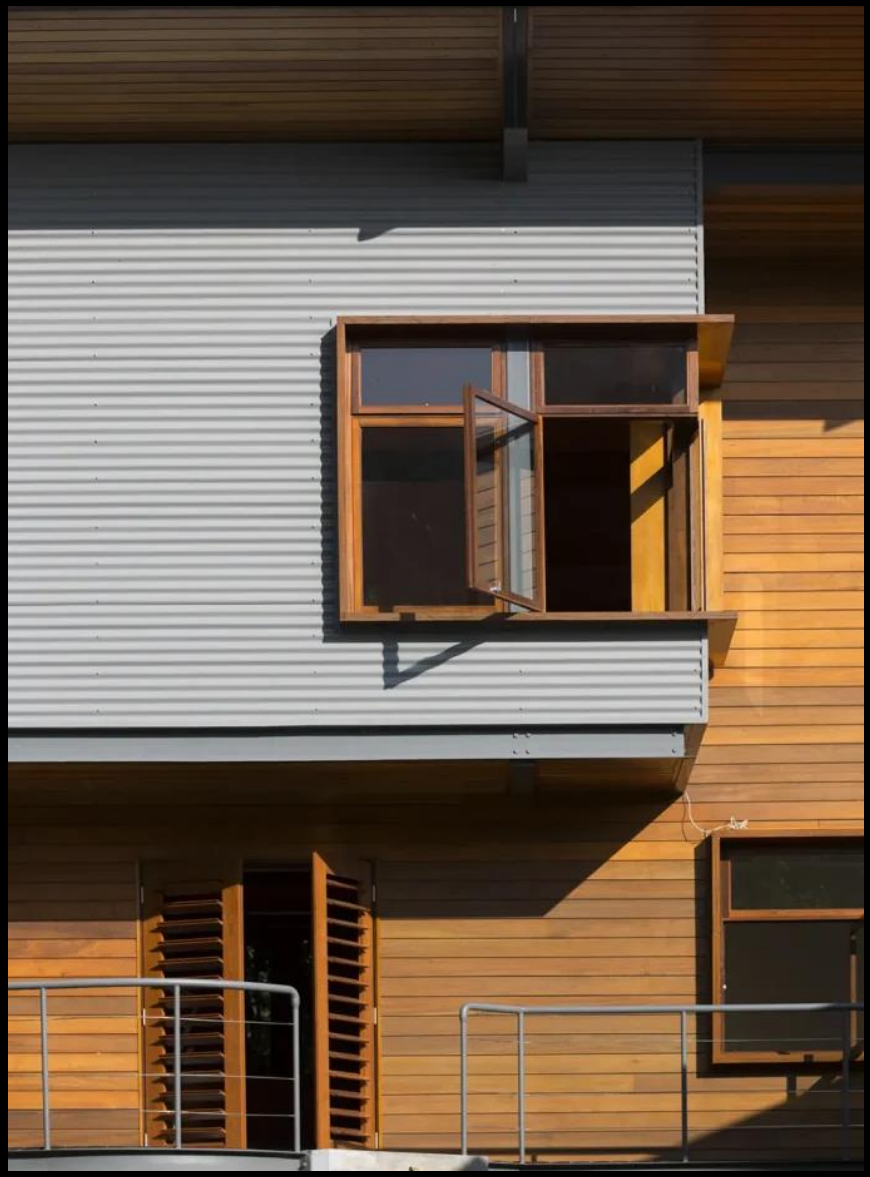


Flood-Resilient Infrastructure

Vikrant Bansal

2314094

Introduction

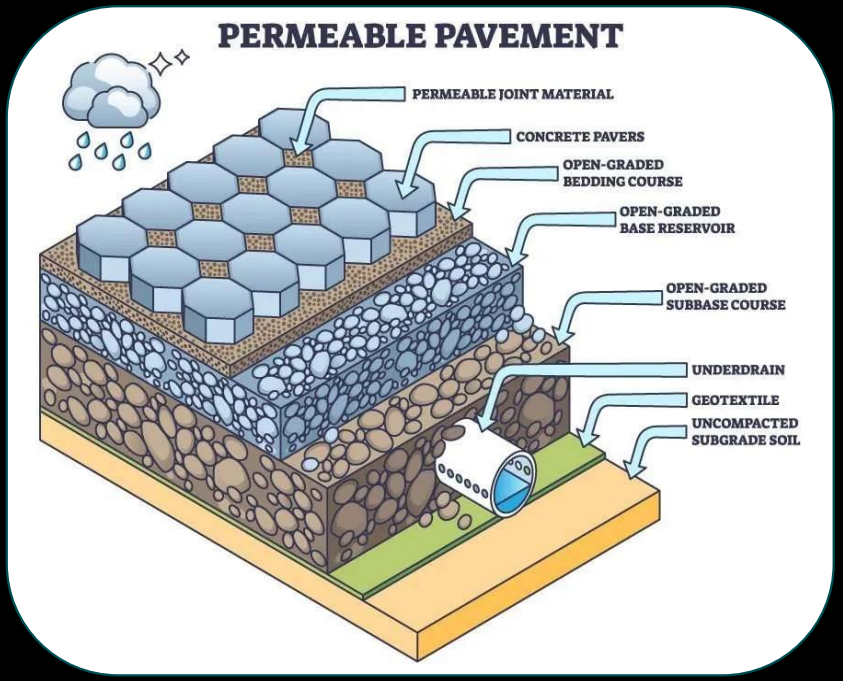
•Flooding is a major global concern due to climate change and urbanization.

•Resilient infrastructure helps cities adapt to frequent and severe floods.

•Combining engineering solutions with nature-based approaches can minimize flood damage.

Permeable Pavements

- → Allows rainwater to percolate into the ground
- → Reduces surface runoff and prevents floods
- → Replenishes groundwater supply
- → Used in roads, parking lots, and sidewalks

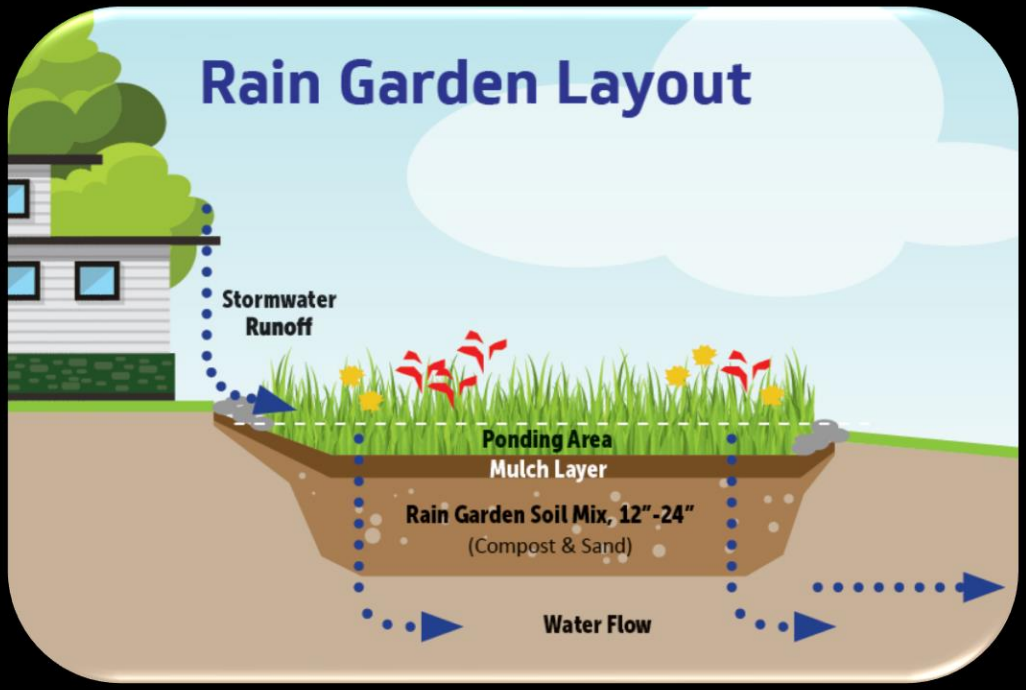


Green Roofs

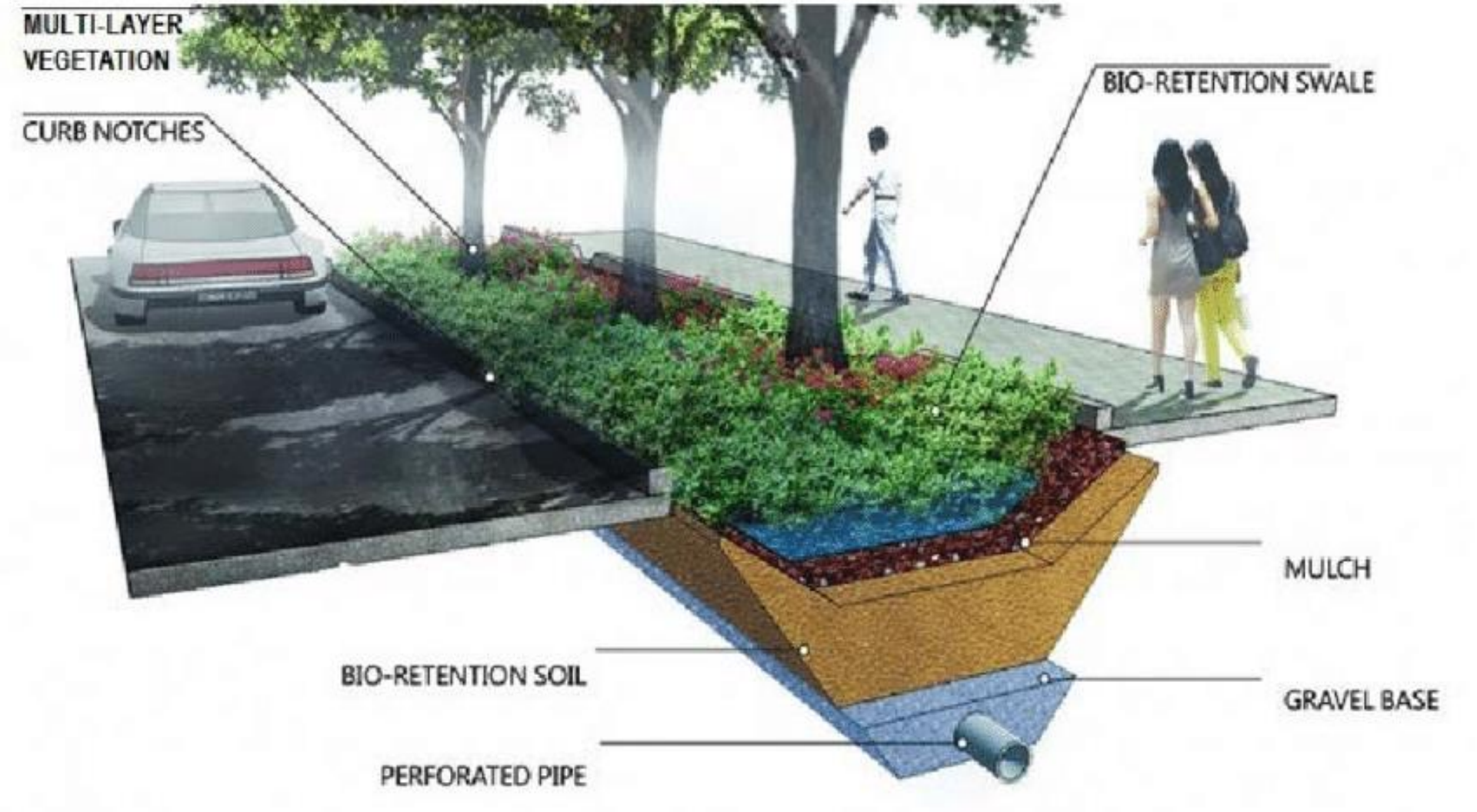
- → Vegetation on roofs absorbs rainwater
- → Reduces runoff and provides insulation
- → Improves air quality and reduces heat islands

Bioswales and Rain Gardens

- → Vegetated channels or landscaped depressions
- → Captures and filters stormwater runoff
- → Slows water flow and reduces pressure on drainage systems

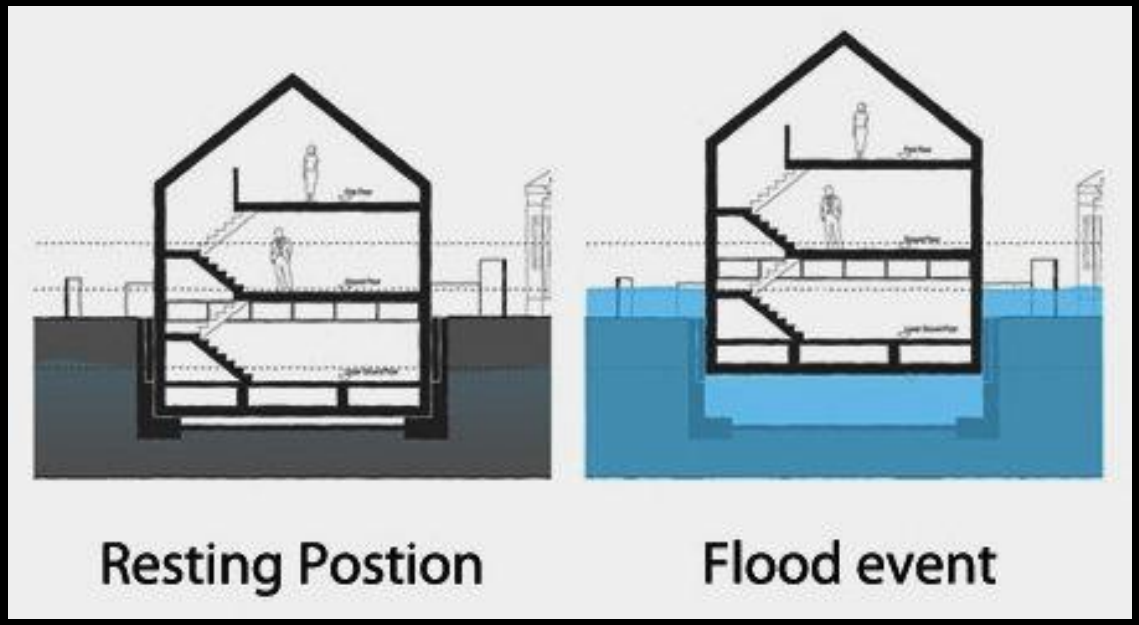


Bioswales


MULTI-LAYER VEGETATION
CURB NOTCHES
BIO-RETENTION SWALE
MULCH
BIO-RETENTION SOIL
GRAVEL BASE
PERFORATED PIPE

Flood-Proof Buildings

- → Buildings designed to withstand floods
- → Elevated structures or flood-resistant materials
- → Protects against flood damage



Amphibious Architecture

High Rise Building

Smart Drainage Systems

→ Incorporates sensors and real-time data

→ Manages stormwater flow during heavy rains

→ Reduces risk of urban flooding

•**Real-time Monitoring**: Sensors placed in drainage systems monitor water levels, rainfall intensity, and flow rates. This allows city authorities to track conditions in real-time and identify areas at risk of flooding.

•**Automated Control Systems**: Smart systems can automatically open or close gates and valves in response to water levels, ensuring optimal flow and preventing water from backing up during heavy rainfall.

•**Improved Maintenance**: With sensors detecting blockages or damage, smart drainage systems alert maintenance crews immediately. Quick intervention helps prevent flooding caused by clogged drains.

•**Dynamic Storage Management**: Some systems use underground storage tanks or reservoirs that can be managed dynamically. During heavy rains, excess water is temporarily stored and gradually released to prevent overwhelming the drainage network.

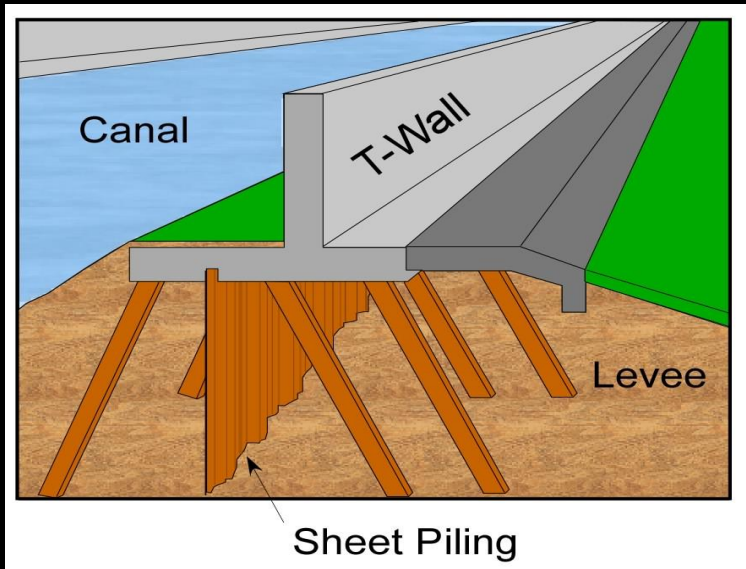
Floodable Parks and Public Spaces

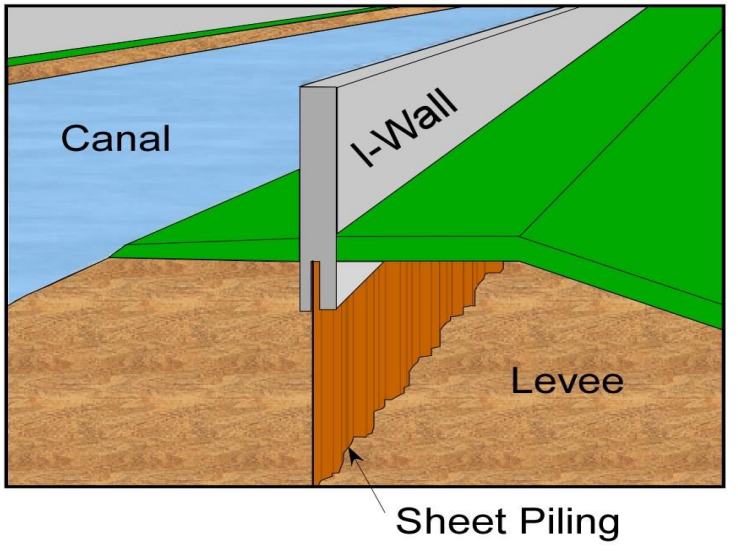
- → Parks or spaces that temporarily hold water
- → Acts as reservoirs during heavy rainfall
- → Gradually releases water to prevent flooding

Floodable Park

Levee and Flood Wall Systems

- → Engineered embankments or walls along rivers
- → Protects areas from flooding
- → Automated floodgates for controlling water flow



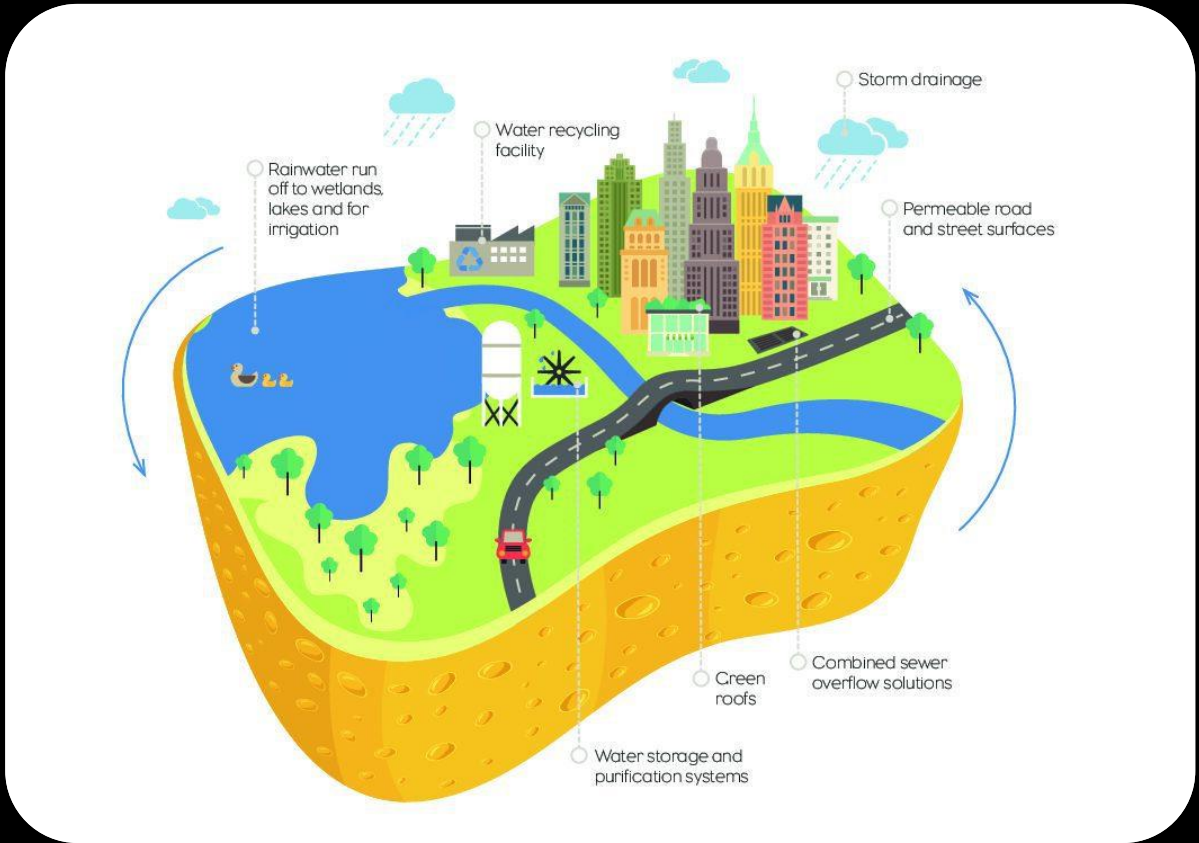


Sponge Cities

→ Urban design approach using natural water storage

→ Incorporates wetlands, green infrastructure, permeable surfaces

→ Absorbs excess water and prevents urban flooding



River and Coastal Flood Barriers

- → Movable or fixed barriers in coastal or river regions
- → Protects cities from tidal surges and river overflow
- → Strategically placed for flood defense

References

- **United Nations Office for Disaster Risk Reduction (UNDRR)**
  Article: "Words into Action Guidelines: Nature-based solutions for disaster risk reduction"
  Publication Number: UNDRR/NA/2020/5
  Source: https://www.undrr.org/publication/words-action-guidelines-nature-based-solutions-disaster-risk-reduction

- **American Society of Civil Engineers (ASCE)**
  Article: "Designing Urban Flood-Resilient Infrastructure"
  Journal: ASCE Journal of Infrastructure Systems, Vol. 25, No. 3
  DOI: 10.1061/(ASCE)IS.1943-555X.0000497
  Source: https://ascelibrary.org/doi/10.1061/(ASCE)IS.1943-555X.0000497

- **World Bank Group - Water Resources Management**
  Article: "Flood Risk Management in Urban Areas"
  Publication Number: WBG-ENV-2021-12
  Source: https://openknowledge.worldbank.org/handle/10986/35690

- **FEMA (Federal Emergency Management Agency)**
  Article: "FEMA P-348: Protecting Building Utility Systems From Flood Damage"
  Publication Number: FEMA P-348
  Source: https://www.fema.gov/sites/default/files/2020-07/fema_p-348.pdf

- **European Environment Agency (EEA)**
  Article: "Adaptation to Climate Change: Nature-Based Solutions for Resilient Cities"
  Publication Number: EEA Report No 1/2017
  Source: https://www.eea.europa.eu/publications/climate-change-impacts-and-vulnerability-2017


THANK YOU