STANDARD OPERATING PROCEDURE
FOR

VEGETATION REMEDIATION AND REMOVAL

(23 November 2021)

Unwanted vegetation within the vegetation-free zone, as described in ETL 1110-2-583 and for which a basic image is shown in Figure *1*, can hinder access to conduct inspections, perform maintenance, floodfight, and in extreme cases, create seepage paths along its root system that can promote/accelerate seepage through the embankment. The purpose of this SOP is to provide guidance for the proper remediation of woody and non-woody vegetation within the vegetation-free zone.

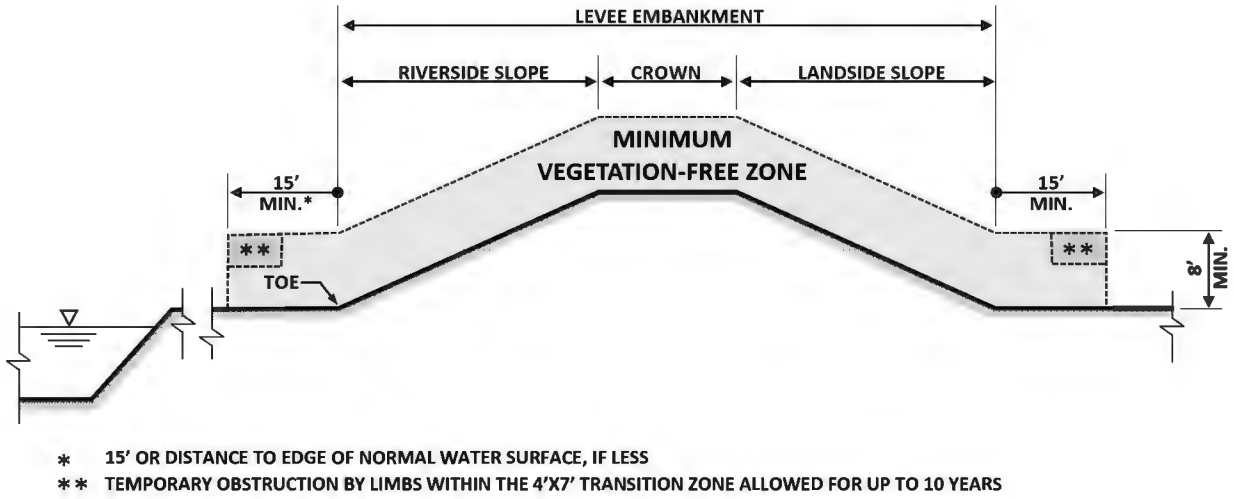

Figure 1: Basic vegetation-free zone.

Non-Woody Vegetation

If not continually fought, undesirable perennial non-woody vegetation, particularly Johnson Grass (*Sorghum halepense*) but also other species of invasive plants, can spread over large areas and displace the native grass intended as the levee's turf cover. Although the major objection to Johnson Grass by Sponsors is not a levee safety concern (it can cause crop losses and threaten livestock), what is a levee safety concern is that it can grow thick and considerably taller than the native grass, obscuring observations and making flood fighting more difficult.

Johnson Grass reproduces by rhizomes and seeds and is resistant to many herbicides, including some variations of glyphosate, making it difficult to eradicate. The following are methods for controlling Johnson Grass, but are usually labor intensive and require vigilance.

- Hand pulling: The intent is to pull out the whole weed, without leaving fragments, when there are new sprouts and the soil is soft, after a soaking rain for instance.
- Mowing: Weed growth will be stunted and rhizomes will become concentrated near the ground surface if the area is regularly mowed for two years when the plants are 8 to 12 inches tall.

- Chemical control: Although resistant to several chemicals, Roundup and Dowpon (containing glyphosate) have been successful in controlling Johnson Grass when used on actively growing 6- to 24-inch-tall plants. Rimsulfuron, Imazethapyr, and Nicosulfuron (acetolactate synthase inhibitors, aka. acetohydroxy acid synthase) have also been successful when applied with a nonionic surfactant three weeks after mowing. Clethodim, Sethoxydim, and Fluzifop, (Acetyl CoA Carboxylase inhibitors) have also been successfully used. Always apply and protect yourself as directed by the manufacturer.
- Removal: A more direct and aggressive method of eradication is the removal of the soil containing the rhizomes and seeds. While tilling the area every few weeks during the winter months can expose the rhizomes to freezing temperatures and possibly eradicate them, it is not desirable that the levee be left in such a disturbed state when high-water events are typically more frequent. Any removal effort that involves excavation into the levee cross section of more than 6 inches requires an approved Letter of No Objection (LNO) from the Louisville District USACE.

Woody Vegetation

From a levee safety viewpoint, woody vegetation (mostly trees but also some brush) is distinguished from non-woody vegetation mainly based on the extent of its root system. This is an important distinction because the root system of large woody vegetation can threaten a levee system by creating seepage paths through the embankment soil. Another potential threat is the removal of a large volume of soil within the levee embankment if a large tree overturned during a storm or flood event. This could remove a substantial part of the structural prism within smaller levees or create a domino effect of slope failures in larger levees. Trees with trunk diameters less than 4 inches (a circumference of 12½ inches) can be cut at the ground surface without removing the rootball, but the rootballs of larger trees must be removed to a point where the roots are less than ½-inch in diameter. Prior to excavating rootballs, the Sponsor will need to locate an approved borrow source and secure an approved LNO from the Louisville District USACE. The borrow source will need to supply more soil than just the amount contained in the rootball, since the area must be overexcavated as indicated in the following repair scenario.

Although not typical, trees, even large trees, have been found rooted in levee embankments or near enough to the toe that overturning could hinder access along the levee or create a seepage exit point by removing a portion of the confining layer (Figure 2).

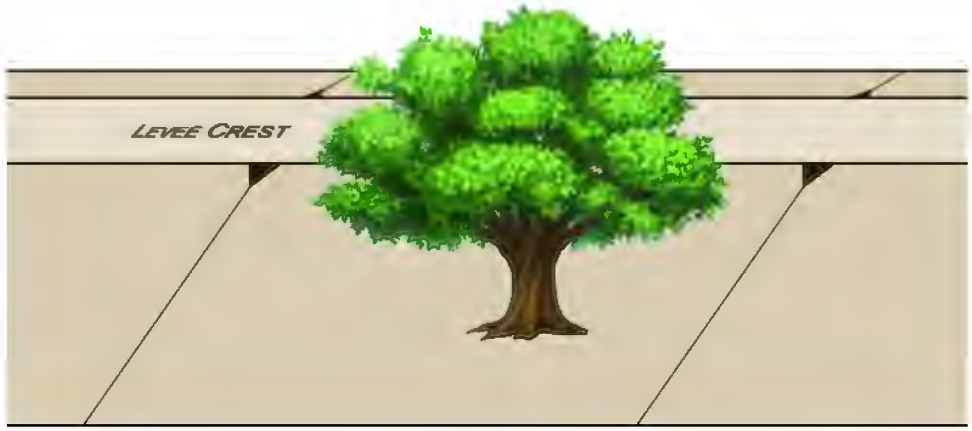

Figure 2: Tree within levee embankment is either cut down or topples.

Any trees within the vegetation free zone should be removed immediately, along with their rootball when applicable. If the tree topples, it typically uproots the majority of the rootball with it, but the need for additional excavation should be expected (Figure 3).

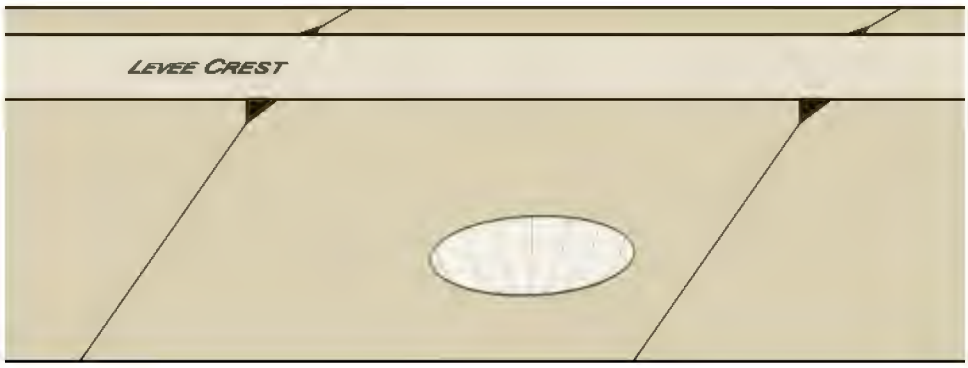

Figure 3: The rootball is removed to a point where roots are less than ½-inch in diameter.

Additional excavation is required to provide benching of the surrounding soil so the backfill material can be properly compacted and bonded with the original levee embankment. The maximum steepness of the benching shall be in accordance with CFR 1926 Subpart P, but approval by the Louisville District USACE is ultimately required. The lowest level of the excavation should provide a "floor" that daylights out of the levee slope, but it is not required that it extend all the way down to the toe elevation as in the example diagram of Figure 4.

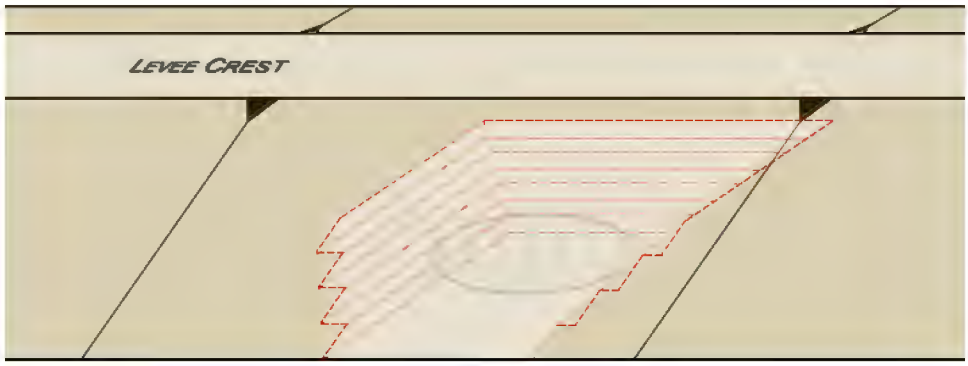

Figure 4: The area surrounding the rootball hole is benched in preparation for engineered fill.

The materials and placement procedures used to backfill the excavation must be in accordance with "SOP-General Earthwork Associated with Levees" to beyond the face of the slope to ensure that any insufficiently compacted material is removed when the fill is cut back in preparation to receive the topsoil for final grading (Figure 5).

Figure 5: The excavation is backfilled and trimmed to allow topsoil placement to the design slope.

Applicability

Not all non-turf vegetation within 15 feet of a levee toe is necessarily considered unwanted. There are cases along riverbanks where vegetation that may normally be considered invasive or generally unwanted serve to slow erosion or help stabilize a slope. Removal of vegetation in such cases may not be prudent unless followed by other measures to reinforce the slope.