

RHODE ISLAND FLOODPLAIN MANAGERS ASSOCIATION

**WOOD - PAWCATUCK RIVERS  
WATERSHED FLOOD PROTECTION  
PROJECT**

**MAY 25, 2023**

An ongoing Environmental Assessment  
through the USDA Natural Resources Conservation Service

Presented by: J. Matthew Bellisle, P.E. – Pare Corporation





Westerly  
Richmond  
Hopkinton  
Hope Valley  
Charlestown  
Exeter  
Stonington  
North Stonington  
Voluntown

**THIS IS WHY WE ARE HERE**





# IN CASE THAT ISN'T CONVINCING ENOUGH...



Route 91 - Chapman Pond in Westerly, 2010.



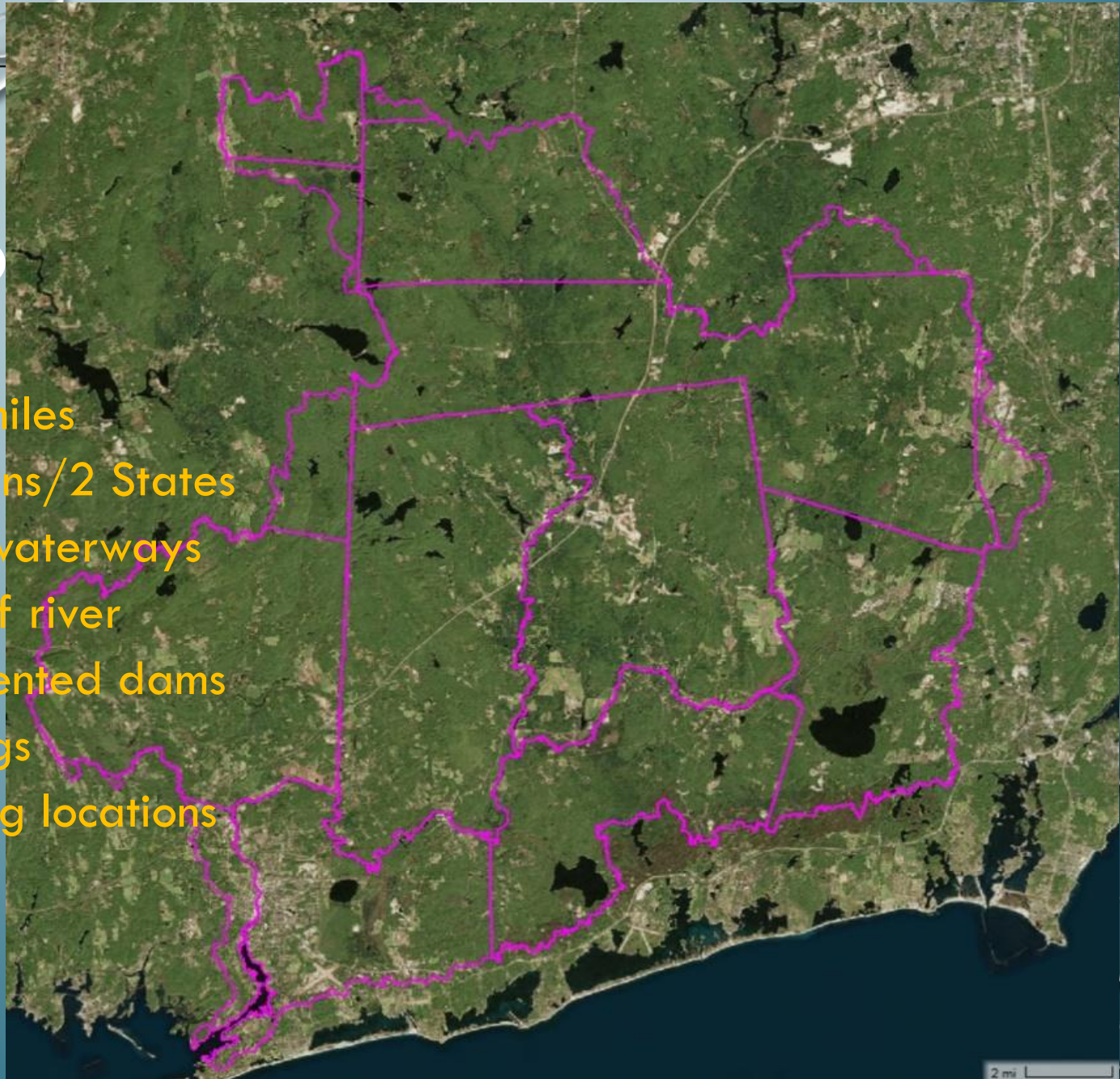
Pawcatuck River, Hopkinton, 2010.





# WATERSHED OVERVIEW

- 303 square miles
- Spans 15 towns/2 States
- 20+ named waterways
- 500+ miles of river
- 160+ documented dams
- 600+ crossings
- 160+ flooding locations





# PROJECT SPONSORS

- SOUTHERN RHODE ISLAND CONSERVATION DISTRICT
- SPONSORING COMMUNITIES
  - WESTERLY, RI
  - RICHMOND, RI
  - HOPKINTON, RI
  - CHARLESTOWN, RI
  - SOUTH KINGSTOWN, RI
  - STONINGTON, CT
  - NORTH STONINGTON, CT
  - VOLUNTOWN, CT



*The Wood River, Richmond,  
RI*



# BRIEF HISTORY OF FLOODING ALONG THE RIVERS

## DECADES OF NOTABLE FLOODING EVENTS:

- **NOVEMBER 1927:** FLOODING DUE TO TROPICAL STORM
- **MARCH 1968:** RECORD FLOODING DUE TO HEAVY RAINFALL ON SNOWMELT
- **JUNE 1982:** FLOODING DUE TO 8-INCH RAINSTORM
- **MARCH 2010:** FLOOD OF RECORD
- **OCTOBER 2012:** FLOODING DUE TO HURRICANE SANDY





# WATERSHED PROJECT PLAN

- FEASIBILITY STUDY
- CONSIDERS SEVERAL PROJECT ALTERNATIVES
- EVALUATES PROJECT ALTERNATIVES AGAINST ENVIRONMENTAL, ECONOMIC, AND PUBLIC CONCERNS.
- DETERMINES IF PROJECT SHOULD BE FUNDED.



# PURPOSE AND NEED

The **Project Purpose** is to reduce the risk of flood damages to homes and other occupied non-residential buildings along the Wood and Pawcatuck Rivers in Washington County, RI and New London County, CT resulting from floodwater in the Wood-Pawcatuck Watershed; and to reduce the risk of flood damages to structures, roads, bridges, and utilities.

The **Need for the Project** results from recurring excessive flooding of numerous buildings (Commercial and residential) and numerous roads, bridges, and utilities. The flooding causes regular flood damages to buildings, public infrastructure, and utilities.

The project needs include a combination of structural and non-structural measures to avoid future damages.





# RESOURCES CONSIDERED IN ADDITION TO RIVER FLOW

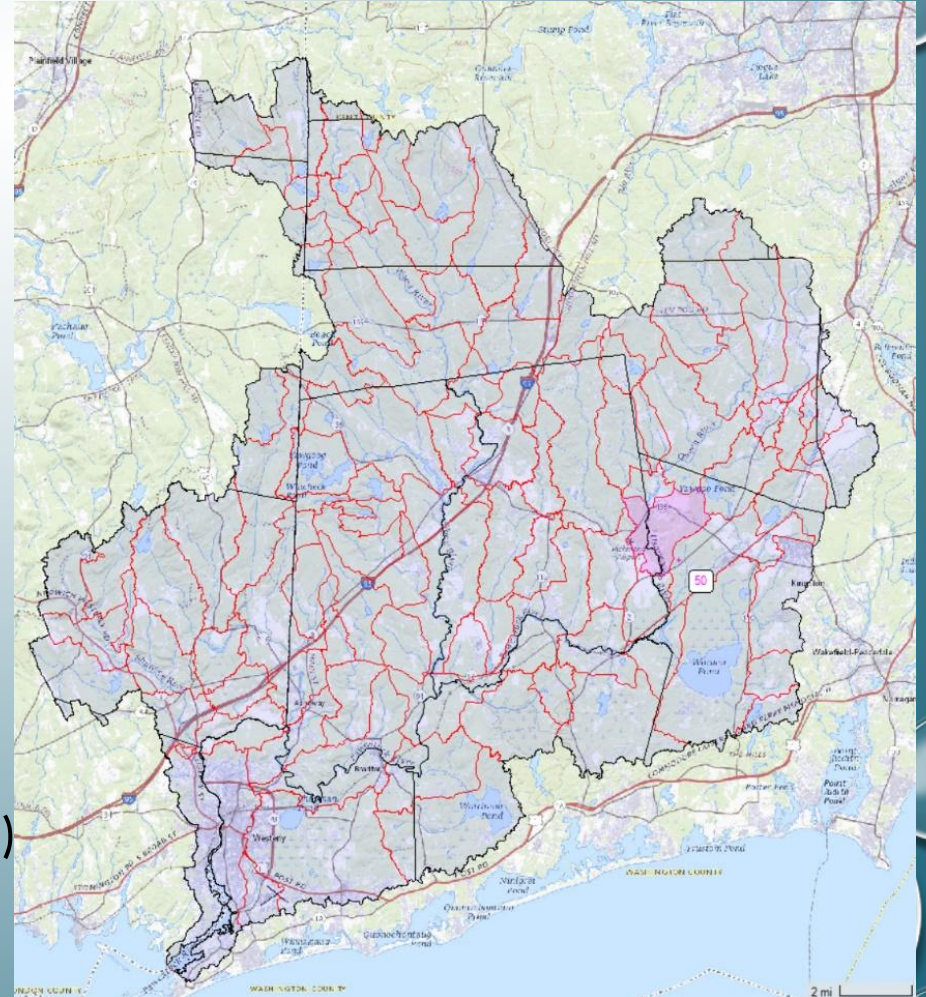
- GEOLOGY AND SOILS
- WATER RESOURCES
- AIR QUALITY
- VEGETATION
- FISH AND WILDLIFE
- SOCIOECONOMICS (INCLUDING ENVIRONMENTAL JUSTICE)
- LAND USE
- TRANSPORTATION
- PUBLIC HEALTH AND SAFETY (INCLUDING INFRASTRUCTURE AND UTILITIES)
- CULTURAL RESOURCES (INCLUDING TRIBAL CONSULTATION)
- VISUAL CHARACTER / AESTHETICS



# HYDROLOGIC MODEL

Produces the Runoff Hydrographs for the Hydraulic Model

- HydroCAD and HEC-HMS Software
- Rainfall Data: NOAA Atlas 14
- Land Cover + Soil Group = Curve Number
- Time of Concentration
- Runoff Hydrograph
- Drainage Area Subdivision (120 each)
- Storage Areas / Hydraulic Structures
- Model Calibration
- Final Runoff Hydrographs for Hydraulic Model

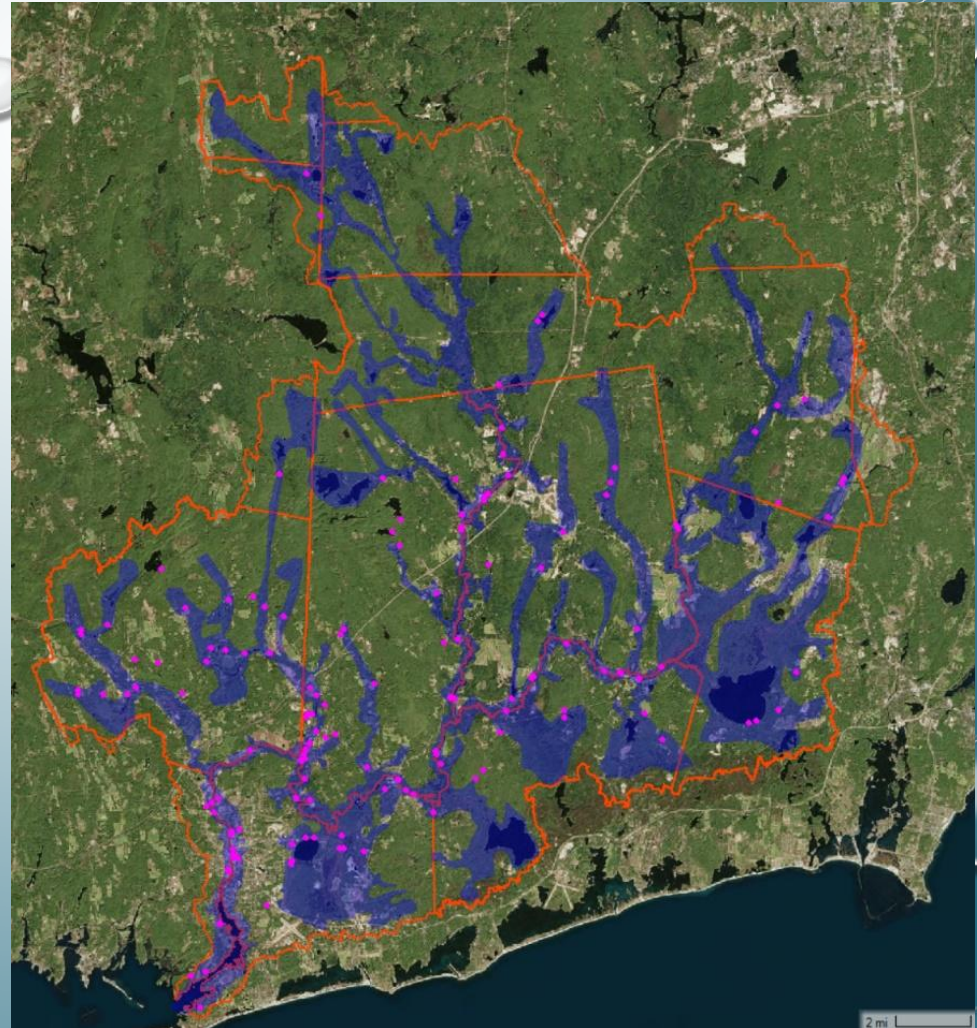




# HYDRAULIC MODEL

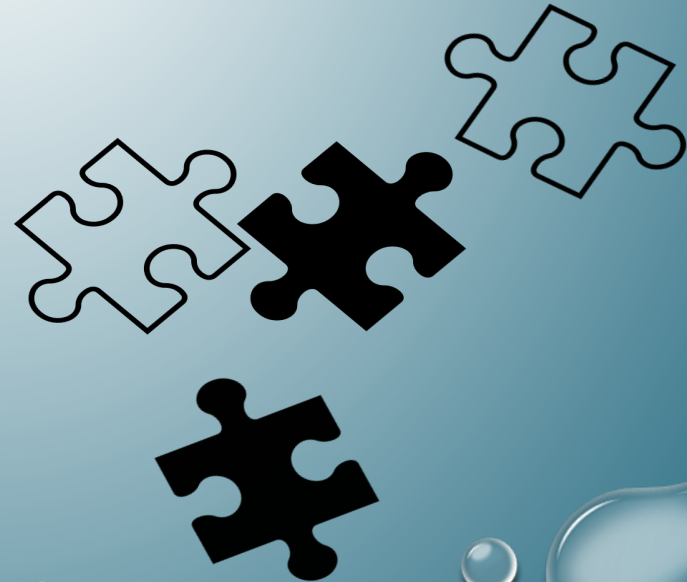
Determines the Hydraulic Conditions within the Model Limits

- HEC-RAS 2D Software
- Terrain, Roughness, Mesh, Hydraulic Structures, Boundary Conditions
- Run recurrent storm events under existing conditions
- Results used to determine and monetize model-wide damages
- Results used to identify potential alternatives
- Base model used to model, assess, and refine alternatives



# FLOOD MITIGATION SOLUTIONS

- FLOOD VOLUME AND RATE REDUCTION
- AVOIDANCE
- FLOODPROOFING
- BARRIERS
- DAM REHABILITATION/REMOVAL
- DRAINAGE IMPROVEMENTS
- NATURE BASED SOLUTIONS





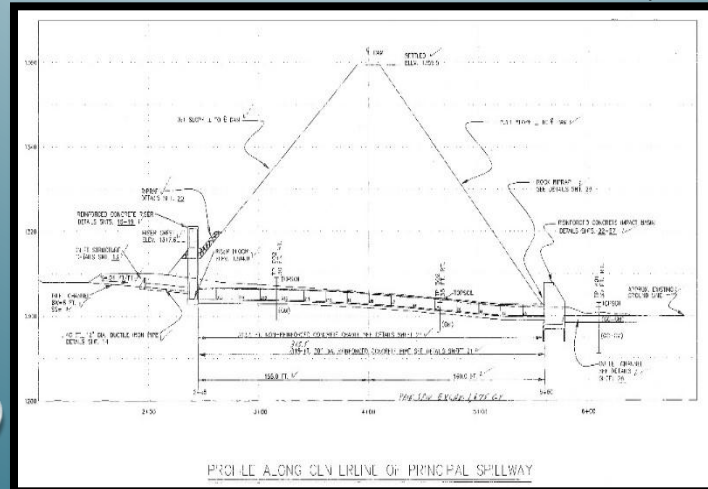
# FLOOD VOLUME AND RATE REDUCTION

## DETENTION STRUCTURES

TEMPORARILY STORE WATER  
REDUCING DOWNSTREAM  
IMPACTS DURING STORM EVENTS,  
COULD INCLUDE DAMS OR  
FLOODPLAIN AREAS



NY-5A Dam – Photo courtesy of Google Earth 2020



NRCS As-Built Plans – Floodwater Retarding Dam NY-5A



# FLOOD VOLUME AND RATE REDUCTION

## INFILTRATION STRUCTURES

INFILTRATE RAINFALL OR SNOWMELT,  
REDUCING VOLUME OF WATER  
CONVEYED DOWNSTREAM

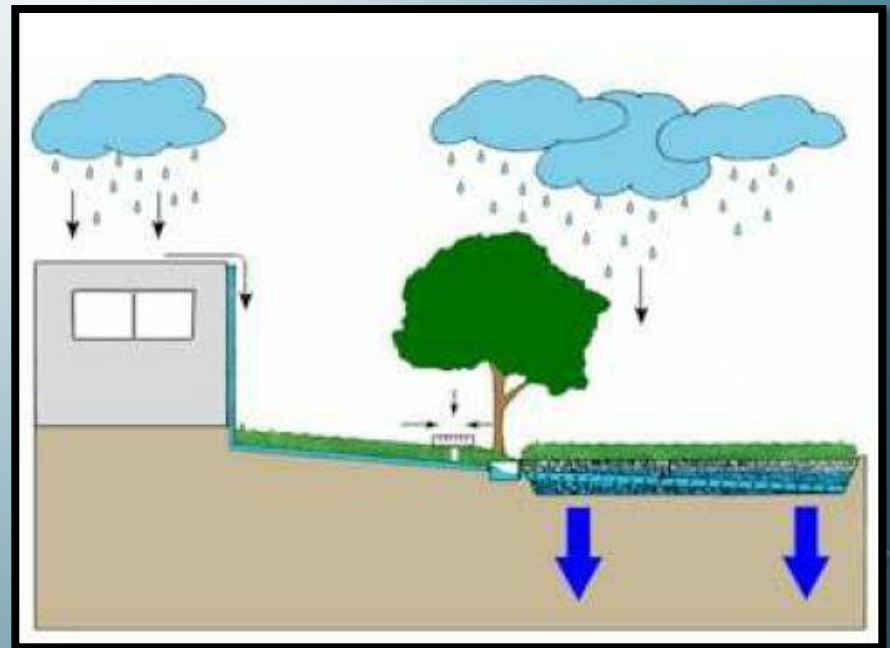


Photo courtesy of PADEP Stormwater Manual 2006



# FLOOD VOLUME AND RATE REDUCTION

## LAND USE CHANGES

ESTABLISH FORESTS OR GRASSY VEGETATION OVER LARGER WATERSHED AREAS TO PROMOTE INFILTRATION AND REDUCE THE RATE OF STORM FLOWS

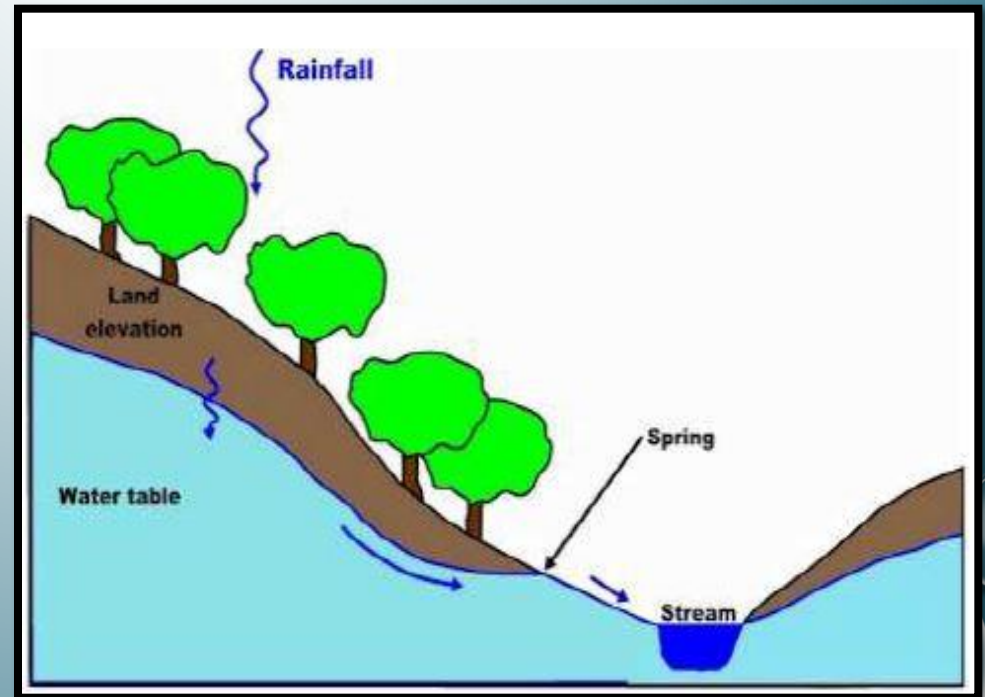


Photo courtesy of PADEP Stormwater Manual 2006



# AVOIDANCE

RESIDENCE OR BUSINESS  
BUYOUTS/RELOCATION

PURCHASE PROPERTIES IN  
FLOODING AREAS AT FAIR MARKET  
VALUE AND CONVERT THE  
PROPERTY TO GREEN SPACE



Photo courtesy of NRCS



Photo courtesy of NRCS



Photo courtesy of NRCS





# AVOIDANCE

ELEVATING STRUCTURES OR ABANDONING  
LOWER FLOOR

RAISE STRUCTURES ABOVE PREDICTED FLOOD  
LEVELS



Photo courtesy of NRCS



Photo courtesy of NRCS



Photo courtesy of NRCS



# FLOODPROOFING

## DRY FLOODPROOFING

STRUCTURE IS RETROFITTED TO PREVENT FLOODWATER FROM ENTERING

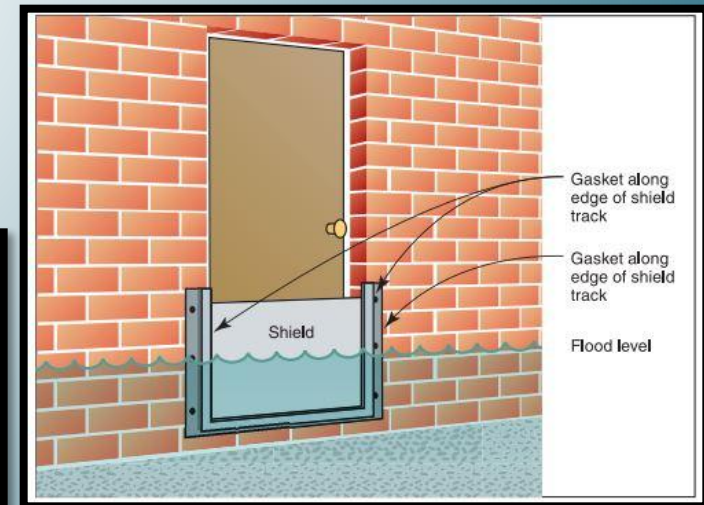
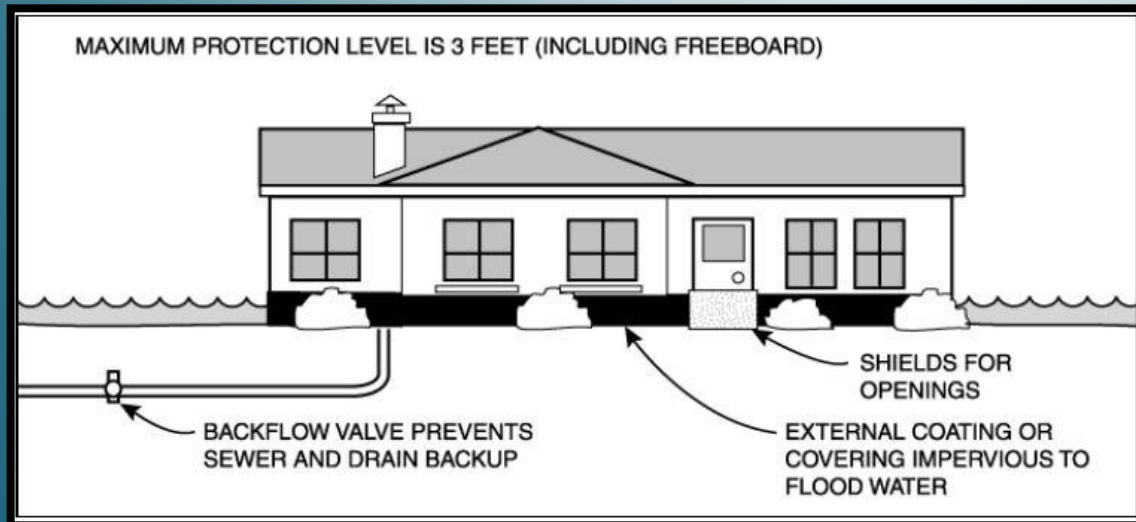


Photo courtesy of FEMA P-312: Homeowner's Guide to Retrofitting

Photo courtesy of FEMA P-551: Selecting Appropriate Mitigation Measures for Floodprone Structures





# FLOODPROOFING

## WET FLOODPROOFING

STRUCTURE IS RETROFITTED TO PREVENT  
DAMAGE FROM FLOODING

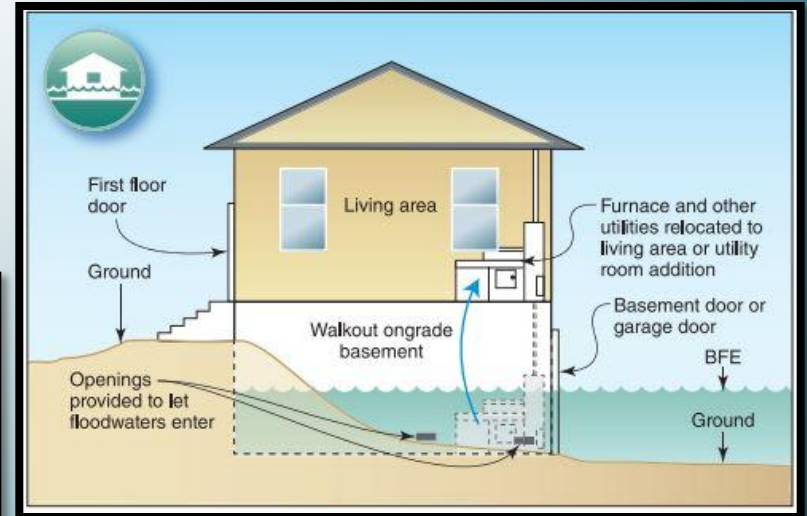
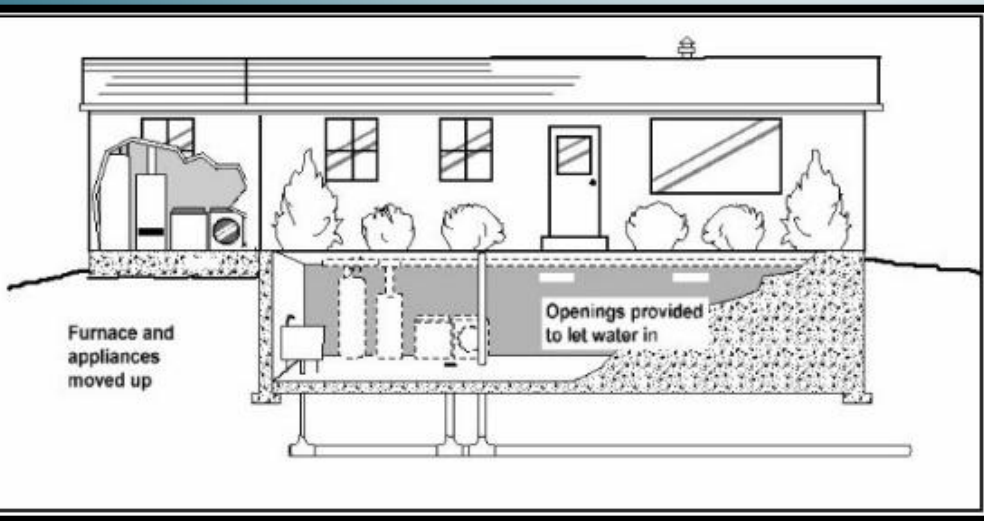


Photo courtesy of FEMA P-312: Homeowner's Guide to Retrofitting

Photo courtesy of FEMA P-312: Homeowner's Guide to Retrofitting



# BARRIERS

## FLOODWALLS AND LEVEES

FLOODWATERS ARE DIVERTED AROUND SENSITIVE STRUCTURES

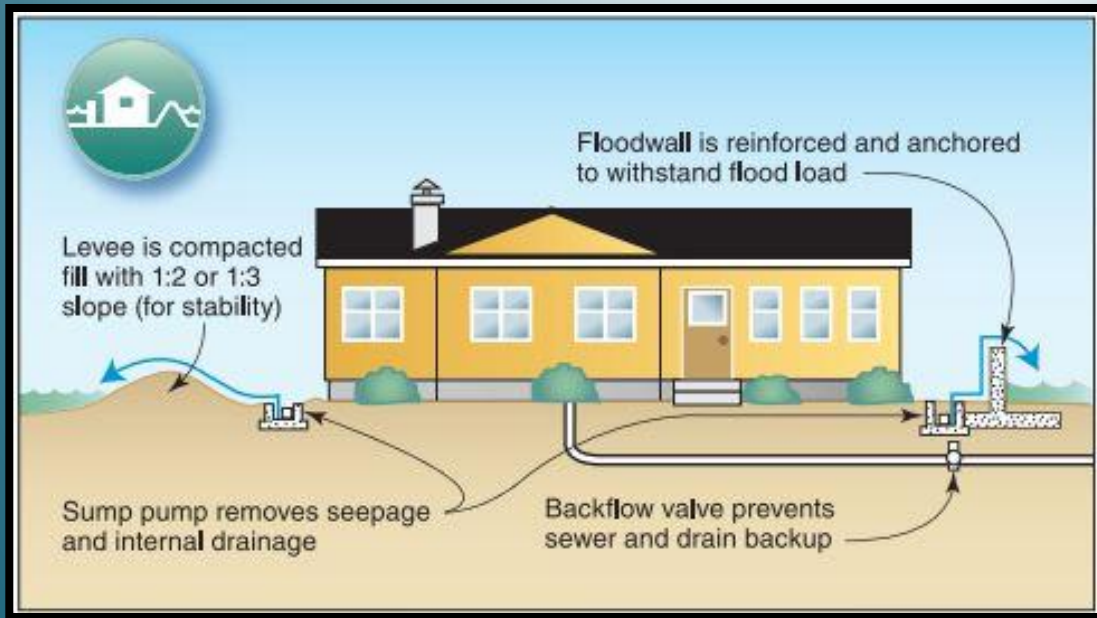


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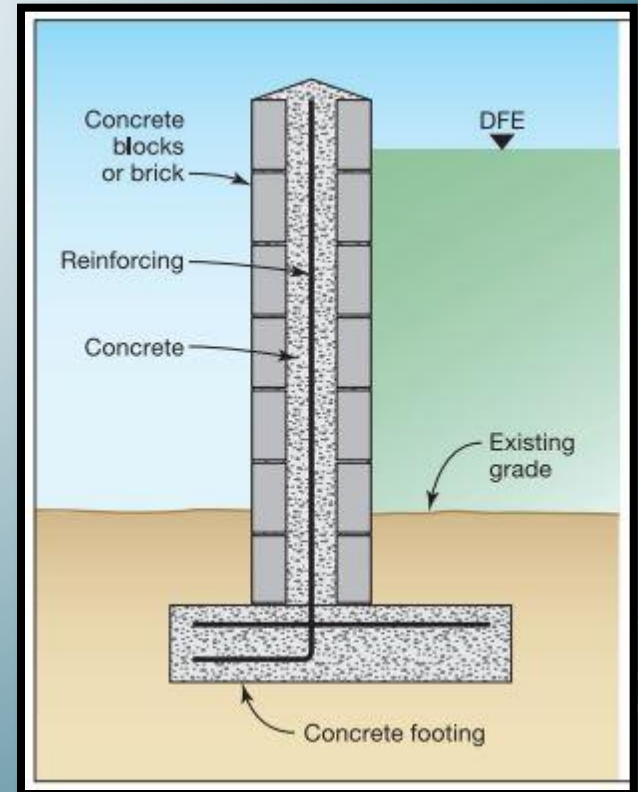


Photo courtesy of FEMA P-259: Engineering Principles and Practices for Retrofitting Flood-Prone Residential Structures





# DAM REHABILITATION/REMOVAL

REPAIR OR REMOVE DAMS

INCREASE STORAGE

CAPACITY OR DECREASE

WATER SURFACE

ELEVATIONS



# DRAINAGE IMPROVEMENTS

**ENLARGE CULVERTS OR STORM SEWERS**

**INCREASE CAPACITY OF DRAINAGE STRUCTURES TO LOWER FLOOD LEVELS**

**RAISE BRIDGE DECKS**

**RAISE BRIDGE DECK TO ENLARGE OPENING AND INCREASE FLOW CAPACITY**



Photo courtesy of FHWA Hydraulic Design of Highway Culverts





# DRAINAGE IMPROVEMENTS

WIDEN AND ENLARGE  
STREAM CHANNELS

INCREASE CAPACITY OF  
STREAM CHANNELS TO  
LOWER FLOOD LEVELS



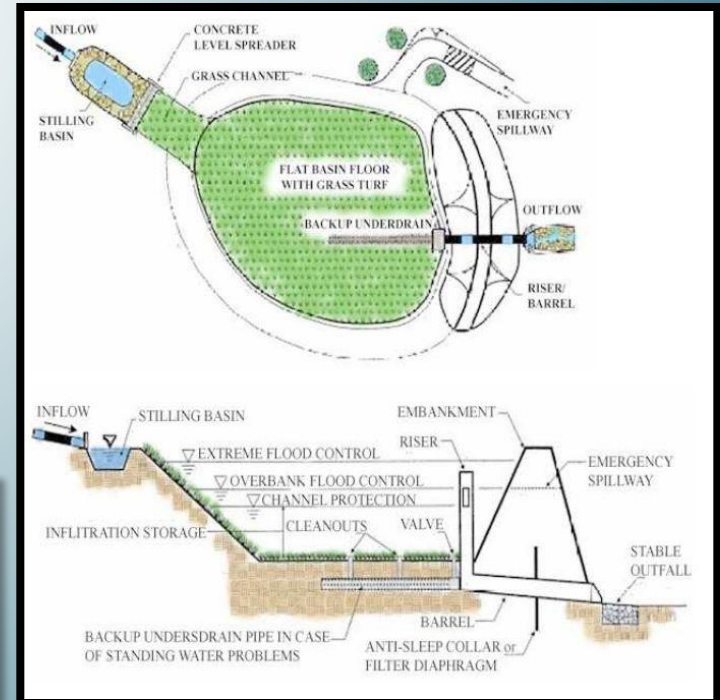
# WATER QUALITY / GREEN INFRASTRUCTURE

## FLOOD MITIGATION CAN IMPROVE WATER QUALITY AND PROVIDE GREEN INFRASTRUCTURE

- Stream Channel Stabilization
- Riparian Corridor Establishment
- Stormwater Controls
  - Water Treatment
  - Stormwater Infiltration
- Landuse Changes
  - Reduce Soil Erosion
  - Provide Buffers
  - Reduce Runoff



Vegetated Infiltration Area - Photo courtesy of PADEP Stormwater Manual 2006



Infiltration Basin - Photo courtesy of PADEP Stormwater Manual 2006





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# CONTACTS

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