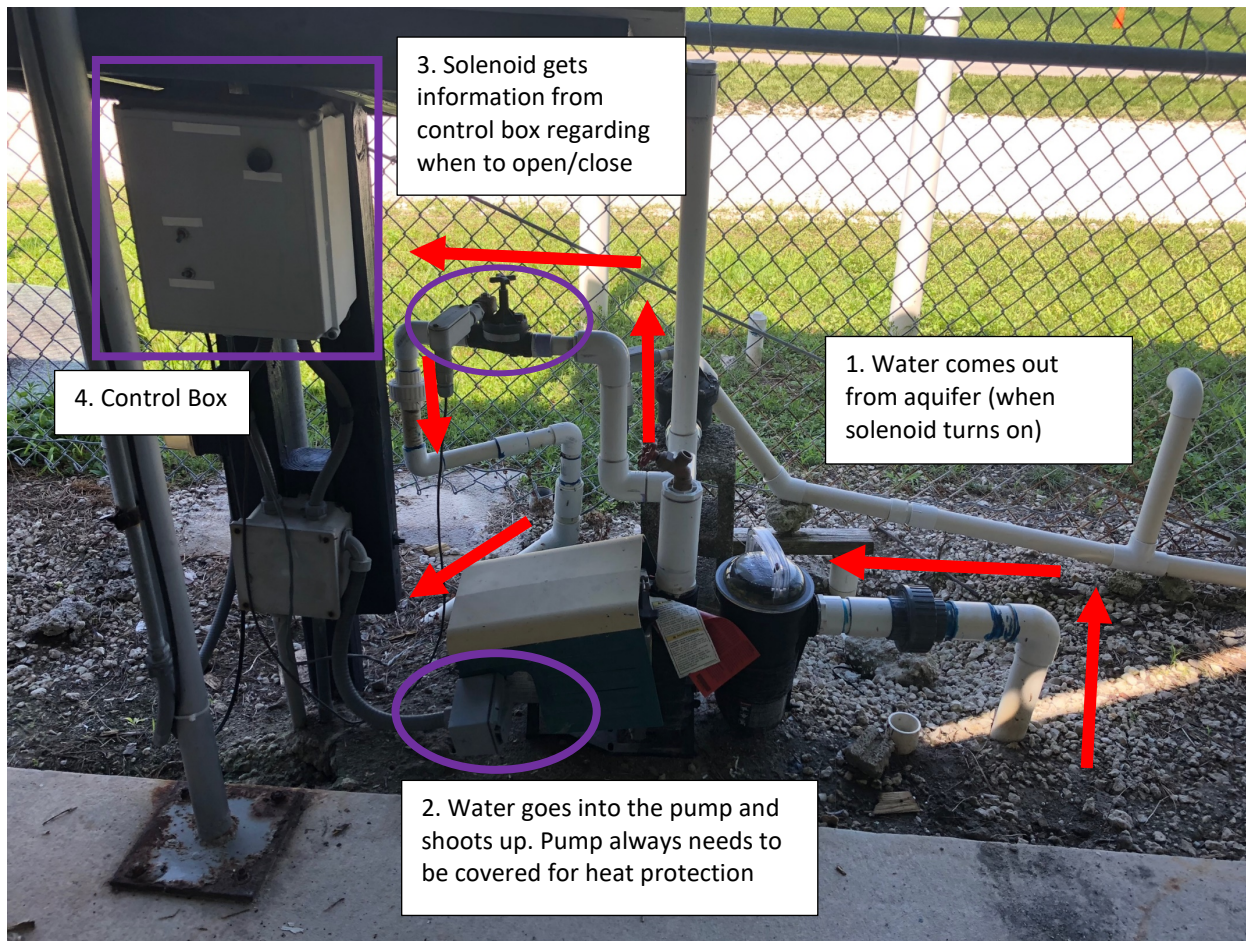
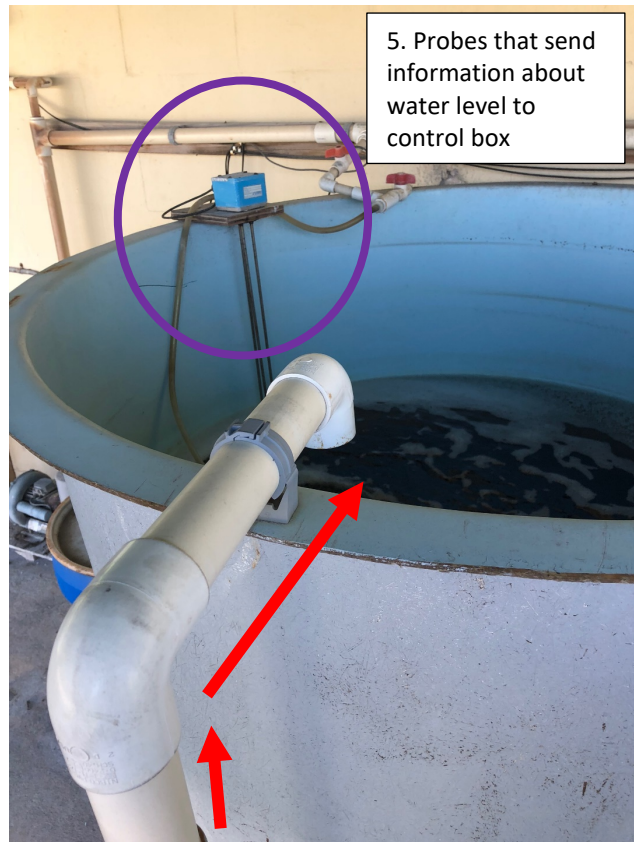


Salt Water System Outside

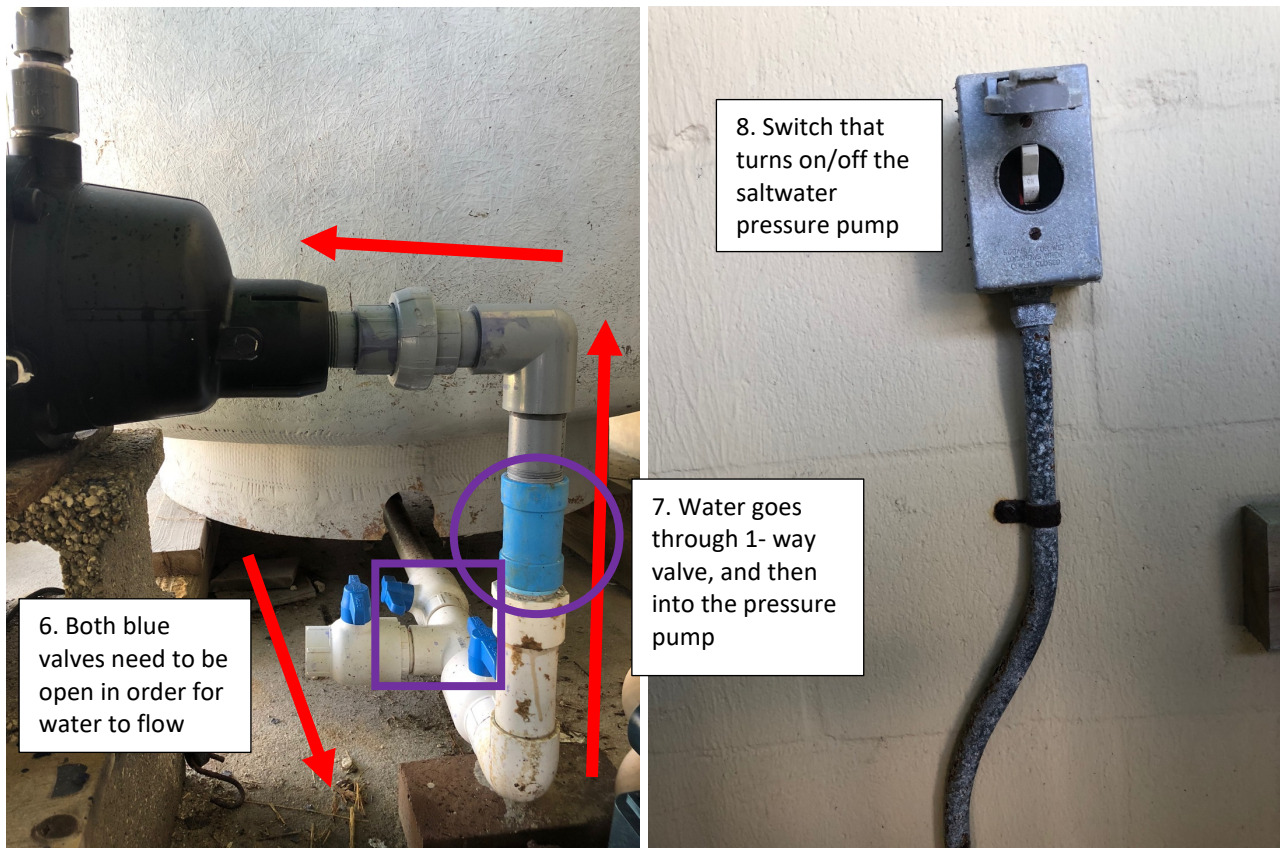
The source of full-strength seawater (30 ppt) comes from a saltwater aquifer supplied by Biscayne Bay. This is located at the front of the lab, right next to the fence, in front of the saltwater vat.



1. Water comes out from aquifer (when solenoid turns on). There are probes in the saltwater vat that send information regarding the water level. When the water level is low in the saltwater vat, information is sent to the control box by the probes. The control box sends this information to the solenoid, which then tells the pump to turn on.
2. Water from the aquifer is pulled out with the force of the pump. This pump should always be covered so it does not over heat. It has a switch to the right that controls if the pump is on (but not always running), or off. *In case of an emergency, this switch should be turned off.*
3. Solenoid gets information from the control box and tells the pump to turn on/off.
4. The control box has two switches on the front. The top one is labelled **"Override"** (in case you need to instruct the pump to do something specific) *and should always be pointing down*. The second switch is labelled **"Disconnect"**; *this one should always be pointing upwards* because if opposite happened, the control box would instruct the saltwater pump to not turn on even when the solenoid is indicating the contrary, frying the pressure pump that is in charge of sending the saltwater inside the building.



5. These are the three probes that are always reading the level of the water vat. When water is low, this information is sent to the control box, then to the solenoid, then to the pump.



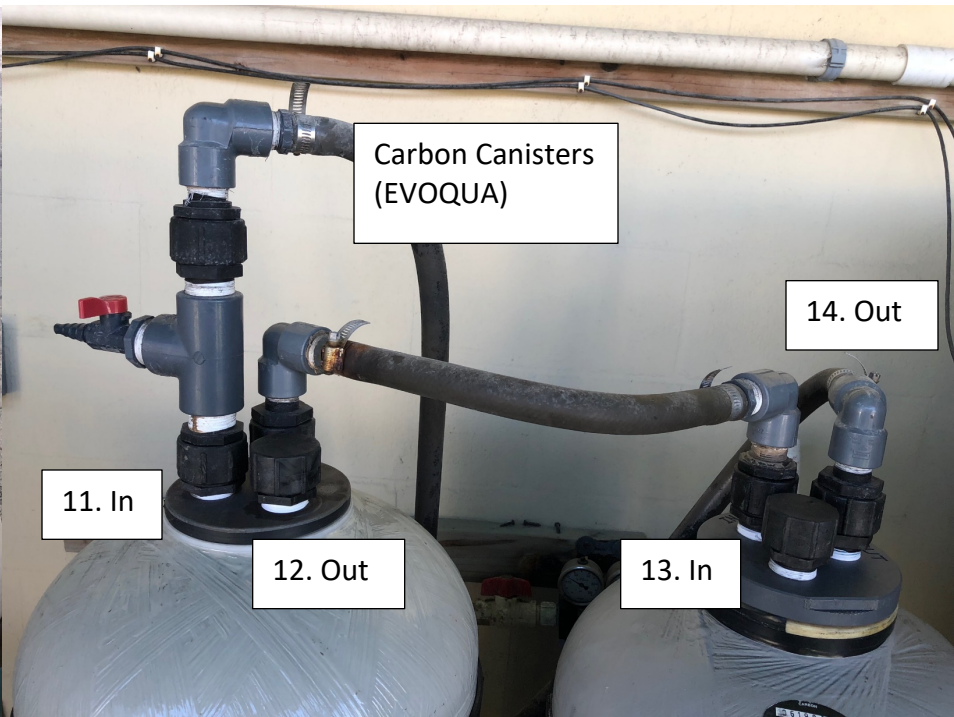
6. Both blue valves need to be open in order for the water to flow. In case you want to empty the vat, you could open the third blue valve, but be sure to turn off all pumps when doing this, as well as the UV system inside the building.
7. The 1-way valve was placed there so water could only go in one direction: towards the pump, away from the vat.
8. This switch needs to be on, in order for the pressure pump to work.

**** What to do in case of an emergency?**

Turn off the pressure pump, AND turn off the saltwater pump, flip the second switch on the control box down (disconnect). Go inside of the building and disconnect the UV system.

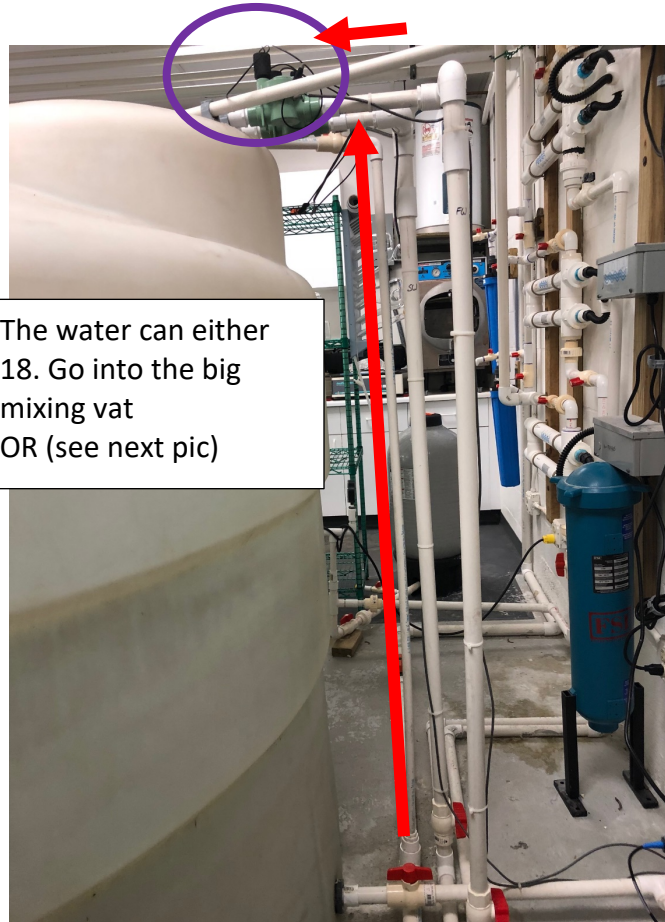
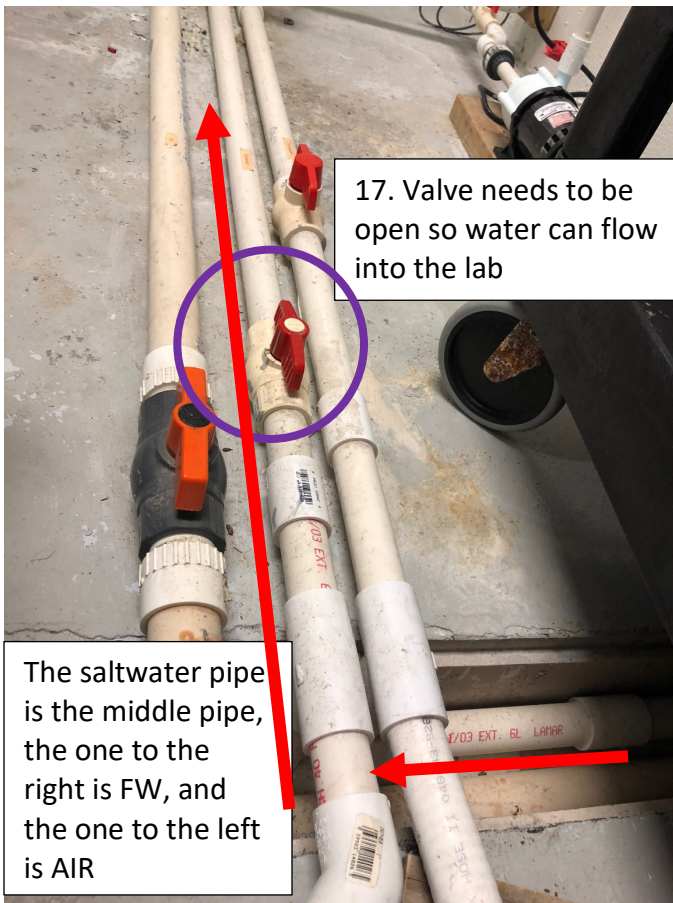


9. The pressure cylinder gives out pressure so the SW can get to the inside of the building. It is made out of fiber glass. It should not be filled with water and it should be changed if it doesn't sound hollow.
10. The red valve has to be open so water can flow from the pump into the 4 mechanical filters. These filters should be changed twice a year (**ask abe**). Once the water passes through all mechanical filters is then sent to the two big EVOQUA carbon tanks. Carbon tanks should be changed every 3 months if used regularly.

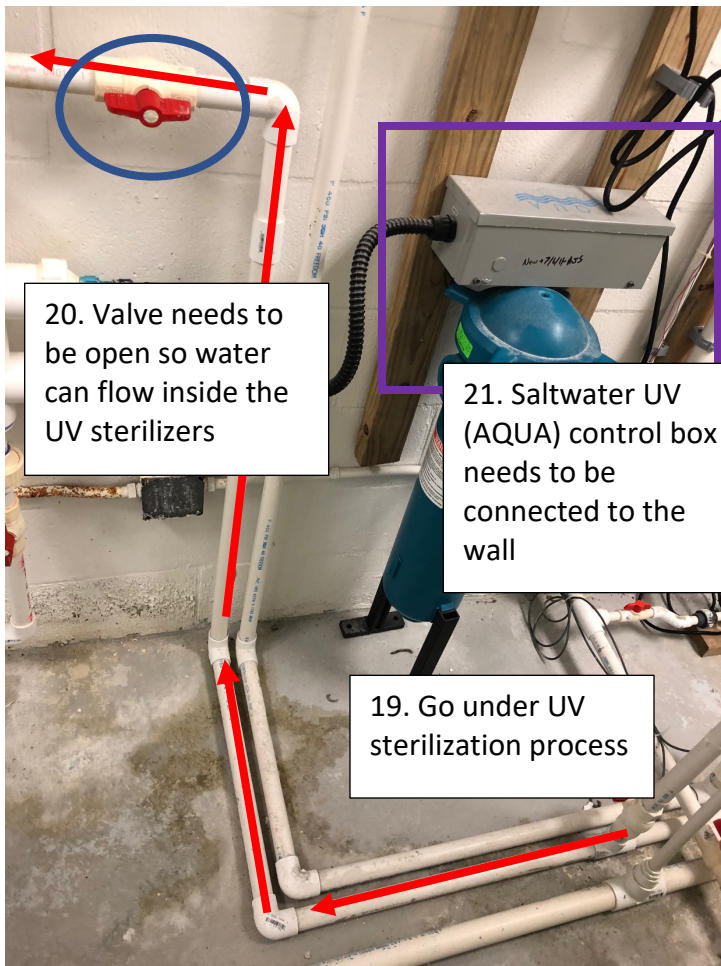


11. After the water has gone through the 4 mechanical filters (which should be changed every 6 months – ask abe), a hose will conduct the water that was mechanically filtered to the first carbon tank. The hose will attach to the “IN” valve of the first carbon tank (EVOQUA).
12. Then a small hose will connect the “OUT” valve of the first carbon tank to ...
13. The “IN” valve of the second carbon tank.
14. Finally, another hose will come out of the “OUT” valve of the second carbon tank and will send the water through...
15. a last mechanical filter (EVOQUA). (Should be changed every 6 months).
16. After the water is filtered, the water will be sent inside the lab. The saltwater pipe is the bottom white pipe.

Inside of the laboratory (Back)



17. Once the water flows inside the valve, the red valve in the middle will need to be open so water can flow through.
18. The water can either 1) Go up and into the mixing vat (estuarine water) OR (see next picture)



20. Valve needs to be open so water can flow inside the UV sterilizers

21. Saltwater UV (AQUA) control box needs to be connected to the wall

19. Go under UV sterilization process

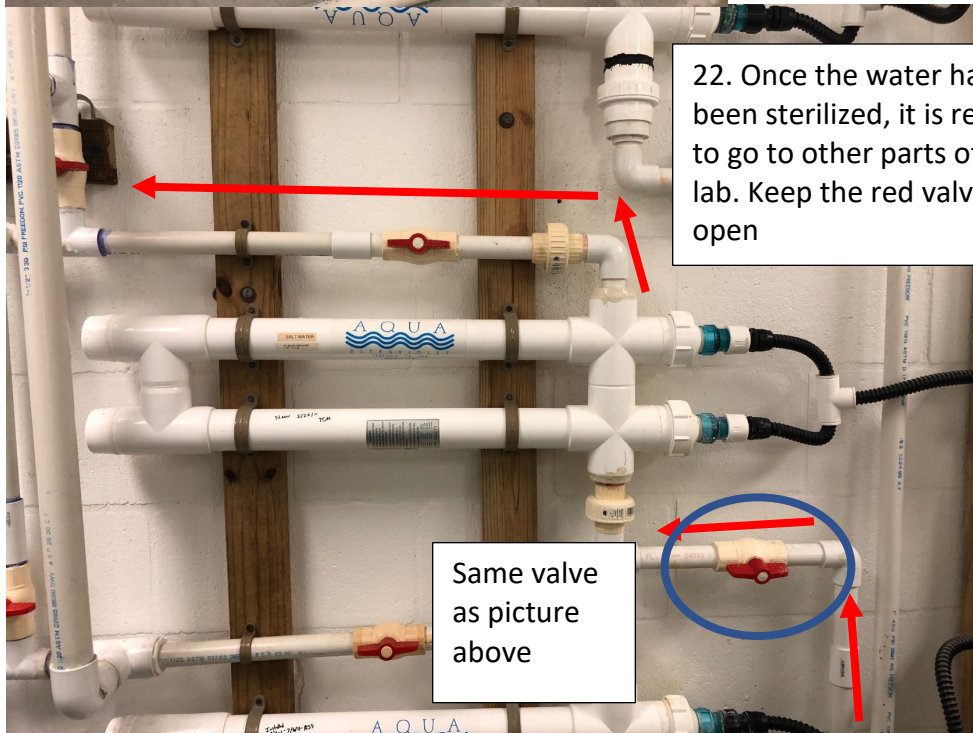
19. Or the water can go through UV sterilization

20. The valve needs to be open so water can sterilize properly.

21. The black cord that comes out from the SW UV control box needs to be plugged into the wall so the UV system can work.

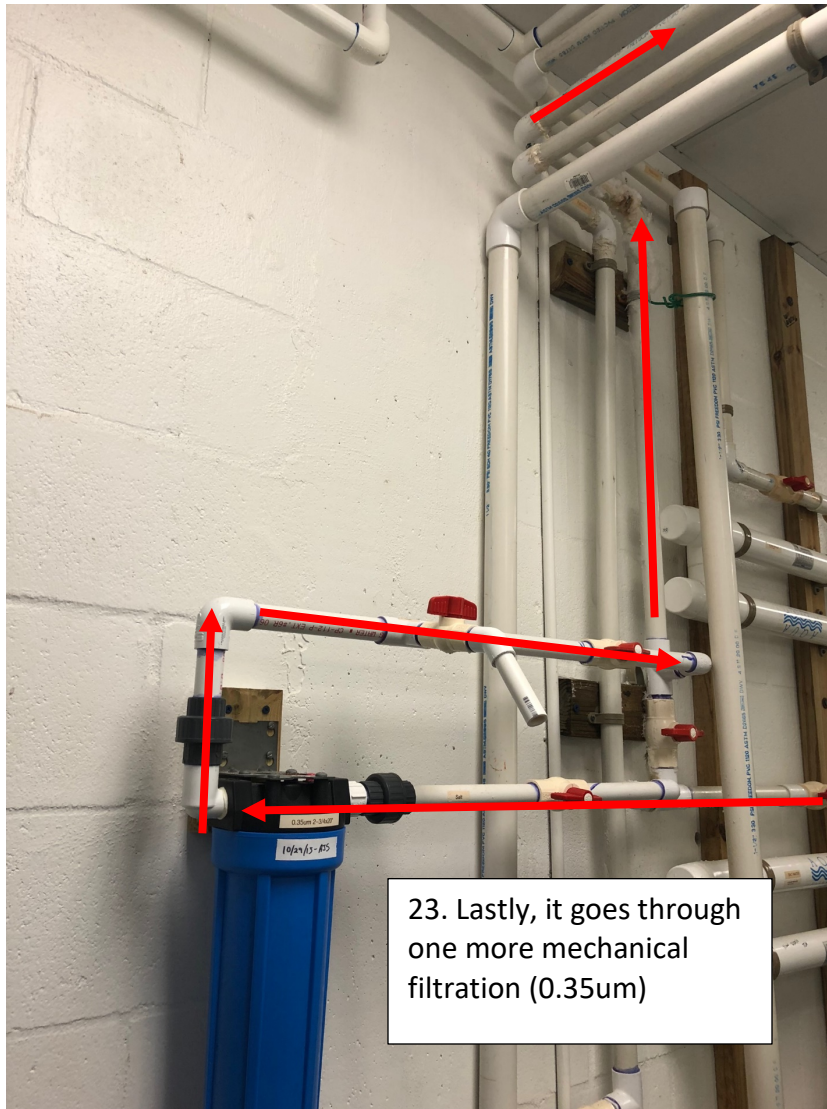
**** In case the saltwater system (from the previous pages) needed to be turned off, this plug NEEDS to be disconnected or the UV bulbs will run dry, melt and stop working.**

22. Keep the red valve open so it can flow to the next filtration process.



22. Once the water has been sterilized, it is ready to go to other parts of the lab. Keep the red valve open

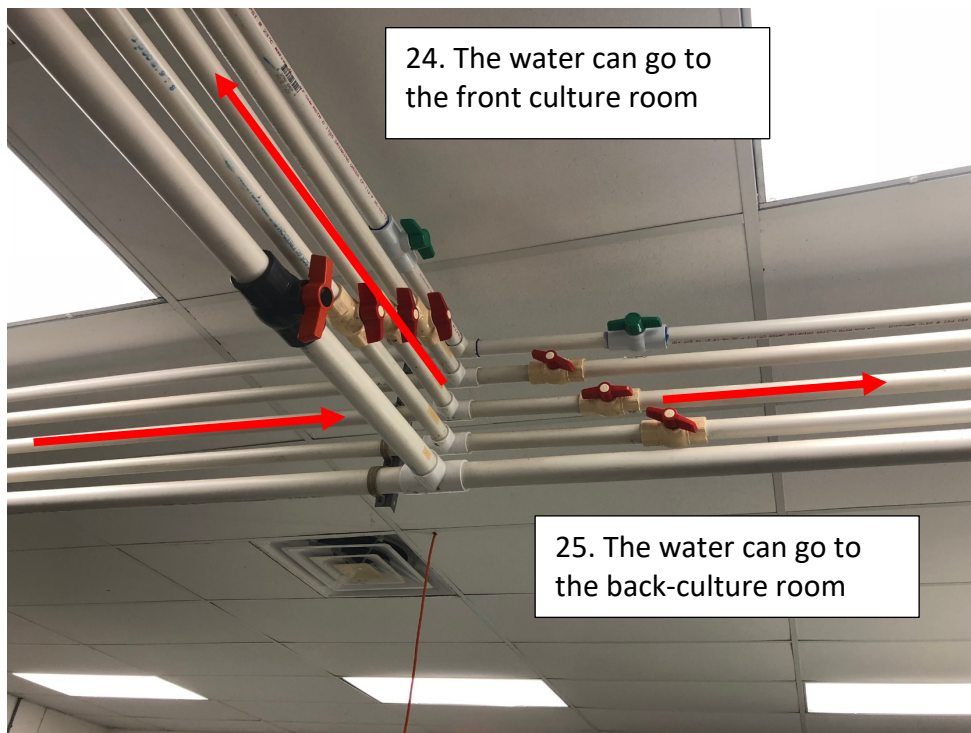
Same valve as picture above



23. After the water is UV sterilized, it goes through one more mechanical filtration. The mechanical filter is of 0.35 um and should be changed yearly (ask abe).

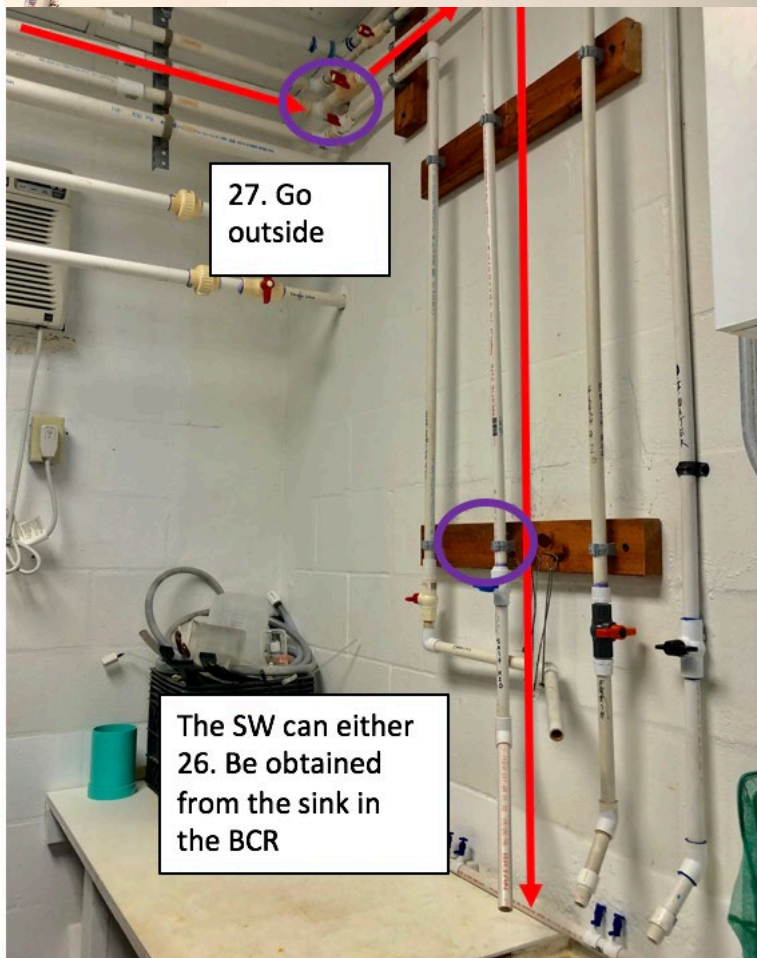
24. The pipe that transfers the filtered SW, can either go to the front culture room, where you can obtain SW from the sink or from the ceiling.

25. Or the water can keep going straight into the back-culture room.



BACK CULTURE ROOM

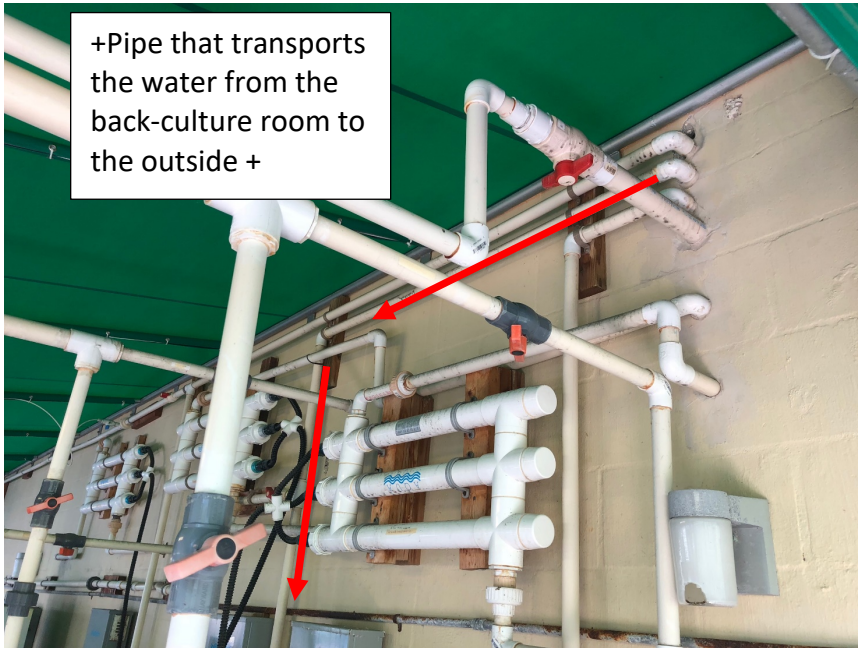
This first image, was taken from right above the door of the back-culture room. The second image was taken inside the back-culture room right above the sink.



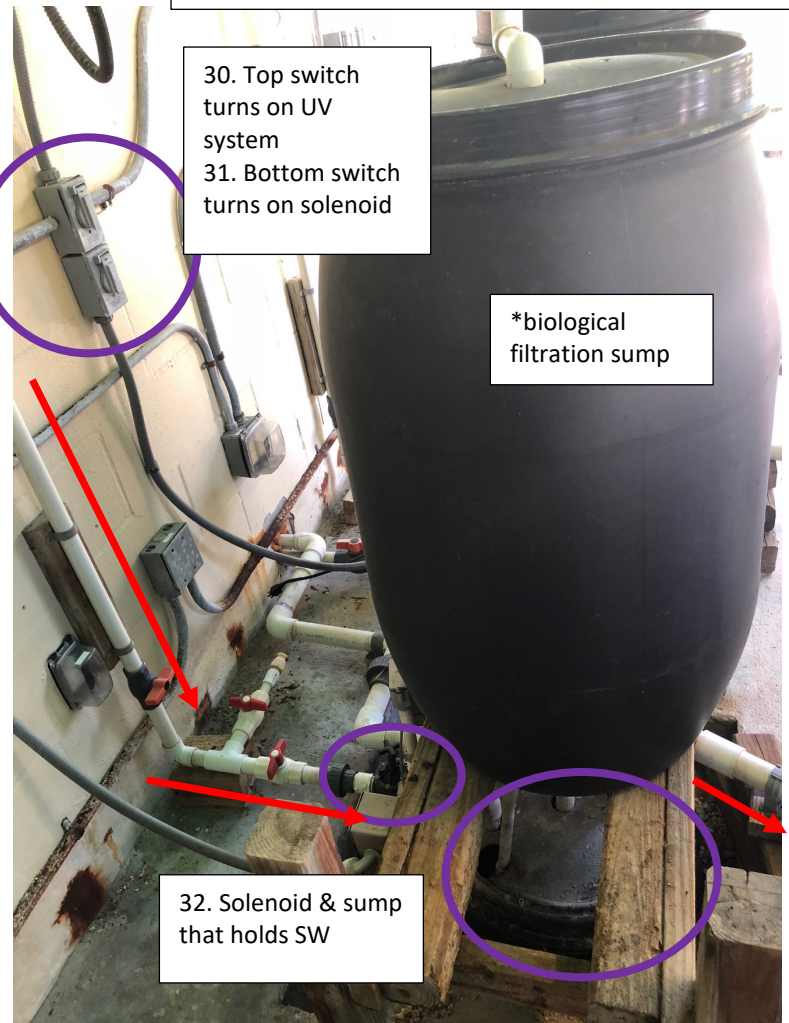
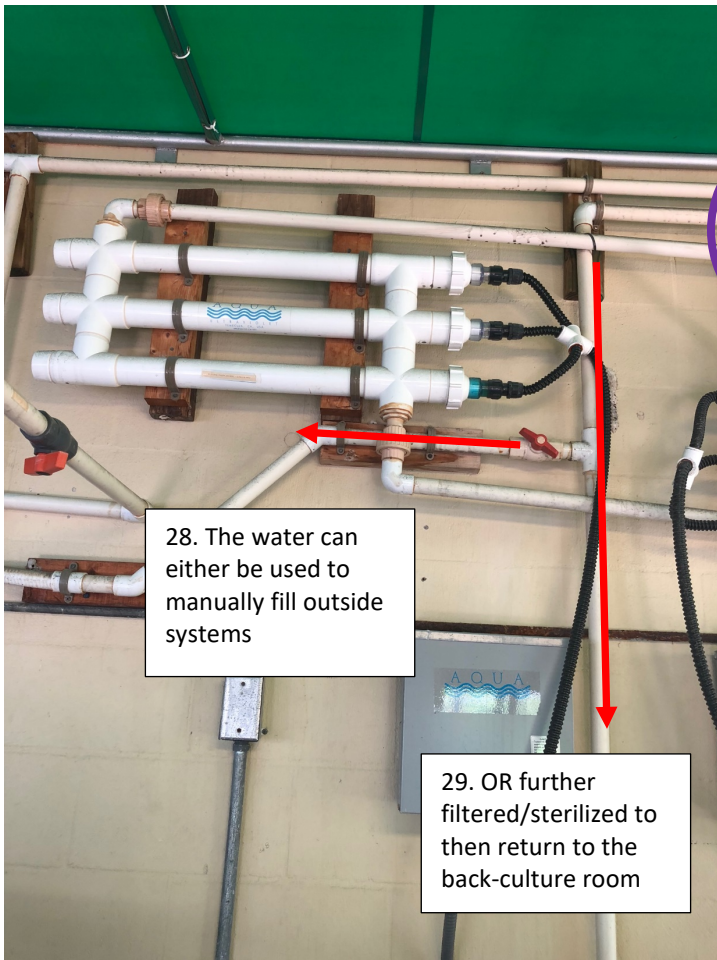
26. The SW can be obtained from the pipes on top of the sink. The blue valve needs to be open.

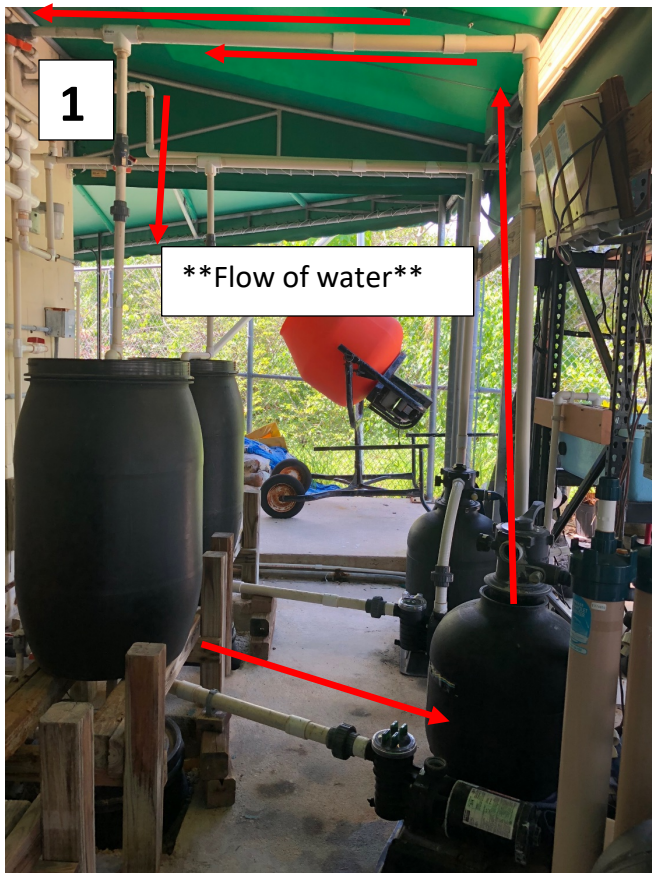
27. OR the water can also be sent outside if needed. Outside, the water will go under further UV sterilization, sand and biological filtration. After sterilization is completed, the water goes back into the back -culture room to a recirculating/renewal saltwater system.

OUTSIDE (BACK) – SALTWATER SYSTEM



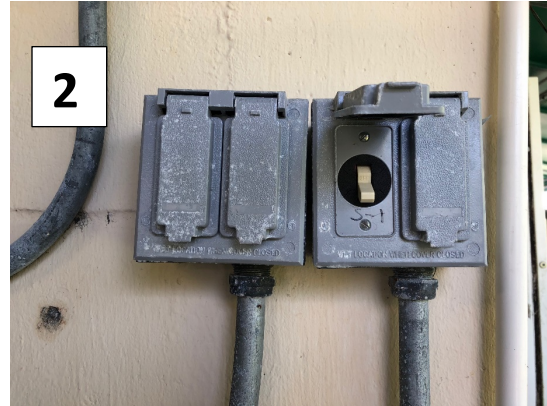
- 28.** The water can either be used to manually fill outside systems
- 29.** OR directed towards sand filtration, biological filtration & UV sterilization; water will then return to the back-culture room.
- 30 & 31:** If the SW circulating system in the BCR is being used, both switches should be turned on. The top switch turns on the UV system, and the bottom one controls the solenoid that indicates if the underground sump needs to be filled with water. The bottom switch should be turned on before the main switch (next page), so the sump can have enough water to send to the pressure pump. After the main switch is turned on, the UV switch should be turned on as well.
- 32.** The underground sump needs to be filled at all times so the pressure pump doesn't run dry. Red valve should be opened (closed in picture since SW system wasn't on).



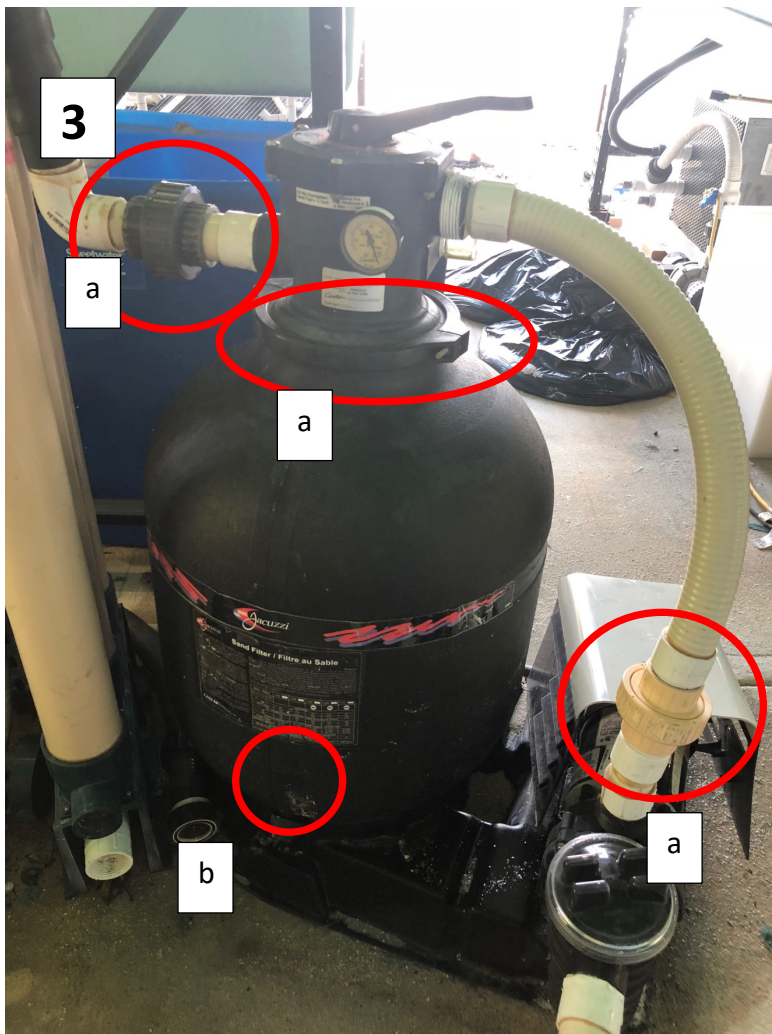


This page indicates:

- 1) The flow of water (1st picture)
- 2) **What to do in case of an emergency/leak**
 - a. If SW is not coming into the building at all because the SW pump + SW pressure pump located in the front (outside) part of the lab are off, then everything in this zone should be turned off.
 - 1) The switch that turns on the SW pressure pump (S-1/ MAIN switch) should be the first thing to turn off.

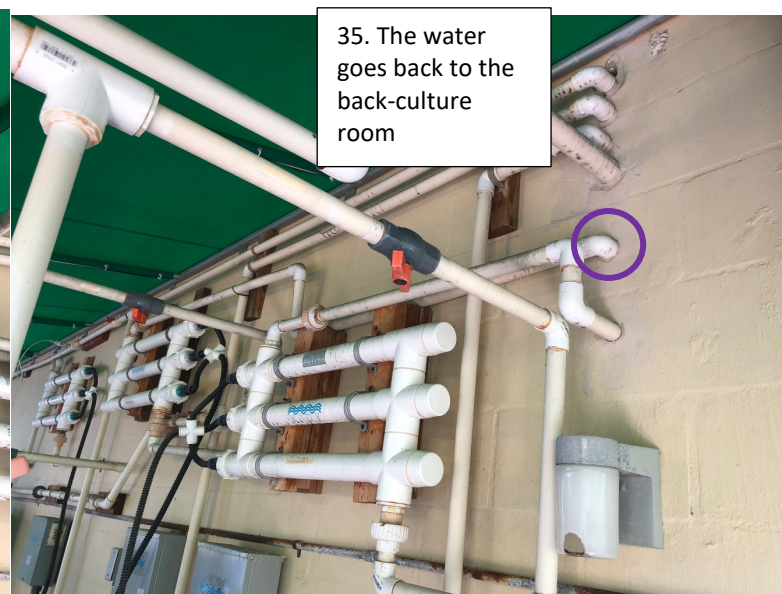
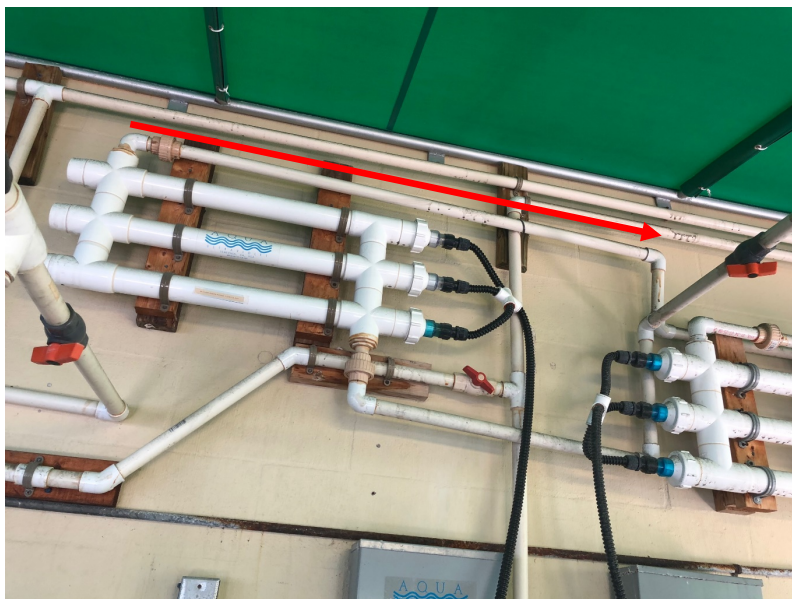
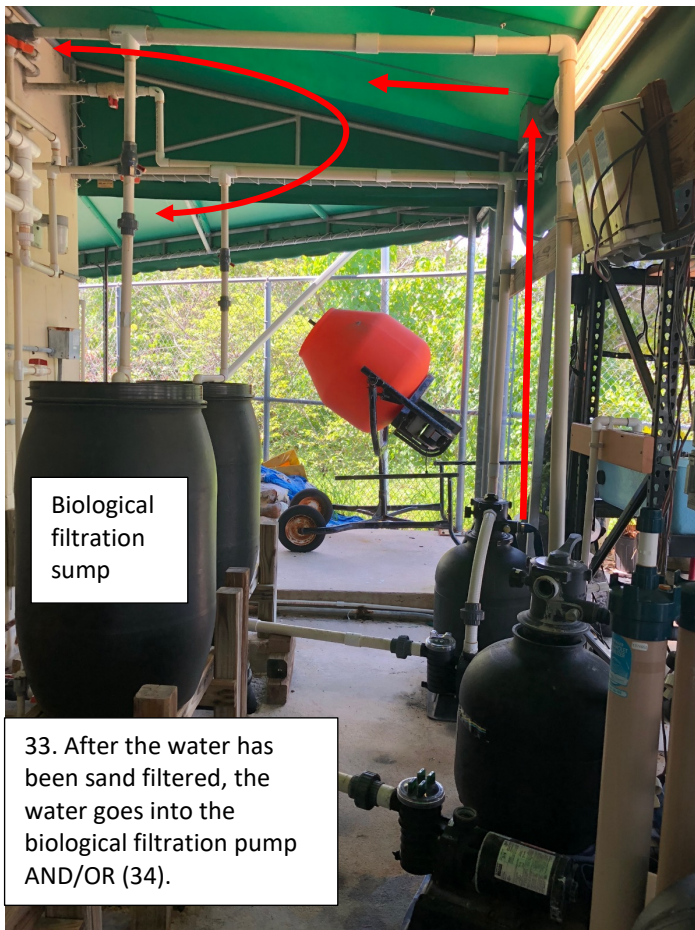


- b. Then, the UV system switch, and the switch that fills up the underground sump should be turn off immediately after the main switch is off.



- 3) The sand needs to be changed at least once a year with pool filter sand (**no** other sand; sold at home depot).

- a. To do this, disconnect the connections shown in the picture. You may need to use wrenches. Be careful when taking out the metal ring because there is a plastic O-ring inside that needs to be attached so there is no leaking.
 - b. Open the bottom cap to release some of the water. Then start taking out the sand with a beaker or something similar, until enough of the sand is out and you can tilt the barrel to remove what's left of the sand
 - c. Then wash out all the sand left in the black barrel. Close the cap at the bottom.
 - d. You will find a piece inside of the barrel, that needs to be centered, it's very important that it is centered. Start adding the new sand into the barrel around the piece, you only need 2/3s of the barrel filled with sand.
 - e. Reconnect all the pieces and make sure there is no leaking.



33. After the water has been sand filtered, it's directed towards the biological filtration sump. If the pH is too high, here (sump) is where you would add crushed corals in a porous bag, right under the inflow of the water, so the water pH goes down. Remember that all red valves must be opened so that the water can flow appropriately.

34. The water is also directed towards UV sterilization.

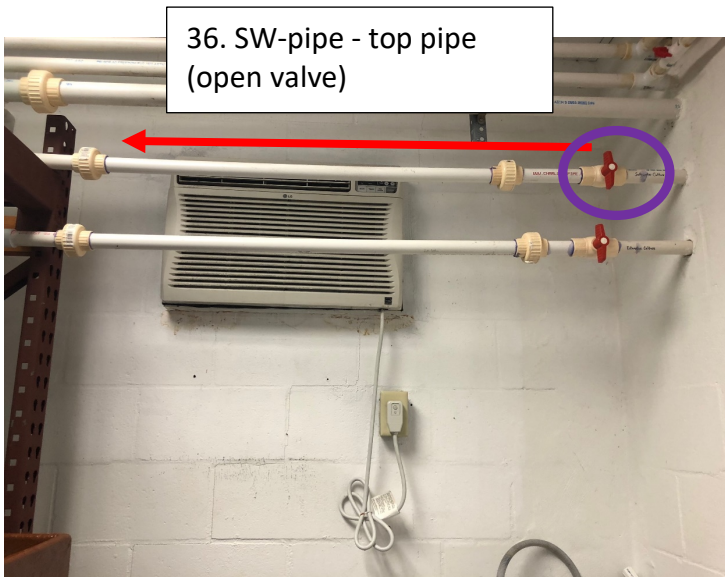
35. And finally back into the back-culture room.

The system must be backwash every week, at least once a week, to remove all the dirt/waste that has been accumulating in the sand barrel. To do this

- 1) You must first turn off the main switch (S-1),
- 2) Go to the sand sump, and turn the "grip" to backwash
- 3) Turn the switch back on,
- 4) Wait or 30-60 seconds, you will see water coming out of the blue hose attached to the top piece of the sump
- 5) Turn off the main switch
- 6) Go back to the sand barrel, and turn the "grip" back to filter
- 7) Turn the main switch on



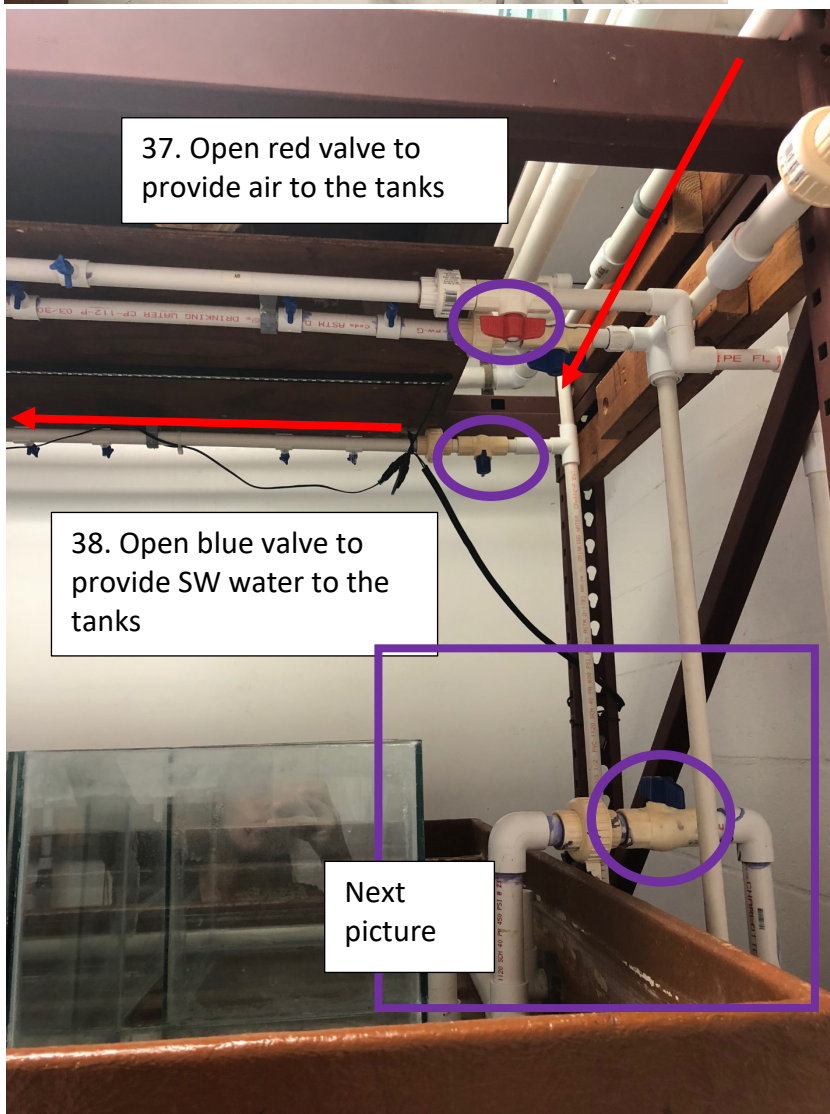
Back Culture Room



36. This is the pipe that brings SW from the back/outside part of the lab into the back-culture room. This red valve must be opened so the water can flow into the SW systems in the back-culture room.

37. Red valve must be opened to provide air to the tanks. Air stones must be cleaned every time fish species are changed.

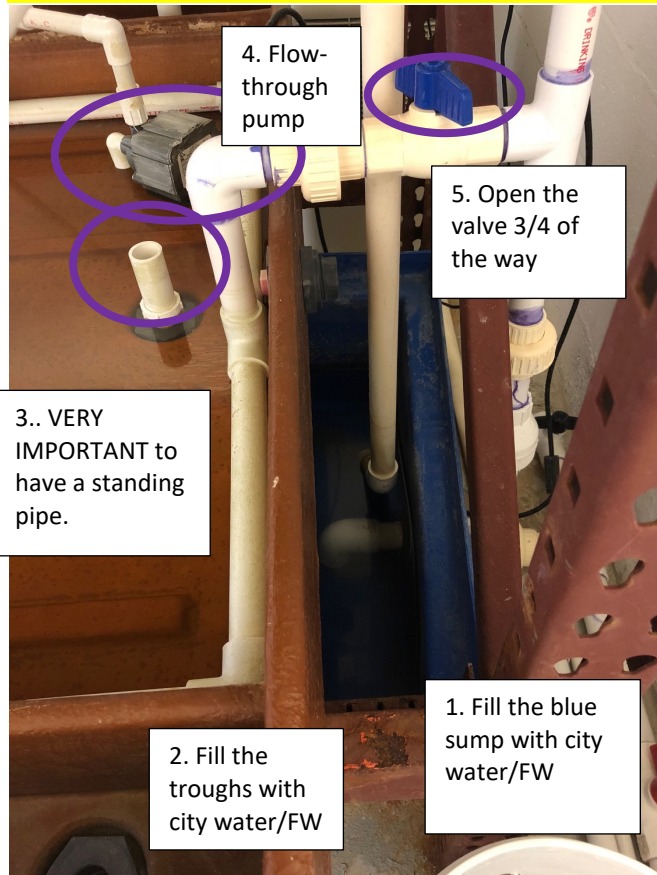
38. Blue valve must be opened to provide SW to tanks.



In case of emergency

Close the red valve from the first picture (step 36) to cut the incoming flow of water.

How to add city water/FW into the troughs to regulate the temperature in the tanks.



1. Fill the blue sump with City water/FW. There is a FW source in the sink right in front of these troughs and a city water source right by the back door, next to the mixing estuarine vat.

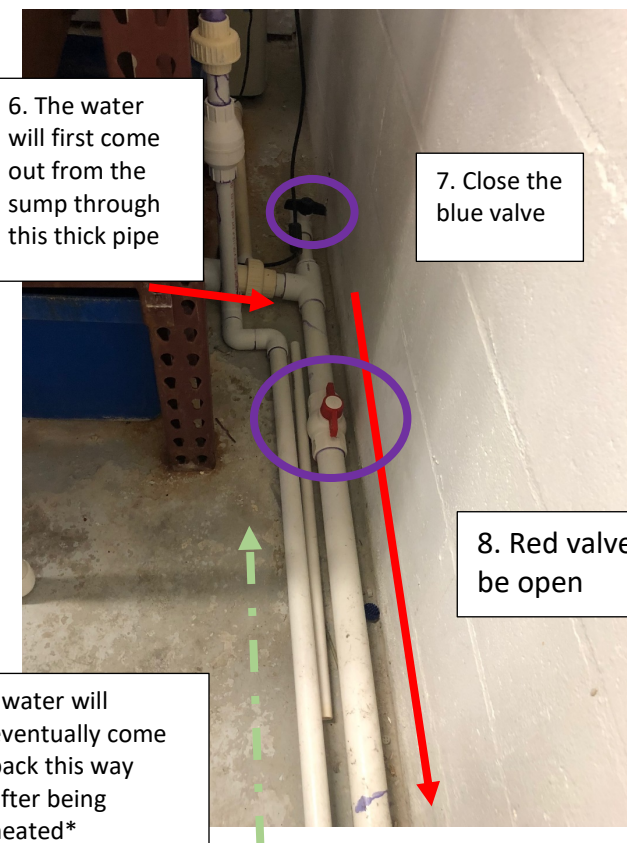
2. Fill the trough as well with the same water that you filled the blue sump with. The water must go all the way to the top of the standing pvc-pipe.

3. It's important to have a standing pvc-pipe because it keeps the level of the water high enough to be able to regulate the temperature in the tanks.

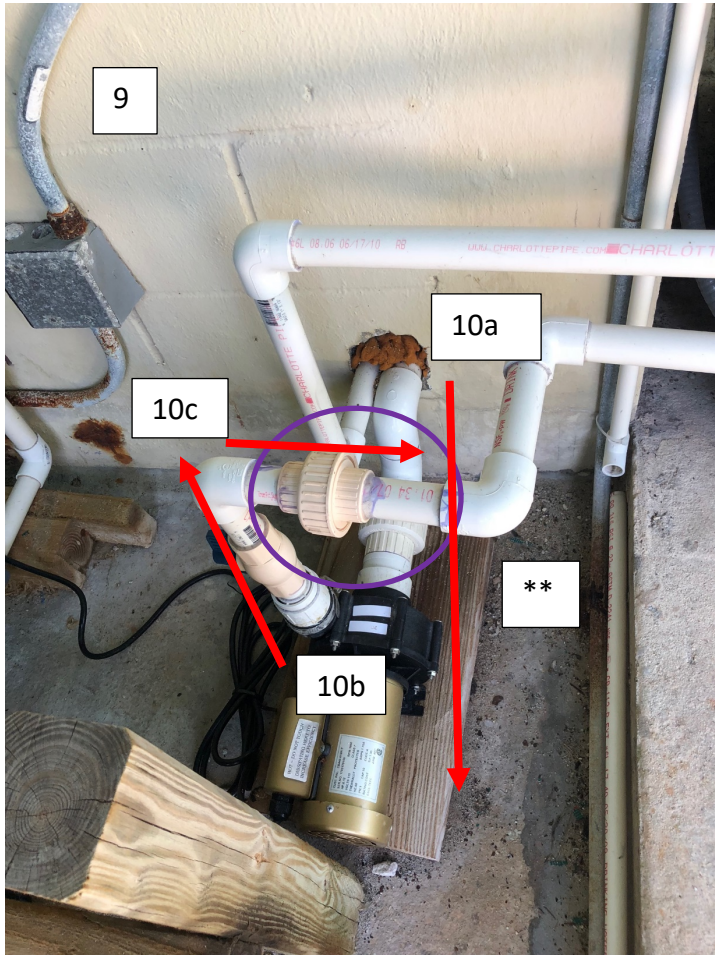
4. Get a flow through pump that's fully submergible in water. This will help you to keep the water moving around the troughs.

5. Open the valve $\frac{3}{4}$ of the way.

6. The first step of the water is coming out from the sump through the thick pipe towards the pressure pump that's located on the back/outside of the lab, next to the estuarine system.



* The last step of this protocol will end with the water coming back through this pipe into the troughs after being heated. This heated water will help the temperature in your tanks to stay constant. Also, be aware that changes in the ambient temperature may affect the water temperature, so keep the AC constant as well *



9. You must plug in the black cord that comes out of the pressure pump so the pump turns on. Avoid any water near this pump.

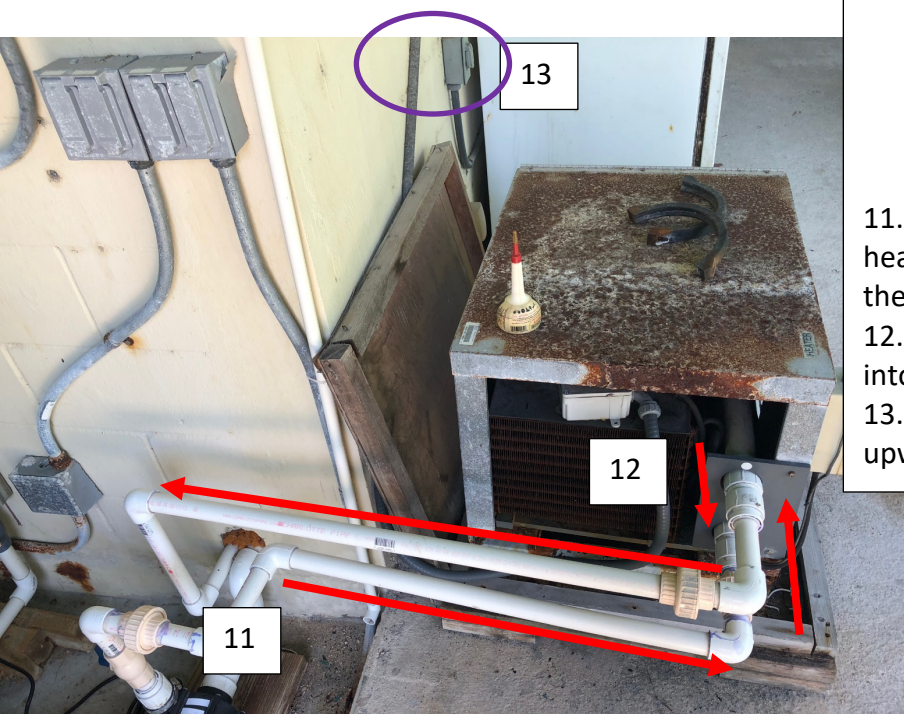
10a. The water comes out from the back-culture room and goes into the pump

10b. The water comes out of the pressure pump and it is pushed up

10c. The water is directed towards the heat pump

**In case you plug the cord in, and the pump isn't doing its job (e.g. pushing water through the heat pump and into the back-culture room into the troughs):

- 1) Unplug the cord
- 2) Disjoint connections
- 3) if water is coming out through the thick pipe onto the ground from the back-culture room, then you know there may be a bubble stuck in the pipes, or maybe the pump is not working anymore. To test this assumption, put the connections back together, plug in the pump's cord and check for water movement in the troughs. If no water is moving from the sum to the troughs, then
 - A) there is a problem with the pump.
 - B) OR, One of the valves is closed
 - C) Or, There is a bubble stuck somewhere else (disconnect joints).



11. Even if heater is not on, water will flow into the heat pump and out of the heat pump. This pipe flows the water into the heat pump.

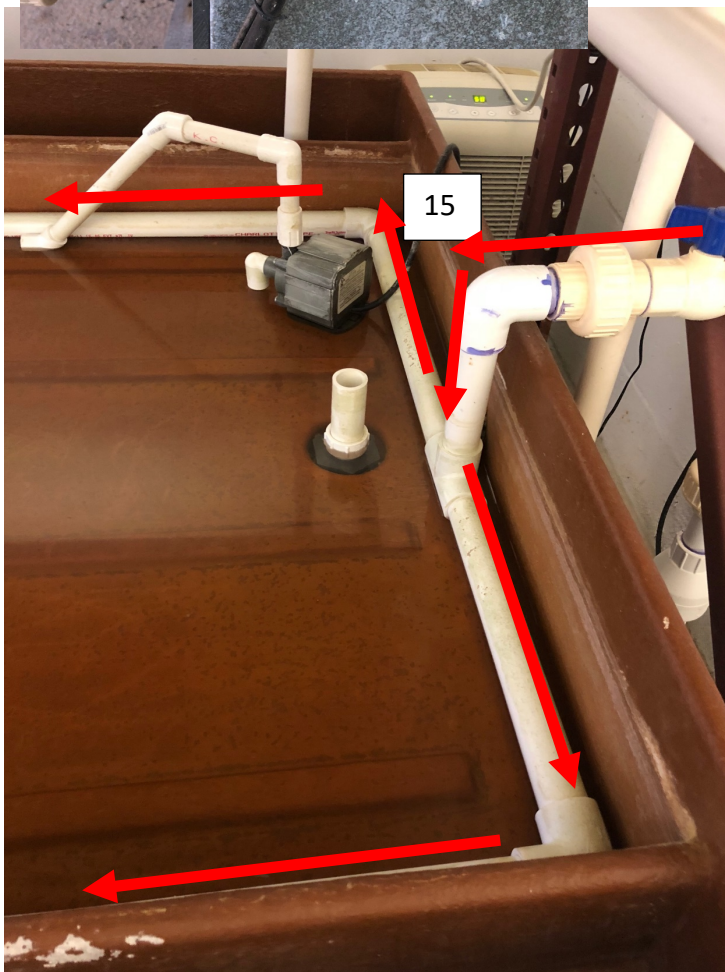
12. This pipe flows the water out from the heat pump into the back-culture room.

13. To turn on the heat pump, flip the switch upwards



To adjust the temperature,

- a) press SET twice,
- b) then go up or down until you find the lowest desired temperature,
- c) then press SET again,
- d) choose how much (in Celsius) your temperature can vary (1-2 Celsius) from the lowest desired temperature.
- e) Press SET,
- f) go up or down until you find the highest desired temperature
- g) then press SET again,
- h) choose how much (in Celsius) your temperature can vary (1-2 Celsius) from the highest desired temperature.
- i) Press set



15. As shown before in step 12, after the water is heated, the water goes back into the back-culture room through a thin pvc-pipe and then into both troughs through this system of pipes.

SALT WATER FLOW CHART

