Structural and Nature-based Measures

RESILIENCY TOOLS

Beach Nourishment

- Sand is brought from a nearby beach, quarry, or ocean floor and spread along the beach using a bulldozer. Sand sourcing has environmental impacts, and sand must match the deposition location in size, color, and composition
- Nourished beaches require regular re-nourishment, with no end point
- This is not a permanent solution for shorelines facing erosion due to development, hard armoring, or increasingly intense storms

American Shore & Beach Preservation Association, 2007.

Insert preference here:

Building Retrofits

- According to the US Green Building Council, building professionals need to understand the probable impacts of climate change on the built environment and incorporate appropriate adaptation strategies into practice
- This will ensure that buildings and surrounding environments will be suitable for a range of future uses
- Strategies address general actions, site, building structure, building enclosure, building systems, building operations, and people and building use


Resilient Building Design Guidelines, Princeton Hydro, 2013

Insert preference here:

Coastal Construction Guidelines

- FEMA's Coastal Construction Manual provides guidance for designing and constructing residential buildings in coastal areas that will be more resilient to the damaging effects of natural hazards
- Guidelines included are pre-design considerations, foundation, building envelope, installation of mechanical equipment and utilities, building construction, building maintenance, and building retrofit
- Communities may consider developing additional guidelines in order to preserve the neighborhood character, as homes are made flood proof and/or elevated.
- Example: Breezy Point Home Elevation Study, NY GOSR.

Insert preference here:

Dune Management

- Sand dunes are important defense against coastal storms and can reduce losses suffered by inland coastal development
- The Beach-Dune Performance Assessment of New Jersey Beach Profile Network Sites assessed beaches pre- and post-Sandy, and it found that beaches with higher, wider dunes protected better against the storm


New dune field at the Bay Shore Park, Port Monmouth

Insert preference here:

Floodable Development

- Structures designed to withstand or retain stormwater. Can be designed to resist damage by occasional or periodic flooding
- Can be a backup strategy in case shoreline armoring fails; or can be retention areas during ocean surges or heavy rainfall. Can manage salt and freshwater floods at orders of magnitude above most LID tools
- Can be hazardous due to contaminated surge waters during a storm; emergency management is required to prevent people from misusing waters or getting trapped in flooding structures


Floodable Parking Garage, Ask NY

Insert preference here:

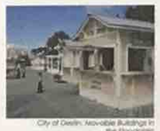
Floodproofing Infrastructure

- Any combination of structural and non-structural additions, changes, or adjustments to reduce or eliminate flood damage to real estate, improved property, water and sanitary facilities, or their contents
- The National Flood Insurance Program allows a new or substantially improved non-residential building in an "A zone" to have a lowest flood below base flood elevation (BFE) it is certified as "floodproofed." as long as it is not in a Coastal High Hazard Area
- Floodproofing is recommend up to one foot above BFE for safety and full flood insurance rating credit

Insert preference here:
- Need more Clarification
- Flood insurance?.

Moveable Buildings

- Raising buildings above flood elevation, as required by the National Flood Insurance Program in many areas, can be cost prohibitive and impractical
- In contrast, portable, wheeled buildings exempt from floodplain requirements can be relocated out of harm's way prior to a storm. Such buildings increase land use flexibility and reduce the presence of vacant structures
- This is appropriate for non-residential buildings in areas not suitable for residential development


City of Destin, Movable Buildings in the Floodplain

Insert preference here:

Shoreline Protection Techniques

- Also referred to as fixed or hard structures, designed to mitigate the effects of shoreline erosion, and capable of providing effective protection for upland property and infrastructure.
- Location and context dependent, can include groins, jetties, and terminal groins), shore parallel structures (bulkheads, revetments, seawalls, breakwaters), and non-traditional protection structures (dewatering systems, hardened dunes, viscous drag mats, geotubes, and biodegradable structures.
- Deployment without adequate attention to natural coastal processes can lead to adverse impacts in the vicinity.


National Park Service & U.S. Department of the Interior, 2016. Coastal Adaptation Strategies Handbook

Insert preference here:

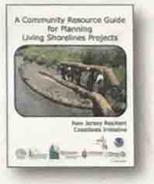
Wetland Restoration

- Swamps, marshes, and bogs—wetland vary widely because of differences in soils, topography, climate, hydrology, water chemistry, vegetation and other factors
- Often found alongside waterways and in flood plains, but some wetlands have no apparent connection to surface waters and yet have critical groundwater connections
- Wetlands provide erosion control, which dissipates wave energy and stabilizes shorelines, as well as flood damage reduction by intercepting stormwater

Insert preference here:

Living Shorelines

- Shoreline stabilization techniques using natural habitat elements (e.g., tall grasses and wetlands) that increase resilience to coastal flooding and erosion
- Wetlands hold soil in place, absorb wave energy, break up the flow of riverine currents, and absorb storm surges
- An alternative to "hard armoring" (e.g., concrete and other artificial barriers), which can divert flooding to other coastal areas and increase erosion



Insert preference here:

Coastal Restoration

- Planning and implementation of Living Shorelines techniques and projects based on ecological parameters (salinity, proximity to salt marsh, relationship to strategic habitat areas) and socioeconomic parameters (shoreline erosion, water quality, public accessibility.
- Based on findings that habitat restoration may be the most effective long-term solution to stabilize the shoreline, reduce nuisance flooding and erosion, and increase or improve recreation, water quality and natural aesthetics.
- Results in identification of project that considers the weight (importance) of each parameter.

Insert preference here:

Living Breakwater

- Breakwaters are submerged structures that create a barrier between the ocean and the shore.
- A living breakwater is designed to incorporate natural habitat components—such as oysters—into its structure, and this natural component has a large impact on its structural and ecological success
- Can have economic benefits, driving fish, oyster aquaculture, and tourism


Living Breakwaters, SCAPE

Insert preference here:

Urban Forest and Urban Tree Management

- A single tree may store 100 gallons or more of rainfall, and it is estimated that the urban forest can reduce annual runoff by 2 to 7 percent
- Other benefits of street trees (e.g., shade, beautification)
- "Stormwater to Street Trees" provides case studies in stormwater management tree systems

Insert preference here:

Coastal Habitat Conservation

- The full spectrum of value derived from coastal ecosystems (including wave attenuation) should be quantified and explicitly incorporated into conservation decision-making. This quantification is highly dependent on the local ecosystem.
- In order to receive funds under the national Coastal and Estuarine Land Conservation Program (CELCP), a state must develop and submit to the National Oceanic and Atmospheric Administration (NOAA) a Coastal and Estuarine Land Conservation Plan, providing an assessment of priority conservation needs and guidance for nominating and selecting such projects within the state.
- The New Jersey Coastal Management Office leads the CELCP and coordinates with the Green Acres program, local jurisdictions, land trust organizations, and other agencies to nominate threatened coastal habitat projects to NOAA in response to competitive funding opportunities.

Insert preference here:

Other Options

1. * NAVFAC Climate Change Guidance 2017
   - Appendices => Utilize Process

2. Microgrids

3. Backfillings / Raising Communities

S.C. MTG

URBAN FOREST & TREE MGMT

- green

MOVEABLE BLDGS

- yellow
- red → may not work in certain communities - physically moving building (eg. Manasquan Beach)

→ raising a Bldg we want this → green

Beach NOURISHMENT

- green - Monmouth Beach

COASTAL CONSTRUCTION GUIDELINES

- green
- All that information local + national reviewed to inform local preparedness + mitigation - learn from others experiences

Wetland Restoration

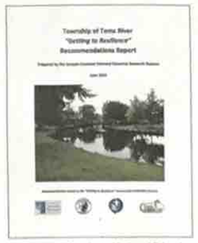
- green - Shrewsbury has many wetlands

Education & Awareness and Incentives Programs

RESILIENCY TOOLS

Digitize Community Knowledge of Past Storms

- Community knowledge and memories of past storms is essential for making sound plans, and they are an important supplement to documentation prepared by state and federal agencies
- The knowledge must be collected and organized in a way that turns individual anecdotes into useful data
- Individual knowledge of location an extent of past floods and community responses can aid in the targeting of resources for mitigation, formulation of evacuation plans, and preservation of necessary emergency response resources



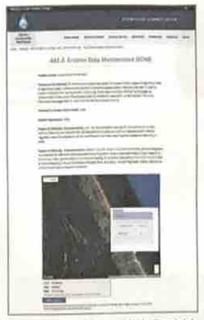
Jacques Cousteau National Estuarine Research Reserve. 2013. T

"Can't just be PDF's we click through" -Jack

Insert preference here:

Erosion Data Maintenance

- Communities can receive 20 Community Rating System points for updating data on coastal erosion rates and regulatory maps at most every five years.
- Maintenance of erosion data encourages sound decisions about what areas to preserve and develop.
- Ongoing monitoring of erosion may assist communities when applying for funding for shoreline restoration projects, as well as in evaluating the success of projects implemented to date



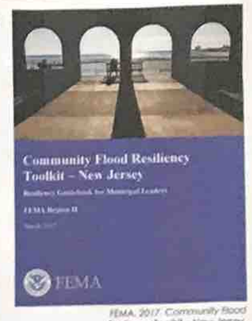
Association of State Floodplain Managers. 2017. Erosion Data Maintenance.

Useful, but not an incentive if town use beach replenishment projects" - Brian

Insert preference here:

FEMA and Coastal Management Trainings

- FEMA offers extensive training in all areas of disaster prevention and response through its Emergency Management Institute
- NJ Office of Emergency Management's (OEM's) Training and Exercise Unit offers emergency management training
- NJ Association for Floodplain Management offers a free Certified Floodplain Manager Certification program for all NJ residents, although priority is given to government officials



FEMA. 2017. Community Flood Resiliency Toolkit – New Jersey.

Insert preference here:

Program for Public Information (PPI)

- National Flood Insurance Community Rating System offers credit to communities that establish a Program for Public Information (PPI). Points are available for public information related to hazard disclosure, flood protection information and assistance, open space preservation, and drainage system maintenance
- PPI is an ongoing local effort to identify, prepare, implement, and monitor a range of public information activities on hazard awareness
- Examples: City of Somers Point has a PPI, and the Atlantic Cape Coastal Commission is setting up a multi-jurisdictional PPI

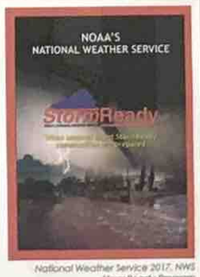
FEMA CRS 2017. Coordinator's Manual. Photo: John Kinley

Insert preference here:

- Great But lots of time + lots of organization
- Need leader

StormReady Community Status

- Voluntary program, administered by the National Weather Service, to recognize both communities and individual sites that have implemented communication and safety measures to protect against future storms.
- Five requirements must be completed:
  - » Establish a 24-hour warning point and Emergency Operations Center
  - » Have more than one way to receive severe weather warnings and to alert the public
  - » Create a system that monitors local weather conditions
  - » Promote the importance of public readiness through community seminars
  - » Develop a formal hazardous water plan, including training sever weather spotters and holding emergency exercise



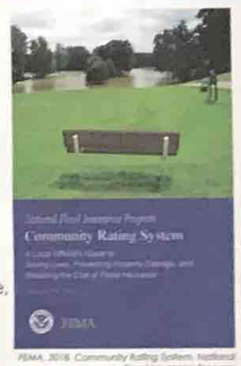
National Weather Service 2017. NWS StormReady Program

"More theoretically helpful than realistically" -Dennis

Insert preference here:

FEMA Community Rating System (CRS)

- A FEMA-run, optional program for communities that participate in the National Flood Insurance Program (NFIP)
- CRS seeks to reduce damages and payouts by incentivizing a comprehensive approach to floodplain management, scoring and classifying towns based on steps they've taken to mitigate the risks of flood hazards; communities that earn more "points" under CRS may have lower flood insurance premiums
- As of October 2016, highest-rated CRS communities are Avalon, Beach Haven, Brigantine, Lincoln Park, Long Beach, Longport, Mantoloking, Margate, Ocean City, Pequannock, Pompton Lakes, Sea Isle, Stafford, Stone Harbor, and Surf City...all with 25% discounts on flood insurance



FEMA. 2016. Community Rating System. National Flood Insurance Program

Insert preference here:

"Gets People to act"

- Problems of competing CRS requirements

Education + Awareness (all)

Other Options

Building Code Requirements + Local Incentives (Glen)
↳ Enforcement (Requirement of Generators, PL

Need to tie that to regional resilie measures. Educati on a systems based resiliency plan"

Expedited Permitting Processes
- to be incentivized

Participation of Counties in IM smaller flood-prone communities

- Interactive knowledge Sharing for munis

↓

Stop creating pamphlets, engage locals to market idea.
Interactive, community lead (ex: arts)
Engage (Ex: instead of a high H_2O sign, have a mural)

- Participation of Planners/Engineers in buiding resiliency, cross-train w/ building officials

Interactive Resilience (or other) plans instead of static map.

* Tool to get over CRS barrier: County shared services agreement (NEW)

* SBP does outreach - pre disaster prep (insurance docs etc) → webinar / live stream
(St. Bernard Project)

↑ Kim G. Highlands

Education & Awareness (pm)

Local Policy & Regulations

RESILIENCY TOOLS

Coastal Hazard Disclosure Policy

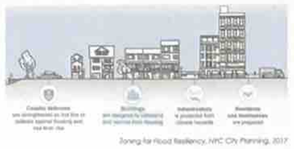
- Objective is to inform prospective buyers about the known flood hazard risks **before** a decision has been made to purchase the property, so it can be factored into the purchase decision, which is consistent with:
  - State and federal laws already require the disclosure of certain information at or before the time of property transfer
  - A local disclosure policy can standardize disclosure practices and ensure information is delivered in a timely and consistent manner, but such a policy is better implemented at a regional or state level

Matt Moletti, New York Times

Insert preference here:

Conservation Overlay Ordinance

- An overlay is a mapped zone applied over an existing zoning district, establishing an additional "layer" of standards
- Such an overlay may be a "hazard overlay district," which could disallow rebuilding after a storm or require protecting retrofitting, thus gradually shifting development away from hazardous areas and lowering overall community flood risk
- Overlay could relate to conservation of natural resources



Zoning for Flood Resiliency, NYC City Planning, 2017

Insert preference here:

Dune and Beach Protection Ordinance

- An easement may be required from private property owners to allow for construction or maintenance of dunes on their property.
- An ordinance would allow for appropriate access to ensure dune integrity.
- Advantages include flood prevent, tax base preservation, establishment of beach sand reservation, and habitat and recreation enhancement.

Vegetated dune in Ocean City, Kelly Pilcher

Insert preference here:

Development Fees in Vulnerable Areas

- Also known as impact fees, these are one-time charges imposed on new development projects by local governments, usually to cover costs for the infrastructure needed to support that development
- In vulnerable areas, significant infrastructure is often needed to ensure new developments are protected from flood hazards, and that those developments don't cause critical damage to local environments
- These fees ensure that taxpayers are not liable for all of the infrastructure costs of new construction; instead, the developers and potential users of that new construction pay their share

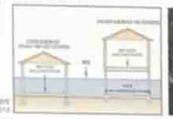
Eastern Research Group, 2015. What will Adaptation Cost? An Economic Framework for Coastal Community Infrastructure

Insert preference here: NEW/EXISTING DEVELOPMENT. RE

Location Specific Fees?

Flood Damage Prevention Ordinance

- Communities wishing to maintain good standing with the National Flood Insurance Program must adopt and enforce a flood damage protection ordinance
- The aim of this ordinance is to reduce future flood risks to new construction in flood-prone areas (such as through required design components) and provide protection to property owners against potential losses



Elevated structures and the BFE, Insurance Institute, 2012

Design proposals with shared platform spaces, Rutgers University, 2014

Insert preference here:

Floor Area Ratio (FAR) Ordinance

- An FAR ordinance may entice residents to reconstruct or elevate their homes or use the space underneath for garages and parking
- Parking under homes not only reduces off-site parking, but also reduces lot coverage and encourages more green space on residential lots (which can be used for stormwater absorption and management)

City Of Portland Oregon - Bureau of Development Services, 2017. Zoning Code Information Guide.

Insert preference here:

Landscaping and Vegetation Ordinance

- Vegetation and mature trees trap sediment and prevent erosion, stabilize slopes, dissipate the force of strong winds, and capture stormwater runoff. In coastal areas, vegetation can reduce wave action and reduce erosion. These features provide critical habitat and improve quality of life through connection with the natural environment
- Such ordinances restrict lot clearing, set vegetation standards, and preserve and manage the character of vegetation within a community by setting requirements prior to issuance of a building permit
- Example: Borough of Cape May Point ordinance

Allie Caulfield, Image of Cape May Point Borough

Insert preference here:

Lot Size Averaging Ordinance

- A planning technique that allows the lot size of a parcel of land to vary, while the density or number of permitted uses stays constant
- Providing flexibility may allow for greater clustering of development, preserving natural areas or areas at risk of flooding with no cost to the public or reduced profitability of development
- Generally most effective for parcels of 10 to 20 acres for subdivisions

Conventional Large Lot Zoning (10 +), Lot Size Averaging (5), NJFuture, 2012b

Insert preference here:

Noncontiguous Parcel Clustering

- NJ Municipal Land Use Law allows on parcel to be permanently preserved, while its development right density is transferred and developed on a non-contiguous parcel
- This can result in scattered preserved areas, but can also shift development away from flood-prone or high-hazard locations to locations more suitable for that development, but without the associated costs of acquisition

Insert preference here: fragmentation eco-impacts worse than clustering better than bad ≠ good.

Open Space Preservation

- NJ DEP Green Acres Program assists jurisdictions in the acquisition of open spaces and development of outdoor facilities.
- An Open Space and Recreation Plan must meet certain requirements and be approved by Green Acres, providing an opportunity for a community to formulate a plan that incorporates coastal hazard planning.
- Acquisitions may include environmental protection goals, such as greenways or water resource protection.

Hayes, Gruel & Associates, Township of Long River NJ, 2016. Conservation, Recreation, and Open Space Element

Insert preference here:

Residential Cluster Development Ordinance

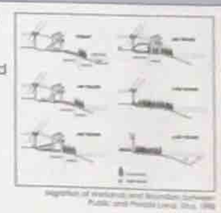
- Clustering residential development maintains the same overall built density but configures the development pattern such that the amount of infrastructure needed to service the development is reduced.
- This ordinance can result in open space and habitat preservation, as well as shifting of development from high-hazard areas. It allows for more flexible site design around centers under the Coastal Rules.

State of Massachusetts (Photo, gov)

Insert preference here:

Rolling Easement

- A highly location-dependent feature that allows the landowner to continue use of the property until the land becomes submerged, at which time the land transfers to the state under wetland or public doctrine rules.
- Most suitable in less-developed areas to enable sea level rise adaptation.
- Can be used in combination with Transfer or Development Rights.



Migration of Wetlands and Boundary between Public and Private Land, Ohio, 1996

Insert preference here:

Stormwater Management Ordinance

- All municipalities are required to have a stormwater management plan and associated ordinance to address new residential development.
- The plan applies for disturbance greater than 1 acre, or an increase in impervious area by more than 0.25 acres
- Addresses stormwater to reduce flood damage, minimize runoff, reduce erosion, increase groundwater recharge, minimize surface water pollution, and protect public safety

Lucas Berger, Jersey Water Works, 2015. Water Jersey Article

Insert preference here:

Transfer of Development Rights (TDR)

- Similar to noncontiguous parcel clustering, but different in that TDR requires development of planned "sending" and "receiving" areas – which restrict where the development density can be transferred within a municipality or region.
- Advantages include reduction of asset exposure to floods, reduce imperious surface coverage and associated stormwater, increased habitat and open space, reduce public service area and infrastructure needs, and preservation of local farmlands.

Diagram of TDR principles, CCH, NJFuture, 2010

Insert preference here:

Local Plans

RESILIENCY TOOLS

Capital Improvement Plan (CIP)

- 4- to 6-year plan identifying capital projects and forecasting available funding
- Under NJ Municipal Land Use Law Art. 4 40:55D-29, municipalities may use CIP for hazard projections and investment in resilience measures
- Example: Capital investment in San Francisco seawall


City of San Francisco, 2017

Insert preference here:

Climate Adaptation Plan (CAP)

- Typically comprises (1) identification of climate change projections and associated impacts; (2) assessment of vulnerabilities and risks from those impacts; and (3) recommendation of adaptation strategies to reduce those risks
- Municipalities are eligible for 20 points toward Sustainable New Jersey certification if their CAP includes a flooding risk assessment
- CAP can link to other plans (HMP, HPP) and include adaptation examples, possible funding sources, and associating Community Rating System activity


Krause, S. 2014. Development of Climate Change Adaptation Elements for Municipal Land Use Plans: Building Resiliency in Ventnor City, NJ.

Insert preference here:

Dune Vegetation Management Plan (DVMP)

- Contains standards to maintain and improve municipal dune system integrity, to maintain flood risk reduction and protect dune flora and fauna
- May require approvals from NJ DEP Division of Land Use Regulation for CAFRA and/or Waterfront Development


Cara Boyington/The Nature Conservancy

Insert preference here:

Environmental Resource Inventory (ERI)

- Also referred to as "Natural Resources Inventory," is a compilation of natural resources and features to inform community land use decisions
- Can identify areas that provide a resilience benefit, how those areas could be enhanced, and what climate change risks they face


Barnegat Environmental Resource Inventory, 2017

Insert preference here:

Green Infrastructure Plan (GIP)

- A community's guidance document for implementation of green infrastructure, which allows stormwater and coastal and riverine surge to be absorbed into the ground and treated, stored, or used in soils or by vegetation
- Analyzes land use, topography, and opportunities and constrains to result in implementation recommendations
- N.J.S.A. 40:56A and N.J.S.A. 40:55D-1 requires municipalities to have a land use plan element in their master plan, and this element must address floodplains, marshes, and woodlands

Hoboken Green Infrastructure Strategic Plan

Insert preference here:

Hazard Mitigation Plan (HMP)

- Identifies risk and vulnerabilities of natural and manmade hazards, as well as strategies to reduce potential loss of life and property
- Required for federal grants in disaster relief or hazard mitigation projects; documented public participation is required (the community chooses its actions)
- Approved by FEMA and updated every 5 years, based on a scenario risk analysis


Monmouth County HMP Update, 2014

Insert preference here:

Build-Out Analysis Within a Hazard Mitigation Plan

- Analysis of full development as-of-right to show future (flood) risk as part of mitigation planning:
- More development = less pervious surface to absorb storm water as of result of which:
  - Stormwater flood levels are higher, increasing potential asset damage
  - Flood prone areas will be larger, exposing more assets.
  - Flooding will occur more frequently, exposing assets more frequently
  - More frequent inability to discharge through gravity
- More assets located in a (coastal) flood zone.
- Important to inform cost benefit analysis for future conditions


Medfield Hazard Mitigation Plan, 2011

Insert preference here:

Incorporating Climate Adaptation into a Master Plan

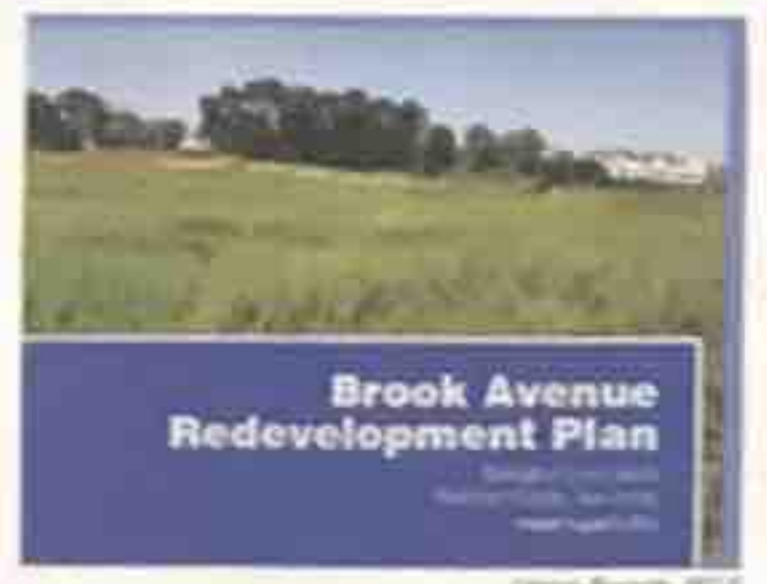
- Also referred to as "comprehensive plan," is mandated by NJ Municipal Land Use Law to be updated every 10 years
- Guides future growth, development, and land use decisions; can incorporate flood and sea level rise considerations
- Example: Monmouth County 2016 Master Plan, Somers Point Master Plan Reexamination


Zoning and SLR, SLR Somers Point, 2016

Insert preference here:

Long-Term Recovery or Post Disaster Redevelopment Plan

- Provides a vision for resilient redevelopment of areas impacted by natural disasters
- Identifies a pipeline of multiple types of resilience projects (e.g., land use, infrastructure, transportation, etc.)
- Examples: Ocean County Long-Term Community Recovery Plan, Brook Avenue Redevelopment Plan in Union Beach



Union Beach, 2013

Insert preference here:

- Shouldn't want to keep people/ [illegible] things in harm way - should [illegible] better [illegible] as [illegible], for example

- If you haven't got MP and HMP [illegible] should make [illegible] one of these (plus MPs + HMPs are mandated)

Open Space and Recreation Plan

- Developed to protect and enhance a community's open space resources
- Such open spaces can absorb and store water with natural features, and coastal open spaces (such as wetlands) can act as erosion and wave buffers
- Green acres program requires an Open Space and Recreation Plan for issuance of enhanced open space funding, and Sustainable Jersey awards 10 points to toward certification to municipalities with such a plan

South Harrison Open Space Plan

Insert preference here:

Resilience Plan

- Examines how communities can address challenges to assure long-term resilience
- Addresses not just hazards (from HMP), but also elements that impacts long-term ability of a neighborhood to withstand and respond to disasters; social cohesion is a major aspect
- Example entities with resilience plan: NJ Transit, Port Authority of New York and New Jersey


Louis Berger & Perkins Eastman, NY Governor's Office of Storm Recovery, 2014

Insert preference here:

Shoreline Protection or Management Plan

- Outlines strategies to restore and maintain beach systems and manage coastal erosion, such as dune restoration and groins
- Example: NJ DEP 1981 Shore Protection Plan encompasses Shore from Raritan Bay to Delaware River, and it included guidelines for engineering and land use tools for protection
- Example: Virginia Beach plan recommends a series of shoreline strategies, such as Living Shorelines to enhance wetland, beach, and dune habitat

Insert preference here:

Sustainability Plan

- Also referred to as a "Natural Resources Inventory," is a compilation of natural resources and features to inform community land use decisions
- Can identify areas that provide a resilience benefit, how those areas could be enhanced, and what climate change risks they face

energy / economic

APA, NJ Chapter, 2014

Insert preference here:

local plans/policy/Regs

Other Options

CAP, HMP, SP, RP - larger policies

Towns need "Disaster ~~response~~ Risk reduction in all policies"

ie: resilience element(s) in open space plan

- Flood Zone Buyouts.

RESPONSE SOLUTIONS (NJ VOAD & COAD)

Volunteers of Active Disaster Community " " "

- Require generators for new Development. Particularly Food stores & Gas stations

every plan online to be viewed by public

green

- Climate adapt. in MP
- Post dis Redev. (answer may be in another location or less intensity)
- Resiliency in all plans & publicly available

red

- Dev. fees in vuln areas (should be no dev. in vulnerable areas)