

# Home Hydro Systems

## Twelve plant Hydroponic Flood and Drain System

This is a easy to build hydroponic system, as well as a relatively inexpensive system, and it works beautifully for a lot of different type's of plants. I built it to hold 12 plants, but you can space them as you like. You can also always just cover up any unused openings if you have to many.

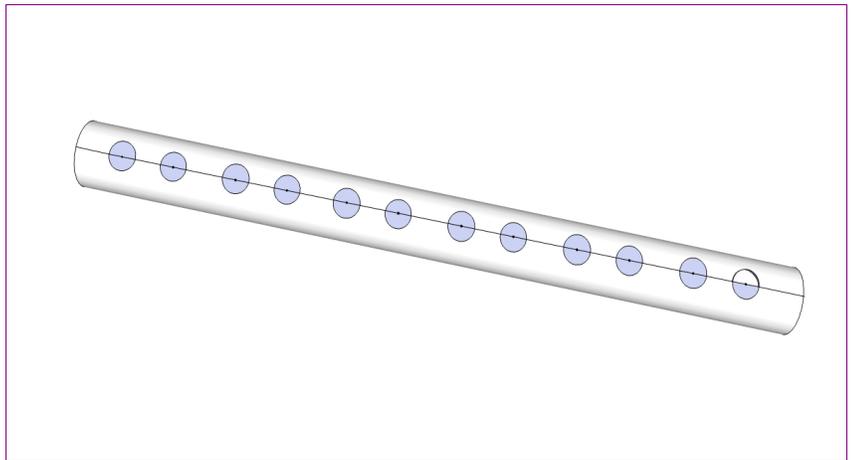


### Parts List

- 1 ten foot long, 4 inch wide ADS tube (Advanced Drainage Systems tubing)
- One 10 foot length of 1/2 inch PVC tubing
- 2-3 feet of 3/4 inch PVC (for overflow side)
- 2 end caps for the ADS tubing
- 1 water pump (submersible fountain pump)
- 2 bulkhead fittings, also called through hole's (ours are from the electrical department)
- 1/2 inch black (or blue) vinyl tubing
- 5/8 inch vinyl tubing
- Minimum 18 gallon storage tote (for the reservoir)
- Two, 1/2 inch PVC connector's (threaded on one side, slip on the other)
- Two 1/2 inch barbed and threaded elbow connector's (found with gardening and irrigation)
- One 3/4 inch "T" connector
- One 3/4 inch end cap
- One 1/2 inch barbed "T" connector (found with gardening and irrigation)
- Timer with pins all the way around the dial

The 4 inch ADS (Advanced Drainage System) tubing is easy to find. It's sold at any Home Depot and Lowe's, and other home improvement stores. Usually near the PVC tubing, but it can vary from store to store. It's irrigation tubing used to direct rain water away that could otherwise flood an area. The ADS tubing comes with a quick connect coupling end already attached, used to connect one tube to another. You want to cut that off first, you can easily cut ADS tubing with a hack saw.

Once you cut off the coupling end, you want to cut your holes for the 3 inch baskets. But you need to make sure you have them in a straight line before you cut them out. To do that first you need to draw a straight line on top of the tube. Make sure the tube is held securely on top of a table so it won't roll around while you draw the line. Then have someone hold a tape measure or string at the top of the tube one side, and secure it in the same position on the other side. Then take a pen or pencil and draw a straight line all the way across the tube.



Next make a mark about 6 inches in on each side on the line. You'll make your holes for the 3 inch baskets between those marks. But first you will need to make a template for the holes. Find a plastic margarine lid, or some lid like it from the trash. The plastic lid is flexible and will allow you to bend it around the tube to make a good circle. Draw an outline of the top of your 3 inch basket on it. Now cut it out, but make it just a little smaller than the circle so the baskets don't fall through. Once you did that, test it to be sure it's the right size. Use the template to make a circle on a piece of cardboard (or something) and cut it out, place your basket in the cut out to make sure it goes in nicely without falling through.

Now make an "X" on the template to mark the center of it, and drill a small hole on the X. Now you can either draw your circles by eyeballing the spacing, or measure it out and place a mark on the line exactly where you want them. If you measured it out, then place your template over each spot and align the hole in the center of the template on your mark. Then draw your circle. If your eyeballing the spacing, place your template where you want the hole, and align the center hole of the template on the line across the top of the tubing and draw your circle.

You could cut the holes out with a hole saw if you have one the exact size you need, but it's much easier and simpler to use a rotary tool with a small drill bit tip. Just follow along the circle you drew to cut it out. It will cut through the ADS tubing very easily.



Now that you have the main tube ready, it's time to install the through holes in the end caps. That is where the water will enter and exit the tube from. Use a small

hole saw to cut a hole just big enough to slide the threaded side of the through-hole through. Make the hole near the outer edge of both of the end cap's, but in just a little (about 1/2 to 3/4 of an inch) from the edge to give you some working room.



Once you have the holes cut out, install the through holes. Make sure the O-ring is on the outside of the end cap, and tighten down the locking ring good and snug on the inside of the end cap. You don't need to glue it the O-ring will make it water tight. If you accidentally made your hole to big and the O-ring wont seat flat, you can replace it with a larger O-ring, or take it out and use plumbing goop instead.



Installing the end cap's is easy, but you don't want to glue them on. We made this mistake the first time. If you glue them on you can't adjust them, and you can't get the root mass out and clean the inside when you want to reuse it to grow more plants later. You can make a rubber gasket using some flat rubber bands. Find some flat (wide) rubber bands that fit around the 4 inch ADS tube. You don't want it to be stretched real tight, just snug. Use two or three on each end. Then rub some cooking oil on the rubber bands before sliding the end caps on. The oil will keep the rubber bands from binding up as you slide the end caps on.

## Supporting the Hydroponic System grow tube

There are a lot of ways you can support the growing tube. The best way for you to do it will depend a lot on the space you want to put it, and what you have on hand. We will give a quick overview of the support structure we built for the system, but you can do anything from using cinder blocks, to crate's, a tabletop, to mounting it on a wall, or even along a balcony. It really just depends on the spot you want to put it, and your imagination. The only things you really need to worry about or consider when supporting the tube are:

1. Make sure it can support the weight. When it's full of water and plants, it can weigh 50-80 pounds.
2. Make sure it's supported evenly. If you just support the ends, it will bow in the center from the weight. Then you will have water spilling out.
3. Make sure it's level. If it's not level you would wind up with uneven watering to the plants inside the tube, or even worse water spilling out.
4. Make sure it's secure. You don't want it rolling or tipping over, and you don't want the wind catching the plants pulling the tube out of place.
5. If the plants you grow in the system are vine like, (as the peas we grew in it were) you will need some type of trellis for it to climb up on

The support system we built for this hydroponic system was thrown together from what we had laying around. First we used scrap 2x4's we had, and made two boxes about 2 feet tall. We also had some white paint laying around we painted it with. It didn't need



to be painted, but it just looks better, especially because it matches the ADS tubing is white on the outside as well. To cradle the ADS tube on top of the wooden box frames, we took a coupler made for the ADS tubing, and cut it into sections and screwed it to the wooden frames. that way it wouldn't roll around. Then just strapped it down with a bungee cord to hold it snug in place.



## Reservoir and Pump System

You don't want your reservoir to be too small, bigger is always better. The type of plants you grow in the hydroponic system, as well as how many of them there will be will make a big difference in the size of your reservoir. Rule of thumb is a minimum of 1/2 gallons per plant for small plants, a minimum of 1 to 1-1/2 gallons per plant for medium size plants, and a minimum of 2-1/2 gallons per plant for large plants. Those are minimums, bigger is always better. But even if you are growing small plants in this system, you will want at least an 18 gallon reservoir. When the pump goes on and floods the tube, it will take about 10 gallons of water to fill it, and you don't want to risk your pump running dry.

At the time the pictures were taken of this hydroponic system, the reservoir had not been painted yet. But you want to paint the storage tote you plan to use for the reservoir with spray paint. First paint it black to block light from getting in, then paint it with a few coats of white paint. White will reflect light and keep your nutrient solution cooler. Make sure to only paint the outside, you don't want paint in your nutrient solution.



Now that you have the grow tube and reservoir ready, you can set up the pump. You could run the vinyl tubing all the way from the pump to the other side by itself, but PVC is cheaper and we had it laying around. 1/2 inch vinyl tubing won't fit on the through holes we used, so we created an adapter to connect them. First cut about a 4 inch piece of the 5/8 tubing and slide it on the barbed end of the through hole in the end cap. Then slide some 1/2 inch vinyl tubing inside the 5/8 inch tubing and cut it flush.



You will see that our 1/2 inch PVC tube is painted black, you don't need to do that. It was one we had laying around that we reused. The black blocks light, but keeps you from being able to slide on the connectors. That's why we scraped off the paint at the end. If you want to block the light inside the tube it's cheaper, and easier to

just put some pipe insulation on it. Now glue on your threaded and slip 1/2 inch PVC connectors on both sides of the tubing. Then just screw on and connect the pieces. Make sure that the through hole is at the bottom of the ADS tube for this end. You can easily align it by turning the end cap till it is where you need it. That finishes the flooding side of the tube.



Connecting the water pump is easy to do. Just measure and cut a piece of the 1/2 inch vinyl tubing to reach from the PVC connector to the pump inside the reservoir. Our pump was too strong so we added a "T" barbed connector and another short piece of vinyl tubing. That splits the water pressure in half. The open end coming from the "T" connector stays in the reservoir, pumping it right back into the reservoir.

### **Setting up the Overflow**



The overflow side is easy to set up as well. Cut a short 2 inch piece of 3/4 inch PVC tubing, install it in the center opening of the 3/4 inch "T" connector. Cut about a 3 inch long piece of the 5/8 inch vinyl tubing. Push it firmly into the same center opening of the 3/4 inch PVC "T" connector. Cut a piece about 2-3 inches long of the 3/4 inch PVC tubing. Install it on one end of the "T" connector. Install the 3/4 inch PVC end cap on it. Then drill some holes in the end cap. This will keep bugs out while still allowing air in. The air allows the water to flow faster, and also helps oxygenate the water flowing back into the reservoir.

The opening is above the water line, so no water will leak out from it. Now attach the "T" connector to the barbed through hole by slipping the 5/8 inch vinyl tubing end on it. Measure and cut another piece of the 3/4 inch PVC tubing, making it long enough to reach down 5-6 inches inside the reservoir, then attach it to the bottom side of the "T" connector.

Now adjust the end cap so the through hole is just under the holes for the plants. You will probably need to readjust it a bit later when you run water in it. You can adjust the water height in the ADS tube by simply turning the end cap.

Now just cut some openings in the lid of the reservoir for the overflow tube, as well as the pump's electrical cord and water line. Now you're ready to grow some plants hydroponically.



### Timer

This hydroponic system is a Flood and Drain (ebb and flow) system. Flood and drain systems use a timer to turn on and off the water pump. That keeps the roots moist, and recirculates the nutrient solution. Any light timer should work,

but there are a few things to look for when buying it for your hydroponic systems. First is look for one that is a 15 amp timer, sometimes called heavy duty timers. Just check the back of the package for the specs. Second is, make sure it has pins all the way around the dial. You'll need a lot of on off cycles, and timers that have removable pins only come with a few pins. You can use a digital timer, but they don't usually have enough settings either, and they lose memory every time you unplug it, or the power goes out. Third, If you can, get ones with a weather resistant cover. It will keep dust and dirt out, and keep it protected if it accidentally gets wet. Even if your growing inside, you could still accidentally splash water on it.