# Levee

## Overview

- Levees are mounds of compacted soil which prevent low to moderate flood levels from reaching a structure.
- Levees require more land than floodwalls and other adaptation strategies.
- Residential levees are typically a maximum of 6 feet high.
- Levees must be designed with several factors in mind:
  - Base flood elevation level
  - Hydrostatic forces
  - Natural topography
  - Water velocities
  - Scour potential
- Sump pumps and emergency back-up power systems should be installed to remove rain and seepage from inside the floodwall.
- Utility lines that are located under the levee must be excavated, backfilled, and relocated in order to prevent seepage along the lines.
- Native vegetative coverage on the flood side of the levee may help prevent levee erosion.
- Depending on the height of the levee, movable closures (shields or flood gates) may need to be installed for driveways or other openings if vehicle ramps are not feasible.
- Levees may not reduce hydrostatic pressures for below-grade foundations due to seepage through the soil layer.
- A geotechnical engineer must ensure that the levee will not cause flooding on adjacent properties or cause flood hazards upstream.
- If a flood event occurs that overtops the levee, flood damage will not be avoided.
- This measure cannot be used to bring non-NFIP compliant structures into compliance.

Photo credit: FEMA

## Key Takeaways

During flooding events, floodwater can inundate a structure's basement or lowest floor.

Additionally, flood waters may exert pressure on the structure's walls and/or carry floating debris and ice which can damage the structure.

In cases where structures cannot be elevated or relocated, levees can be constructed to prevent flood damage costs by acting as a barrier to advancing flood waters, associated pressurization, and flood borne debris.

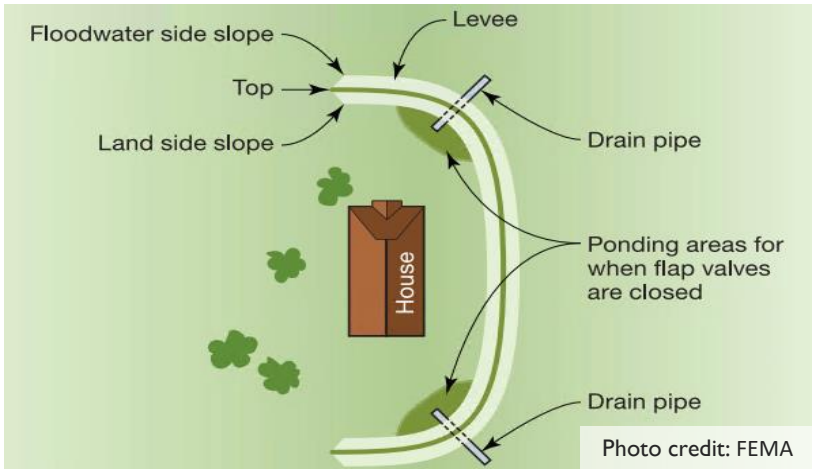


Photo credit: FEMA

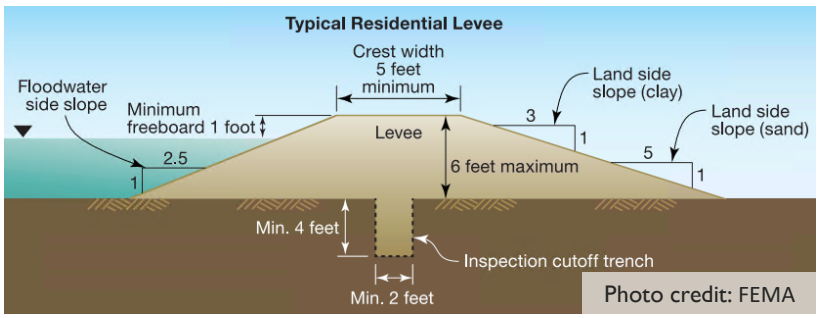


Photo credit: FEMA

# I-ADAPT

## Yard Adaptation

## Levee

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## Estimated Costs/Benefits

*U.S. dollars (2022), estimates are subject to change

| Potential Costs | | Potential Benefits | | |
|---|---|---|---|---|
| *Item* | *Estimate* | *Post-Flood Recovery Actions* | | *Estimate* |
| Levee construction | $35-$60 yard | Flood damage recovery (professional clean-up, mold removal, replacement/ repair of flood damaged items) | 1 inch water | $10,800- $53,500+ |
| Fill | $20-$30 per cubic yard | | ↓ | ↓ |
| Sump pump system | $100-$4,000 | | 3 feet water | $39,800- $185,700+ |
| **ESTIMATED TOTAL COST** | **Highly variable depending on size of levee** | **ESTIMATED TOTAL SAVINGS** | **$10,800- $203,200+** | **$10,800- $185,700+** |

## Potential Funding Sources

- Building Resilient Infrastructure and Communities Grant (BRIC)

## Additional Resources

- FEMA Engineering Principles and Practices for Retrofitting Flood-Prone Residential Structures (FEMA P-259)
- FEMA Homeowner's Guide to Retrofitting (Chapter 8)
- FEMA Levee Design
- USACE Levee Owner's Manual for Non-Federal Flood Control Works

**Resources can also be found at https://de.gov/iadapt**

## Additional Actions

- A sump pump will need to be installed to remove precipitation and any seepage from inside the levee.

## Expected Maintenance

- This measure requires extensive annual maintenance and inspections.
- Keep the vegetation healthy and prevent large tree roots from growing on the levee. Mow regularly.
- Visually inspect the levee regularly.

## Permitting Agencies

Contacts for permitting requirements include but are not limited to the following:

- Your city and/or county government for local flood ordinances or regulations
- Your city and/or county government for building permits
- DNREC Coastal Construction Permit

## Who to Contact

- Flooding contractor
- Geotechnical engineer
- Utility companies

Technical definitions and more information are located on the I-ADAPT website: https://de.gov/iadapt.



For more information, contact DNREC's Division of Climate, Coastal and Energy at DNREC_IADAPT@Delaware.gov