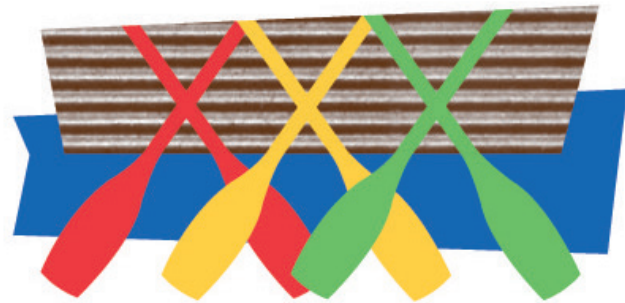




# **CARDBOARD BOAT REGATTA**

**River Legacy Foundation**



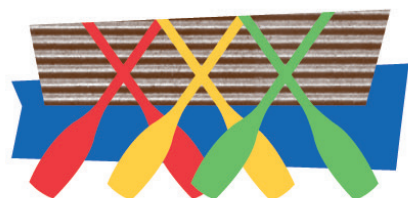
## **BOAT BUILDING MANUAL**

**Presented by River Legacy Foundation**



# **28TH ANNUAL CARDBOARD BOAT REGATTA**

**Saturday • April 22, 2017**  
**Six Flags Hurricane Harbor**



## CARDBOARD BOAT REGATTA

River Legacy Foundation

**Westlake *ACE* Hardware**

### OFFICIAL SUPPLY HEADQUARTERS FOR REGATTA

Visit our convenient Arlington location for your cardboard boat building supplies.  
We have everything you need to construct a seaworthy vessel.

Westlake's Arlington Hardware  
1705 West Park Row  
(corner of Park Row & Fielder)  
817-461-5803

**NEW:** Thanks to our Sponsor Harris Packaging, you can pre-purchase a pre-cut boat kit that all you have to do is assemble, paint and decorate to make it your own theme! Cost is \$100. To order your kit, contact Kristi Payne at 817.860.6752, ext. 107 or via e-mail at [kristi@riverlegacy.org](mailto:kristi@riverlegacy.org).

### SPECIAL THANKS TO SPONSORS:



**VIRIDIAN**



**HARRIS PACKAGING CORP.**

**Star-Telegram**

 **Smurfit Kappa**



### PRESENTED BY:





**CARDBOARD  
BOAT REGATTA**  
River Legacy Foundation

**AHOY, MATEY!**

Welcome to River Legacy Foundation's 28th annual Cardboard Boat Regatta! The first Cardboard Boat Regatta was part of the celebration when River Legacy Parks opened in 1990. It has grown from a small event with 17 boat entries to an eagerly anticipated annual event attracting over 200 boat entries and thousands of spectators. In 1997, the event moved from River Legacy Parks to Six Flags Hurricane Harbor. The Regatta is not only a significant fund-raiser for River Legacy Foundation, but also serves as a great outlet for practical hands-on math and science lessons for students and team building fun for all.

Our 28th annual Cardboard Boat Regatta is scheduled for Saturday, April 22, 2017, at Six Flags Hurricane Harbor, our gracious hosts for this event. In addition to the cardboard boat races, activities include Hook's Lagoon, a Children's Area featuring Hula Hoop Contests & the Mini-Boat Regatta, unlimited rides on the Tornado, Typhoon Twister & Tsunami Surge, Build-on-Site boats, a raffle for a chance to win a whale of a prize & Concessions. The Team Challenge will again include a Horseshoe Tournament & Spikeball for ages 14 and up. Companies, schools, clubs, organizations, and churches are invited to tackle the challenge which combines the boat races with these contests for a fun and friendly competition & Team Challenge Trophy!

The High School Challenge has become a fun, spirited competition among area schools. All high school entries will be entered in the High School Challenge, where schools can compete for bragging rights and the High School Challenge Trophy. Paint your boat in your school colors, make your mascot the captain of your ship, and show your school spirit! Increase your chances of winning by participating in the Team Challenge contests as well!

***Want to come to the Regatta in style?*** Pre-purchase our NEW dry-wicking performance tees! T-shirts can be ordered for groups or individuals online at [Riverlegacy.shirtsforacause.com](http://Riverlegacy.shirtsforacause.com) OR text Riverlegacy to 817-369-3022. Shirt prices range from \$12 to \$16. Get yours today. Order deadline is April 12 to allow time for direct shipping.



If at all possible, we ask that you bring your own life jackets and oars for this event. A limited supply will be available on race day before your scheduled boat launch time. **Please do not pick up life jackets before then.**

River Legacy Foundation is celebrating more than 25 years of excellence in environmental education and stewardship! All proceeds from the Regatta, including concessions, admissions, and registrations, benefit the nonprofit Foundation that provides funding for environmental education programs at River Legacy Living Science Center. The Foundation in partnership with the Arlington ISD provides outdoor education experiences to students throughout the school district. The Foundation also partners with the City of Arlington Parks and Recreation Department to provide funding for the continued preservation and recreational amenities of River Legacy Parks in Arlington.

**PLEASE NO OUTSIDE FOOD, DRINKS OR COOLERS ARE ALLOWED AT REGATTA!**

The following information will take you through the steps necessary to build a cardboard boat. Sink or float, we're certain you'll have a great time in the process.

Cardboard Boat Regatta entry forms can be downloaded from our Web site at [www.riverlegacy.org](http://www.riverlegacy.org), where you will also find more information about this fun, annual event. **For questions, contact Kristi Payne at 817.860.6752, ext. 107 or via e-mail at [kristi@riverlegacy.org](mailto:kristi@riverlegacy.org).** Best of luck at the Regatta!



# BOAT BUILDING BASICS

## **DEVELOPING A CONCEPT**

- Determine division/class/category you want to enter
- Sketch your creative ideas on paper
  - Calculate length, width, height, draft, balance
  - Consider size and weight of crew
- Build a scale model

## **PREPARING FOR CONSTRUCTION**

- Secure adequate work and storage space
- Gather supplies

## **SUGGESTED SUPPLIES**

- Corrugated cardboard - three layers for floor, two layers for walls
- Acrylic latex caulk
- String line or straight edge; right angle or squaring tool
- Carpet knife or Exacto knife; extra blades
- Wood glue, Liquid Nail panel adhesive, or DAP contact cement
- Water sealer; polyurethane
- Foam brush
- Paint brush or roller; paints, including latex house paint
- Paper tape, masking tape - NO DUCT TAPE
- Creasing tool (scissors work well)
- Clamps (spring & quick)
- Measuring tape

## **CONSTRUCTION STEPS**

- Transfer model concept to cardboard
- Mark lines
- Cut cardboard
- Bend cardboard
- Brace
- Glue
- Tape
- Seal
- Waterproof

## **BEING CREATIVE**

- Develop a theme

## **PADDLING**

- Types of paddles - canoe or kayak oars only
- Consider whether you'll be rowing alone or with others

## **TESTING**

- Test prior to the event or take your chances on race day!

**REMEMBER THIS IS A FUN EVENT!**

**SINKINGS ARE AS MUCH FUN FOR SPECTATORS AS AWARD WINNING TIMES ARE FOR PARTICIPANTS!**



## RACE DIVISIONS • CLASSES • CATEGORIES

The first step is to consider the boat division, class and category you might want to enter.

|                                           |                 |                                        |                                           |
|-------------------------------------------|-----------------|----------------------------------------|-------------------------------------------|
| <b>DIVISIONS:</b>                         | Youth<br>(8-13) | Adult<br>(14 and older)                |                                           |
| <b>CLASSES:</b>                           | Class I         | Class II - Mechanical<br>(Adults only) | Class III - Build On Site<br>(Guppy only) |
| <b>CATEGORIES:</b><br>(# of Crew Members) | Guppy<br>(1-2)  | Dolphin<br>(3-5)                       | Whale<br>(6-10)                           |

### Class I Boats

**Boats in this class must be propelled by canoe or kayak oars or paddles.** These propulsion tools, as well as decorations, may be constructed from materials other than cardboard. ALL OTHER PARTS of the boat must be corrugated cardboard. This includes the hull, decking, keel, cowling, superstructure, oar locks, seating and rudder. Nuts, bolts, washers and staples are not allowed.

### Class II Boats - Mechanical (Adults Only)

Class II boats must meet the requirements of Class I boats, with the exception of the propulsion and steering systems.

The muscle-powered propulsion system (propellers, paddle wheels, sails) and the steering system (rudders) do not need to be made of cardboard, but materials used must not contribute significantly to the structural rigidity of the boat. Propulsion and steering systems must be designed and fabricated by the entrant. In addition, the connections between the propulsion and steering systems must be made of corrugated cardboard.

Propulsion and steering devices must not damage the bottom of the Wave Pool. Oars and paddles are prohibited, as is swimming or paddling with a surfboard of corrugated cardboard.

### Class III Boats - Build On Site

Boats in this class will be built on-site at Hurricane Harbor event day. Basic boat building supplies will be provided: 3 pieces of double ply cardboard, 2 rolls of duct tape, 2 sheets of plastic, box cutter, a pencil and yard stick. Participants have 2 hours to build their Guppy boat with the supplies provided to them. Class III boats must abide by all Class I race and safety rules. Class III boats will race in the Wave Pool on the U-shape course and will use oars or paddles to propel themselves. **Build-on-Site boats are the only boats allowed to use duct tape.** Build On Site boats can have unlimited builders, but only 2 crew members can race in the boat.



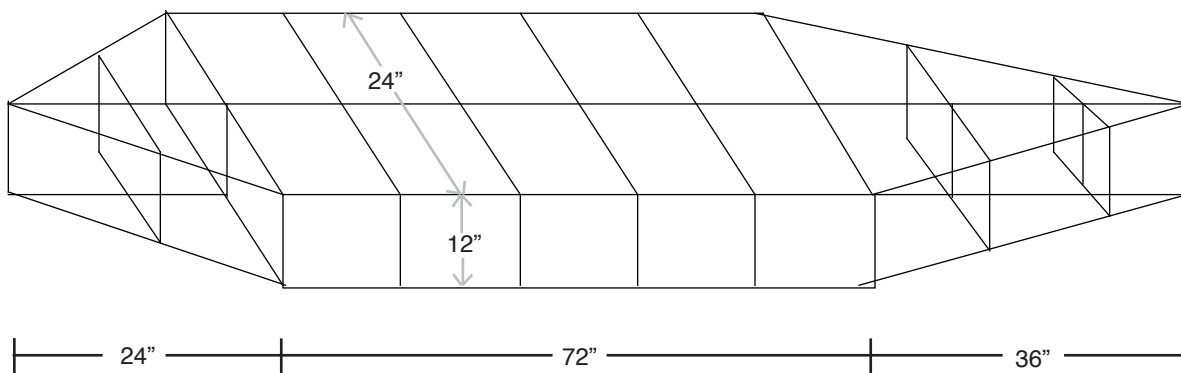
## BOAT DESIGN FUNDAMENTALS

Before you develop a concept, consider these fundamentals of boat design.

A boat floats in the water and displaces a quantity of water equal to the weight of the boat and the crew. If the weight you put into a boat is greater than the weight of the water the boat displaces, the boat sinks.

Water weighs approximately 60 pounds per one cubic foot (12" x 12" x 12" cube).

For illustration, let's look at the smallest size boat, a guppy with a single crew member. Once you understand this example, it'll be easy to calculate for a larger boat.



The above boat sketch is 24" wide, 12" high and 72" long, with an additional 24" tail and 36" nose, which makes the overall length 132" or 11 feet. The inside volume of the boat is 17 cubic feet ( $L \times W \times H - 6' \times 2' \times 1' = 12'$ , plus 2' for the tail and 3' for the nose). As we stated earlier, water is 60 pounds per cubic foot; therefore, this boat's total displacement weight is 1,020 pounds (17' x 60 lbs.).

The side of the boat is 12" high; therefore, it takes 85 pounds to push the boat down into the water 1" (1,020 pounds divided by 12 = 85 pounds). If a single crew member weighs 170 pounds, the boat will be pushed down into the water 2" (**a 2" draft or waterline**). The weight of the boat was not included in these calculations, so the actual draft would be slightly higher. A 2" draft gives the boat approximately 10" before water enters the boat from a wave.

That's the basis of floating (designing) a boat with one crew member. If you put two crew members in this boat (add 175 pounds), the draft would be 4" and would leave only 8" to the top of the boat – maybe okay for smooth water, but a little wave action might sink the boat.

Therefore, more crew members require a larger boat, to displace more water and still keep the draft small relative to the side of the boat to protect from wave action and sinking.

Now, let's look at other aspects that influence the final design of the boat, such as:

- Hull and Prow Types
- Stability
- Balance

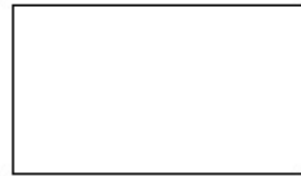


## TYPES OF HULLS

Hulls with flat surfaces are easier to build but are not as stable in the water as others.



**A**



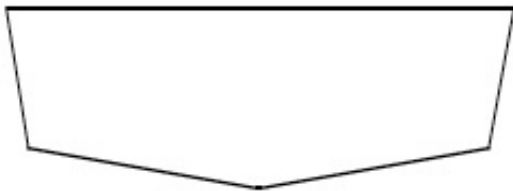
**B**



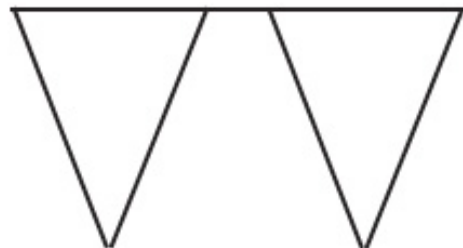
**C**



**D**



**E**

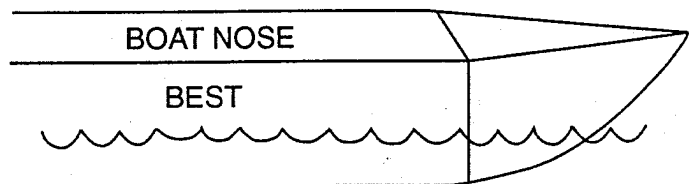
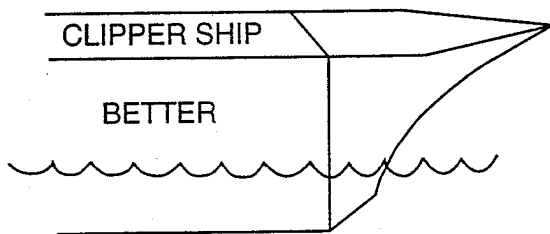
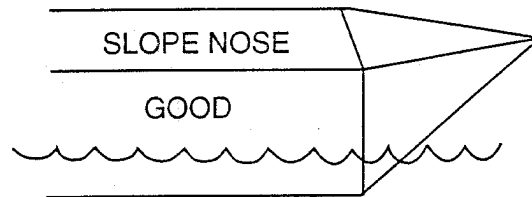
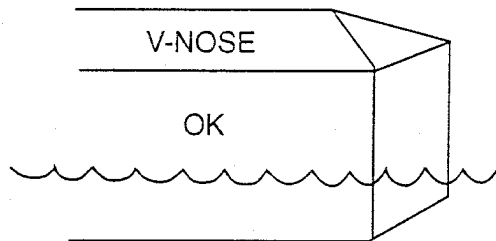
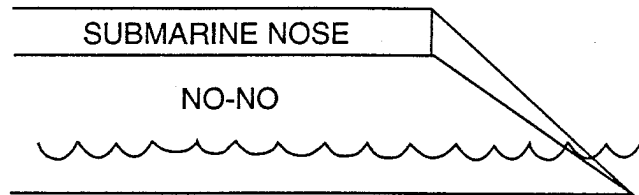
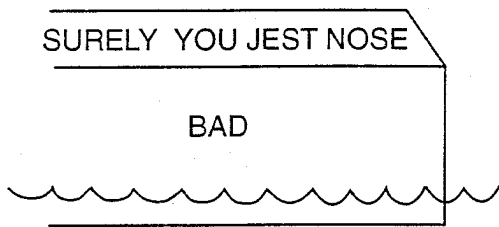


**F**



## TYPES OF PROWS

Some prow types deflect water better in wave action than others. Keep in mind that you'll need to blend your prow shape with your hull bottom shape or "footprint." Consider where the waterline will be when your boat is loaded.

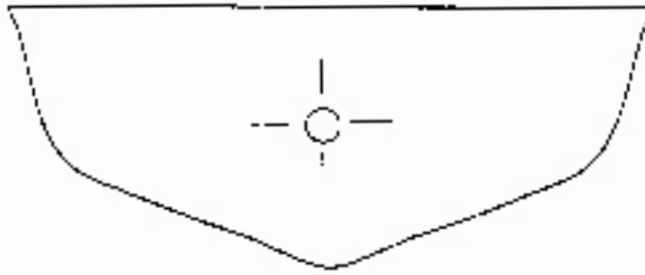




# BOAT STABILITY • DESIGN CREATIVITY

## CENTER OF GRAVITY

The next area to consider is boat stability. The sketch below shows a cross section of a hull and the center of gravity (cg). As crew members position themselves in a boat, some of their body obviously sticks out of the boat. The lower the crew sits in the boat, the lower the cg. Your goal is to make the cg at or below the waterline or draft. This makes the boat more stable and more difficult to tip over.



## BALANCE

The balance of the boat forward and aft is also very important for proper performance. The center of the boat forward and aft is approximately in the middle of the boat. When positioning the crew, keep the most weight to the rear of the boat. By doing this, the prow will tend to stay up in rough water, keeping water from entering the boat from the front.

## DESIGN CREATIVITY

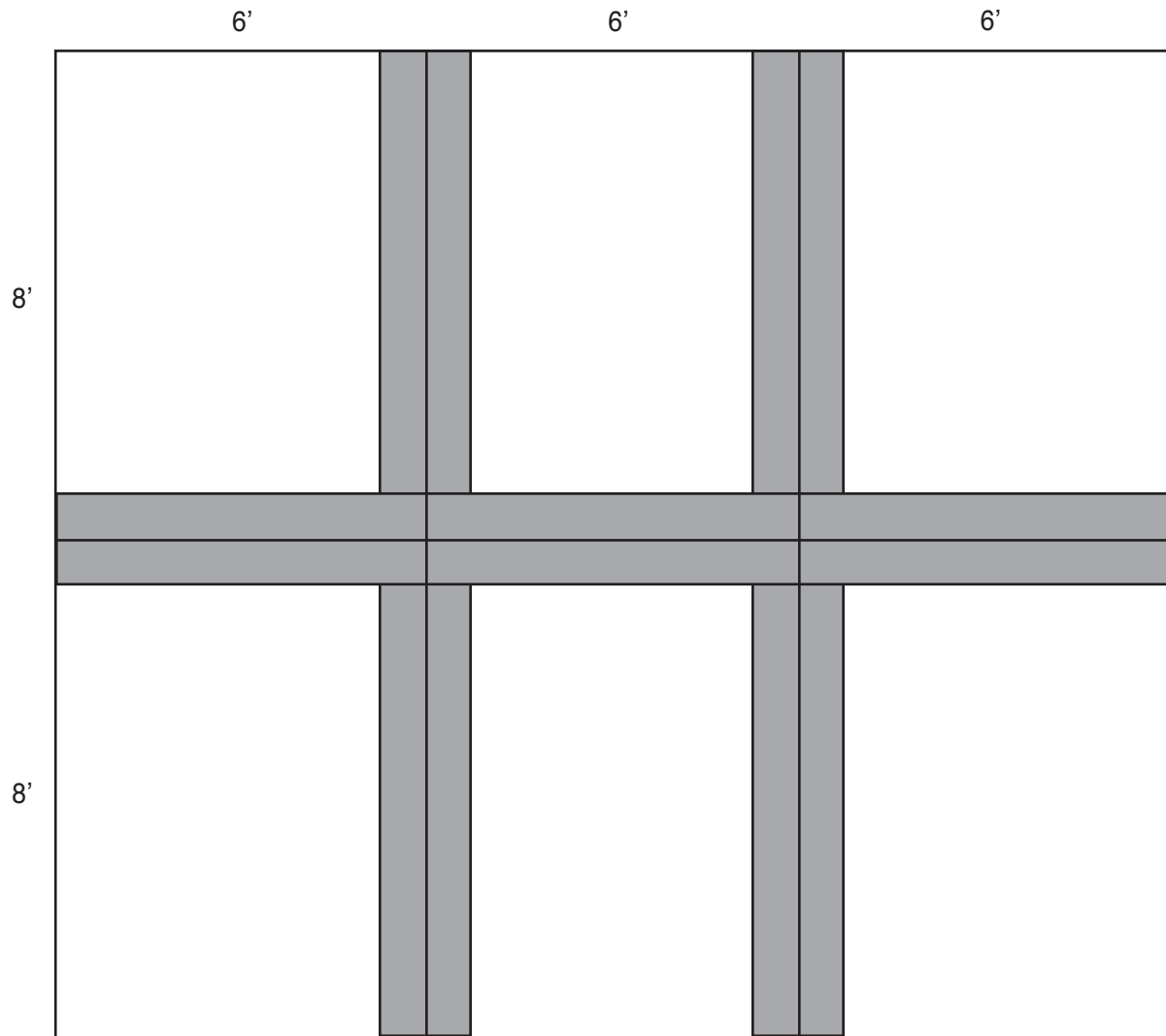
So far, we've only discussed the technical issues of boat design. The more creative part of your boat building project is the boat's theme and decoration for both boat and crew. The sky's the limit as long as you follow basic construction and safety rules, which are listed in the back of this packet.

Your boat could look like a Viking ship, a row boat, a battleship or a tug boat. It could be built to look like a banana, a tube of toothpaste or a school bus. Let your imagination be your guide!



## CONSTRUCTION CONCEPTS

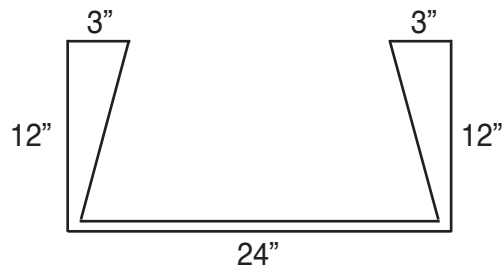
If possible, cut your boat from one sheet of cardboard. Several sheets of cardboard can be spliced together to make a big sheet. Splicing six, 6 x 8' pieces creates one, 18 x 16' piece.



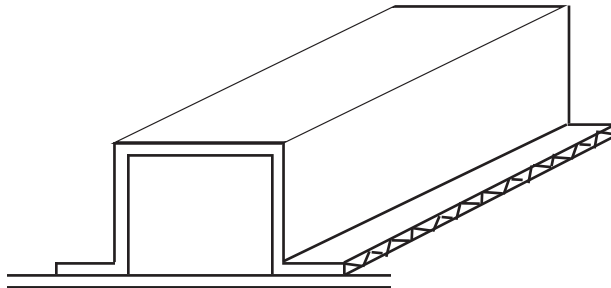


## CONSTRUCTION TECHNIQUES

### CROSS SECTION OF BOAT USING A LARGE PIECE OF CARDBOARD

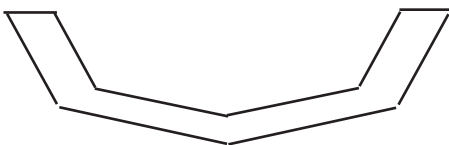


### STIFFENERS GLUED TO THE INSIDE BOTTOM AND SIDE OF THE BOAT ADD STRENGTH

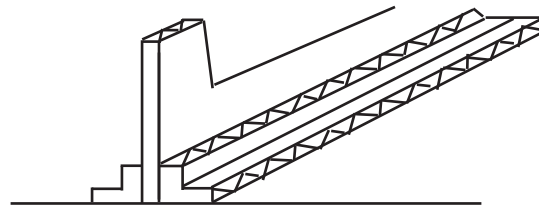


Stiffeners run the length of the boat

### ATTACHING BULKHEADS TO ADJACENT CARDBOARD (OUTER BOAT SKIN)



Bulkhead side view



How to attach bulkheads



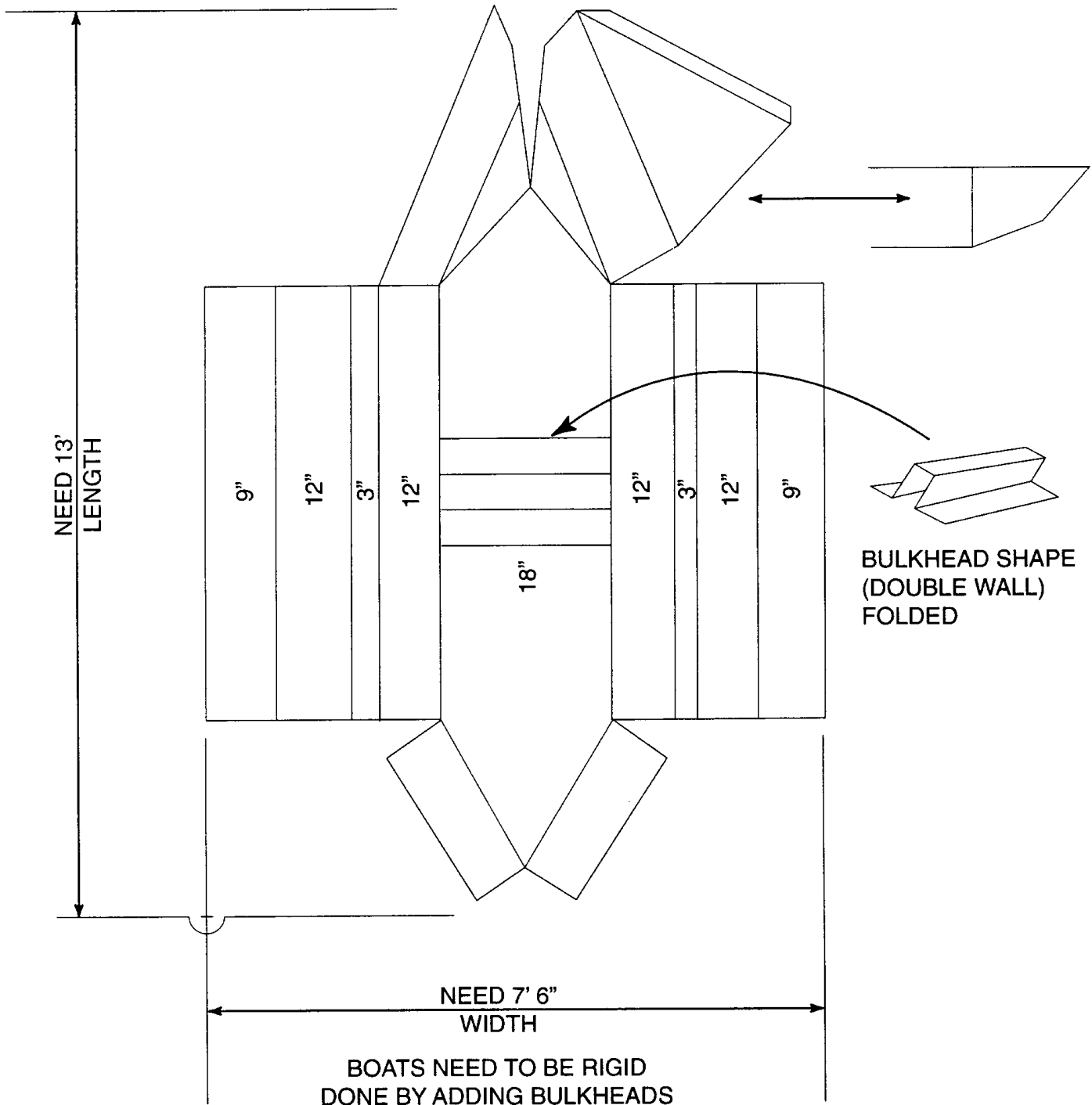
## SAMPLE GUPPY DIMENSIONS

720 LBS.  
1200 LBS.

12 cu. ft. – 1 man  
20 cu. ft. – 2 man

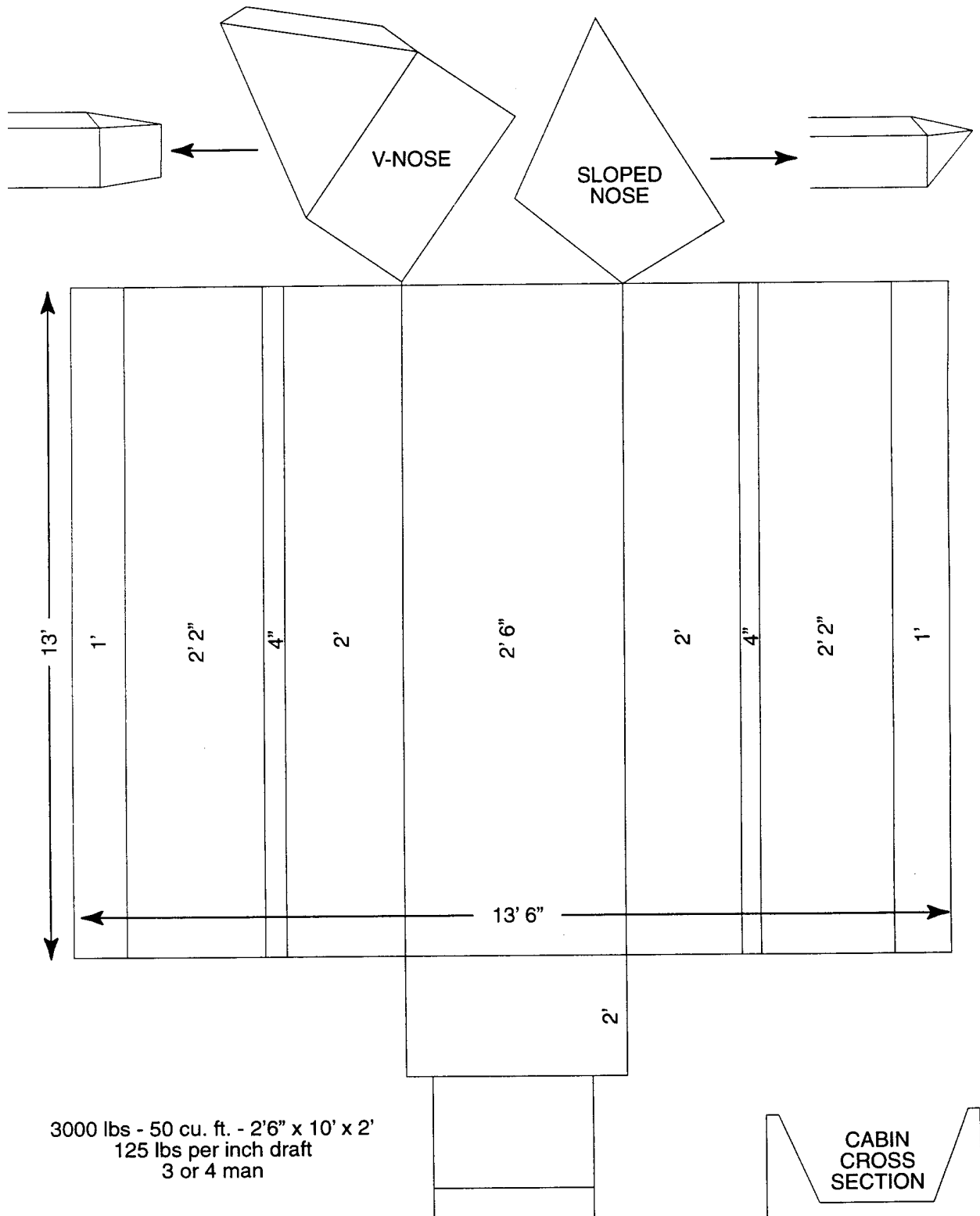
18" x 8' x 1'  
2' x 10' x 1'

8' CABIN  
3' NOSE  
2' TAIL





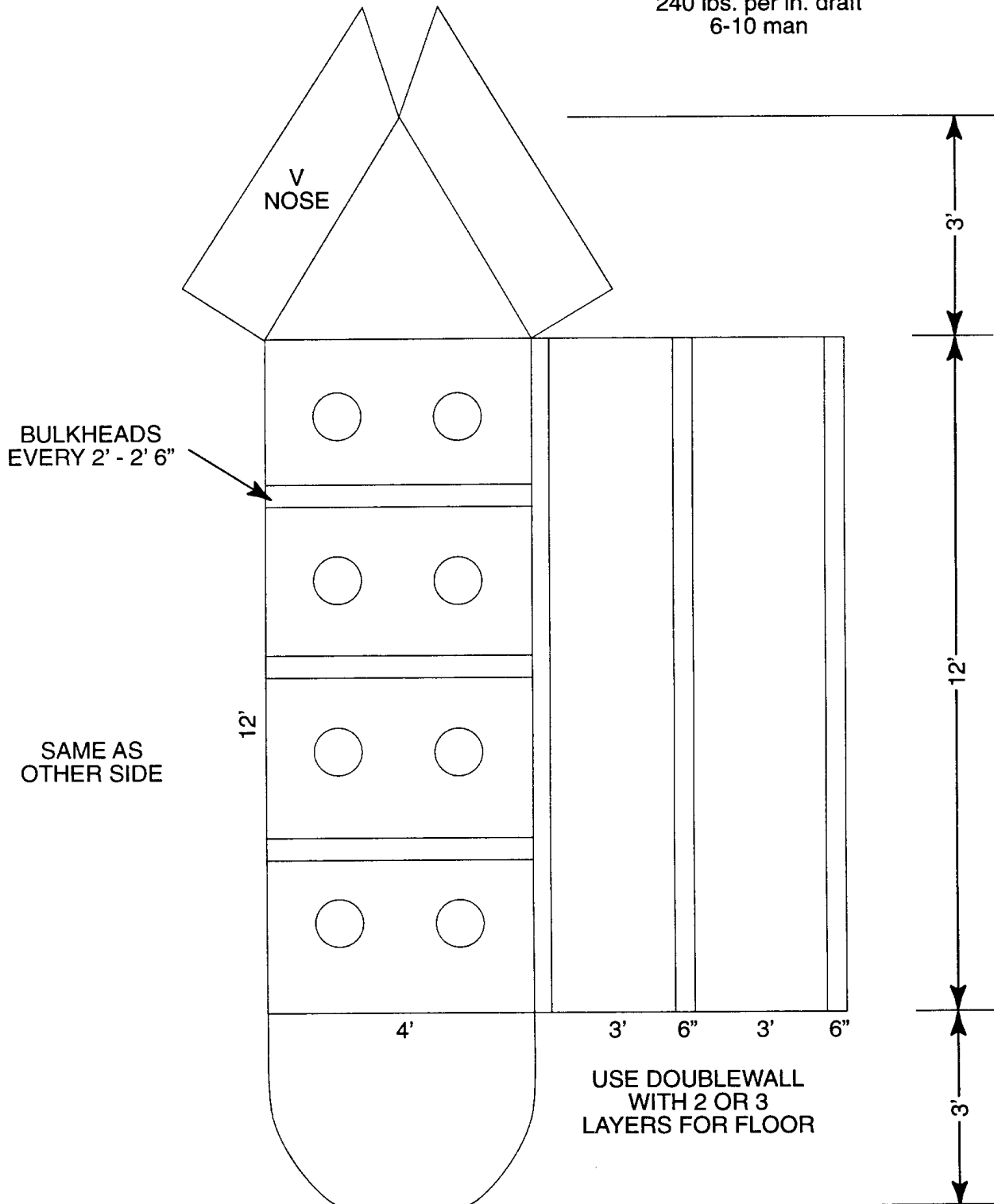
## SAMPLE DOLPHIN DIMENSIONS





## SAMPLE WHALE DIMENSIONS

8640 lbs - 144 cu. ft. - 4' x 12' x 3'  
240 lbs. per in. draft  
6-10 man



# RULES & REGULATIONS • 2017



## CONSTRUCTION RULES & SUPPLIES

1. Any thickness of corrugated cardboard is permitted, but waxed cardboard, carpet tubes and barrels are not allowed.
2. Only paper tape may be used. Tape may only be used on seams, joints or patches. **DO NOT WRAP THE HULL IN TAPE, PLASTIC, SHRINK WRAP OR ANY OTHER MATERIAL.**
3. Caulking may be used, but only on seams and edges.
4. A one-part enamel or lacquer paint and/or polyurethane varnish or water seal is permitted. Do not use tar-based substances, epoxy glue, duct tape, fiberglass resin or any two-part substances, including two-part varnishes and paint. ***Applied paint must be allowed to dry for at least 24 hours prior to launching.***
5. Styrofoam or any other flotation-type foam is a major no-no. Violators will be branded "Pirates" and stripped of any trophies.
6. There is no restriction on decorative materials, as long as they do not aid in the flotation or propulsion of the boat and do not create a fire or safety hazard.
7. All boats must display the assigned entry number on a vertical surface of the boat. The number must be at least 6" tall.
8. Racing height for Class I youth boats, including seated crew members, must not exceed three feet in height from the surface of the water.
9. Racing height for all other boats (Class I Adult, Class II and Class III,) including seated crew members, must not exceed eight feet in height from the surface of the water. Non-racing height, is unlimited.



## SAFETY RULES

1. All boat occupants must wear appropriately sized, properly fastened U.S. Coast Guard-approved life jackets. **LIMITED SUPPLY AVAILABLE ON RACE DAY. IT IS BEST TO BRING YOUR OWN.**
2. The passenger area of the boat must not be permanently enclosed above the shoulders of the occupants. Each occupant must be visible while the boat is in the water.
3. Boats must be free of sharp edges or anything that could pose a danger.
4. Consumption of alcoholic beverages or other substances which might impair a participant's judgement will not be permitted before or during the race. No alcohol is permitted in Hurricane Harbor.
5. Children under 8 years of age will not be permitted to race.
6. All participants must be able to swim.
7. There are race height limitations for all boats. See Construction Rules #8 and #9.



## RACE RULES

1. Each boat must have a designated Captain. The Captain must check in at the registration area on the day of the race during the designated time.  
**Youth** 8:30 - 9:15 am      **Adults** 9:30 - 10:45 am
2. To qualify as a finalist, participants must correctly navigate the race course around the buoys and all crew members must be in the boat as it crosses the finish line.
3. Boats with the fastest times in the time trials will advance to the semifinals, and/or finals.
4. **Filming of a perceived race violation will not be viewed or considered. The official spotters have the final say.**
5. Navigating crews for Youth Class I & Class III boats must start the race in the boat. Navigating crews for Adult Class I boats must start the race out of the boat. Navigating crews for adult Class II boats must start the race in the boat. Navigating crews who start the race in the boat are not allowed to get any help pushing off.
6. Any boat not ready to race at the designated time will be disqualified.
7. **Time trials for Class I youth boats will now be in the Wave Pool.** Youth semi-finals and finals will be in the Wave Pool, without the wave action.
8. Time trials and semi-finals for adult boats will be held in the Wave Pool, without the wave action. Waves will be turned on during the finals. If no boat finishes in the finals, winners will be based on semi-final results. If three or fewer boats are entered in a category, the boats will race in the time trials and finals only.
9. **Participants MUST retrieve their boat – or its remains – from the water.**
10. Youth will race with adults if there are fewer than two youth entries. Any entry with a crew member age 14 or older will race with the adults.
11. A participant may compete in more than one class or category; however, the rules of each class entered must be followed and a different boat must be raced in each category.

## MINI-BOAT REGATTA

The Mini-Boat Regatta provides an opportunity for children ages 4 to 14 to race mini-sailboats along rain gutters by blowing on the sail of their boat. With a huff and a puff they will race their boats to the finish line. Awards will be received in each category for 1st, 2nd and 3rd places.



Registration for the Mini-Boat Regatta is \$5 and does not include Regatta admission. Registration forms are available at [www.riverlegacy.org](http://www.riverlegacy.org).

Mini-Sailboat kits can be purchased at River Legacy Living Science Center's Acorns Gift Shop. A limited supply will be on hand race day for use with a refundable deposit.



## **TROPHIES**

### **STEVE CALLOWAY LEGACY AWARD**

Best of Show



### **ADMIRAL'S PRIDE**

Outstanding entries in each class



### **RAH! RAH! AWARD**

Most spirited team



### **FASTEST FINISH AWARDS**

Winner in each division of both classes



### **JUDGES AWARD**

To guarantee an award, simply chat with the judge\$.  
Bribe\$ are gladly accepted and benefit River Legacy Foundation.



### **TITANIC AWARD**

Each year, the Titanic Award is given to the crew of the boat  
that sinks in the most spectacular fashion.



### **HIGH SCHOOL CHALLENGE**

High School with the most points/awards wins bragging rights!