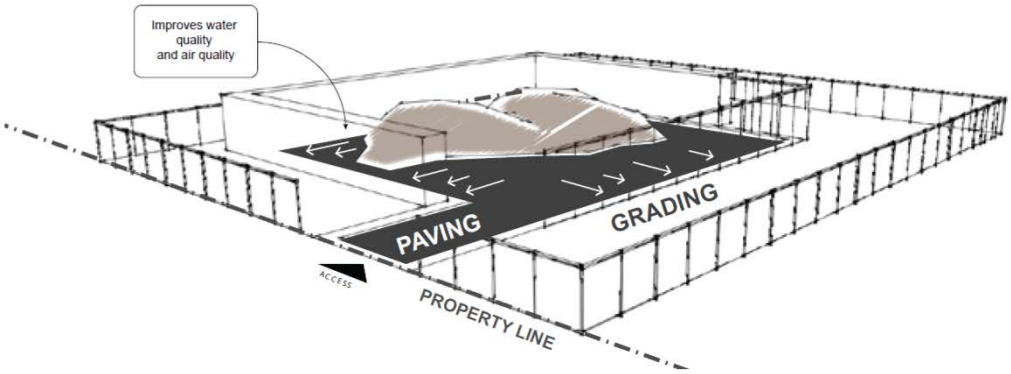
Source: http://www.nyc.gov/html/dcp/html/oius/index.shtml

- The Open Industrial Uses Study seeks alternatives to the current performance-based zoning to regulate where unenclosed industrial uses can locate and the standards to which they must be designed. The study is a resource and a guide. None of the recommendations have been implemented into ordinance, local law, or code.
- The study understands that regulations must seek a balance of promoting economic development, quality of life, and environmental protection and therefore seeks low-cost, effective means of reducing pollution and increasing flood resiliency.
- Many zoning codes are limiting in their definitions of open industrial uses. New York City currently classifies most open industrial uses as "junkyards."
    - "Other cities have adopted or proposed new zoning regulations that, while seeking to limit or control the operations of open uses, also acknowledge that these uses are more than junkyards and in fact represent a number of industries of growing importance as urban populations grow and public polies seek to promote and even require recycling."
- The study proposes a zoning text amendment that will require existing and new industrial uses, whether in currently conforming or non-conforming status, to comply with new physical design standards for effective onsite pollution prevention control and flood hazard mitigation.
- Examples of design standards:
    - Paving and grading of activity and storage area with an impervious surface, sloped to direct runoff into a drainage system.
    - Installation of a drainage system for the paved area, including appropriate treatment, filtration, and dentition systems designed to treat captured contaminated water before it is released back into the sewer systems or waterways.
    - A limitation on the height of material piles such that no pile shall be higher than the fence or wall.
    - Covering all open materials where feasible.
- The study encourages the use of green infrastructure tools as a secondary treatment approach due to its cost effectiveness. The technology must be used carefully and should be well maintained to ensure contaminants are not absorbed into the soil or ground water in concentrated volumes.
- The study encourages the use of emerging pollution controls such as vegetative barriers, phytoremediation (using plants to treat and mitigate pollutants), and package wastewater treatment systems for small facilities that can treat, process, and recycle stormwater on site.

Certain conditions are unique to NYC—high density, small sites, absence of buffering adjacent to residences, and tendency of open industrial uses to locate in flood zones.



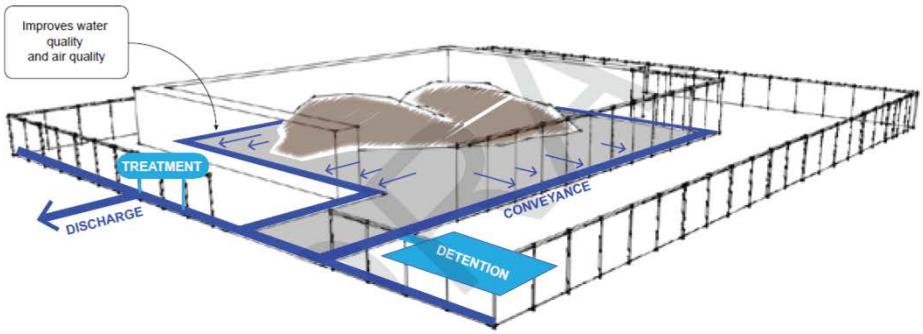
The goals of the Open Industrial Uses study.



PAVING AND GRADING

Surfaces should be graded, constructed, and surfaced, and maintained so as to provide adequate drainage and to prevent the release of dust.

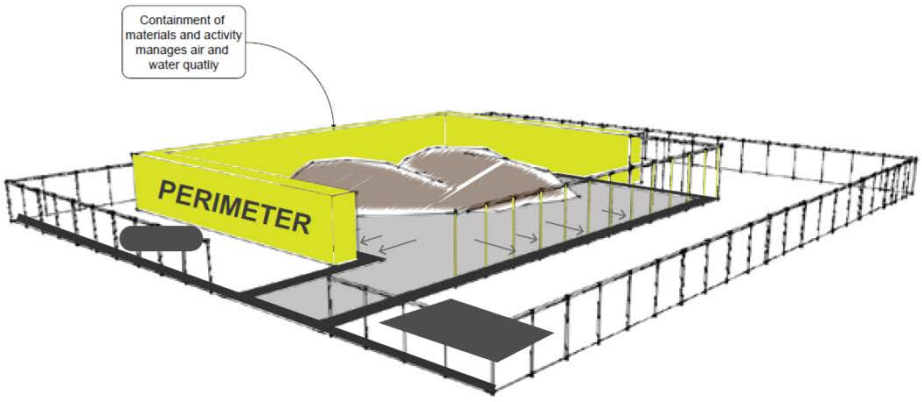
Paving and Grading



DRAINAGE INFRASTRUCTURE

Proper drainage rates shall be attained through conveyance trenches that are connected to detention storage and treatment equipment that meets the drainage, flow, and filtration requirements of DEP and DEC

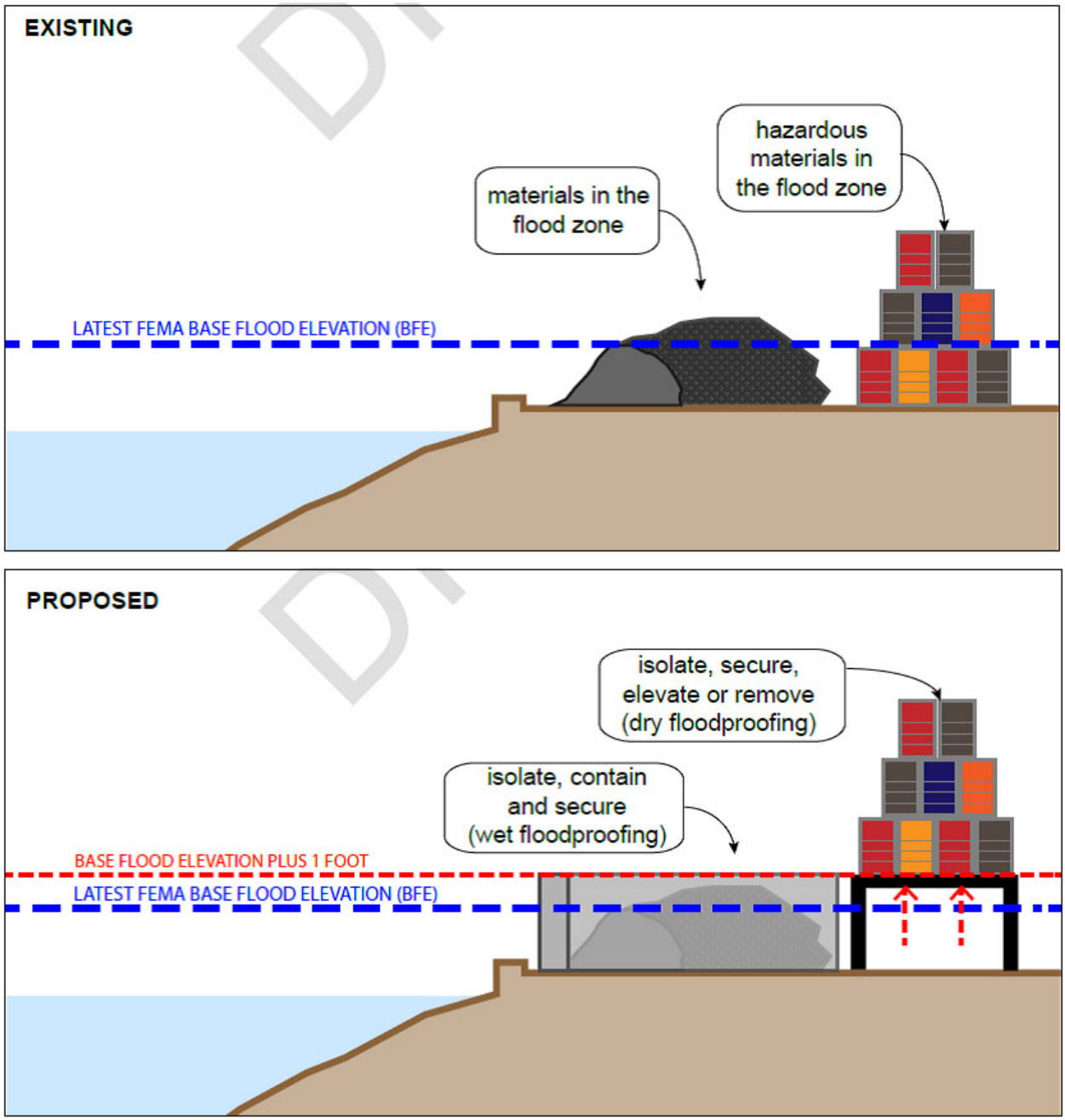
Drainage Infrastructure



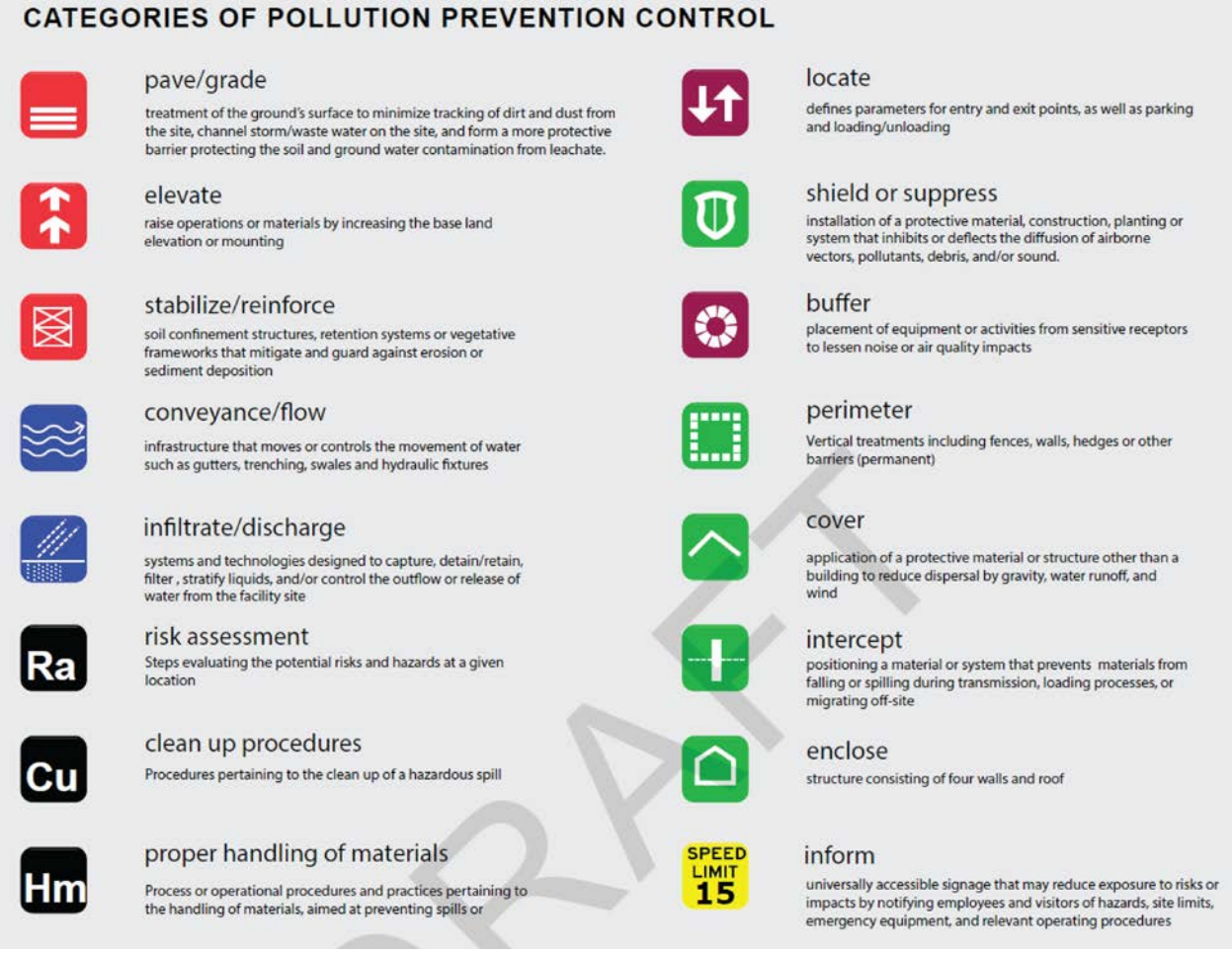
CONTAINMENT

Storage areas must provide perimeter screening and covers, where practicable, to protect piles against wind-borne dispersion.

Containment



Flood resistant construction standards to include flood proofing standards for unenclosed industrial facilities and hazardous materials stored in the flood zone.



Categories of Pollution Prevention Control

SECTION 2
PROGRAM AND PROJECT APPROACHES TO RESILIENCY

Local government can increase resilience to coastal and river flooding by making investments directly or as part of a public/private partnership, initiating plans, or developing new programs. Investments can be made to accommodate floodwater flows or storm surges in new types of facilities and areas, or to improve the defensibility of key sites or public facilities. In addition, communities have responded to the increasing need for climate resilience by beginning multi-stakeholder plans that bring together behavior change education with strategic investments. This section of the tool provides examples of community-based programs and projects to increase climate resilience, organized as follows:

Integrated Water Management

Example 2-1: Coastal Resiliency Measures (New York, NY)

Example 2-2: Integrated Living Water System (New Orleans, LA)

Area-wide Flood Mitigation Plans

Example 2-3: City of Tulsa Flood Park Along Mingo Creek (Tulsa, OK)

Example 2-4: Bee Branch Flood Mitigation Plan (Dubuque, IA)

Site-specific Plans

Example 2-5: Sims Municipal Recycling Facility (New York, NY)

Example 2-6: Metairie's Pontiff Park (New Orleans, LA)

Example 2-7: Hunts Point Landing (New York, NY)

Example 2-8: Gil Hodges Community Garden (New York, NY)

Wastewater Resiliency

Example 2-9: Wastewater Resiliency Plan (New York, NY)

Example 2-10: Dubuque Water and Resource Recovery Center (Dubuque, IA)

Flood-related Taxes

Example 2-11: Fargo Flood-Related Sales Tax (Fargo, ND)

Example 2-12: Sales Tax Abatement Program for Flood Resiliency (New York, NY)

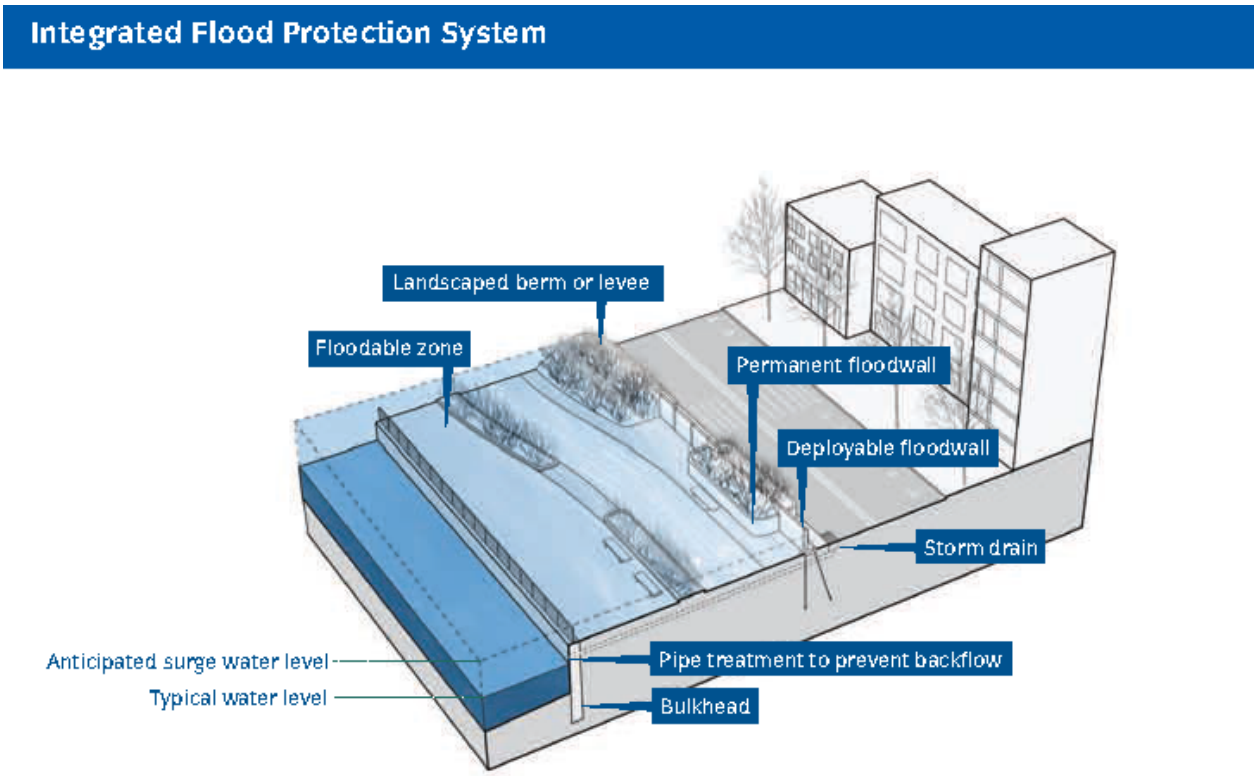
INTEGRATED WATER MANAGEMENT

Integrated Water Management *Example 2-1*

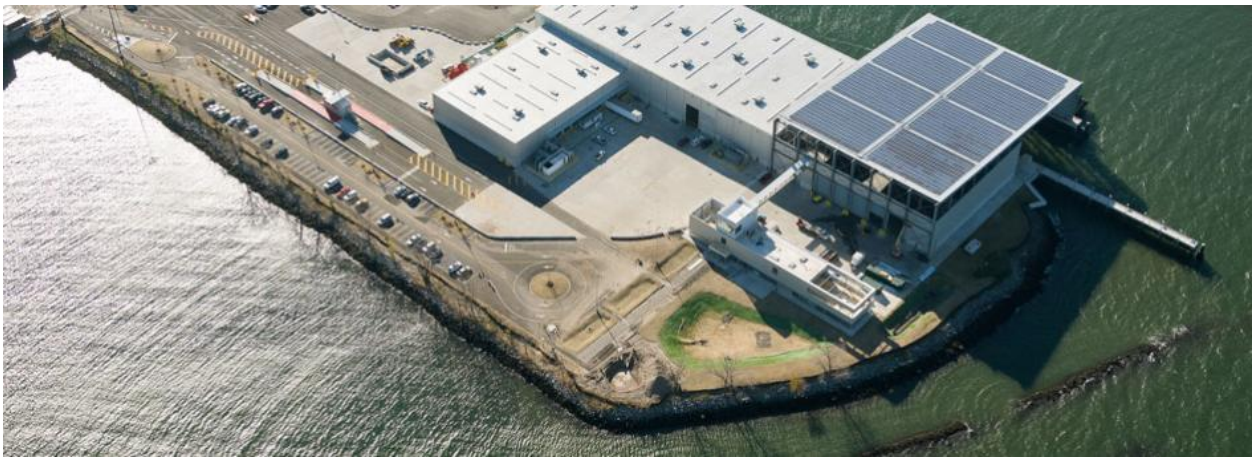
Coastal Resiliency Measures (New York, NY)

Source: http://www.nyc.gov/html/sirr/html/report/report.shtml

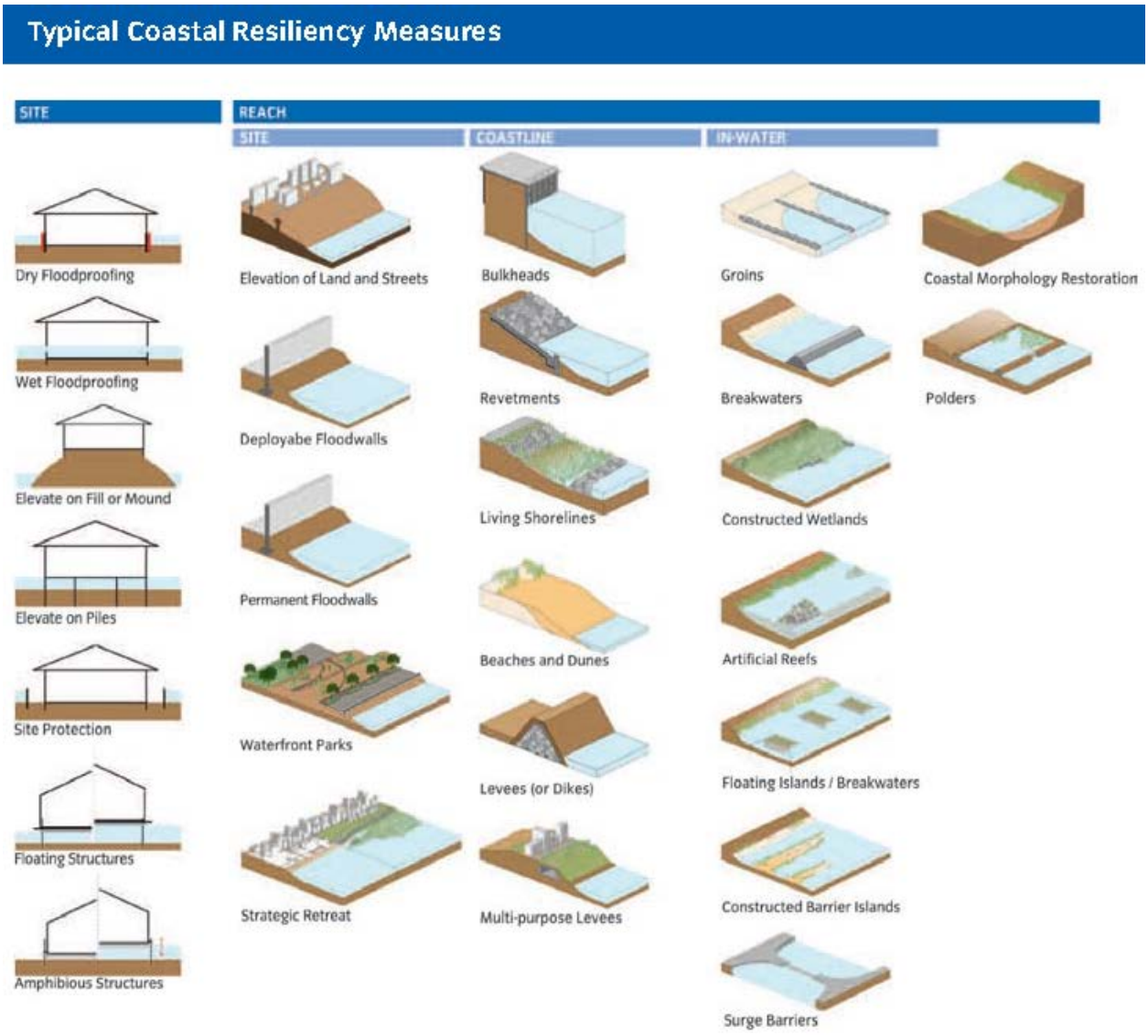
- In the publication, *A Stronger, More Resilient New York*, the city outlines coastal resiliency measures depending on the type of waterfront.
- The publication advocates for an integrated approach to flood protection systems that includes a variety of elements that can be combined and customized in areas where critical infrastructure or vulnerable neighborhoods require a high level of flood protection.
- The elements of the integrated approach can include the following:
    - Landscaped features such as terraces, berms and waterfront parks.
    - Flood-proofed buildings or bridge abutments.
    - Drainage improvements including valves and gates.
    - Temporary features such as deployable floodwalls which can be affixed to permanent in-ground foundations.
- The publication serves as a guide to coastal resiliency measures and does not include a list of proposed regulations. However, some of its recommendations are making their way into law.
    - For example, the New York City Building Resiliency Task Force recommends allowing building owners to install temporary flood barriers on sidewalks. This recommendation led to the passage of Local Law 109/13, allowing removable flood barriers on public sidewalks.



Integrated Flood Protection System



An example of New York City industrial shoreline.



Typical Coastal Resiliency Measures

Integrated Living Water System (New Orleans, LA)

Source: http://livingwithwater.com/plan/

- The Integrated Living Water System offers an innovative approach to water management and is inspired by techniques used by the Dutch.
- The system is a "model for managing stormwater, surface water, and ground water collectively, rather than as isolated phenomena" by using small scale retrofits, circulating canals, strategic parklands, integrated wetlands, integrated waterworks, regional monitoring networks, and waterfront development zones.
- The goal of this approach is to slow, store, and use stormwater in order to reduce the region's dependence on pumping.
- The systems are adaptable, site specific, and can be tailored to scale.

Lafitte Blueway

Existing

Potential

Lakeview Floating Streets

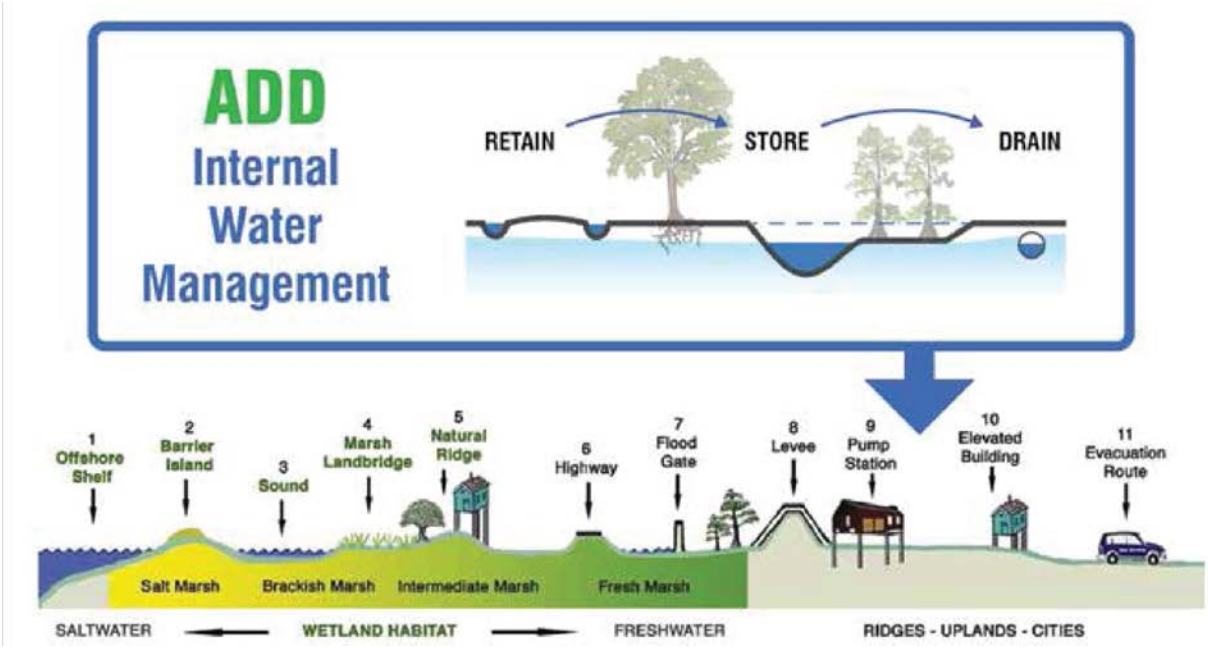
Existing

Potential

Elmwood Fields and Water Lanes

Existing

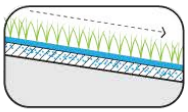
Potential



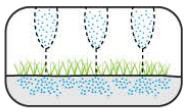
Internal Water Management diagram from the Louisiana 2007 Coastal Master Plan.

Slow

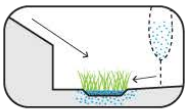
GREEN ROOFS



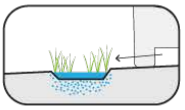
TREES & PLANTS



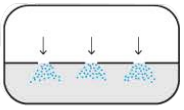
RAIN GARDEN



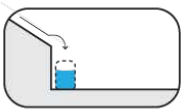
BIOSWALE



PERVIOUS PAVING



WATER HARVESTING



Slow, Store, Drain, and Circulate & Recharge are the practices and strategies that comprise the toolbox of the Urban Water Plan and are defined and discussed in more detail in the Plan's System Design report. Some are familiar and widely used, while others are specific and unique to this project. Familiar practices are listed and illustrated in this section without definition, while specific strategies are illustrated and briefly described.

Slow

"Slow" strategies, otherwise known as stormwater best management practices (BMPs) or green infrastructure, include rain gardens and bioswales, trees and plants, pervious paving, green roofs, and water harvesting. Relatively small in scale compared to store and drain measures, these practices can have significant impact when distributed over a large area. Increasingly popular in recent years, these strategies capture and infiltrate rain where it falls, thus delaying the water's journey to drainage systems and reducing polluted stormwater runoff. Long-term green infrastructure plans are in use in numerous cities around the country, including Philadelphia, Portland, Ore., Seattle, Milwaukee, New York, Syracuse, NY, and Washington, DC.

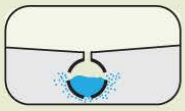
These and other case studies (a few of which are included in Appendix D) have shown that implementation of these practices relies largely on local actions. These include establishing strong water retention standards for new development and redevelopment, providing incentives for private parties to reduce existing impervious surfaces and install green infrastructure, a commitment by local governments to incorporate best practices in public works projects, a dedicated funding source, and close collaboration among agencies.

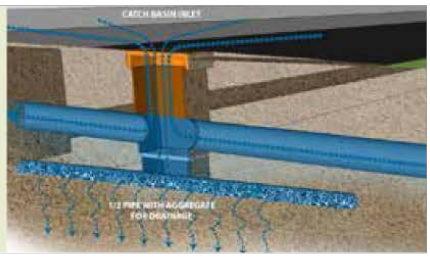
Store & Use

Generally larger in scale, "store" measures include both well-known practices like storage basins, constructed wetlands, and subsurface storage, and specific recommendations like widening existing canals and finding space for new canals to store excess water longer in the region's

Sample page from the Integrated Living Water System showing Slow strategies and Store and Use measures.

EXFILTRATION BASINS are a redesign of typical catch basins and manholes found throughout the region. The basins enable water to gradually enter the groundwater system through a pervious bottom and a spread aggregate base. A system of these basins provides for a distributed method of recharging groundwater.

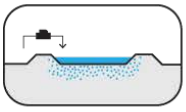




landscape. According to our team's hydraulic model that tested various scenarios, water storage has the biggest impact on flood reduction in the region. These interventions also do more to address subsidence as they allow water to infiltrate the ground and balance water levels. More information on the hydraulic model and its results can be found in the Plan's Water System Analysis report.

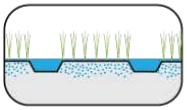
Store

STORAGE BASINS

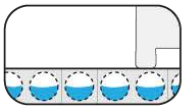


In addition to the action needed for the implementation of strategies that slow down water, the establishment of a stormwater/groundwater management unit in each parish will be key to the implementation of store strategies. Beyond MS4 (municipal separate stormwater sewer systems) compliance, this unit would be dedicated to finding and funding softer and more cost-effective water storage solutions, as well as operating and maintaining them.

CONSTRUCTED WETLAND



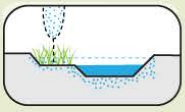
SUBSURFACE STORAGE



Drain

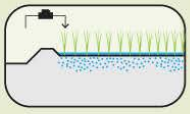
With the progressive installation of slow and store practices, loads on current drainage systems are reduced significantly,

IMPROVED CANAL is an existing canal that has been renovated to widen its banks and provide a stepped platform, where possible, that can serve as an inviting public space during dry weather and as extra water storage during heavy rains. This practice of controlled flooding is widely used in the Netherlands.



REDIRECTED DISCHARGE is a strategy that provides a shorter drainage route by redirecting some of the discharge to the river, the Industrial Canal, and the natural wetlands. This will relieve currently overloaded canals, allow for raised water levels in proposed circulating networks, and contribute to wetland restoration.

Drain



Sample page from the Integrated Living Water System showing Store and Drain measures.

Solutions at Multiple Scales

1 Lot

Houses & Gardens Slow the Flow

4 Sub-basin

Redirected Discharge Optimizes Current Drainage System

2 Block

Vacant Lots Store Water

5 Basin

Redirected Discharge Restores Natural Wetlands

3 District

Street Retrofits Slow the Flow

6 Region

Integrated Water System Builds Safety and Value

Solutions at Multiple Scales

AREA-WIDE FLOOD MITIGATION PLANS

Area-wide Flood Mitigation Plans *Example 2-3*

City of Tulsa Flood Park along Mingo Creek (Tulsa, OK)

Source: *http://resiliency.lsu.edu/planning/proactive-floodplain-management-in-tulsa-oklahoma/*

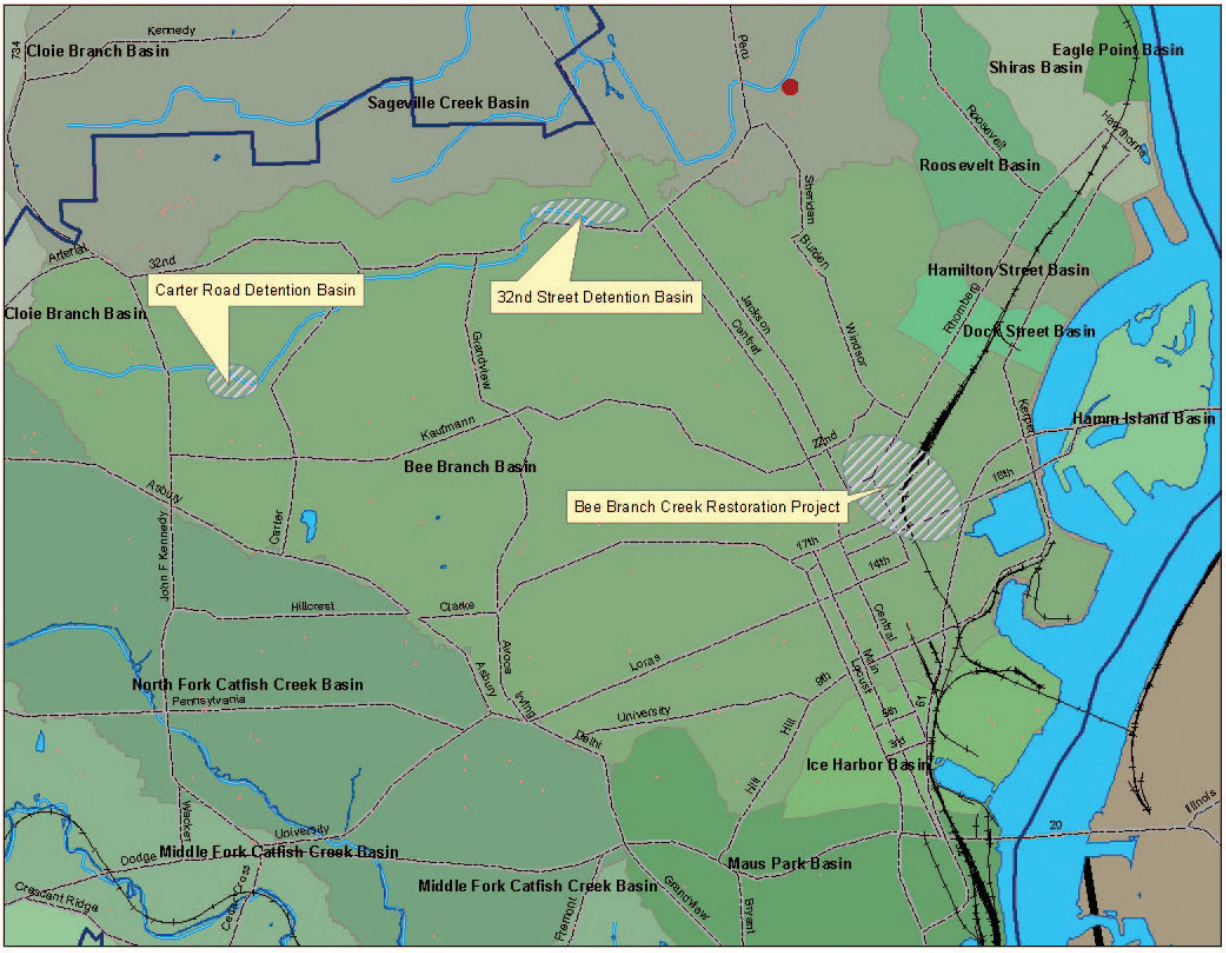
- After experiencing devastating losses in the Memorial Day Flood of 1984 (14 dead and $292 million in damage), the City of Tulsa shifted from a reactive approach to flood mitigation to a proactive, comprehensive, watershed-wide approach.
- The city embarked on a flood control system comprised of a network of landscaped buffers and detention basins.
- A key part of this comprehensive approach included a city acquisition program to remove structures located in flood-prone areas and convert these areas into open spaces for recreation and stormwater surge.
    - With financial support from FEMA from the Hazard Mitigation Grant Program and a 25% local match, the city purchases flooded properties after a storm event.
    - After the 1984 flood to 2004, the city had cleared more than 900 buildings from the floodplain.
    - Since 1990, more than $200 million has been spent on capital projects and programs with 40% of the funds coming from the federal government.
- Local funding for flood mitigation comes from a construction sales tax and stormwater fees.
- There has been no record of flooding in any structure built after 1987 and Tulsa became the first CRS community.
- Due to its high CRS ratings, residents receive a 40% premium reduction on their flood insurance and have access to recreational amenities.

Tulsa Park, Oklahoma during the Memorial Day Flood of 1984 (left) and today (right).

Bee Branch Flood Mitigation Plan (Dubuque, IA)

Source: *http://www.cityofdubuque.org/index.aspx?NID=1813*

- Flooding of the Bee Branch in Dubuque, IA has caused an estimated $69.8 million in damage between 1999 and 2011 and been the source of six Presidential Disaster Declarations.
    - The areas most vulnerable to flooding are historic neighborhoods with a large stock of market-rate affordable housing for working families and the elderly; populations that are the least able to recover from repetitive flood loss.
    - From 2004 to 2009, the value of commercial property in Dubuque grew 39% but fell 6% in the flood area.
- The Bee Branch Watershed Mitigation Project is a multi-phased investment based on a holistic approach to mitigate flooding, improve water quality, stimulate investment, and enhance the quality of life.
- The project features daylighting 4,500 feet of buried creek and restoring it and its associated floodplain; creating a linear park along the open waterway; creating parkland along the lower Bee Branch Overlook and incorporating a bio-island, rain gardens, and bioswales; building an amphitheater adjacent to elementary schools; adding biking and hiking trails; planting over 1,000 trees; and adding over six acres of permeable paver alleys and parking lots with the end goal of preventing 2,400 pounds of sediment and 750,000 cubic feet of runoff a year from entering the Mississippi River.
- The Project has a 12 phase plan: Phases 1-3 are complete, 4 and 6 are under construction, and 5 and 7-12 are under design, using a patchwork of funding from federal, state, local, and public/private partnerships.
    - Iowa Flood Mitigation Board (IFMB): Created in 2012, charged with creating a flood mitigation program for Iowa. Program will allow certain governmental entities to submit flood mitigation projects to the board for review and possible approval for funding. Funding will come from sales tax increments or appropriations from the General Assembly.
    - IFMB approved $98.5m for Bee Branch Mitigation Project. The funds will come from a sales tax increment over a twenty-year period per the schedule outlined. Revenue comes from the incremental increase in the state sales tax in the community seeking flood protection funds.
    - Using a sales tax increment approach, the city provides an average of $5 million in funding yearly and does not exceed $7 million.



Map showing locations for the Carter Road Detention Basin, 32nd Street Detention Basin, and the Bee Branch Creek Restoration Project.

Table 1: Funding Sources

Funding Source	Federal	State	Local	Total
U.S. DOT TIGER Grant	$5,600,000			$5,600,000
I-Jobs II Grant		$3,965,500		$3,965,500
RECAT Grant		$2,250,000		$2,250,000
U.S. DOT National Scenic Byways Grant	$1,000,000			$1,000,000
State Recreational Trail Grant		$100,000		$100,000
U.S. Economic Development Administration Grant	$1,227,183			$1,227,138
Dubuque Metropolitan Area Transportation Study Grant			$640,000	$640,000
U.S. EPA Clean Water SRF Federal Financial Assistance	$49,021,052			$49,021,052

Funding Source	Federal	State	Local	Total
General Obligation Bonds			$48,227,604	$48,227,604
Private Donations			$165,244	$165,244
Stormwater Utility Fees			$14,394,096	$14,394,096
Sale of Assets and Land			$336,358	$336,358
State of Iowa Sales Tax Increment		$52,122,544		$52,122,544
Total Construction Funding	**$56,848,190**	**$58,438,044**	**$63,763,302**	**$179,049,536**
Interest on Bond and SRF loan (State Sales Tax Increment)		$21,880,000		$21,880,000
Total Project Funding	$56,848,190	$80,318,044	$63,763,302	**$200,929,536**

- Private investment has followed the project: Since 2008, $139 million has been invested in the area and an additional $215 million is expected to flow in the next five years.

Restoration of Bee Branch Creek (left), and permeable pavement installation (right).

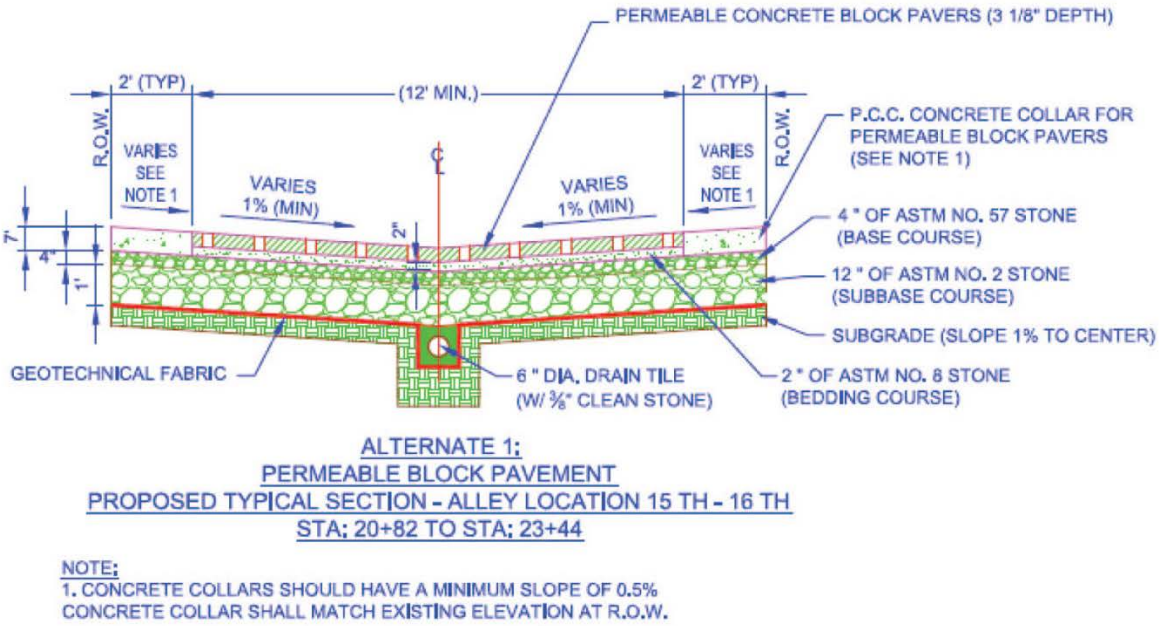


Diagram showing permeable pavement.

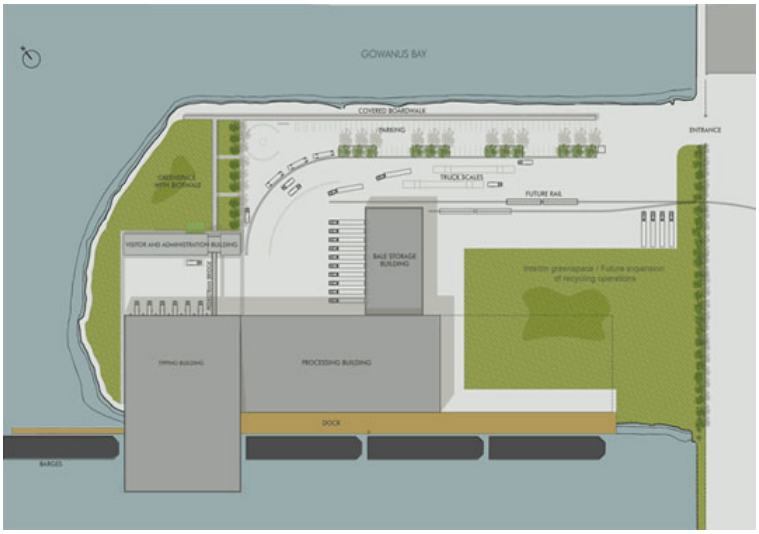
SITE-SPECIFIC PLANS

Site-specific Plans *Example 2-5*

Sims Municipal Recycling Facility (New York, NY)

Source: http://www.nycedc.com/project/sims-municipal-recycling-facility

- This new recycling facility serves as the principal processing facility for all of NYC's curbside metal, glass, and plastic recyclables as part of a long-term contract between Sims Municipal Recycling and New York City Department of Sanitation, and uses elevation, low impact development, and living shoreline techniques to promote resiliency.



Proposed recycling facility plan.

- The facility is built on an 11 acre city-owned pier in the South Brooklyn Marine Terminal, making it accessible via barge, rail, or truck. The majority of inbound material accesses the facility by barge from SMR facilities in the Bronx and Queens. The majority will leave via barge and rail, taking thousands of truck trips off of the streets of New York.
- The site specific plan incorporates multiple innovative elements that promote sustainability and resiliency:
    - Stormwater is managed on-site using landscape features, bioswales, grading, and a retention pond.
    - The site has a 600kW solar power installation to generate its own electricity.
    - The city constructed three artificial reefs to mitigate the effects of the necessary dredging on the site to promote biodiversity.
    - All of the buildings, high voltage electrical gear, scales, and recycling gear were raised four feet above the new FIRM maps and remained dry during Hurricane Sandy.
- As a public/private partnership, this facility required a $48 million investment from NYC and a $46 million investment from Sims.
    - The facility is retained by the city and is currently on a 20 year lease to Sims with the option for a 7-year or 10-year renewal.

Site-specific Plans *Example 2-6*

Metairie's Pontiff Park (New Orleans, LA)

Source: *http://livingwithwater.com/reports/*

- Metairie's Pontiff Park highlights successful water management into recreational public spaces. The park's high performance landscape maintains the appearance of a traditional suburban park.
- The park contains a three foot tall earthen berm that is constructed around the perimeter of the park. The berm creates a 40 acre stormwater retention area that is designed to retain up to 52 million gallons of water for up to a day before being siphoned into the canal system.
- The community received a FEMA grant of over $3 million for these retrofits.

Flooded park area in New Orleans (left), and an example of a leveed basin (right).

Site-specific Plans *Example 2-7*

Hunts Point Landing (New York, NY)

Sources: *http://sustainablesites.org/hunts-point-landing*

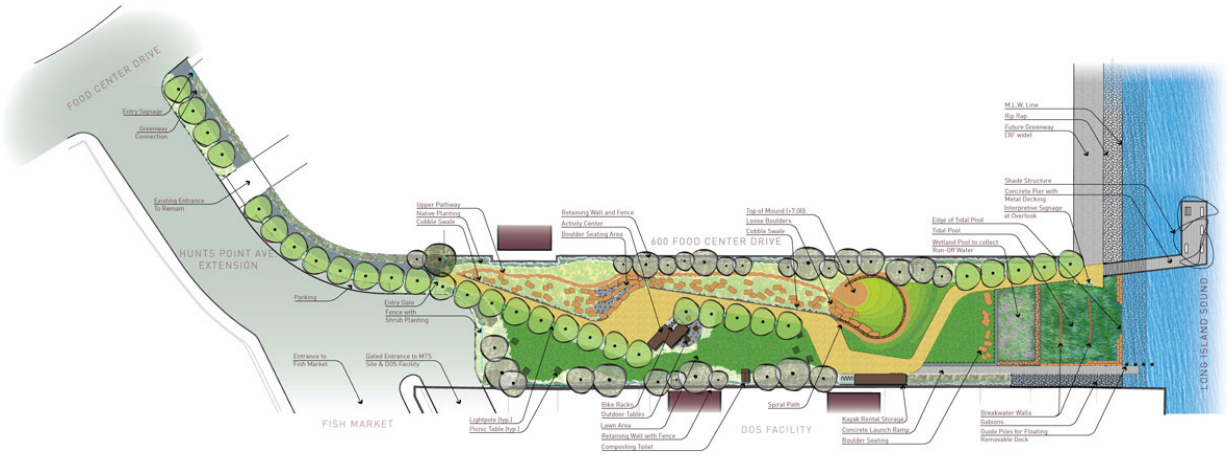
http://www.archdaily.com/236895/a-lesson-in-dedicated-collaboration-hunts-point-landing-on-the-south-bronx-greenway-mathews-nielsen-landscape-architects/04-21-08_final-diagrams-ai-2/

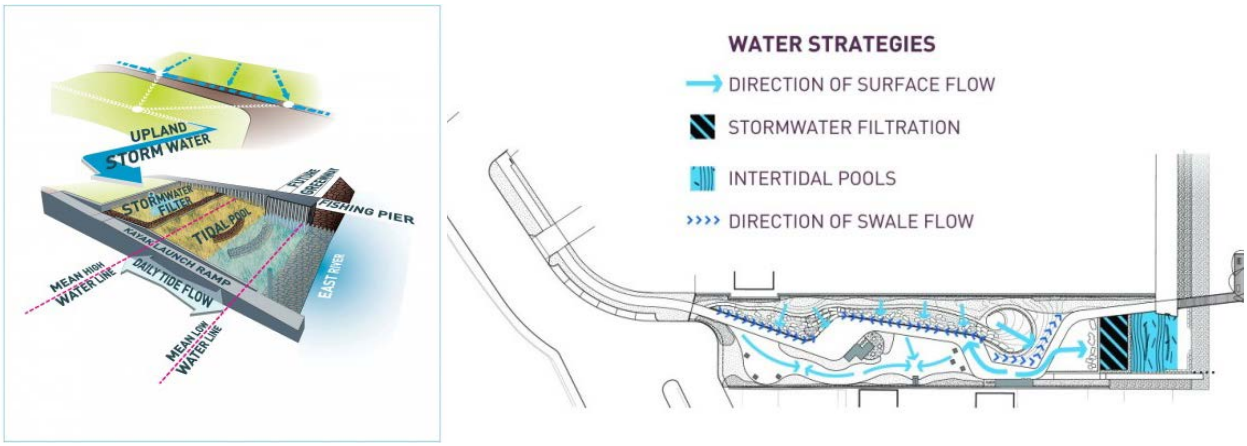
Hunts Point Landing is a component of the South Bronx Greenway Master Plan that provides public access to the waterfront, links pedestrian and bicycle improvements, and incorporates open space and flood mitigation techniques on a former brownfield site.

- The park used materials from the former street and bridge that was demolished.
- Hunts Point Park's design restores the natural shoreline by incorporating intertidal and freshwater pools which improve water quality, foster biodiversity, and provide a flood buffer.

Hunts Point Landing

- The total cost of the project was $6.8 million and the funding sources were City Capital Funds, New York State Environmental Protection Fund, The Wildlife Conservation Society (WCS), and the WCS-National Oceanic and Atmospheric Administration South Bronx Waterfront Partnership.





Conceptual drawings of the Hunts Point Landing project before its completion.

Gil Hodges Community Garden (New York, NY)

Sources: *https://www.nyrp.org/green-spaces/garden-details/gil-hodges-community-garden/*

http://brooklyneagle.com/articles/flood-prone-gowanus-garden-becomes-storm-resilient-oasis-2013-09-27-175300

- The Gil Hodges Community Garden in Brooklyn, New York, highlights innovative stormwater management systems in a community garden setting.
- The garden includes bioswales, rain gardens, and permeable pavers that capture stormwater runoff, improve water quality, and prevent sewers from overloading and draining untreated into the nearby Gowanus Canal.
- The green components can manage 150,000 gallons of stormwater annually.
- The project uses a public/private partnership between the nonprofit organization, New York Restoration Project, the Jo Malone London Company, and the New York City Department of Environmental Protection.
    - New York Restoration Project (NYRP) completed the renovation of the public space and installed a DEP-designed bioswale through private support and a New York City Department of Environmental Protection Green Infrastructure Grant.
- Monitoring equipment was installed in the bioswales to record data for City College of New York to help understand how bioswales perform over time.

Gill Hodges Community Garden, before (left) and after restoration (right).

WASTEWATER RESILIENCY

Wastewater Resiliency *Example 2-9*

Wastewater Resiliency Plan (New York, NY)

Source: *http://www.nyc.gov/html/dep/html/about_dep/wastewater_resiliency_plan.shtml*

- With a high percentage of critical facilities located within the floodplain, New York City has taken aggressive measures to promote resiliency in design and retrofits to its existing network of wastewater facilities.
- The major initiatives are:
    - Hardening of pumping stations: The city seeks to raise or flood-proof critical equipment, construct barriers, and install backup power supplies.
    - Hardening wastewater treatment plants: The city seeks to raise or flood-proof critical assets to the treatment process, construct barriers, improve waterfront infrastructure, and implement redundancy measures to avoid failure.
    - Develop cogeneration facilities: The city seeks to use methane generated by the wastewater treatment process to provide continuous power to the facility.

Adaptation Strategy		Resiliency/Effectiveness	Cost
	**Elevate Equipment** on pads or platforms, to a higher floor, to the roof, or to a new elevated building.		$$$$
	**Flood-Proof Equipment** by replacing pumps with submersible pumps and installing watertight boxes around electrical equipment		$$$
	**Install Static Barrier** across critical flood pathways or around critical areas.		$$$
	**Seal Building** with water-tight doors and windows, elevating vents and secondary entrances for access during a flood event.		$$
	**Sandbag Temporarily** around doorways, vents, and windows before a surge event.		$
	**Install Backup Power** via generators nearby or a plug for a portable generator.	Does not protect equipment, but ensures rapid service recovery	$$$

Wastewater resiliency adaptation strategies, showing resiliency, effectiveness, and cost.

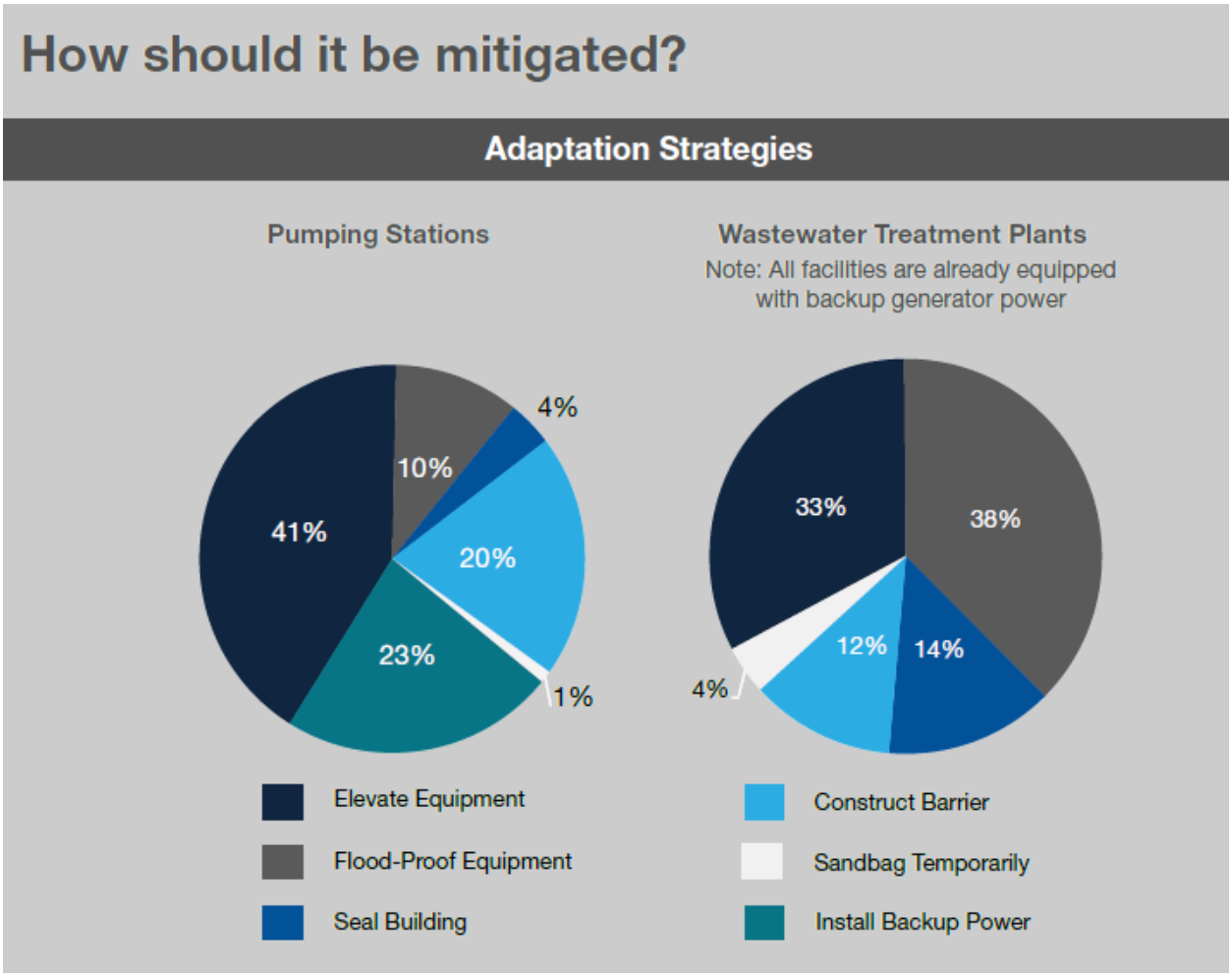


Chart showing mitigation of wastewater treatment adaptation strategies.

Dubuque Water and Resource Recovery Center (Dubuque, IA)

Source: *http://www.cityofdubuque.org/656/Facility-Upgrade*

- The Dubuque Water and Resource Recovery Center underwent strategic upgrades to extend its lifespan and foster sustainability. The majority of the plant was built in the 1960s and 1970s and the equipment was operating well beyond its designed life.
- The Center is a secondary wastewater treatment facility that provides screening, grit removal, primary treatment, secondary treatment by the oxygen activated sludge process, final clarifications, and ultraviolet disinfection.
- Using structural repurposing and an innovative site design, the facility uses anaerobic digestion to break down accumulated biosolids in wastewater, uses the methane produced to produce electricity to power the plant, and safely discharges clean water into the Mississippi River.
- The plant uses ultraviolet disinfection instead of traditional chlorine.
- All of the buildings are Energy Star Rated and the landscaping uses elevation and rain gardens to mitigate stormwater runoff.
- While the upfront costs of the upgrades are high ($64 million), the yearly operating costs are lowered, the lifespan of the plant has been extended 35 to 40 years, and the plant has the potential to become electrically self-sufficient.
- The City of Dubuque funded the upgrades to the Waste Water Treatment Plant through the Iowa Clean Water State Revolving Fund loan fund, which will be repaid through sanitary sewer fee revenue.

Street view (left) and aerial view (right) of the Dubuque water and resource recovery center.

FLOOD-RELATED TAXES

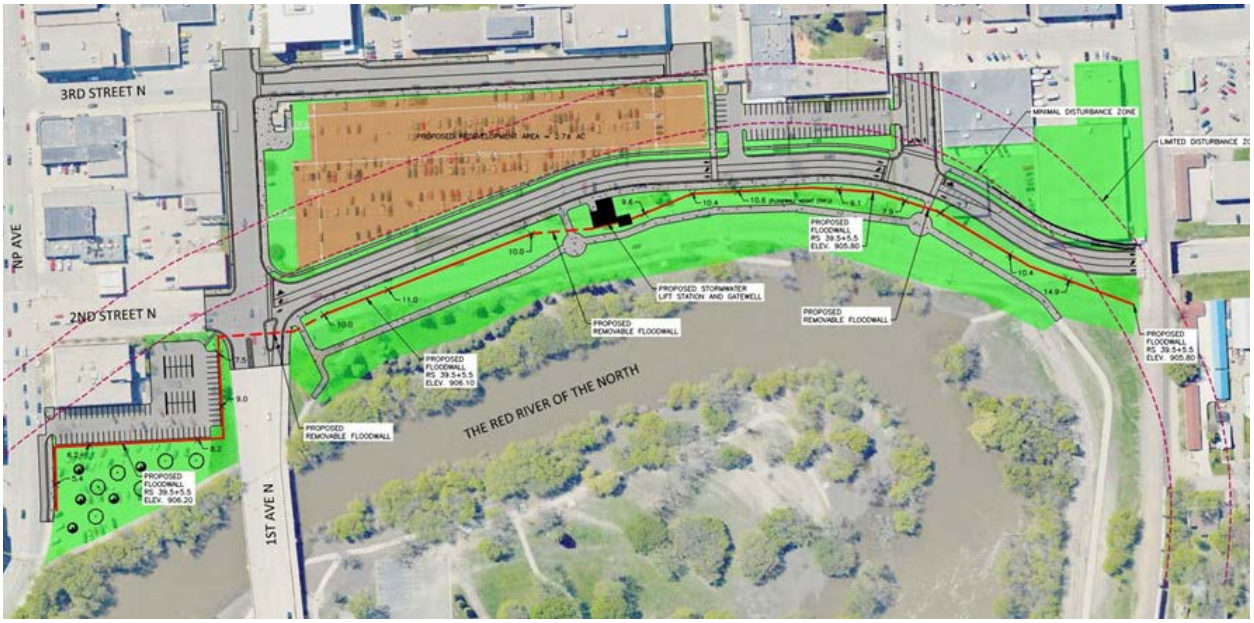
Flood-related Taxes *Example 2-11*

Fargo Flood-Related Sales Tax (Fargo, ND)

Sources: *https://www.cityoffargo.com/attachments/b2589bf1-bcae-4202-843b-e3c0c0e9d182/Extended%20Version_2013.pdf*

http://minnesota.publicradio.org/collections/special/2013/floods/before-after-homes/

- Following a flood disaster in 2006, the City of Fargo implemented a 1% infrastructure sales tax and a 0.5% flood control sales tax.
- Both of the taxes have lifespans of twenty years and were reauthorized in 2009 and 2010.
- The taxes generate at least $11 million annually and cost the average household $56 a year.
- Due to economic growth and population increase, the sales tax is expected to bring in $22 million a year by 2031, resulting in a total income of $312 million over its lifetime.
- The dedicated funds have funded flood mitigation efforts, buyout programs, and wastewater infrastructure updates.
- The city has identified $247 million worth of projects and property acquisitions. These projects are divided into five different phases through 2016, to be funded in part by the new tax revenues.
- A key initial project is the realignment of 2nd Street Flood North to provide additional flood protection for portions of the downtown area and integrate public greenspace and a walking path along the river. The project will replace temporary levees with permanent, reliable protection.
- The raised revenue from related taxes has been used to remove hundreds of flood-prone homes along the red river. The mixture of buyout programs and levee system upgrades has created more predictable flood scenarios.



Map of proposed additional flood protections in Fargo.

Sales Tax Abatement Program for Flood Resiliency (New York, NY)

Source: *http://www.nycedc.com/program/open-industrial-uses-sales-tax-exemption-program*

- Provides a tax exemption of up to $100,000 per company on the purchase of building materials used for projects.
- The sales tax abatement program provides $10 million in sales tax abatements in $100,000 increments to qualifying industrial businesses seeking resiliency retrofits.
- The sales tax abatement is justified because industrial businesses frequently run on thin profit margins and are clustered along the waterfront.
- The program will prioritize 1- to 2-story buildings whose ground elevation is more than four feet below the applicable BFE.
- The program targets industrial businesses with unenclosed or open industrial uses, such as:
    - Waste recycling facilities.
    - Scrap metal processors.
    - Automobile dismantling operations.
    - Concrete and asphalt manufacturing.
    - Construction and demolition debris transfer stations.
    - Unenclosed storage of construction materials.
- The scope of renovations can include the following:
    - Improvements to control environmental emissions at open facilities.
    - Paving, grading, containment walls, storm water management systems, and flood resilient construction.
- The parameters of the program include the following:
    - Applicants must commence improvements within one year of receipt of the sales tax letter.
    - The sales tax letter will expire no later than three years from the date of its issuance.

SECTION 3
EPA CLIMATE ADAPTATION PLANNING RESOURCES

The following EPA resources may be helpful in identifying resources to aid in planning, designing, or implementing climate resiliency measures in brownfields revitalization projects.

- Green Infrastructure for Climate Resiliency
  http://water.epa.gov/infrastructure/greeninfrastructure/climate_res.cfm
- Implementing Stormwater Infiltration Practices at Vacant Parcels and Brownfield Sites
  http://water.epa.gov/infrastructure/greeninfrastructure/upload/brownfield_infiltration_decision_tool.pdf
- Brownfields Grants & Funding
  http://www.epa.gov/brownfields/grant_info/index.htm
- CHECKLIST: How to Address Changing Climate Concerns in an Analysis of Brownfield Cleanup Alternatives (ABCA)
  http://www.epa.gov/brownfields/sustain_plts/factsheets/EPA_OBLR_Climate_Adaptation_Checklist.pdf
- State and Local Climate and Energy Program
  http://www.epa.gov/statelocalclimate/state/topics/impacts-adaption.html
- Technical Assistance to Brownfields Communities (TAB) Program
  http://www.epa.gov/brownfields/tools/#tab
- Environmental Finance Centers
  http://www2.epa.gov/envirofinance/efcn
- Smart Growth for Coastal and Waterfront Communities
  http://www.epa.gov/smartgrowth/sgcoastal.html