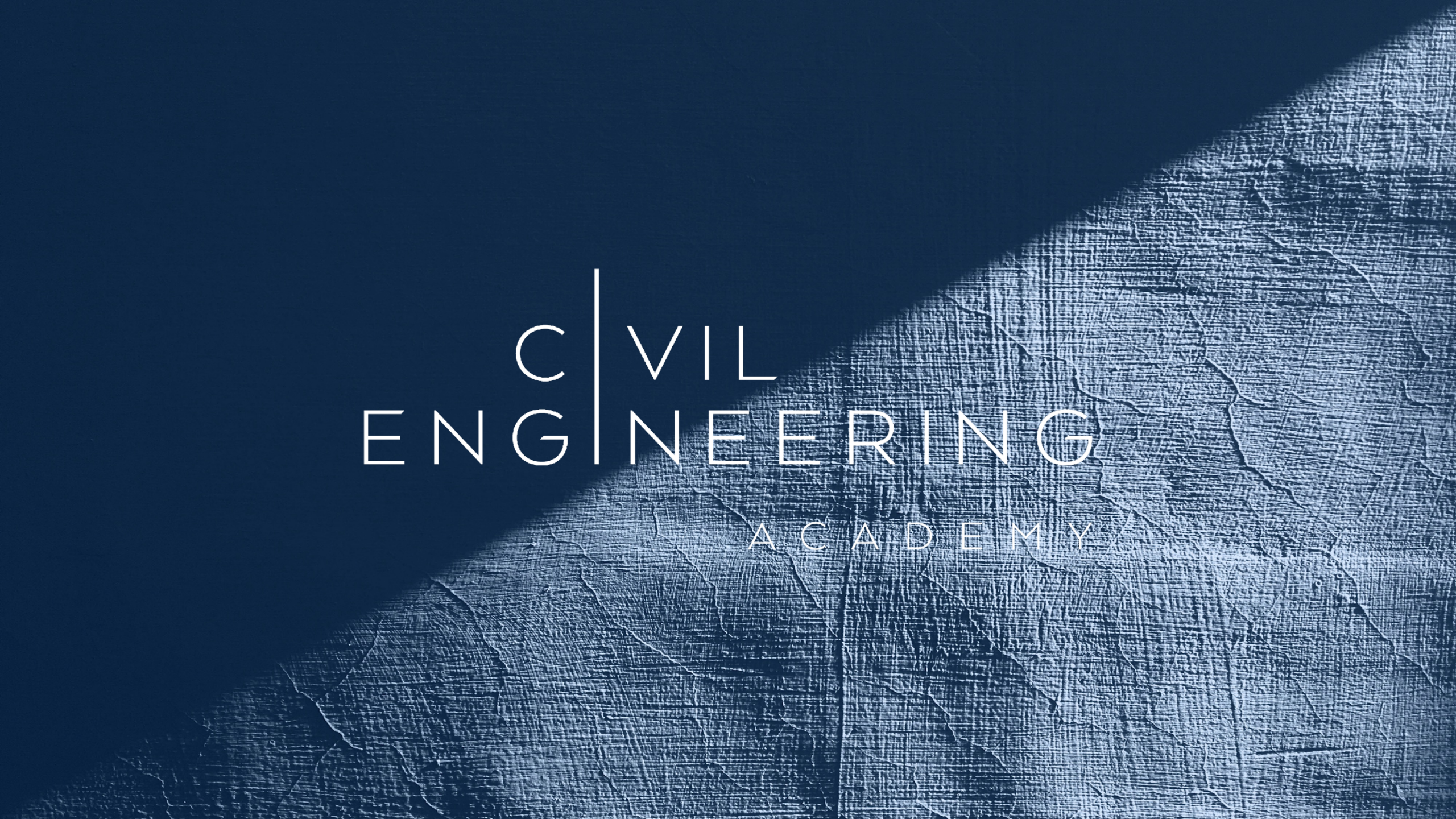
CIVIL
ENGINEERING
ACADEMY

THE ULTIMATE FLOODPLAIN MANAGER REVIEW COURSE

FLOODS & FLOODPLAIN MANAGEMENT

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- Flood – occurs when an area receives more water than it can handle
  - Typically caused by increased precipitation, but can be influenced by tides, storms, or snowmelt

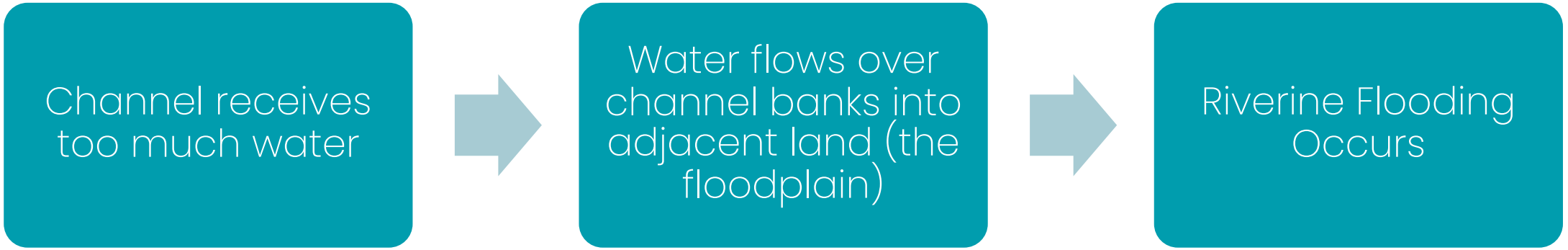
- Floodplain – the portion of land inundated by a flood

- 3 major types of Floods:
  - Riverine Flooding
  - Coastal Flooding
  - Shallow Flooding

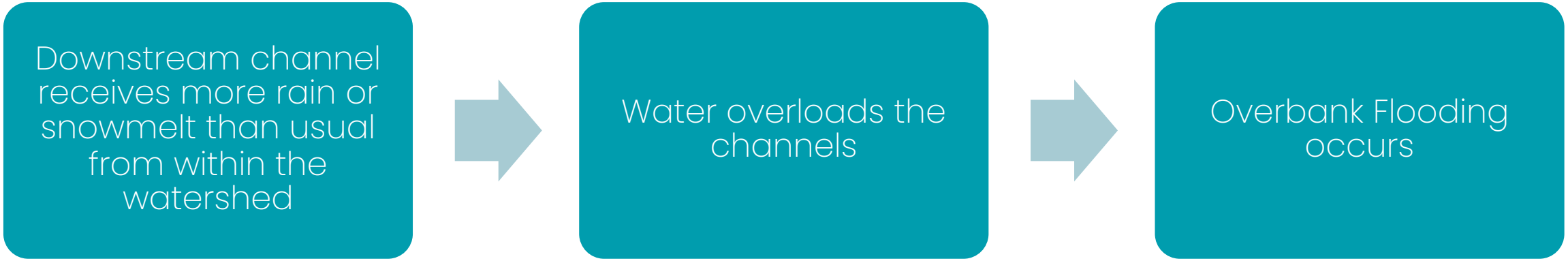
- Velocity – speed of the moving flood water
  - Flood waters faster than 5 ft/sec → high velocity flood

Riverine Flooding

- Watershed – area that drains into a lake, river, bay, or other larger water body
- Channels – defined features that convey water through and out of the watershed
  - Streams, creeks, ditches, etc.



- Riverine Flooding
  - Overbank Flooding – most common type of flooding in United States



- Riverine Flooding
  - Flash Flood – Occurs when a severe storm brings large quantity of rainfall in a short time period
    - Can occur anywhere but areas with steep slopes and narrow streams are most at risk
    - Can also occur in urban environments due to impervious surfaces increasing runoff speed
    - Dam failure and ice jams can also create flash floods.
  - Flash Floods are the main cause of flood related deaths in the United States

- Riverine Erosion
  - As the water moves downstream, the river channels change
    - Thalweg – Channel bottom
    - Meander – curve in the channel
  - Water causes erosion on the outside of a meander and deposits sand and sediment on the inside of the meander.

- https://depositphotos.com/315977146/stock-photo-river-bends-in-ponidzie-countryside.html

Coastal Flooding

- Areas along the coast (along oceans, the Gulf of Mexico, and large lakes) experience coastal storms and coastal erosion.

- Coastal Storms – hurricanes, nor'easters, tropical storms, other severe storms cause most coastal flooding

- Storm Surge - High wind and changing air pressure push water inland
- Tides can also increase the severity of flooding

- Tsunami – pressure wave caused by an underwater earthquake or underwater volcanic activity, can raise sea level to heights greater than 15 ft.

FLOODS & FLOODPLAIN MANAGEMENT

- Coastal Erosion – long term process that shapes and changes shorelines
  - Natural Factors – sand source, sand size and density, sea level, wave dynamics – currents, tides, etc.
  - Shoreline with either accrete or recede

  - Construction of groins, seawall, jetties, channel dredging, etc. may alter natural sand transport systems

- Coastal Flooding
- Lake Flooding – shorelines along large lakes experience same flooding and coastal processes that ocean coastlines do
  - Severe storms have caused erosion and produced wave and storm surge along the Great Lakes
  - FEMA Great Lakes Coastal Analysis and Mapping to map this region using same techniques as ocean coastal areas.

- Shallow Flooding – seen in flat areas without channels or with channels that are undersized which do not allow water to drain
  - 3 types:
    - Sheet Flow
    - Ponding
    - Urban Drainage

- Sheet Flow – no defined channel, floodwater spreads out over large area
  - Zone AO on FEMA Floodmap, No BFE

- Shallow Flooding

- Ponding – flat areas, runoff collects in depressions and can't drain; creates temporary pond until the water infiltrates into soil or evaporates
  - Sometimes may have to be pumped out
  - Zone AH on FEMA Floodmap "H = Holding"

- Shallow Flooding

- Urban Drainage
- storm sewer infrastructure – ditches, inlets, pipes, retention ponds etc. built to a certain design-level storm event
  - 10-year, 15-year, 50-year storm

- Special Flood Hazards – 5 types:
  - Closed Basin Lakes
  - Uncertain Flow Paths
  - Dam Breaks
  - Ice Jams
  - Mudflows

- Closed Basin Lakes
  - Lakes with no outlet, or lakes with undersized, regulated or elevated outlet
  - Seasonal rainfall increases cause water level to rise faster than it can drain
  - Water may stay elevated for a long time and surround buildings and structures

- Special Flood Hazards

- Uncertain Flow Path
  - Some areas – every flood changes the channel
  - Alluvial Fans in mountainous area caused by sediment dropping and spreading out from floodwater; not predictable
  - Hazards:
    - Velocity of Floodwater
    - Sediment and debris
    - Channel may relocate/move during the flood

- Special Flood Hazards

- Dam Break
  - Releases large volume of water at high velocity
  - Typically, little/no warning → little/no time for evacuation

  - 3 potential reasons:
    - Foundation Failure – seepage, settling, earthquake
    - Deficiency in design, construction, or materials
    - Capacity of dam spillway exceeded by flooding

- Special Flood Hazards

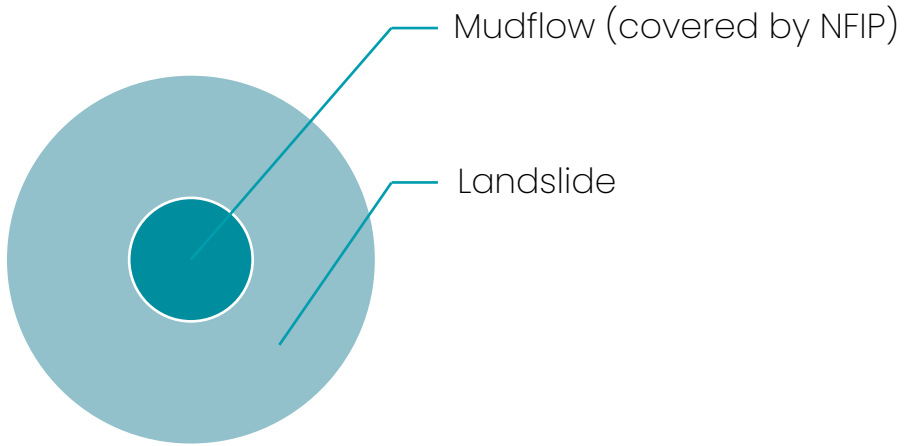
- Ice Jam
  - Warm weather and rain melt ice and broken chunks float downriver until blocked by an obstruction → cause upstream flooding

  - 3 hazards :
    - Sudden flooding of upstream areas with little/no warning
    - Moving ice chunks topple trees and crush buildings
    - Ice jams break and cause sudden flooding of downstream areas

- Special Flood Hazards

- Mudflow/Mudslide
  - "Flow or inundation of liquid mud down a hillside as a result of a dual condition of loss of vegetation and the subsequent accumulation of water on the ground preceded by a period of heavy/sustained rain."

  - Flood insurance (NFIP) covers mudslides that meet this definition
    - But not all landslides, because not all landslides are caused by water



- Benefits of Floodplains

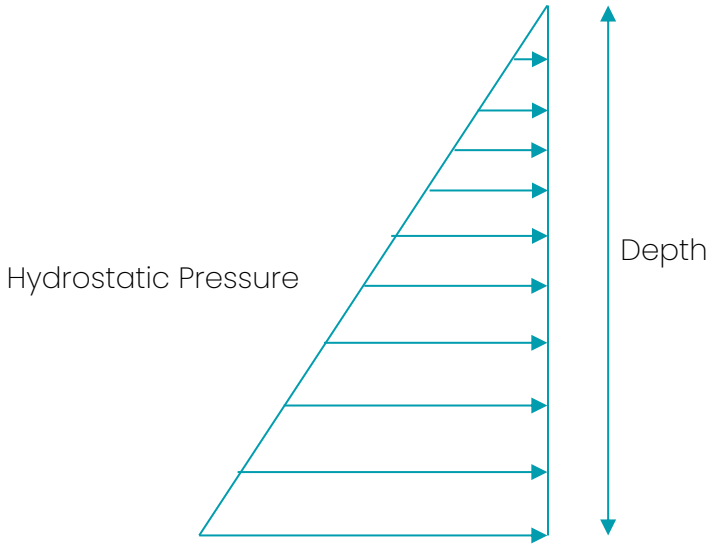
  - Maintain water quality by filtering nutrients and impurities from runoff
  - Enhance biological productivity, maintain biodiversity of ecosystems, provide habitats for fish and wildlife

  - Opportunities for scientific study, research, outdoor education
  - Increase community quality of life: parks, bike/walking paths, aesthetic features

  - https://st.depositphotos.com/1372276/2123/i/600/depositphotos_21235401-stock-photo-shoes-of-trekking-in-wood.jpg

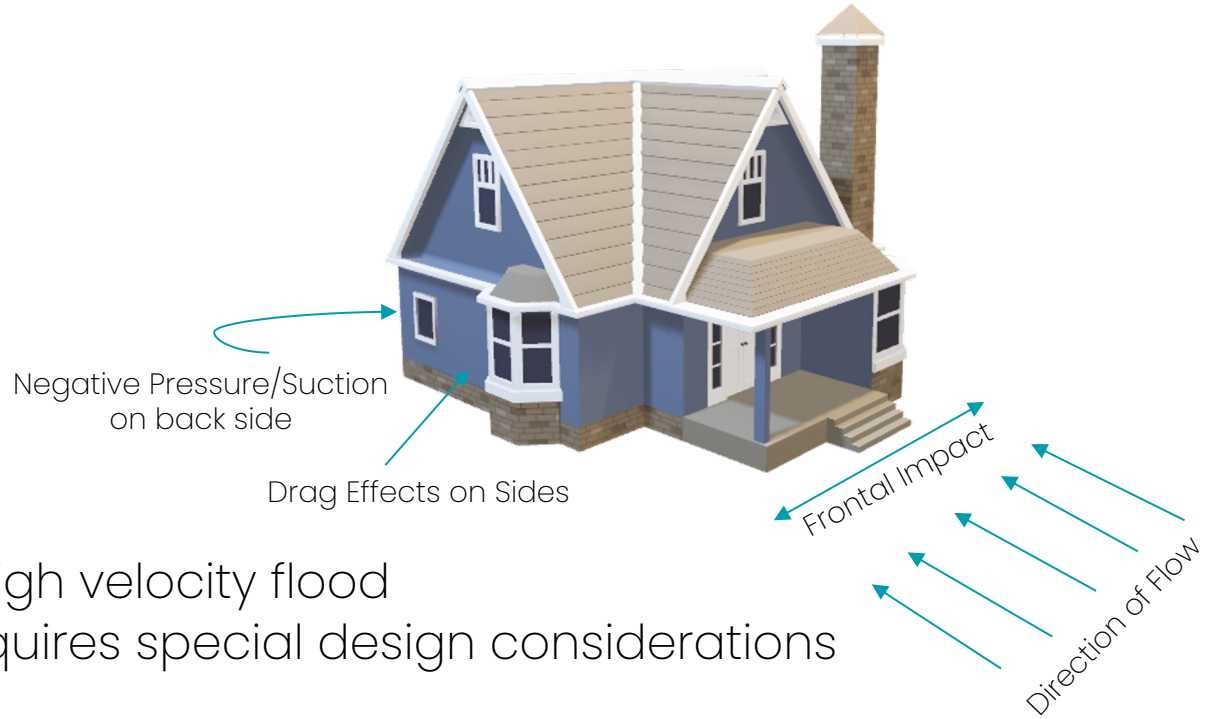
- Flood Damage – 5 types:
  - Hydrostatic Forces
  - Hydrodynamic Forces
  - Debris Impact
  - Soaking
  - Sediment and Contaminants

- Flood Damage – Hydrostatic Forces
  - Weight of standing water puts hydrostatic pressure on a structure
  - Deeper water → more it weighs → greater hydrostatic pressure
  - 3 ft. of standing water can collapse the walls of a house



As depth of water increases, hydrostatic pressure increases

- Flood Damage – Hydrodynamic Forces
  - Hydrodynamic Force is created by moving water & damages a buildings walls
    - Water strikes structure → frontal impact
    - Water runs along sides of buildings → drag forces and effects
    - Negative pressures/Suction created on downstream side of structure as water passes



  - 5 ft/s = high velocity flood
    requires special design considerations

- Flood Damage – Debris Impact
  - Floodwaters pickup and float large object: lumber, logs, ice, fuel tanks, vehicles, dumpsters, debris, etc..
  - These objects can cause damage to structures, and injure or kill people

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- Flood Damage – Soaking
  - Furniture, home contents, and building materials get soaked with floodwater and change composition and shape
  - Engines and appliances will not work
  - Lasting impacts of mold, mildew, etc..

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- Flood Damage – Sediment and Contaminants
  - Furniture, home contents, and building materials get soaked with floodwater sediment, and pollutants/other contaminants
  - Drying out is not enough, must be professionally cleaned and remediated
    - Mold, mildew concerns, etc.
    - Floodwaters may also contain untreated sewage if upstream wastewater treatment plants were inundated
    - Sediment and sand in floodwaters in coastal areas and western desert areas

- Floodplain Management
  - Decision making process that aims to achieve the wise use of the nation's floodplains. Wise use means both reduced flood losses and protection of the natural resources and functions of floodplains.

  - Unified National Program for Floodplain Management – created by National Flood Insurance Act of 1968 to coordinate efforts of everyone involved in floodplain mgmt. (fed, state, local, and private parties);

    - Identified 4 floodplain mgmt. strategies.
    - Coordinated Federal Interagency Floodplain Management Task Force

- 4 Floodplain Management Strategies:
  - Modify Human Susceptibility to Flooding
  - Modify the Impact of Flooding
  - Develop Projects that Control Floodwater
  - Preserve and Restore Natural Resources

- 4 Floodplain Management Strategies:
  - Modify Human Susceptibility to Flooding
    - Zoning ordinances and development policies – keep development out of hazard areas
    - Preserve open space in floodplain areas & natural functions of floodplains
    - Elevate or floodproof buildings
    - Prepare people for flooding via emergency plans

- 4 Floodplain Management Strategies:
  - Modify the Impact of Flooding
    - Provide information and education to assist homeowners and educate about flood protection measures
    - Educate about following flood emergency procedures during and after event
    - Reduce financial impacts of flooding – disaster assistance, flood insurance, tax incentives
    - Preparing post-flood recovery plans to help people rebuild and protect against future floods

- 4 Floodplain Management Strategies:
  - Develop Projects that Control Floodwater
    - Building dams and reservoirs, dikes, levees, and floodwalls
    - Alter channels to be more efficient, and divert flows from developed areas
    - Land application treatments to increase infiltration to store water
    - On-site retention ponds and other measures to store excess runoff
    - Construct shoreline protection measures that account for natural shoreline movement
    - Control runoff from areas developing outside the floodplain

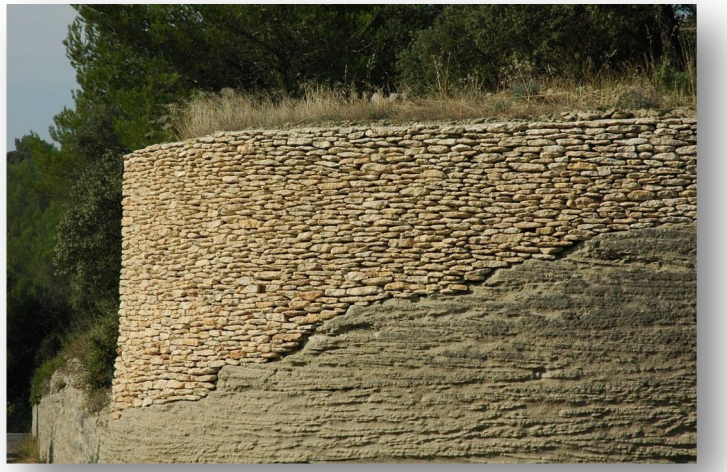
- 4 Floodplain Management Strategies:
  - Preserve and Restore Natural Resources

    - Steer development away from natural areas
    - Policies on design and construction and location of public infrastructure, public utilities, etc..
    - Acquire land and preserve natural open space to preserve natural functions and habitats
    - Educate citizens on natural benefits of floodplains
    - Tax incentives to preserve land or restore to natural state
    - Beach nourishment projects and dune building to protect inland development by maintaining protection of natural features.

COMING UP

Keep Going!

- FEMA 480 Unit 1 Review Questions
- Unit 2 National Flood Insurance Program (NFIP)

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