

Water Rescue Flood Fighting Guidelines

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Reference:

“Flood Fighting Methods, Volume II”, State of California, Department of Water Resources, Division of Flood Management, Flood Operations Branch, Revised 1997

Information Sheet #1

TOPIC: **GUIDELINES FOR TEMPORARY FLOOD CONTROL MEASURES**

INTRODUCTION: Choice of techniques for food control methods

Erosion of Levee Due to Boils – Reduce Water Flow and Prevent Earth Loss
Caused by Seepage Through or Under Levee or Tunnels of Burrowing Animals

Control Boil on Ground Behind Levee

GUIDELINES FOR CREATING A SACKRING AROUND A BOIL

Control Boil on Levee Slope

GUIDELINES FOR CREATING A U SHAPED CHIMNEY AROUND A BOIL

Stop Water Flow on Inlet Side

GUIDELINES FOR PLUGGING INLET ON WATER SIDE OF LEVEE

Erosion of Levee Due to Current or Wave Action – Put Covering on Face of Levee
Caused by High Wind, Current or Waves

Cover Front of Levee With Plastic Sheetting

GUIDELINES FOR PREVENTING EROSION OF LEEVE WITH PLASTIC

Cover Front of Levee With Wooden Panels

GUIDELINES FOR PREVENTING EROSION OF LEEVE WITH PANELS

Overtopping of Levee Due to High Water Level – Raise Height of Levee
Caused by Waters Rising Higher Than Levee

Create Wooden Front and Back With Sandbags

GUIDELINES FOR CREATING A LUMBER AND SACK TOPPING

Create Tow Rows of Wooden Supports to Hold Fill Material

GUIDELINES FOR CREATING A MUD BOX

Lay Sandbags in Rows to Raise Height

GUIDELINES FOR CREATING A SACK TOPPING

Wrap Fill Material in Plastic Sheet

GUIDELINES FOR CREATING A TEMPORARY LEVEE

Information Sheet #2

TOPIC: GUIDELINES FOR WORKING WITH SANDBAGS

INTRODUCTION: Method for effective use of sandbags

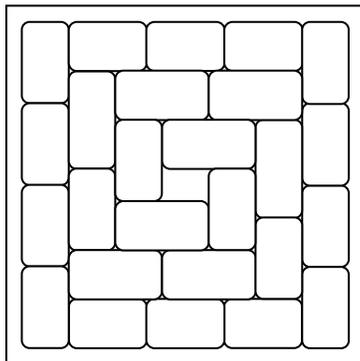
Filling Sandbags – Two Person Operation (3rd Person for Tying Bags As Needed)
 One Person Holds Bag Open (Sit On Sandbags or Squat – Get Comfortable)
 Second Person Shovels Sand Into Bag (1st Shovelful on Lip to Hold Bag Open)
 Fill Bag 1/3 of the Way
 Avoid Unneeded Motion (Twisting, Turning, Steps, ...)
 Rotate Every 15 Bags or As Needed
 Rest 10 Minutes Every Hour – Water Break Every 30 Minutes

If Tying Bags – 3rd Person Ties and Packs on Pallet
 Twist Free Section of Bag and Tie Overhand Knot
 Or Use Existing Bag Ties (Wire Ties Work Well Also)

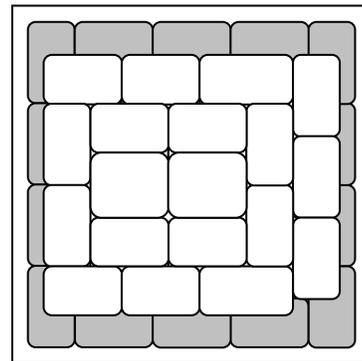
Alternate Filling Method (If Materials Available) – Construct Filling Station
 Cut Top of Road Cone Off and Fix Base to 2x4 Frame
 Put Bag Below Funnel While Other Person Fills Bag 1/3 Full

Packing Sandbags on Pallet – Ready for Transport With Heavy Equipment
 Estimate Weight of Load for Transport Limits (Crane, Forklift, Truck,...)

Ring Outer Part of Pallet With Bags, Then Place In Middle of Pallet
 Stagger Each Successive Layer Inwards of Previous Layer (Up to 4 Layers)



First Layer

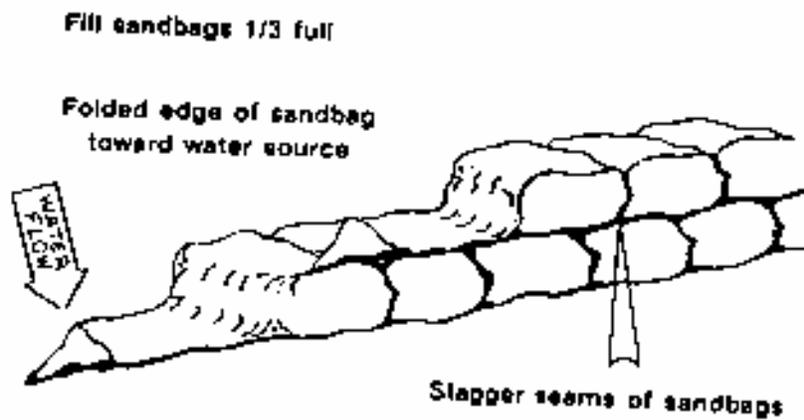


Second Layer

Placing Sandbags

- Fold Over Top of Sandbag in Triangle to Keep Sand From Leaking
- Place Each Bag Over Folded Top of Preceding Bag
- Stomp Row Into Place Before Starting Next Row
- Stagger Next Row of Bags on Preceding Row

Each Bag Will Cover 6" High By 6" Long Area for Planning



Information Sheet #3

TOPIC: GUIDELINES FOR WORKING WITH PLASTIC

INTRODUCTION: Method for effective use of plastic or canvas sheeting.

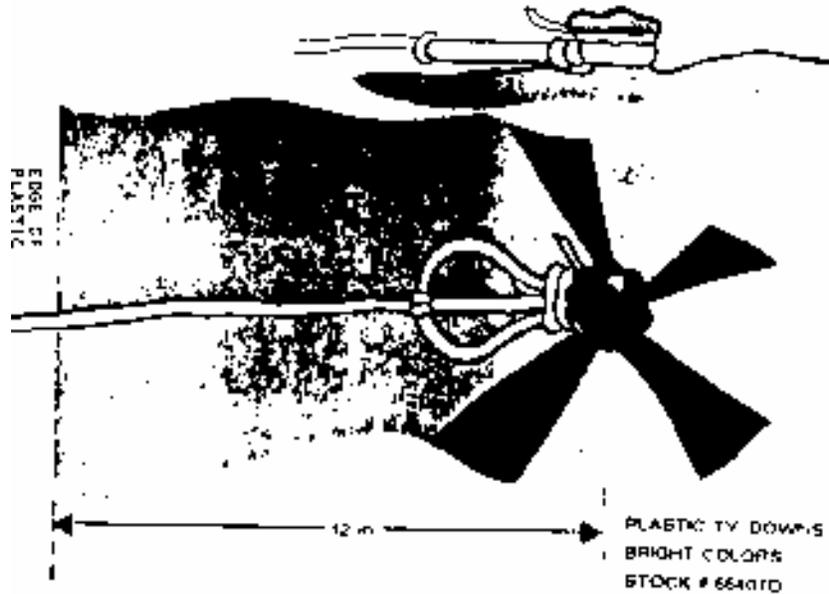
Securing Plastic to Rope – Use Commercial Ties if Available

Create "Button" in Plastic About 12" From Edge

Place Smooth Rock In Plastic and Bunch Material Around

May Twist Plastic Some to Secure Rock's Location

Tie Rope to Button Using Slipknot (Double Half Hitch)



Information Sheet #4

TOPIC: GUIDELINES FOR CREATING WOOD PANELS

INTRODUCTION: Method for construction of wood panels used in flood control

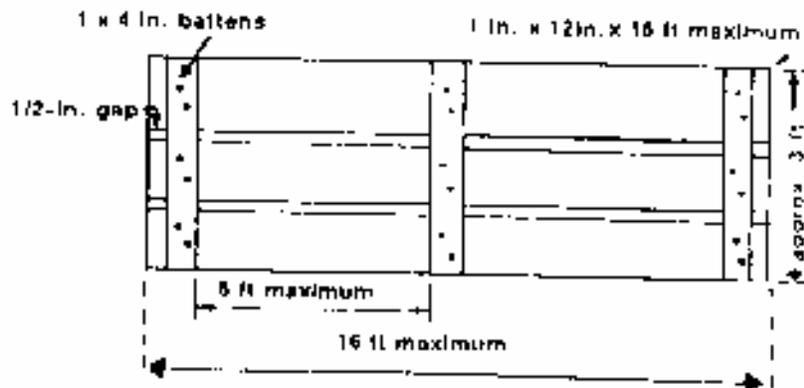
Locate Wood Source – Determines Construction Method and Length
 Try to Use Preexisting Wood Lengths if Able (Less Cutting Needed)
 Consider Transport Method Limitation on Wood Lengths

Lay Out Wide Boards for Main Section (1x12 Preferred)
 Lay Next to Each Other For Approximately 3' Total Height Typically
 Use ½" Gap Between Boards (Use Spacers As Able)

Connect Battens Every 6' or Less (1 x 4 Preferred)
 Cut to Height of Finished Panel
 Screw Or Nail Battens to Panels – 2 Per Connection
 Avoid Punch Through With Screws or Nail – May Rip Plastic or Cut Personnel

Used In Control Methods of:

- Erosion of Levee Due to Current or Wave Action
- Overtopping of Levee Due to High Water Level
- Wooden Front (Backed With Sandbags)
- Sides of a Mud Box (Filled With Material)



Information Sheet #5

TOPIC: GUIDELINES FOR CREATING A SACKRING AROUND A BOIL

INTRODUCTION: Method for sandbag control around boil leaks in a levee

Lay Outer Ring of Sandbags – Bottom Width At Least 1 ½ Times the Height
 Refer to GUIDELINES FOR WORKING WITH SANDBAGS
 Large Enough to Encompass Area Surrounding Discharge Spot

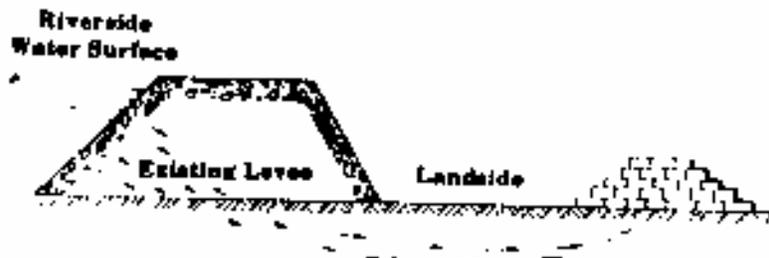
Continue to Add Layers of Sandbags – Slow Down Flow Rate
 Flow Should Not Be Stopped Completely – Slow Down Water Flow
 If Stopped Completely – Boil Breaks Out Other Place
 Prevent Further Discharge of Earthen Material (Water Runs Clear)

Add Pipe, Plastic, or Trough as Needed – Direct Water Away
 Prevent Pooling of Water Around Sandbag Ring
 Lower Erosion Rate of Water Flowing Away From Boil

For Nest of Boils – May Need to Surround With Small Levee Around
 Refer to Methods For – Overtopping of Levee Due to High Water Level



Bottom width should be at least 1½ times the height.
 Do not use balls not carrying material, but maintain surveillance during floods.



NEVER completely stop the flow from a sand boil. This may cause the boil to "break out" in an adjacent area. **ALWAYS** control the boil to a point where it causes to carry material and the water runs clear.

Information Sheet #6

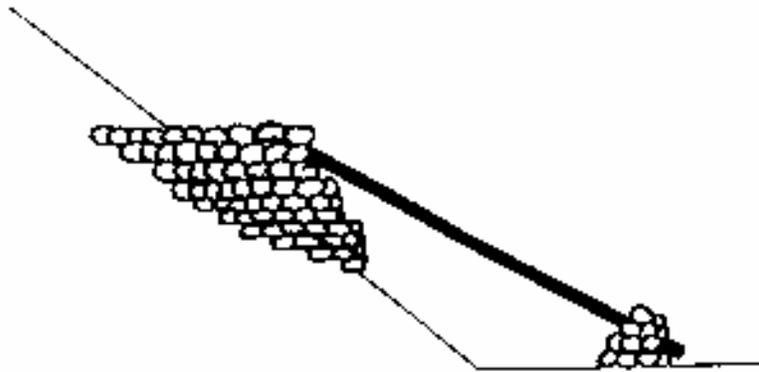
TOPIC: GUIDELINES FOR CREATING A U SHAPED CHIMNEY AROUND A BOIL
BOIL

INTRODUCTION: Method for dealing with water coming from boil on levee side

Lay U Shaped Chimney of Sandbags – Allow For Tapering of Sandbags With Height
Refer to GUIDELINES FOR WORKING WITH SANDBAGS
Large Enough to Encompass Area Surrounding Discharge Spot

Continue to Add Layers of Sandbags – Slow Down Flow Rate
Flow Should Not Be Stopped Completely – Slow Down Water Flow
If Stopped Completely – Boil Breaks Out Other Place
Prevent Further Discharge of Earthen Material (Water Runs Clear)

Add Pipe, Plastic, or Trough – Direct Water Away
Prevent Erosion of Water Running Down Levee Slope



Information Sheet #7

TOPIC: GUIDELINES FOR PLUGGING INLET ON WATER SIDE OF
LEVEE

INTRODUCTION: Method for stopping boils by plugging water entry point

Locate Inlet – May Be Difficult to Determine Location

Swirl At Water Edge

May Lightly Stir Up or Add Loose Material In Clear Water to Determine Inlet

Create Cover – Use Plastic or Canvas Stitched to Pipe

6' Section of 1.5" or 2" Diameter Pipe

5' x 6' Section of Sheeting

Lace Pipe to Sheeting

Wrap Wire or Twine to Around Through Sheeting

May Need to Punch Small Hole in Plastic for Lacing

Roll Up Loose Sheeting Around Pipe

Secure Top of Sheeting to Top of Levee

Drive Two 2" x 4" x 2' Stakes Into Shoulder of Levee

Connect Sheeting To Stakes – GUIDELINES FOR WORKING WITH PLASTIC

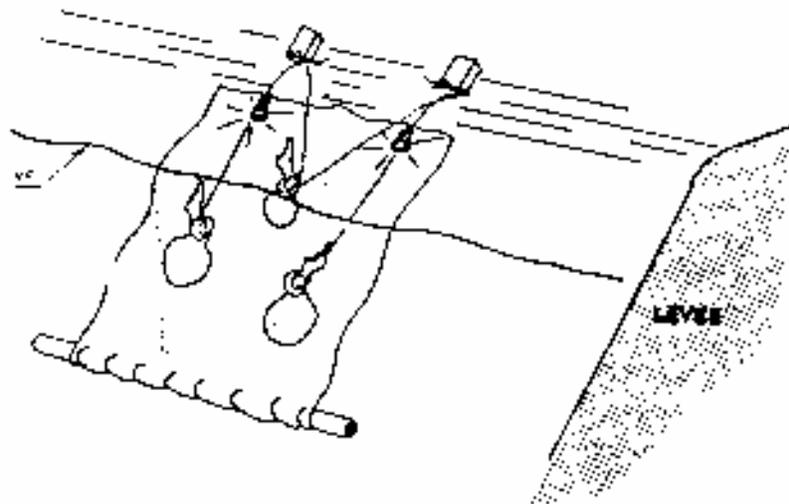
Place Sheeting Over Inlet Hole

Roll Out Pipe Down Levee Face – May Use Pole to Help Roll Out

Place Sandbag On Sheeting to Hold in Place

Bag at Lower 2/3 of Sheeting Straight Down From Each Stake

One Bag At Water's Edge Suspended Between Stakes



Information Sheet #8

TOPIC: GUIDELINES FOR PREVENTING EROSION OF LEEVE WITH PLASTIC

INTRODUCTION: Preferred method for preventing erosion in most situations

Prep Coverage – Lay Out Materials for Quickly Setting Plastic in Place

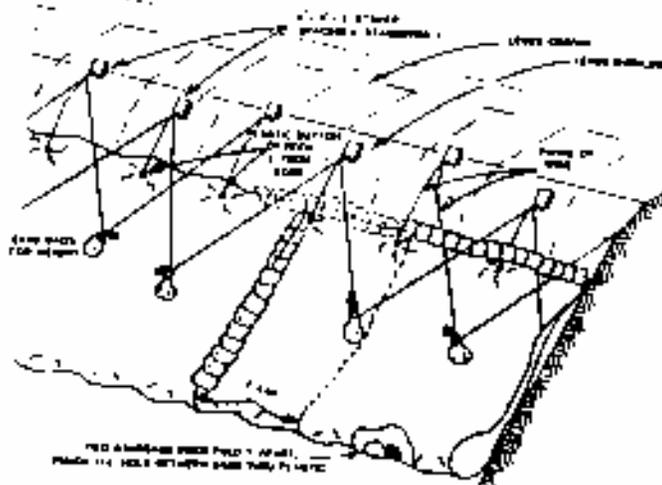
- Set 2" x 4" x 2' Stakes in Ground Just Above Levee Shoulder Next to Water
- Wide Side of Stake Toward Water, Leaning at Slight Angle From Water
- Put Stake Every 4 ft Distance, Stagger Each Stake by 1 ft
- Place Sandbags Every 1 ft Along Top of Levee (Weight Down Plastic Fold)
- Prep Lines for Holding Plastic To Stake – Cut To Length, Secure, Prep Tie End
- Prep Sandbag on Line for Holding Outside of Plastic Down
- Measure Length of Line Needed for Sandbag at Desired Level
- V Shaped Line Tied To Every Other Stake With Sandbag at Center

Set Visquine in Place – Use 8 to 10 People to Assist, Be Careful in Windy Conditions

- Use Large Sheet of Visquine (20 ft Wide by 100 ft Long by 10 mm Thick)
- Roll Out Over Area to Be Covered – Use Shovel Handles for Help Roll Out
- Shake Out Visquine So That It Is Folded in Half (Fold Toward Water)
- Punch ¼ Inch Holes in Plastic Fold Every 1 ft (Water Drainage)
- May Place Some Sandbags Early in Fold to Hold Visquine Down
- Anchor Top Of Visquine to Prepared Lines
- See GUIDELINES FOR WORKING WITH PLASTIC
- Weight Bottom Fold of Sheet With Sandbags (Every Foot)
- Weight Water Face of Sheet With Sandbags Suspended by Rope
- Weight Down Loose Sections With Sandbags Secured to Top of Levee

Overlapping Sections – Secure Multiple Sections As Needed, Overlap Area of 4 ft

- Note Direction of Current / Wind for Overlap – Top Sheet Upwind / Upstream



Information Sheet #9

TOPIC: GUIDELINES FOR PREVENTING EROSION OF LEEVE WITH PANELS

INTRODUCTION: Method preventing erosion for fast current conditions

Prefabricated Wooden Panels – See GUIDELINES FOR CREATING WOOD PANELS

Prep Coverage – Lay Out Materials for Quickly Setting Wooden Panel in Place
 Set 2" x 4" x 2' Stakes in Ground Just Above Levee Shoulder Next to Water
 Wide Side of Stake Toward Water, Leaning at Slight Angle From Water
 Put Stake Every 4 ft Distance, Stagger Each Stake by 1 ft
 Place Sandbags Every 1 ft Along Top of Levee (Weight Down Plastic Fold)
 Prep Wire for Holding Panels To Stake – Secure Wire to Bottom of Stake
 Leave Extra Wire at Top for Adjusting Panel

Prep Wooden Panels

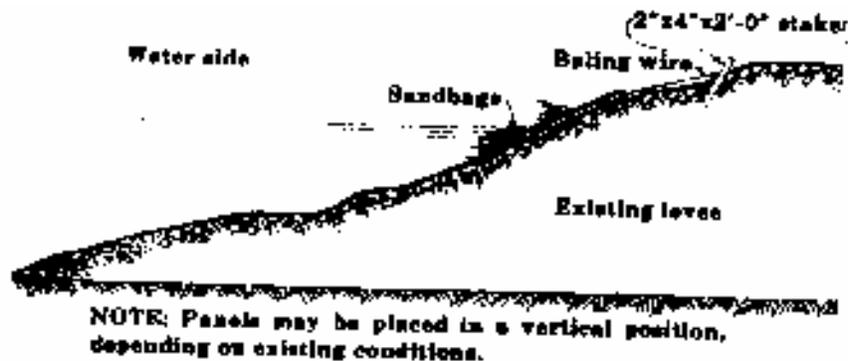
Lay Out Panels Lengthwise Above Coverage Area (May Use Panels Vertically)
 Can Stand Panels on Edge Leaning Against Lower Stakes
 Attach Wire to Hold Panels Through Top ½ Inch Gap and Around Batten
 Wire Sandbags to Bottom of Panel to Weigh Down Below Water Surface
 Bags Tied Off - See GUIDELINES FOR WORKING WITH SANDBAGS

Place Panel On Levee Slope

Move Panel to Edge of Water
 Push Panels Into Water With Pike Pole or Other Tool

Multiple Panels

For Bank Coverage > Length of Panel – Overlap Downstream Panel by 1 ft
 For Slope Coverage > Width of Panel – Wire Addition Panels Together



Information Sheet #10

TOPIC: GUIDELINES FOR CREATING A LUMBER AND SACK TOPPING

INTRODUCTION: Method to temporarily raise height of levee

Prefabricated Wooden Panels – See GUIDELINES FOR CREATING WOOD PANELS

Wooden Panel Secured to Top of Levee

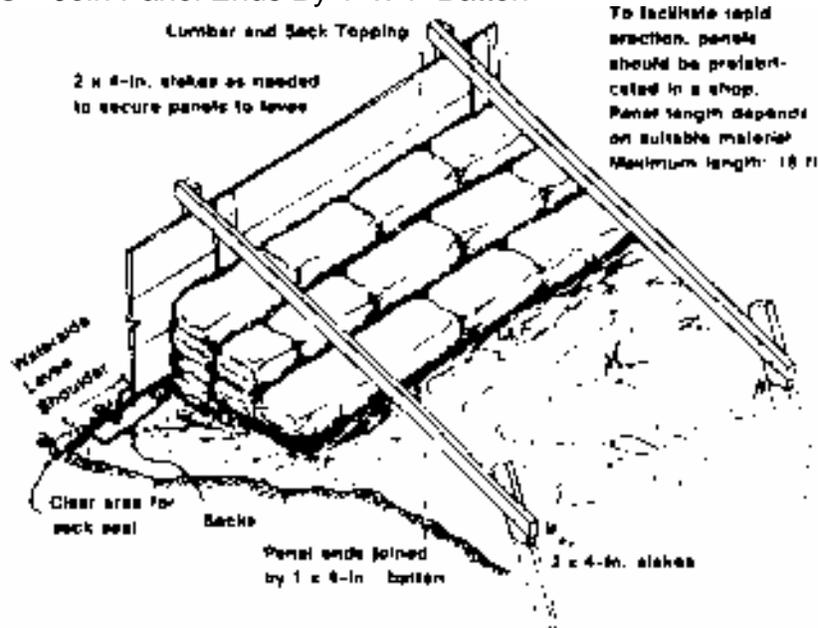
- Drive Support Stakes Into Top of Levee
 - 2" x 4" x 6' Long Stake Driven Into Top of Levee ~2.0' Deep
 - 6 ft Distance Between Stakes
- Dig Shallow Trench to Seat Wooden Panel
 - Line Trench With Empty Sandbags
 - Wooden Panel Rests in Trench and Is Attached to Stakes
- Nail or Screw Panel to Landside of Stakes

Back Wooden Panel With Sandbags as Needed – Based on Expected Water Height
May Be More Practical to Back With Tamped Earth

Attach 2" x 4" x 10' Long Lumber Kicker to Panel

- End of Kicker Secured to 2" x 4" x 2' Stake (At Angle Towards Panels)
- Secure Panel to Landside of Stakes (Minimum of 2 Nail / Screw Per Attachment)

Multiple Panels – Join Panel Ends By 1" x 4" Batten



Information Sheet #11

TOPIC: GUIDELINES FOR CREATING A MUD BOX

INTRODUCTION: Method to temporarily raise height of levee

Prefabricated Wooden Panels – See GUIDELINES FOR CREATING WOOD PANELS

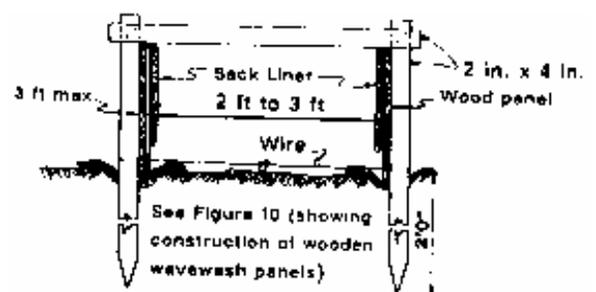
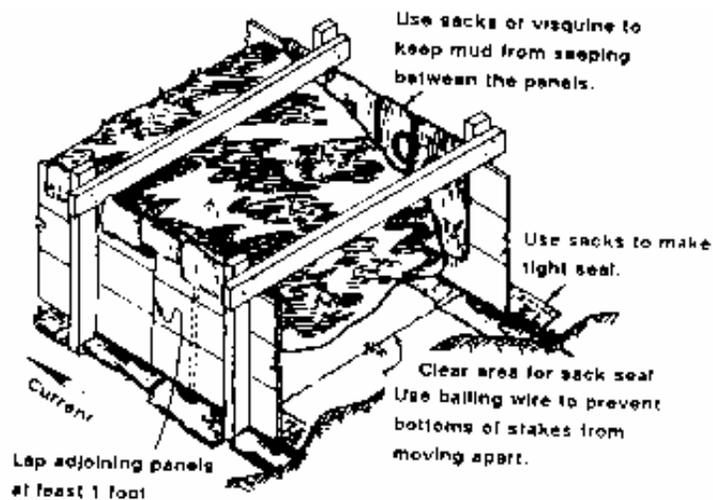
Wooden Panel Secured to Top of Levee – Near Waterward Levee Shoulder
 Drive Support Stakes Into Top of Levee – 6 ft Distance Between Stakes
 2" x 4" x 6' Long Stake Driven Into Top of Levee ~2.0' Deep
 Dig Shallow Trench to Seat Wooden Panel
 Line Trench With Empty Sandbags
 Wooden Panel Rests in Trench and Is Attached to Stakes
 Nail or Screw Panel to Landside of Stakes
 Add Plywood Sheet to Waterside Face for Mud Flows (Smooth Surface)

Secure 2nd Wooden Panel to Top of Levee – Similar Method to 1st Panel
 Place On Landward Side and Parallel to 1st Panel
 Wall Height to Box Width Proportional to 2 ft High to 30 In Wide
 Nail or Screw Panel to Waterside of Stakes

Attach Panels Together

Wooden Kicker Attaches Top of Stakes on Either Side Together
 Minimum of 2 Nail / Screw Per Attachment
 Bailing Wire Holds Stakes at Bottom on Either Side Together
 "Soupy" Fill Material - Line Space Between Panels (Plastic, Canvas or Burlap)
 If Lined With Plastic - Punch Pencil Sized Hole in Bottom for Drainage
 At Least 1 ft Overlap for Adjoining Panels (Note Overlap and Current Direction)

Add Fill Material – Fill Past Height of Expected Water Level



Information Sheet #12

TOPIC: GUIDELINES FOR CREATING A SACK TOPPING

INTRODUCTION: Method for temporarily raising the height of levee

Working With Sandbags – See GUIDELINES FOR WORKING WITH SANDBAGS

One Sack Provides About 3 – 4 Inches of Height

Bottom Layer of Sandbags

- Start With Row Above Shoulder of Levee on Waterward Side
- Lay Bags Parallel to Levee Shoulder
- Lap Bag Each Bag in the Row by 1/3 Over the Preceding Bag
- Lay Subsequent Rows of Bags to Inland Side of Levee
- Stomp Row (or Layer) Before Adding Sandbags Other Layers

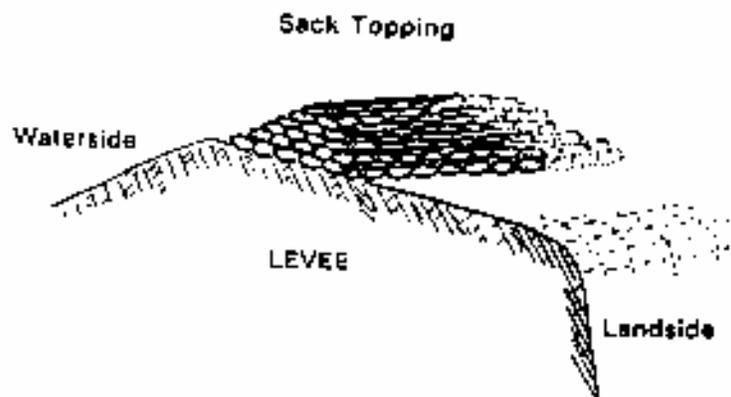
Next Layer of Sandbags

- Start On Top of 1st Layer Bags Closest to Waterward Side
- Taper Placement of Bags by ½ of Bag Width from Previous Layer Edge
- Lay Bags Crosswise to Bottom Sandbag Direction
- Lay Bags Staggered to Previous Location of Bags
- Stomp Row (or Layer) Before Adding Sandbags Other Layers

Following Layers of Sandbags

- Start On Top of Preceding Layer Bags Closest to Waterward Side
- Taper Placement of Bags by ½ of Bag Width from Previous Layer Edge
- Alternate Direction of Sandbag Placement
- Stagger Placement of Sandbags to Previous Layer
- Stomp Row (or Layer) Before Adding Sandbags Other Layers

For Example: Sack Topping 3 Bags High – Bottom 3 Wide, Middle 2 Wide, Top 1 Wide



Information Sheet #13

TOPIC: GUIDELINES FOR CREATING A TEMPORARY LEVEE

INTRODUCTION: Method for creating a temporary levee

Lay Out Large Section of Visquine – 20' x 100' x 10 mm Sheet Preferred
 Lay Out Flat in Position Desired for Temporary Levee (Water's Edge)
 May Use Shovel Handles in Ends of Tube to Help Roll Out
 May Need to Hold Down Edges Of Visquine in Wind (Sandbags on Edge)

Place Fill Material on Rear 1/3 Section (Away From Water's Edge)
 May Use Heavy Equipment to Place Material
 Leave Minimum of 2' Exposed Plastic Behind Fill Material

Secure Plastic Around Fill Material
 Wrap Entire Material With Plastic -
 Anchor Rear Area With Sandbags Row of Sandbags

May Need to Construct Emergency Spillway – Direct Expected Overflow
 Line Spillway With Sandbags and Plastic Sheeting As Needed

