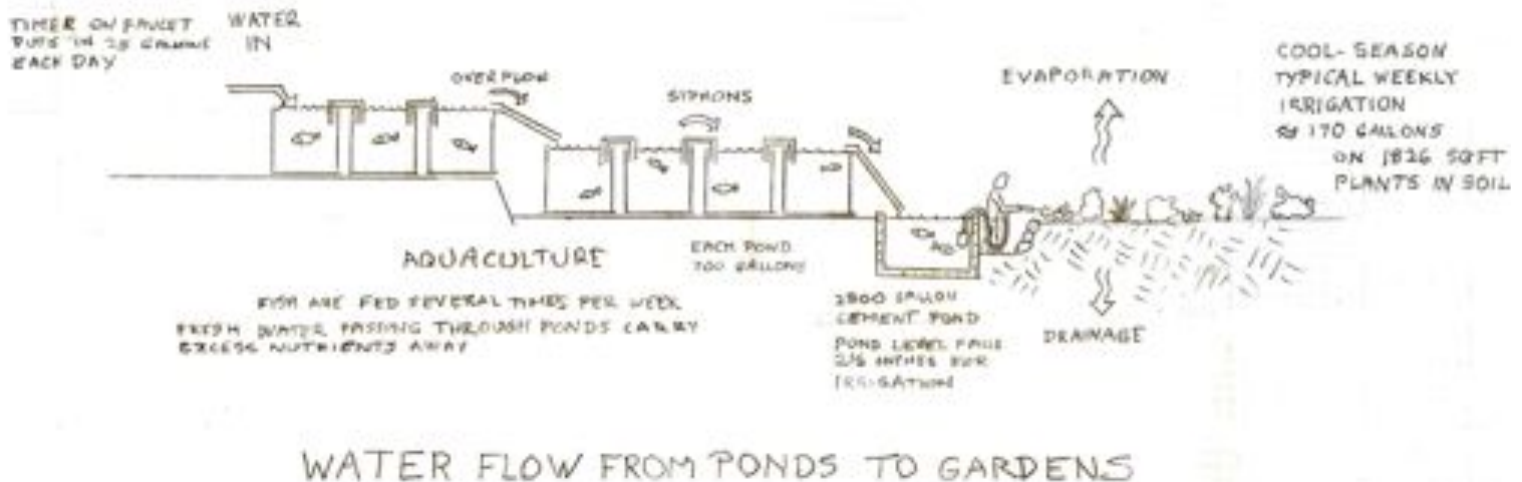


This shows the fishponds and irrigation as it is set up now. In this system, water and nutrients flow through the ponds on their way to being used for irrigation. It is not recirculating.

I am not trying to maximize fish growth. The biomass of fish in each pond is kept low enough that the ponds don't need aeration. The presence of the fish keeps the water in the ponds dark green, making them better solar collectors.

I could maximize fish production by adding continuous aeration and optimum feeding rate, but constant aeration 4 feet deep is harder than it sounds.



Aquaponics – What combination of fish & plants will avoid the need for a solids filter?

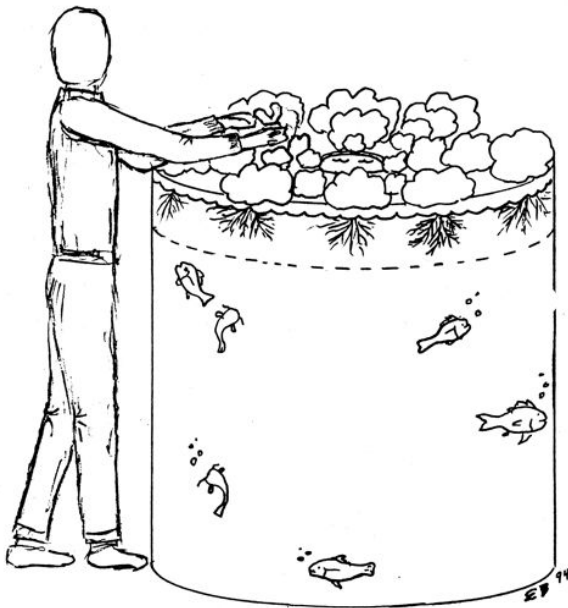
In a fish pond with only algae and bacteria, there are not enough other micro-organisms to capture and eat the solid material in the water, mostly because there is no habitat for them. Gravel beds are a step towards making a habitat for more organisms to eat the material, but the activity is still mostly bacterial.

You can start adding other species/habitats to the ponds to convert the solids into micro-organisms and snails and scavenger fish, etc. and soon you're doing what John Todd does with his wastewater treatment systems, where the goal is to clean the water, using any combination of species that will capture and store the waste nutrients, but each additional species needs space and additional habitat, and, you have to periodically remove scavenger species to remove the excess nutrients. Also, instead of raising only useful fish and useful crops, you end up raising snails and bulrushes, etc. When you add fish food, the fish only absorb part of it, and the crop plants absorb some more, but usually the nutrients in do not exactly match the nutrients out, and either there are mineral deficiencies in the plants or gradual accumulation of minerals in the water that neither the fish nor the plants absorb.

The Zweig Hydroponic Pond



In a Zweig pond the biosolids end up in the roots of the lettuce, which is the habitat for lots of micro-organisms that eat it and eat each other. As they grow they sequester the excess nutrients in the things attached to the roots. Then weekly the 18 outer lettuces are removed, including all their roots and all the biomass living on the roots.



“Three small aquarium air diffusers should be suspended equidistant from each other around the pond circumference 15 cm from the bottom to provide oxygen for the fish and plant roots as well as to cause a gentle upwelling of aerated, fertile water through the pond. This improves the availability of nutrients and oxygen to the plant roots. The plant roots have a second major function as water clarifiers. The plant roots collect suspended detritus, thereby helping to maintain high water transparency. When the plant is harvested, the root systems are fully developed and have captured a significant quantity of detritus. The detritus removal further reduces the accumulation of BOD in the system and excess build-up of organic matter. The roots also function as a substrate for nitrifying (*Nitrosomonas* and *Nitrobacter*) bacteria which control and convert dissolved ammonia to nitrate which is then taken up by the plants.

The plant roots further become a habitat for zooplankton, nematodes, and midge larvae which consume the detritus on the roots. Dense cladoceran, copepod, midge larva, and nematode blooms were observed among the roots and probably developed as a result of the fish being restricted from preying upon them in the root cage area. With water movement created by the aeration, these organisms are most likely made available to the fish as recycled feeds when they leave the root masses.”

Ron Zweig says that the hydroponic pond is extremely stable after the first 2 weeks as the root systems become covered with micro-organisms. Another fundamental advantage of this system is the minimal physical structure involved - a pond, 3 aerators (which are essential), and the floating foam structure. No water pumps, no piping, no filters or strainers, no plant troughs or beds.