



GENERAL GUIDELINES

1. The most commonly used bags are treated burlap or woven polypropylene about 24 inches by 14 inches. Unused empty bags can be stockpiled for emergency use and will be serviceable for years, if kept dry and properly stored out of the sun and weather. Filled bags of earth material will deteriorate quickly. In an emergency any kind of bags can be used.
2. Untied sandbags are recommended for most situations. Tied sandbags should be used only for special situations or for specific purposes such as filling holes, holding visquine or straw bales in place or to form barriers backed by supportive planks or aluminum sheet piles.
3. Untied bags should be filled approximately 2/3rds full. Tied bags can be filled more, but leave enough neck so that it can be tied properly.
4. A sandy soil is most desirable for filling sandbags but any other available material such as silt, clay, gravels or a mixture of

these may be used. Sand is a pervious material and additional weight is obtained when the soil in the sack gets saturated, and sand filled sacks shape really well. Clay materials are difficult to fill bags with and are difficult to shape. Gravels are too pervious and are very difficult to shape. In emergencies, when vehicle access is cut off, use the back side of the levee or adjacent dry field to obtain the sandbag material. Sandbag levees can be constructed by two people. Teams are better. A filled sandbag weighs 40-50 pounds.

5. Sandbag filling operations can be accomplished at or near the placement site, or at centrally located filling sites such as fire stations, or other public works, or at sand borrow pits. If the bags are to be prefilled at a distant location, due consideration must be given to transportation vehicles and placement site access. In many cases, access may be only by boat, tractor or helicopter.

Sandbag Measurements

- 1 Pallet = 1 Ton (approx) = 75 Full Bags
- 1 Pallet = 75 Bags
- 1 Semi-Truck = 1,500 Bags = 20 Pallets
- 1 Tandem Truck of Sand = 10 Cubic Yards
- 10 Cubic Yards of Sand @ 30# Bag = 1,200 Bags
- 12 Cubic Yards of Sand @ 30# Bag = 1,450 Bags
- 1 Bag = 30# (approx)
- 1 Bag = 1 1/2 Cubic Feet (approx)
- Bags 55-60 percent filled provide best engineering properties

Estimating Bag Requirements

PLAN OF BOTTOM LAYER

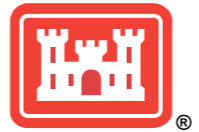
BAGS REQUIRED PER 100 LINEAR FEET OF LEVEE	
Height Above Levee	Bags Required
1 foot	600*
2 feet	2100
3 feet	4500
4 feet	7800

*Single width course requires 300 bags per 100 linear feet, on foot high

Rule of Thumb
Width 3X (times) height.

For complete information please reference the U.S. Army Corps of Engineers, St. Paul District Flood Flight Handbook at

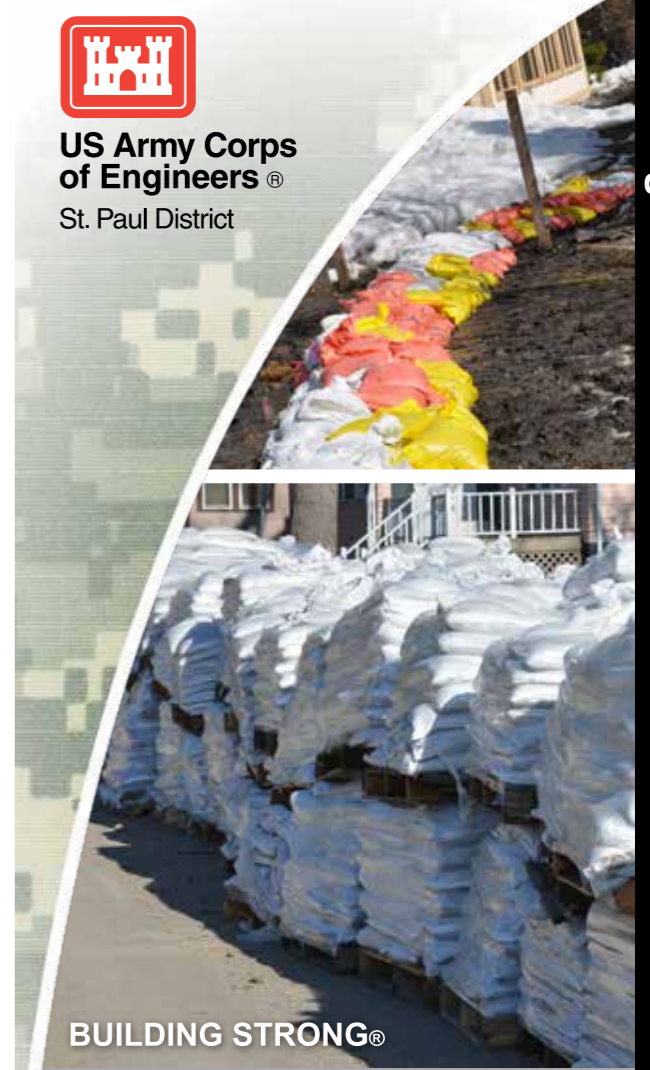
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US Army Corps of Engineers®
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BUILDING STRONG®

The use of sandbags is a simple, but effective, way to prevent or reduce flood damage. Properly filled and placed, sandbags can act as a barrier to divert moving water around, instead of through, buildings. Sandbag construction does not guarantee a watertight seal but is satisfactory for use in most situations. Sandbags can also be used to prevent overtopping of leveed streams; to divert current flow to a specific area; to contain seepage behind levees; and to provide weight on back slopes of levees, poly sheeting, and other barriers.

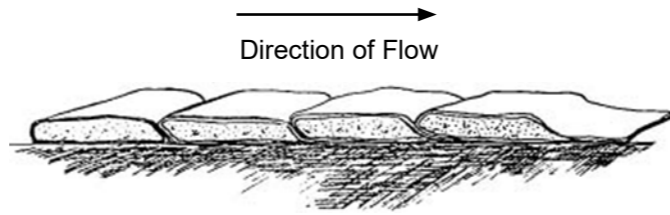


HOW TO FILL A SANDBAG

Normally, filling sandbags is a two- or three-person operation. One member of the team should place the bottom of the empty bag on the ground slightly in front of wide spread feet with arms extended. The throat of the bag is folded outward about 1-1/2 inches to form a collar and held with the hands in a position that will enable the second team member to empty a rounded No. 2 shovel full of material into the open end. The shoveler should carefully release the shovel full of material into the throat of the bag. Haste in this can result in undue spillage and added work. The third team member stockpiles and/or stacks the 2/3rd full open sacks. The use of gloves is necessary so as not to injure hands during the filling operations. The use of safety goggles is desirable, especially during dry and windy days.

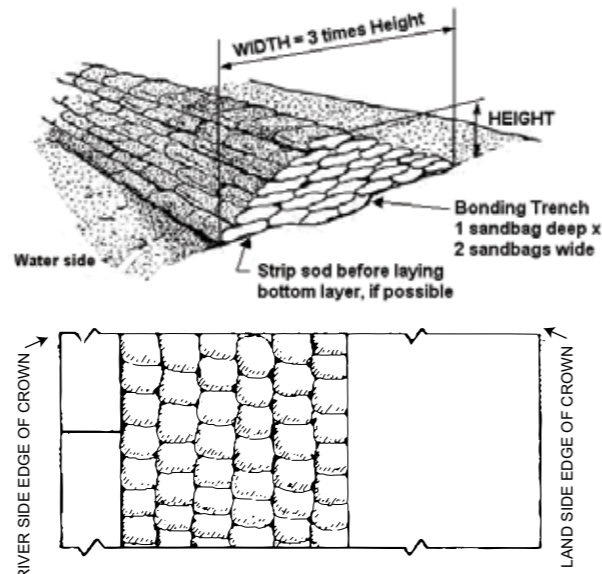
For large scale operations, filling sandbag can be expedited by using bag holding racks, funnels on the back of the dump trucks used for sanding operations and various power loading equipment.

PLACEMENT

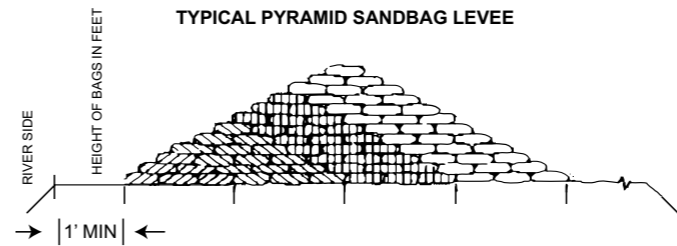


Remove any debris from the area where bags are to be placed. Place the 2/3rd filled bags lengthwise and parallel to the direction of flow, with the untied open end of the bag facing downstream. Initially fill the low spots before placing bags the full length of the area to be raised. Always keep the slope of the top of the sandbags the same as the adjacent water surface slope. Start the sandbag operation about one foot landward from the river's edge at the levee top. Place succeeding bags with the bottom of the bag tightly and partially on the open end of the previous bag. Offset adjacent rows or layers by one-half bag length to eliminate continuous joints. To eliminate voids and form a tight seal, compact and shape each bag by walking on it and continue to walk on it as succeeding layers are placed.

STACKING SANDBAGS



PYRAMID PLACEMENT METHOD



Width of bottom of bags for various heights in feet
 Calculation of number of sandbags required per one foot raise in levee height

$$N = \frac{3H+9H^2}{2}$$

1 bag length equals about 1 foot
 3 bag widths equals about 2-1/2 feet
 3 bags high equals about 1 foot

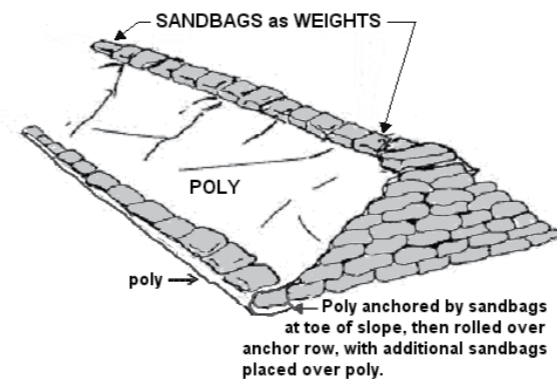
when H = 1 N = 6
 when H = 2 N = 21
 when H = 3 N = 45
 when H = 4 N = 78

Pyramid placement is used to increase the height of sandbag protection.

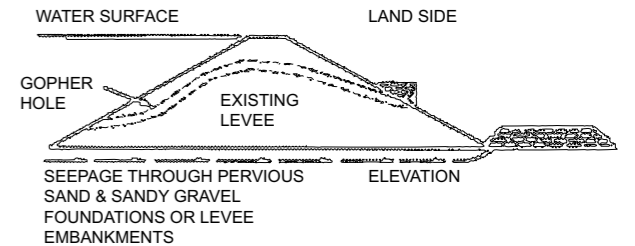
Place the sandbags to form a pyramid by laying equal numbers of rows on the bottom as there are vertical courses.

It is very 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.

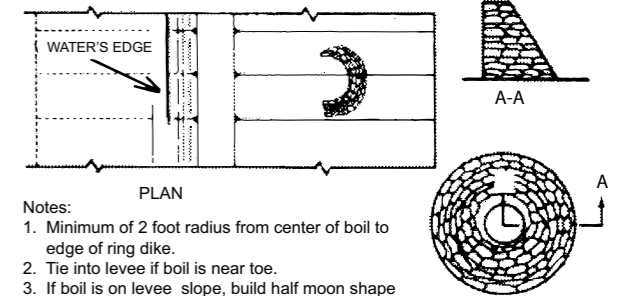
SEALING THE LEVEE



RINGING SAND BOILS



- Notes:
1. Do not sack boil which does not put out material.
 2. Height of ring dike should be only sufficient enough to create enough head to reduce flow through boil so that no more material is displaced and boil runs clear.
 3. Never attempt to completely stop flow from boil.
 4. Build an overflow section, so water over tops ring dike in a controlled manner. Divert overflow water away from teh ring dike over visquine or by other methods to reduce erosion on levee slope.



- Notes:
1. Minimum of 2 foot radius from center of boil to edge of ring dike.
 2. Tie into levee if boil is near toe.
 3. If boil is on levee slope, build half moon shape ring dike on levee slope.

CORPS OF ENGINEERS SANDBAG POLICY

It is the responsibility of local governments and flood control districts to maintain a supply of sandbags adequate to cover anticipated emergencies. The St. Paul District maintains a limited stockpile of sandbags and other flood fighting materials intended to augment the stocks of local jurisdictions during actual flood emergency situations. At the discretion of the District Engineer, a portion of the St. Paul District's stockpile may be loaned to meet a specific local flood emergency situation. Unused stocks must be returned to the St. Paul District as soon as the emergency conditions are over. Consumed supplies must be replaced in kind or be paid for by local interests. District commanders may waive loan replacement requirements for sandbags and plastic sheeting when a Presidential disaster or emergency declaration under the Stafford Act has been made.

