

SPONSOR MAINTENANCE GUIDE

The purpose of this maintenance guide is to provide guidance for the maintenance of your levee. The following paragraphs outline maintenance standards and procedures for various project elements.

1. EARTH EMBANKMENTS. Earth embankments shall be maintained to remedy any adverse conditions threatening the integrity of the structure. Cracks, ruts, washes, settlements, or sloughing caused by erosive elements either natural or man-made should be promptly repaired by replacing any loss of material from the crown or slopes with like material and compacting it to proper density. Embankment crowns shall be graded as necessary to drain freely such that impoundment of water on the crown does not occur. After repairs, the embankment should be graded sufficiently smooth to provide for ease of maintenance and to prepare the necessary surface for establishing sturdy vegetative growth.

2. EROSION PROTECTION OF REVETTED AREAS. Erosion protection or revetted areas shall be maintained to provide the intended degree of protection and to insure the integrity of the main structure or earth embankment. Stone or riprap materials which have been displaced, washed out, deteriorated or should be replenished with sufficient quantities of like material, of proper size and quality to provide the necessary protection required. Areas where bedding or bank material beneath riprap is exposed or disturbed shall be repaired with suitable material and compacted prior to placement of stone or riprap.

3. CHANNELS, FLOODWAYS, OR PONDING AREAS. Shall be maintained to avoid significant increases in the floodway water surface elevations. If the capacity of these areas is reduced by earth deposits, debris, trash, undesirable vegetation, or unauthorized structures or encroachments, the obstructions should be removed and properly disposed of. Removal of normal or annual siltation is the responsibility of the sponsor's Operation and Maintenance program. All undesirable brush and trees larger than 2-inches in diameter should be removed.

4. SLOPE STABILITY. The cross-section template data shown below should be used as a guide for inspection of levee slopes made of different materials. Reference Page 3, Figure 1.

LEEVE MATERIAL	RIVERWARD SIDE-SLOPE	LANDWARD SIDESLOPE HEIGHT	MAXIMUM WIDTH	TOP
Clay	1V on 2H	1V on 2H	12 Feet	8 Feet
Sand	1V on 3H	1V on 4H	15 Feet	10 Feet

Flatter side-slopes may be required if the levee height exceeds the values listed, or if ordinary maintenance of the slopes are reduced because of the steeper side-slope. The judgment of the inspector will be used for materials other than clay or sand.

5. MINIMUM LEEVE SETBACK. Levee setbacks are principle control measures for foundation underseepage landside and embankment stability riverside. Both eliminate hazards by providing additional weight and additional length. The landside setback is required to reduce upward seepage forces and uplift pressures at the toe of the berm, while the riverside setback reduces the effects of damage from wave action. Reference Page 3, Figure 1.

6. VEGETATIVE GROWTH.

A. Sod Cover. Maintenance, including reseeding, mowing, and fertilizing of sod growth on earth embankments is required as sod is one of the most effective means of protecting flood control structures such as levees against erosion from rain, current, and wave wash. Periodic mowing is essential to *maintain* a good sod growth and should be done at intervals necessary to control weeds and other noxious growth. The last mowing of the season should be accomplished under conditions which will allow the grass to obtain a height of approximately 8" to 10" going into the winter season. Mowing shall be performed to a distance of at least 15 feet beyond the toe of the embankment. Whenever possible, initial mowing should be made after 15 July to allow habitat for wildlife hatching. Also, local interests are encouraged to sell hay from their projects to help offset their cost of maintaining the structure. In addition, programs of fertilizing and reseeding are encouraged to maintain a heavy sod cover.

B. Undesirable Growth of Trees, Brush and Weeds. Undesirable growth which affects the maintenance, inspections and stability of the structure, or interferes with and/or jeopardizes proper operation of the project during high water conditions shall be cleared and disposed of. Spraying with herbicides as needed during the growing season may be desirable for weed and brush control. Herbicides shall be used in accordance with state laws and regulations. Absolutely no undesirable growth should be allowed to grow on earth embankments, immediately adjacent to floodwalls or similar structures, or within revetted areas. The root-free and vegetation-free zones shall be maintained.

C. Root-Free Zone Policy. The root-free zone provides a space between the greatest expected extent of plant roots and the beginning face of the basic project structure. The bottom of the root-free zone is the external limits of the cross section of the levee, floodwall or embankment dam established for stability and/or seepage control. **NO** roots will be permitted to penetrate into the root-free zone.

D. Vegetation-Free Zone Policy. The vegetation-free zone is required for maintenance and flood-fighting activities and must be accessible at **ALL** times. This is the area adjacent to the landside and riverside toe of the levee, floodwall or embankment dam and appurtenant structure. **NO** type of vegetation, except grass, is permitted in this area.

(1) Levees. All vegetation will be located **OUTSIDE** the limits of the basic levee project structure, see Figure 1. This basic levee project structure is the engineered feature required for human safety. See Figure 1 for a diagram and terms used to describe a normal levee structure. *Note:* The vegetation-free zone is 15 feet beyond of the levee toe and toe drain, see Figures 2 & 3.

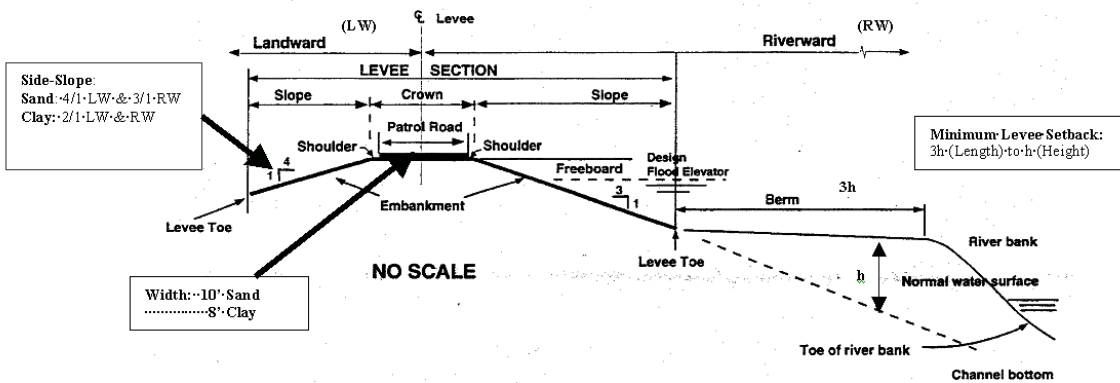
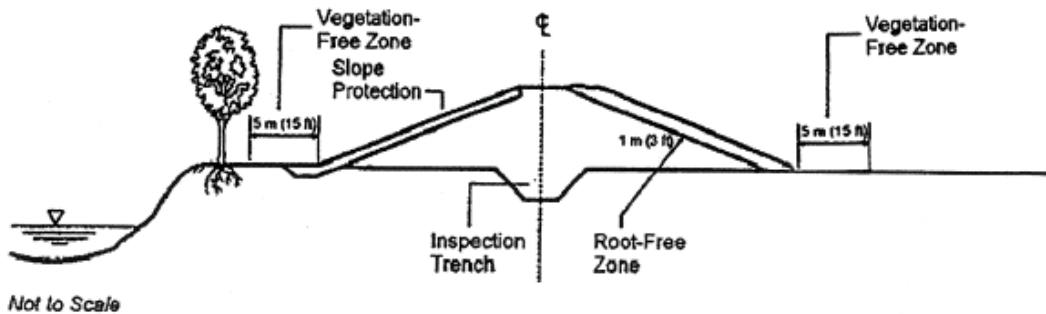
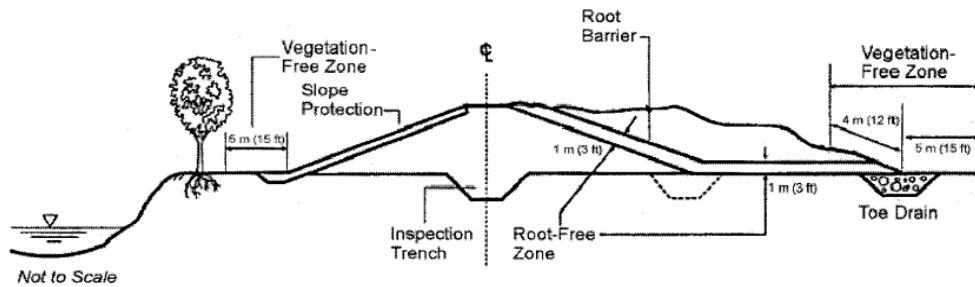


Figure 1. Normal levee structure.



a. Vegetation- and root-free zones

Figure 2. Basic Levee Project Structure.



b. Toe Drain

Figure 3. . . Basic Levee Structure with Toe Drain

(2) Floodwalls. Floodwalls are used where land and/or materials used to construct a levee are not economically available. The two most common types of floodwalls are the inverted T-Type reinforced concrete wall and the cantilever I-type sheet piling wall. *Note:* The vegetation-free and root-free zones are 8 feet beyond any toe drains, see Figures 4 & 5.

a. Inverted T-Type. A vegetation and root free zone will be established at the top outside edge of the toe. This T-type may have a toe drainage system to check & control piping & boils, control seepage, and control uplift pressures. These walls must be protected from invasion of roots, which could clog the drainage system. See Figure 4, which shows (a) Vegetation-Free Zone, (b) Root-Free Zone with vertical joint occurring at section, (c) Additional Soil Cover, and (d) Basic Structure.

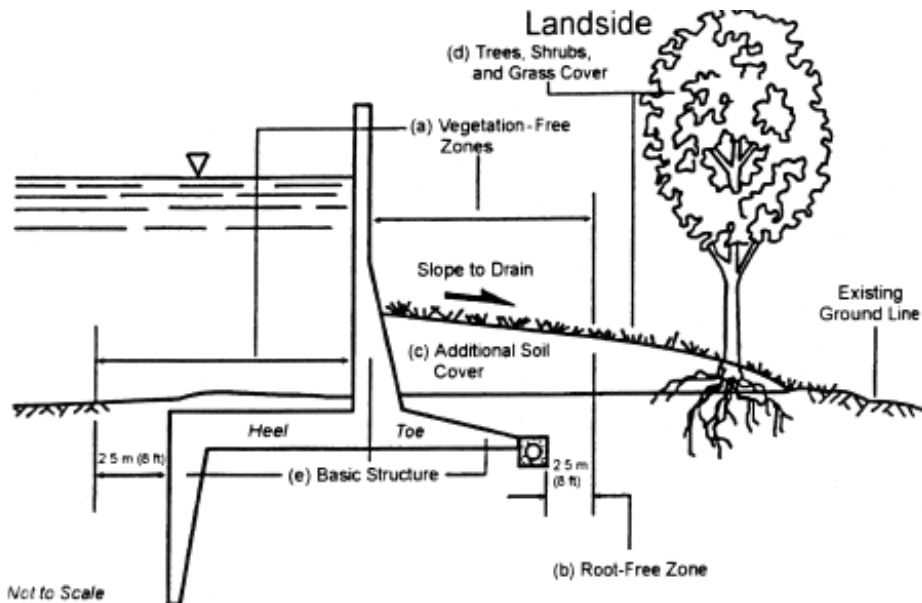


Figure 4. Inverted T-Type Floodwall

b. Cantilever I Type. Vegetation & root free zones will be established similar to that of the T-type walls. See Figure 5, which shows (a) Vegetation-Free Zone, (b) Root-Free Zone with vertical joint occurring at section, and (c) Basic Structure.

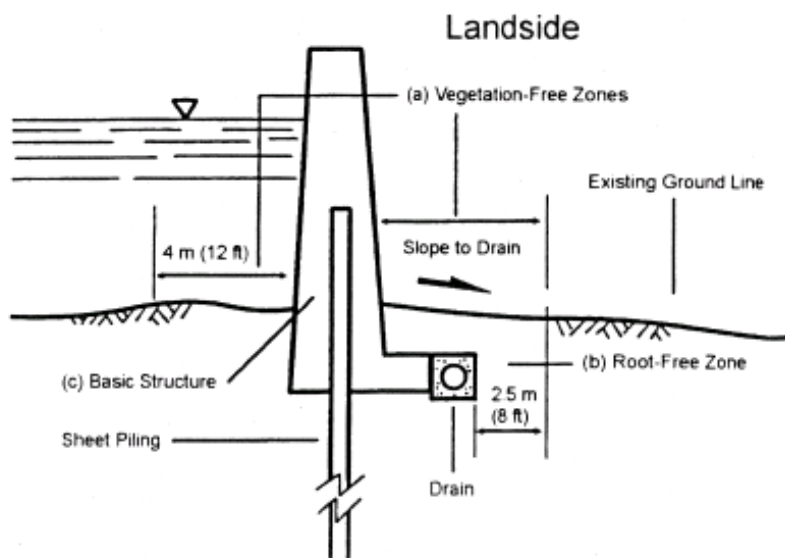


Figure 5. Cantilever I-Type Floodwall.

(3) EMBANKMENT DAMS – Two types of dams to consider are earth dams and rock-filled dams.

a. Earth and Rock-fill Dams – A 50 foot vegetation free zone will be established downstream of the toe of the dam in the floodplain and on abutments because of the need for access for maintenance, and construction equipment during periods of flooding.

7. VEGETATION GROWTH VARIANCES. The Omaha District policy is in accordance with EM 1110-2-301 regarding guidelines for vegetation on FCW projects. Some local jurisdictions have passed laws and ordinances prohibiting tree cutting or tree root removal. ER 500-1-1, in implementing 33 CFR Part 203 and Public Law 84-99, takes precedence over state and local laws and ordinances addressing this matter. This situation applies even when the public sponsor is performing this work on Non-Federal FCWs. However, a public sponsor of an Active project may seek a vegetation variance from Corps policy to allow additional vegetation to grow on levees.

The vegetation variance must be in writing to the District Emergency Management Office. Contact the Emergency Management Office for specific vegetation variance criteria.

A. Public Sponsor Requirements. The Public Sponsor will be required to submit a plan for variance which clearly describes the types and locations for vegetative growth, maintenance schedule, and an engineering determination that the plan does not affect the operation, flood fight, or structural integrity of the project. The plan will be reviewed by the Corps of Engineers and if approved formally adopted into the existing Operation and Maintenance Manual for the project.

8. CONTROL OF GRAZING, ENCROACHMENT, AND TRESPASS. All feasible efforts such as fencing, gates, surveillance, etc., shall be made to discourage and/or control grazing, encroachment by construction of unauthorized vehicular traffic, etc., through over or adjacent to the project. Damages resulting from such activities should be repaired to preserve the integrity of the structure and project.

9. CONTROL OF BURROWING ANIMALS. An effective program shall be maintained for controlling burrowing animals. All animal burrows in earth embankments or immediately adjacent to the flood control structures should be properly filled, compacted, and reseeded as necessary to preserve the structure's integrity and function. One of the best ways to control burrowing animals is to control the vegetative growth. Burrowing animals like to hide under tall vegetation such as, brush, tall weeds, etc.

10. MAINTENANCE OF ROADWAYS, GATES, AND FENCES. Access roads to and on embankments, or other flood control structures, should be bladed, and if applicable, surfacing material replenished as

necessary to keep the roadway shaped properly and free of ruts, pockets, and washes. Ramp embankments shall be maintained to their net section and design grade to assure proper access. Maintenance should be performed to repair fences, gates, etc., used to restrict encroachment and trespassing onto the structure or within the project's right-of-way, especially where private or public roads cross over such structures.

11. BANK CAVING CONDITIONS RIVERWARD OF FLOOD CONTROL

STRUCTURE. Caving which may endanger the stability and/or function of the structure must be corrected immediately. This may require stabilization of the river bank by any acceptable and proven method (technical assistance can be requested from the Corps of Engineers), or in extreme cases, relocation or setback of the flood control structure. Note that work within the river channel which involves adding of material will require a 404 permit from the Corps of Engineers.

12. MISCELLANEOUS FLOOD CONTROL FACILITIES, STRUCTURES AND

APPURTENANCES. Miscellaneous flood control facilities, structures, culverts, flap gates, manually operated gates or valves, (inlets or outlets, etc.) which are constructed on, over, or through flood control structures, shall be maintained in good operating condition. The condition of these facilities or structures shall be inspected annually, and those items which are operative only during high water stages shall be checked carefully and repaired prior to the high water season.

13. FLOODWALLS AND OTHER FLOOD CONTROL RELATED STRUCTURES OR APPURTENANCES MADE OF CONCRETE OR SIMILAR MATERIALS.

Structures applicable to this category, which are deteriorated or showing signs of settlement shall be promptly repaired, replaced, corrected and routinely maintained to function as intended.

14. POOR MAINTENANCE. Rehabilitation assistance will not be provided to an FCW that, as a result of poor maintenance, has deteriorated to the point that substantial reconstruction is required.

15. DEFICIENT OR DEFERRED MAINTENANCE. If deficient or deferred project maintenance is outstanding when damage to an FCW occurs, then the deficient and deferred maintenance will be accomplished by or at the expense of the public sponsor, either prior to or concurrently with the approved Rehabilitation Assistance.