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Emergency Levees



Typical Levee Design

Levee fill material

- Dependent on materials at hand – clay or sand
- Clay Fill (preferred)
 - Impermeable
 - Smaller levee section compared to sand fill due to impervious nature of soils
 - Resistant to erosion
 - May be more difficult to construct than sand levee if materials frozen
- Sand Fill
 - Permeable – possible seepage related problems
 - Levee section requires flatter slopes than clay fill levee due to seepage
 - Less resistant to erosion



Typical Levee Design (cont)

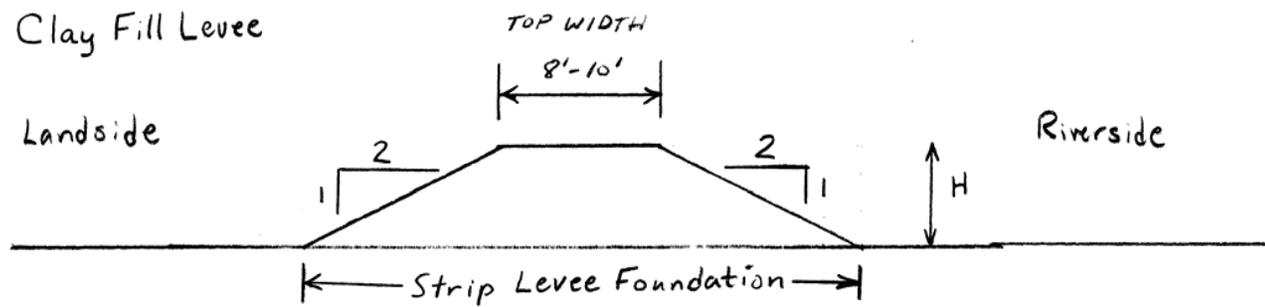
Emergency Levee Dimensions

- Top Width: 8 to 10 feet
Minimum required width for operation of construction equipment
- Side Slopes:
 - Clay Fill: 1V on 2H to 2 ½ H both sides
 - Sand Fill:
 - 1V on 3H riverward
 - 1V on 5H landward

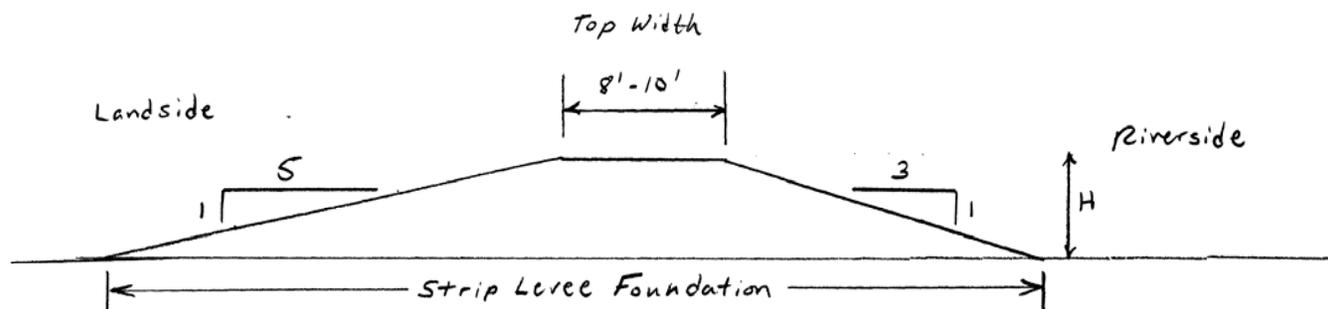


Typical Levee Design (cont)

1. Clay Fill Levee



2. Sand Fill Levee





Emergency Levee Construction

- Strip foundation of levee footprint to create clean interface between levee fill material and foundation soils. Remove snow, ice, organic material (ex. topsoil, turf, etc.)
- Break through frost if possible



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Emergency Levee Construction

- Place fill material in 9 to 12” lifts
- Compact levee fill with construction equipment (ex. Dozers, dump trucks)



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Stripping topsoil prior to placing levee fill



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Placement of clay fill over stripped levee foundation



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Spreading and compacting clay fill for levee



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Placement and compaction of clay fill



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Finished emergency clay fill levee



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Emergency Construction Earthen Levee - Problems

- Foundation Preparation: stripping levee footprint
 - Soft foundation conditions – difficult to operate heavy construction equipment
 - Frozen soil – difficult to remove
 - Trees and brush in levee footprint
 - Structures / utilities in levee footprint



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Earthen Levee – Problems (cont.)

- Constricted areas: site conditions may make it difficult to fit levee in the required space (structures, utilities, trees)
 - Example: A 5 foot high clay levee requires a minimum clear base width of approximately 30 feet
- Settlement: Weight of levee can cause consolidation of foundation soils resulting in settlement of levee
- Stability: Foundation soils may not be able to support weight of levee, causing the levee to fail



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Earthen Levee – Problems (cont.)

- Seepage: Height of water surface on riverward side of levee coupled with types of soils in the levee and foundation can cause seepage through and/or under levee. If seepage forces are high enough material can be lost from within the levee or foundation soils
- Interior drainage: Levees often cutoff normal drainage paths to river, which could result in interior flooding



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Earthen Levee – Problems (cont.)

- Erosion of levees due to:
 - High channel velocities
 - Ice and debris flows in channel
 - Erodeable levee material (sand)



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Earthen Levee – Problems (cont.)

- Removal of levees after flood event
 - Costly
 - Messy
 - Disruption to traffic
 - Safety issues due to construction and hauling activities



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Emergency Construction Earthen Levee – Problems (cont.)

Examples



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Levee constructed adjacent to electrical substation



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Garage damaged during levee construction



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Levee stability failure



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Cracks developed on levee slope



Sand boil development due to seepage



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Ring levee constructed to contain seepage on the landside of levee



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Aerial photo showing interior drainage blocked by levee



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Pumping interior runoff from landside of levee