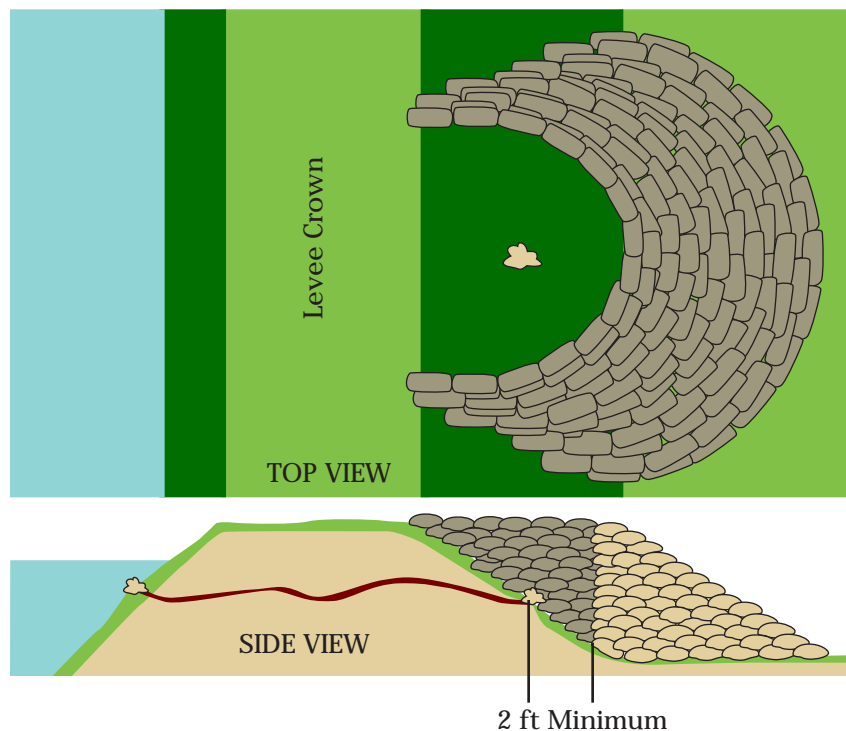


# RINGING SAND BOILS

- Minimum 2 ft. radius from center of boil to edge of ring dike.
- Tie into levee if boil is near toe of levee
- Build half-moon shaped ring dike if boil is on levee slope.



## RINGING SAND BOIL METHOD

A sand boil is created by water seepage through the levee foundation or embankment. When that seepage transports dirty water, the levee's integrity is threatened.



Corps employees demonstrate building a ring dike.

It's generally not necessary to build a ring dike around a boil that is not transporting soils but monitor the boil for any change in condition.

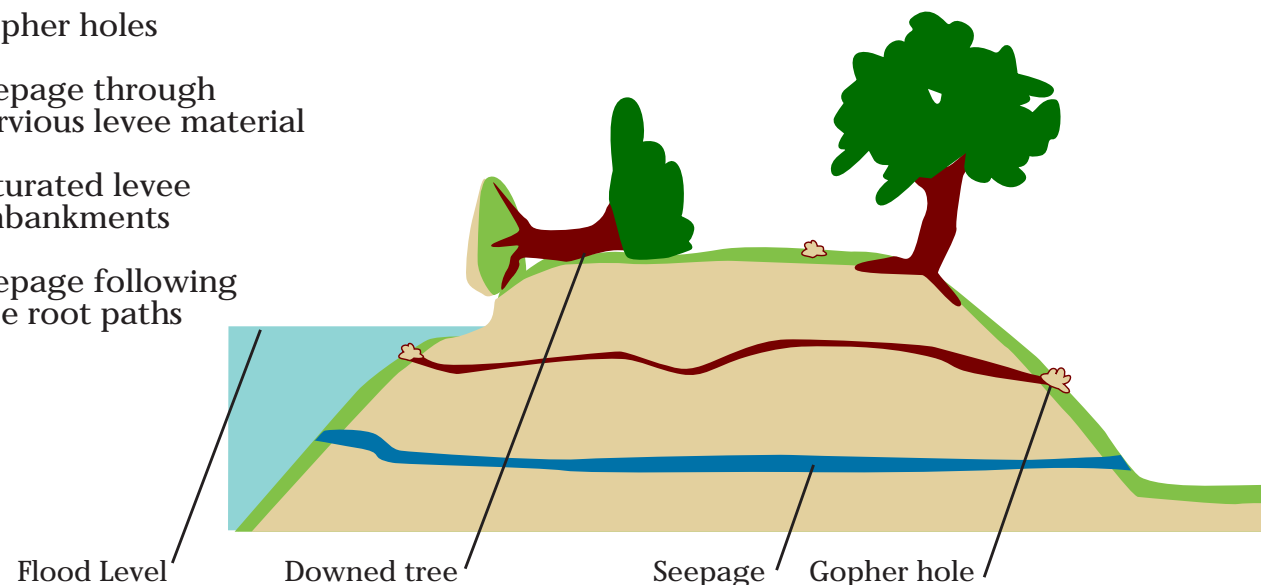
Don't attempt to place sandbags directly on the boil. Pressure applied to plug the boil will cause water seeping through the levee to seek other avenues to follow and could cause levee failure.

As a minimum, there should be a 2 to 3 foot radius from the center of the boil to the inside edge of the ring dike. Take care to contain the entire area experiencing boils within the ring dike.

Build a spillway section in the dike so water runs out in a controlled manner. This diverts the overflow water away from the dike and reduces erosion on the levee slope. Once the spillway water runs clear, and is not transporting soils, then the ring dike is completed.

# CAUSES OF LEVEE FAILURE

- Overtopping
- Downed trees on levee slope
- Gopher holes
- Seepage through pervious levee material
- Saturated levee embankments
- Seepage following tree root paths



## CORRECT FILLING PROCEDURES

Filling sandbags is normally a two or three person operation. One member of the team, while crouching with feet apart and arms extended, should place the bottom of the empty bag on the ground.

The opening of the bag is folded outward about 1-1/2 inches to form a collar and held open to allow the second team member to empty a fully rounded No. 2 shovel of material into the open end of the bag.

Don't hurry. Haste can result in undue spillage and added work. The third team member stockpiles or stacks the open sacks. The three team members

should rotate duties often to reduce job-specific muscle fatigue.

Untied bags should be filled approximately one-half to two-thirds full. Tied bags can be filled slightly more, but with enough room left at the top to tie the bag off properly.

Always use gloves to protect your hands during the filling operation. After handling treated bags, avoid contact with your eyes and mouth.

Dress appropriately and layer clothing. Safety goggles should be used on dry and windy days. Sandbag filling operations are done either near the actual placement site or at centrally located filling sites such as fire



This two-member team uses correct positions for sandbag filling.



stations, diking districts or sand pits.

If the bags are filled at a distant location, vehicle transportation and access to the flood site are primary planning considerations.

For large scale operations, a variety of specialized filling equipment - such as funnels on the back of dump trucks - is commercially available.

Such equipment is not always available during an emergency and may be best suited for a staging area where bags can be filled and then delivered to the site.

### PROPER PLACEMENT

Remove any debris from the areas where bags are to be placed. Place the bags lengthwise and parallel to the direction of flow. Fill the low spots first before placing bags the full length of the area to be raised.

Start at approximately 1 foot landward from the river or levee's edge. Fold the open end of the bag under the filled portion. Folded end of bag should face upstream. Place succeeding

bags with the bottom of the bag tightly and partially overlapping the previous bag.

Offset adjacent rows or layers by one-half bag length to avoid continuous joints.

To eliminate voids and form a tight seal, compact and shape each bag by walking on it and continue the process as each layer is placed.

This flattens the top of the bag and prevents slippage between succeeding layers.



Place each succeeding bag tightly against and partially overlapping the previous one. Compact and shape each bag by walking on it.

### SINGLE STACK PLACEMENT

Sandbags stacked in a single row work well in flood areas where there is no streamflow velocity or danger from floating debris, such as logs and tree stumps, or from wave action which could topple the bags.

Although generally not recommended to be above three courses or layers in height (approximately 1 foot), higher single stack placement can be effectively used as a barricade to protect structures from impending water damage as shown in the photo.



Single stack placement

### PYRAMID PLACEMENT METHOD

Use pyramid placement to increase the height of sandbag protection; however, use caution when raising the levee height. Determine the height of the sandbag raise by using the best available forecasts of flood conditions.

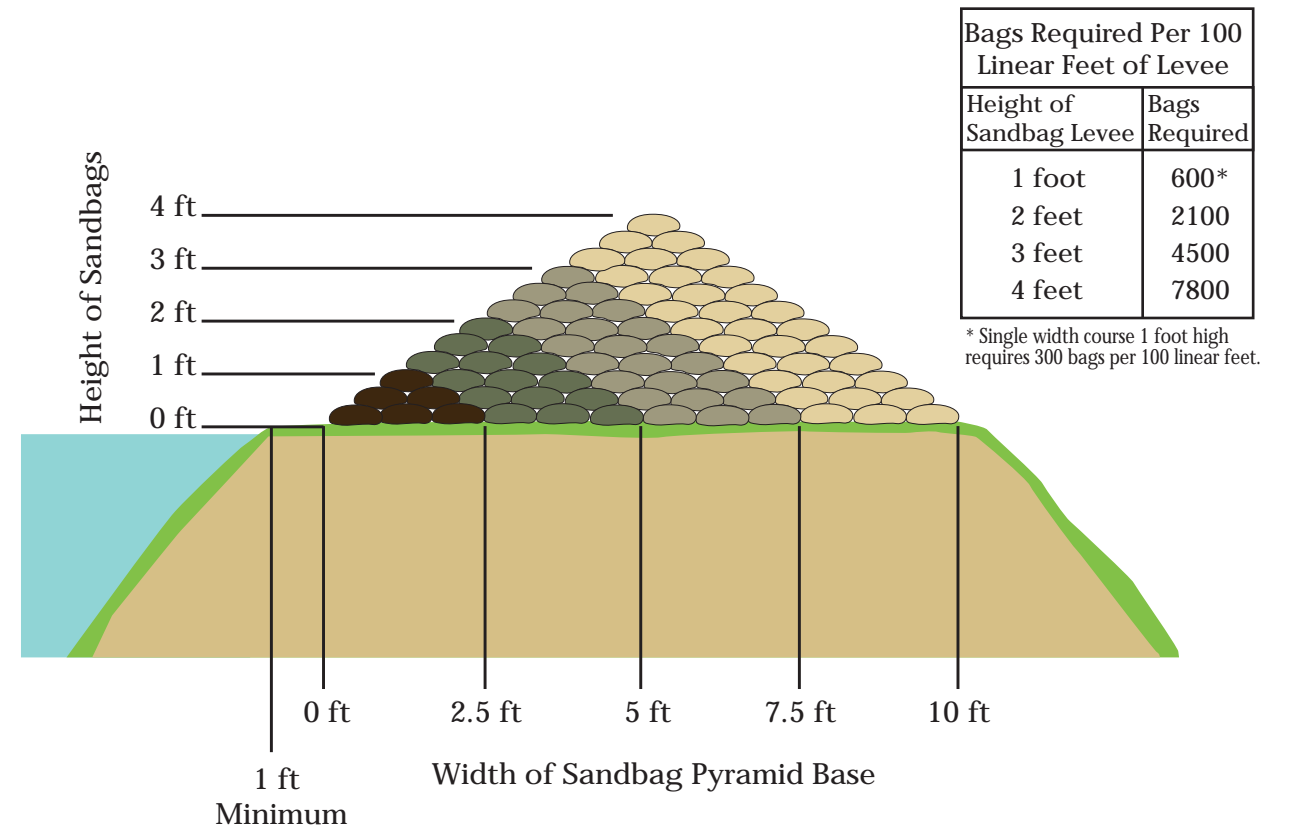
An example: When the water level is currently 1 foot below the top of the levee and is predicted to rise 3 more feet, construct a 2-1/2 foot sandbag operation which includes one-half foot of height

as a safety factor.

It's important to compact each bag in place by walking on it, butting the ends of the sacks together, maintaining a staggered joint placement and folding under all loose ends.

Watch for flooding elsewhere, and watch for boils on the landward side of the levee due to the increased water elevation.

## TYPICAL PYRAMID SANDBAG PLACEMENT



The pyramid placement method issued to increase the height of sandbag protection.

Use this rule of thumb in determining dimensions of the pyramid:

- 1 bag in length equals about 1 foot
- 3 bags in width equals about 2-1/2 feet.
- 3 bags in height equals about 1 foot.

Place the sandbags by laying an equal number of horizontal rows on the bottom as there are vertical layers.

It's important to compact each bag in place by walking on it, butting the ends of the sacks together, maintaining a staggered joint placement and folding under loose ends.



Veteran flood engineer Ernie Sabo demonstrates that the sandbag should be two-thirds full, folded at the top.