Marker Buoys

The idea is to build (8) 3-foot long distance markers for the sidelines of the test area. We have found that over the past 5 years (10 tests so far) that this design offers the several advantages over some of the markers we used in the past.

They are:

- The dogs don’t seem to bother with the markers, as they don’t look like anything to play with. Just a 12” of white post in the water.
- With the anchoring lines at least 18” below the surface, there is much less of a chance that the line will foul a swimmer or a dog if they get too close to the markers.
- Once you get the hang of it the set up time will go much quicker because you will be dropping the anchor at the prescribed distance with all the line you need on the anchor side of the tightener, then coming back to take up the slack just enough to bring the marker just above the anchor. This is made easy due to the Line Tightener that is attached to the bottom eyebolt of each marker with a carabineer. The line will pull freely through the tightener in only one direction, from the solid body and through the plunger. To get the line to go in the other direction you have to pull the plunger away from the body slightly. This loosens the grip of the ball bearings that are inside the body. When you prepare to put out the markers you let all the line out on the Anchor (body) side of the tightener. Remember you can pull the line through by pulling on the free end (the end with the ¾” nut tied to it) without pulling out on the plunger.

Fig 1: Note: The above picture does not show the carabineer which attaches to the brass colored handle on the tightener and to the eye. It makes it easier to grab the line when you use the carabineer.

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Figure 1: Close-up of Line Tightener Assembly

Pull Plunger To Release Rope

Free End to 3/4" Nut

To Anchor
Parts & Materials List  (For 8 marker buoys)

3  10 Foot length of 3 Inch diameter White PVC *Drain* COEX Solid pipe. Cut to 3-foot lengths
16 Caps for the above *Drain* pipe (not the test caps)
8  ¼” X 2” Eyes
16 Nuts to fit the eyebolts
16 ½” Fender washers
16 ½” Regular washers
8  ¼” lock washers
32 ¾” long, #14 pan head screws
8  ¾” *Galvanized* nuts – for weights to be tied on the free end of the line after it is threaded through the line tightener to weigh down this line so that it will not interfere with the dogs.
1 Piece of 2’ x 4’ x 1½” foam insulation, (Polystyrene-GA) - $4.32
1 Small tube of blue Loctite to apply to the threads on the eye bolts to keep them tight.
8 S-3 line tightener
   • Ace Hardware or True Value Hardware can order them for you, or you can look them up on the Internet. Made by: S-R Manufacturing, Schenectady, N.Y. 12306
   • Some of the line tighteners list the max line size as ¼” others say 5/16”. From what I can see they are the same piece of hardware so if you are going to use 5/16” line test it out first. It may be tight.
8 Small *Aluminum* spring link Carabineers
8 Small river rock or weight approx 10-12 oz.

Assembly is as follows:
1. Cut the 3” *white plastic COEX drainpipe* into 3-foot lengths with a hacksaw.
2. Use a pipe cap as a template and with a magic marker draw out several circles on the 1½” Polystyrene wall insulation. Test out a few to see if they fit tightly in the tubes before you cut them all out and adjust your procedures accordingly. A good fit needs to be pushed into the tube so that it will go in straight. I push them down just enough to place the next one on top then push some more until I get all 14 foam discs into the top 21” of each tube. The last one should be flush with the top of the tube. *See Note 1 below.*
3. Install a cap on the top being sure it’s all the way down on the tube. Pre-drill (2) 1/8” holes through the cap and tube half way down the cap, with a 1/8” bit on opposite sides of the cap.
4. Fasten with (2) ⅜” #14 Pan head screws.
5. Measuring down from the top, drill (2) ½” holes, 23” down from the top, on opposite sides of the tube. Then drill (2) more 33” down from the top. This is to let the water come into the tube so that it will right itself in the water. It also requires much less weight this way.
6. To assemble the bottom caps start by drilling a ¼” hole in the center of each of the 8 caps. Then assemble the eyebolt on the caps as follows:
   • Screw a nut all the way up each eyebolt.
   • Add a washer and a fender washer to the eyebolt.
   • Insert this through the hole in the cap with the eye on the outside.
   • Then add a fender washer, a washer, a lock washer, and a nut and tighten thoroughly.
   • Place a few drops of Loctite on the threads and let dry.

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7. Insert the weight inside the tube. A small round rock about 12 oz. works well.
8. Install the eye bolt/cap assembly on the bottom of the tube being sure it’s pushed all the way down on the tube. Pre-drill (2) 1/8” holes through the cap and tube, half way down the cap, with a 1/8” bit on opposite sides of the cap.
9. Fasten with (2) ¾” #14 Pan head screws.

Notes
1. This is the most time consuming part of the assembly process. Cutting 112 foam discs that are used for buoyancy isn’t hard (I used a scroll saw which works very well but it still takes some time. While at a National, it was suggested to try those “Water Noodle “ toys used in swimming pools. These are about 4’ long and the idea looked promising. As long as they keep their buoyancy over time and fit nice and snug in the tubes then I think it should work out just fine. I know that they would save time. Good luck and please let me know if they work.
2. Anchoring lines for the marker buoys use ¼” Solid braid Nylon line, Length as needed for your site. If you use the same site from year to year it pays to mark the tops of the markers and adjust the line you carry on each accordingly. Example: Left side-35, LS-50, LS-75, Right side-35, RS-50, RS-75.) At our site the length of line varies from 6’ to about 40’ long. It’s easier if you know which one goes where so that you don’t end up needing one with a long line and only have the short ones left.
3. Anchors to suit site location. Depending on location, something in the area of 3 to 10 lbs. Some ideas from the past include cement blocks (bulky, but solid), several Diver’s lead weights, and small grappling hook or mushroom anchors from Army Navy stores. For the distance markers we have used 2-liter plastic pop bottles or gallon plastic juice bottles filled with cement and inserted a 1/4” x 4” eyebolt with a nut on the bottom into the cement while it was still wet. Let it dry overnight at least. They worked well for us.
Moorings for WRDX

This is very similar to the marker construction, only everything is on steroids. We will be working with 4” white COEX plastic drainpipe and larger fittings throughout.

Parts & Materials List (For 2 mooring buoys)

(1) 5’ piece, White 4” COEX Drain pipe, (10 ft. piece = $10.00), cut into (2) 5 foot pieces
(4) White 4” COEX Drain pipe caps (several different types so be sure that whatever you get, fits)
(2) 5 1/2” long, 3/8” diameter hex bolts
(8) 3/8” nuts
(6) 3/8” Nyloc nuts
(3) 3/8” eye bolt, 3” long, (need just 2 inches of threads) for the bottom cap
(2) 3/8” eye bolt, 5” long, (needs just 2 inches of threads), For the Top Cap
(8) 3/8” Fender washers
(8) 3/8” washers
(6) 3/8” Lock washers
(2) Line Tightener
(2) 5/16 spring link carabineer
(2) Approximately. 1LB weight. A round, river rock about 31/2” diameter. Works well.

(Depending on the type drainpipe you get, you will need to vary the amount of weight that you need. The end result should be that the mooring will right itself and float with about 18 to 24” above water. I used Schedule 40 pipe once, which is very heavy and besides being overkill for what we needed, it weighted so much that it didn’t need any weight at all. That’s why I now recommend the COEX pipe.)

(6) #14 X 1” Pan Head Phillips, Sheet-metal, screws
(2) Galvanized 1” Nuts for weight on line
(1) Polystyrene housing insulation, (2 ft. x 4 ft. = $4.81)
(*) 5/16” Braided Nylon line, (50 ft. = $ 9.77) Depends on test site

The Moorings for WRDX will need 5/16” Braided Nylon line. This larger diameter line is easier on your hands when you’re pulling up the larger anchors that you will need to keep the moorings in place during the test. It does not however feed thru the line tightener easily. This is how I do it.

Caution: This melted Nylon is VERY hot and will cause a very nasty burn. Ove-gloves and several pieces of cardboard folded over will help. The melted Nylon will also will drip if you melt it too long, and it stays hot for quite some time. ---- Danger Will Robinson!

The idea is to heat up the line with a lighter about 6” from one end and draw the melted nylon out so that it is thinner. Then you cut the line at the thinnest spot and use the newly tapered end to thread through the line tightener. This sounds more complicated than it is, but we don’t want to get burnt. I insert the line through the plunger side of the tightener, as it seems to go better that way. On one occasion I had a real tough time and found that I could pull back on the outer sheath of nylon on the line and expose the cord filling inside. I pushed the sheathing back about 6” and cut the cord core out. Then I pulled the sheathing back and melted the end as described above. Without the core it was thin enough to get through the line tightener. Remember you should only have to do this once for each mooring.
Assembly is as follows:

1) Cut the 10 ft. piece of 4” white plastic drainpipe into 5-foot lengths with a hacksaw.

2) Measuring down from the top, drill (2) ½” holes, 41” down from the top, on opposite sides of the tube. Then drill (2) more 57” down from the top. This is to let the water come into the tube so that it will right itself in the water. It also requires much less weight this way.

3) Use 3 “pipe cap or a food can as a template and with a magic marker draw out several circles on the 1 ½” thick Polystyrene wall insulation. Test out a few to see if they fit tightly in the tubes before you cut them all out and adjust your procedures accordingly. A good fit needs to be pushed into the tube so that it will go in straight. I push them down just enough to place the next one on top then push some more until I get all 26 foam discs into the top 39” of each tube. The last one should be flush with the top of the tube. Pushing the foam down some 39”can get difficult toward the end. I found that if get about half of them down to just above the holes you drilled at 41”, then you can poke a hole in each disc just big (smaller than a pencil) enough to let the air escape as you push. They go in easier that way.

4) To assemble the caps start by drilling a 3/8” hole in the top center of each of the 4 caps. In the (2) caps that will be used on the bottom, drill a 3/8” hole straight through so that the 51/2” long, 3/8” diameter hex bolt will go through. Position this hole half way down the length of the cap. You will need help with this to get it straight. Note: I made a box jig out of 3/4“ plywood to do this accurately and safely. The cap’s outer circumference fit tightly into the inside of the box. I had predrilled the holes in the box and made sure that they were properly positioned to assure that the 3/8” hex bolt fed through. The box held the cap in position and I then drilled the 3/8” hole in the sides of each cap. See Figure M1 &M2 below.

5) Then assemble the eyebolt on the caps as follows:
   i) Screw a nut all the way up each eyebolt.
   ii) Add a washer to the eyebolt.
   iii) Insert this through the hole in the cap with the eye on the outside.
   iv) Then add a 2 fender washers, a washer, a lock washer, a nut and a Nyloc nut and tighten each thoroughly.
   v) Install a Top Cap on the tube being sure it’s all the way down on the tube.
   vi) Pre-drill (3) 1/8” holes, half way down the cap each a third of the way around through the cap and tube.
   vii) Fasten with (3) 1” #14 Pan head screws.

6) Then assemble the eyebolt on the Bottom caps the same as the top. Note: The length of the eye bolts on the bottom inside the tube need to be short enough so that they do not interfere with the 51/2” long, 3/8” diameter hex bolts that are used to assure the bottom cap does not come off.

7) Insert the weight inside the tube. A small round rock about 12 oz. works well.

8) Insert the 5 ½” hex bolt through the cap and tube and secure with a 3/8 nut and a 3/8 Nyloc nut and tighten each thoroughly.
Fig M3 Bottom mooring cap assembled

Fig M4 Inside bottom Mooring cap Note: I had used J.B.Weld, but I don’t think it’s necessary.